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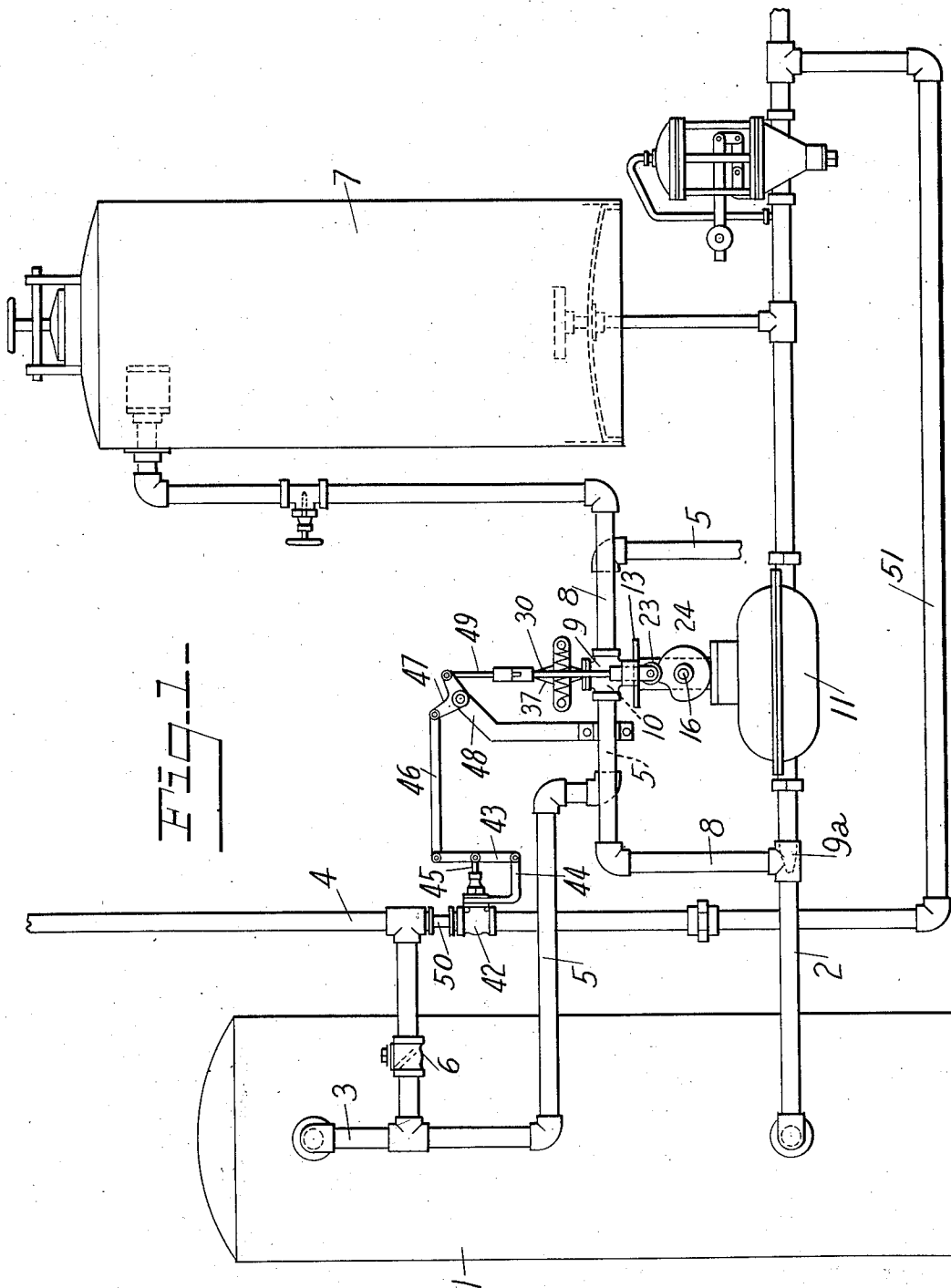
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VALVE ACTUATING DEVICE

Filed Aug. 10, 1925

2 Sheets-Sheet 1



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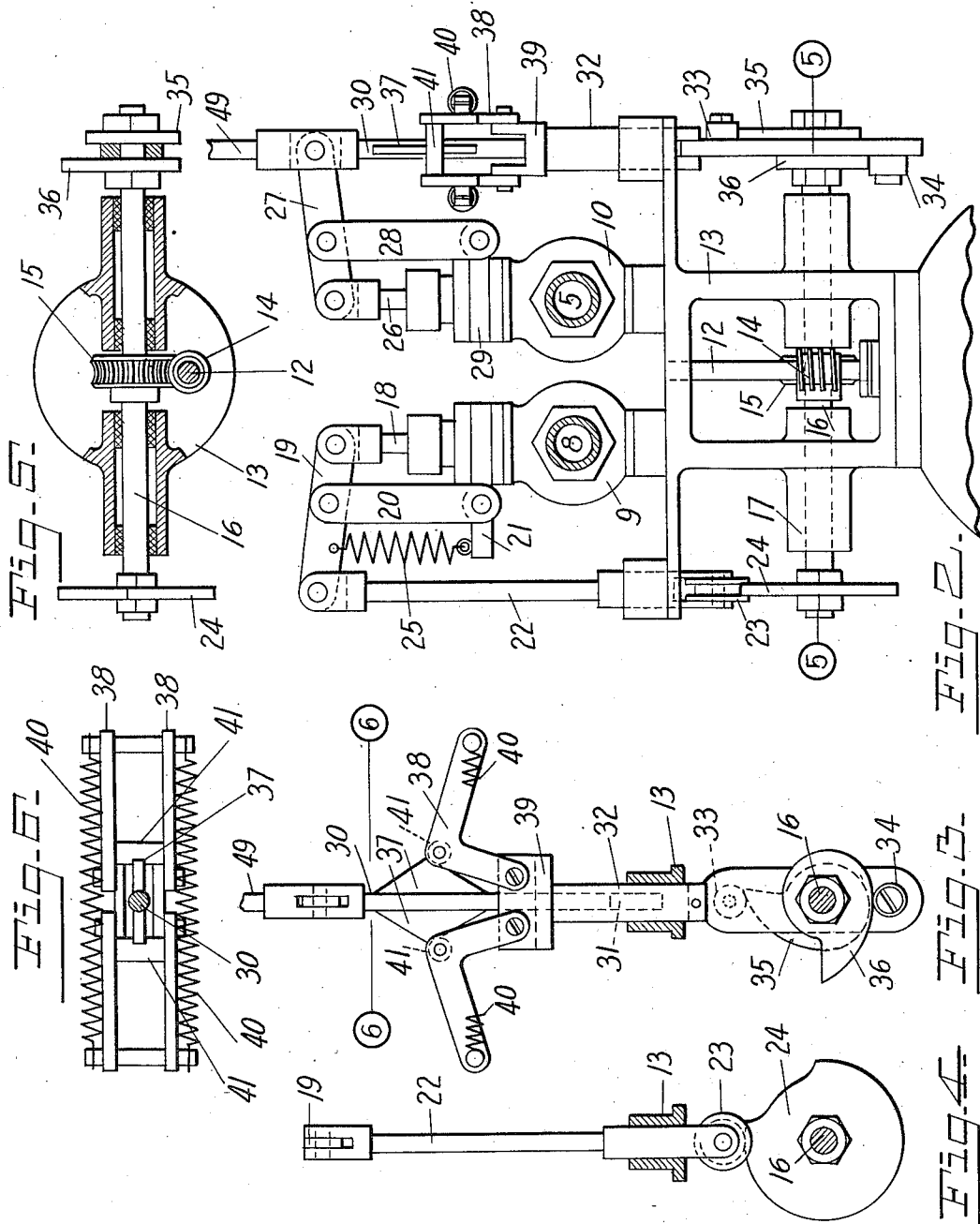
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VALVE-ACTUATING DEVICE

Application filed August 10, 1925. Serial No. 49,361.

This invention relates to valve actuating devices and is designed more particularly for use in connection with water softening apparatus.

One object of the invention is to provide means whereby a valve may be quickly shifted from one position to another by a part having continuous movement.

A further object of the invention is to provide such a device which will positively retain the valve in one position until the time arrives for shifting the same and will then move the valve quickly to its other position.

A further object of the invention is to provide such a device which will be simple in its construction, positive in its operation and of a strong durable character.

A further object of the invention is to provide in a water softening device means for automatically connecting the service pipe with the supply of hard water during the reconditioning operation; and for controlling this connection by means of the actuating devices for the valves which control the reconditioning operation.

Other objects of the invention will appear as the device is described in detail.

In the accompanying drawings Fig. 1 is a side elevation of a water softening apparatus showing my invention applied thereto; Fig. 2 is a front elevation of a valve and its operating device; Fig. 3 is a side elevation of an actuating device for one of the valves shown in Fig. 2; Fig. 4 is a side elevation of the actuating devices for the second valve shown in Fig. 2; Fig. 5 is a section taken on the line 5—5 of Fig. 2; and Fig. 6 is a section taken on the line 6—6 of Fig. 3.

The present application is in the nature of a division of the application for patent filed by me February, 25, 1925, Serial No. 11,435, and I have here shown the invention as applied to a water softening apparatus of the type shown in that application. It will be understood, however, that the valve actuating mechanism is not limited to use with water softening apparatus and that it

may be used in connection with apparatuses of various kinds.

The water softening apparatus here illustrated comprises a tank or container 1 adapted to contain a quantity of water softening material, such as zeolite, glauconite or the like, and it is connected at its bottom with a water supply pipe 2 and is connected near its upper end with an outlet pipe 3 which is connected both with a service pipe 4 and with a drain pipe 5. The connection between the service pipe 4 and the outlet pipe 3 is provided with a check valve 6 which will be seated by the back pressure of the water in the service line when the drain pipe is open. The salt solution is conveyed from a tank 7 through a pipe 8 to the hard water supply pipe 2 into which it is introduced through an injector 9, as described in the above mentioned application. The salt solution pipe 8 is controlled by a valve 9 and the drain pipe 5 is controlled by a valve 10.

In the normal water softening operation the valves 9 and 10 are both closed and the water passes through the supply pipe 2 into the container, through the water softening material and out through the pipe 3 to the service line 4. When a predetermined quantity of water has been softened the valves 9 and 10 are both opened, thus causing the salt solution to be delivered to the container along with the hard water and permitting the liquid to escape from the container through the drain pipe, the service pipe being cut off by the check valve 6 as above explained. After the salt solution has been delivered to the container for a predetermined period of time the valve 9 is closed, thus interrupting the supply of regenerating solution, but the valve 5 is retained in its open position for a further period of time sufficient to enable the hard water to wash out and remove all salt from the container. At the end of said period the drain valve is closed and the water softening operation is resumed. The operation of the valves 9 and 10 is automatically effected and in the apparatus here shown a water motor 11, which also serves as a me-

ter, is interposed in the supply line and means are provided whereby this motor will actuate the valves 9 and 10 at the proper times, the time of operation being determined by the amount of water passing through the supply pipe. The water motor may take various forms and the one here shown forms no part of the present invention, so that it need not be described in detail but it will be sufficient to state that it comprises a rotary shaft 12 which projects above the same and is journaled at its upper end in a bearing formed in the upper member of a frame 13 which is mounted on the motor. This shaft has secured thereto a worm 14 which meshes with a worm wheel 15 rigidly secured to a shaft 16 which is journaled in bearings 17 carried by the frame 13 and this shaft 16 serves as the operating shaft for the valve actuating devices.

The valves 9 and 10 may be of any suitable character and the controlling mechanism may take various forms, that here shown having been chosen for the purposes of illustration. Preferably the timing of the valves is effected by means of cams operated by a shaft 16. In the present apparatus the valve 9 for the regenerating solution pipe 8 comprises a reciprocatory valve stem 18 which is connected with one end of a lever 19 which is pivotally mounted on a supporting link 20 carried by a fixed support which, in the present instance, is mounted on the valve casing, as shown at 21. The other end of the lever 19 is connected with an actuating rod 22 which is guided in a part of the frame 13 and the lower end of which carries a roller 23 which rides over the periphery of a cam 24 rigidly secured to the shaft 16 and is held in engagement with that cam by means of a spring 25 extending between the lever 19 and the supporting member 21 for the link 20. This arrangement is such that when the roller is in engagement with the concentric portion of the cam 24 the valve will be held in its closed position but when the cut-away portion of the cam is brought into line with the roller the spring 31 will open the valve and retain the same open until the roller again engages the concentric periphery of the cam and it will thus be apparent that the valve will be opened once upon each complete rotation of the cam shaft 16 and will be held open for a period of time which is determined by the shape of the cam. The speed of the shaft 16 is so controlled as to permit the desired quantity of water to be delivered to the container only between the successive openings of the valve.

It is desirable that the valve 10 which controls the drain pipe 5 should be quickly opened and closed and the actuating mechanism here shown is of such character as to positively and quickly open and close the

valve. This valve also comprises a reciprocatory valve stem 26, one end of which is connected with a lever 27 pivotally mounted on the upper end of a link 28, the lower end of which is mounted on a fixed support, in the present instance a part 29 carried by the valve casing. The opposite end of the lever 27 is pivotally connected with the upper end of an actuating rod 30, the lower end of which is slidably mounted in an axial recess 31 formed in the upper portion of a plunger 32 which is guided in a suitable bearing in the frame 13. The lower end of this plunger has secured thereto two projections or rollers 33 and 34 which are here shown as projecting in opposite directions from the plunger and are arranged to be acted upon respectively by cams 35 and 36 secured to the cam shaft 16. These cams are here shown as snail cams and are so arranged with relation one to the other that the valve will be held in its closed and opened positions for the desired periods of time and it will be noted that the arrangement of the cams with relation to the plunger is such that the cam 35 will move the plunger upwardly and the cam 36 will move the same downwardly. The connection between the plunger 32 and the actuating rod 30 is such that these parts may have relative movement, and operative movement will not be imparted to the rod 36 and to the valve until just before the cam, 35 or 36, clears its roller on the plunger. In the present arrangement, the actuating rod 32 has secured thereto and projecting from the opposite sides thereof tapered projections 37 which, if desired, may consist of the opposite edges of a diamond shaped plate rigidly secured to the rod and projecting beyond the respective sides thereof. The angles or apices of the two projections or angular plates 37 are arranged in transverse alinement. Cooperating with these tapered projections or angular plates 37 are bell crank levers 38 each having its downwardly extending arm pivotally mounted on a collar 39 rigidly secured to the upper end of the plunger 32. The other arms of the bell crank levers are connected one to the other by means of springs 40 which tend to move the angles of the two levers one toward the other. Each bell crank lever is provided at the angle thereof with a stud or roller 41 which rollers engage the respective plates 37 and are held in contact therewith with the springs 40. In the present construction the bell crank levers 38 each comprises parallel bars and the rollers are mounted between the bars of the respective levers, as shown in Fig. 6. With the parts in the positions shown in Figs. 2 and 3, the levers 38 are acting on the lower inclines of the tapered plates 37 and thus serve to hold the actuating rod 30 in its uppermost position with the valve closed. In these drawings,

however, the cam 35 has moved the plunger 32 almost to its uppermost position and a slight further movement of the cam will force the studs or projections 41 across the apices or widest points of the plates 37 and thus cause the rollers or studs to act upon the upper inclined edges of the plates 37, which will result in the plates and the rod being moved quickly downward and the valve opened. When the cam 35 clears the roller 33 on the plunger the latter will be retained in its uppermost position by the contact of the rollers or studs 41 with the upper inclined edges of the plates 37. As the shaft continues to rotate the cam 36 will force the plunger downwardly and just before the plunger reaches the lower limit of its movement by the cam 36 the rollers 41 on the levers 38 will again pass the wide points or apices of the plates 37 and will act upon the lower inclined surfaces of these plates to impart upward movement to the actuating rod and thus close the valve. The cams on the shaft 16 are so arranged with relation one to the other that the valve 10 of the drain pipe will be opened either simultaneously with or slightly before the valve 9 of the regenerating solution pipe, thus preventing any of the regenerating solution from entering the water softening unit while it is connected with the service pipe. It will be apparent that when the valves 9 and 10 have been opened the regenerating solution or salt water will be carried into the container 1 by the water delivered thereto through the supply pipe 2 and the flow of regenerating solution to the container will continue until the cam 24 has again closed the valve 9. The closing of the valve 9 will take place in a less period of time than will the closing of the valve 10, due to the arrangement of the cams, and consequently the water from the supply pipe will continue to flow through the container to the drain pipe after the supply of regenerating solution has been interrupted, thereby causing the container to be rinsed or washed out by this additional water. When sufficient water has passed through the container to thoroughly rinse the same the valve 10 is again closed and the water from the supply pipe will pass through the container to the service pipe.

Inasmuch as the supply of soft water is interrupted during the reconditioning operation it may be desirable that hard water should be available in the service line and I have here shown means whereby this may be automatically accomplished. The hard water supply pipe 2 is connected with the service pipe 4 by means of a by-pass 51 which is controlled by a valve 42. The valve 42 is preferably so connected with the valve actuating mechanism that it will be opened during the reconditioning process and closed

during the water softening operation. As here shown, the valve is actuated by a lever 43 pivotally mounted at one end on a bracket 44 secured to the valve casing, connected between its ends with the valve stem 45, and connected at its other end by a link 46 with one arm of a bell crank lever 47, pivotally mounted on a bracket 48 and having its other end pivotally connected with a rod 49 which is connected with the upper end of the valve actuating rod 30 forming part of the actuating mechanism for the valve 10 of the drain pipe. The arrangement is such that when the valve 10 of the drain pipe is opened the valve 42 of the by-pass 51 will also be opened, thus permitting water to flow directly from the supply pipe to the service line, but when the valve 10 is closed the valve 42 will also be closed, thus forcing the water to pass through the water softening unit to the service line. Preferably the by-pass is provided with a restricted orifice, as shown at 50, which will cause a reduction in the pressure of the service line, thus notifying the user that he is receiving hard water instead of soft water. The reduced orifice serves to insure the passage through the injector 9 of a quantity of water sufficient to introduce the regenerating solution to the container.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an apparatus of the character described, two pipes, a valve to control the flow of liquid through one of said pipes, a longitudinally reciprocating actuating member operatively connected with said valve, and means for imparting operative movement to said actuating member at intervals determined by the quantity of water passing through the other of said pipes.

2. In an apparatus of the character described, two pipes, a valve to control the flow of liquid through one of said pipes, a longitudinally reciprocating actuating member operatively connected with said valve, a second member mounted for movement relatively to said reciprocating member, means mounted on said second member for imparting movement to said reciprocating member when said second member has been moved to a predetermined position with relation thereto, and means controlled by the water which passes through the other of said pipes to actuate said second member.

3. In an apparatus of the character described, two pipes, a valve to control the flow of liquid through one of said pipes,

a reciprocatory actuating member operatively connected with said valve, said member having a part projecting beyond the side thereof and provided with inclined surfaces, a spring pressed member to engage the inclined surfaces of said part, and means controlled by the water which passes through the other of said pipes to impart bodily movement to said spring pressed member to cause it to successively contact with the inclined surfaces of said part.

4. In an apparatus of the character described, two pipes, a valve to control the flow of liquid through one of said pipes, a reciprocatory actuating member operatively connected with said valve, cam plates projecting beyond the respective sides of said reciprocatory member and each having oppositely inclined edges extending lengthwise of said member, contact members arranged to ride over the inclined edges of said cam plates, springs to press said contact members against the edges of said plates, and means controlled by the water passing through the other of said pipes to impart bodily movement to said contact members, whereby each of them will be moved out of contact with one inclined surface of the adjacent cam plate and into contact with the other contact surface of said cam plates.

5. In an apparatus of the character described, two pipes, a valve to control the flow of liquid through one of said pipes, a reciprocatory actuating member operatively connected with said valve, cam plates projecting from the respective sides of said member and each having oppositely inclined edges extending lengthwise thereof, a plunger mounted for movement relatively to and lengthwise of said reciprocatory member, parts mounted on said plunger and arranged to ride over the edges of the respective cam plates, springs to press said parts against the edges of the respective plates, a motor actuated by the water which passes through the other of said pipes, and an operative connection between said motor and said plunger.

6. In an apparatus of the character described, two pipes, a valve to control the flow of liquid through one of said pipes, a reciprocatory actuating member operatively connected with said valve, cam plates projecting from the respective sides of said member and each having oppositely inclined edges extending lengthwise thereof, a plunger mounted for movement relatively to and lengthwise of said reciprocatory member, parts mounted on said plunger and arranged to ride over the edges of the respective cam plates, springs to press said parts against the edges of the respective plates, a motor actuated by the water which passes through the other of said pipes, and cams connected with said motor and acting on said plunger

to positively move the same in opposite directions.

7. An actuating device of the character described, comprising a plunger having a longitudinal bore in one end thereof, means for imparting reciprocatory movement to said plunger, an actuating rod adapted to be connected with the part to be actuated and having one end extending into the bore in said plunger, cooperating parts carried by said plunger and said rod and so arranged that when said plunger has been moved to a predetermined position with relation to said rod said parts will cooperate to impart operative movement to said rod.

8. An actuating device of the character described, comprising a plunger having a longitudinal bore in one end thereof, means for imparting reciprocatory movement to said plunger, an actuating rod adapted to be connected with the part to be actuated and having one end extending into the bore in said plunger, triangular plates projecting from the opposite sides of said rod and having their apices arranged in the same transverse line, levers pivotally mounted on said plunger, parts carried by said levers to engage the inclined edges of the respective plates, and a spring acting on said levers to move said parts one toward the other.

9. An actuating device of the character described, comprising a plunger having a longitudinal bore in one end thereof, means for imparting reciprocatory movement to said plunger, an actuating rod adapted to be connected with the part to be actuated and having one end extending into the bore in said plunger, triangular plates projecting from the opposite sides of said rod and having their apices arranged in the same transverse line, bell crank levers having downwardly extending arms pivotally mounted on said plunger and having other arms extending outwardly from the upper ends of the first mentioned arms, a spring to connect the last mentioned arms one to another, and parts carried by said levers at the angles thereof to engage the edges of the respective plates.

10. An actuating device of the character described comprising two longitudinally movable elongated members, means for operatively connecting one of said members with a device to be operated, the second member being movable with relation to the first mentioned member, a part carried by said first mentioned member and having outwardly converging surfaces, a spring pressed device carried by said second member to engage said inclined surfaces and impart movement to said first mentioned member and when said spring pressed device passes the apex of said part, and means to actuate said second member.

11. An actuating device of the character de-

scribed comprising a movable rod, means to operatively connect said rod with a part to be actuated, said rod having plates projecting from the opposite sides thereof, the edges of each of said plates converging outwardly, a plunger slidably mounted on said rod for movement lengthwise thereof, contact members pivotally mounted on said plunger and arranged to engage the edges of the respective plates, a spring acting on said contact members to move them one toward the other, and means for actuating said plunger to move said contact members past the points of greatest width on the respective plates.

12. An actuating device of the character described comprising two longitudinally movable elongated members, means for operatively connecting one of said members with a device to be operated, the second of said members being movable with relation to said first mentioned member, triangular plates projecting from the opposite sides of said first mentioned member, bell crank levers having downwardly extending arms pivotally connected near their lower ends with said second member and having other arms extending outwardly from the upper ends of the first mentioned arms, a spring to connect the last mentioned arms one to the other, and parts carried by said levers at the angles thereof to engage the edges of the respective plates.

13. In an actuating device for a valve having a stem, an actuating member, means adapted to operatively connect said actuating member with said valve stem, a second member mounted for reciprocatory movement with relation to said actuating member, a yieldable device connected with said second member and arranged to act on said actuating member to cause operative movement to be imparted to said actuating member when said second member has been moved to a predetermined position with relation to said actuating member, and means for imparting movement to said second member.

14. An actuating device of the character described comprising two longitudinally movable members, means for operatively connecting one of said members with a device to be operated, the second member being movable with relation to the first mentioned member, a yieldable device carried by one of said members and arranged to act on the other of said members to cause operative movement to be imparted to the first mentioned member when said second member is moved to a predetermined position with relation to said first mentioned member, and means for imparting movement to said second member.

15. An actuating device of the character described comprising two longitudinally movable members, means for operatively con-

necting one of said members with a device to be operated, the second member being movable with relation to the first mentioned member, a device carried by one of said members and comprising two movable parts, and yieldable means for moving said parts one toward the other, a device carried by the other of said members and so arranged with relation to said parts that during the movement of said second member with relation to said first mentioned member it will move said parts one from the other and after the second member has been moved to a predetermined position with relation to said first mentioned member said parts will act on the last mentioned device to impart movement to said first mentioned member, and means for imparting movement to said second member.

In testimony whereof, I affix my signature hereto.

EDWARD T. TURNER.