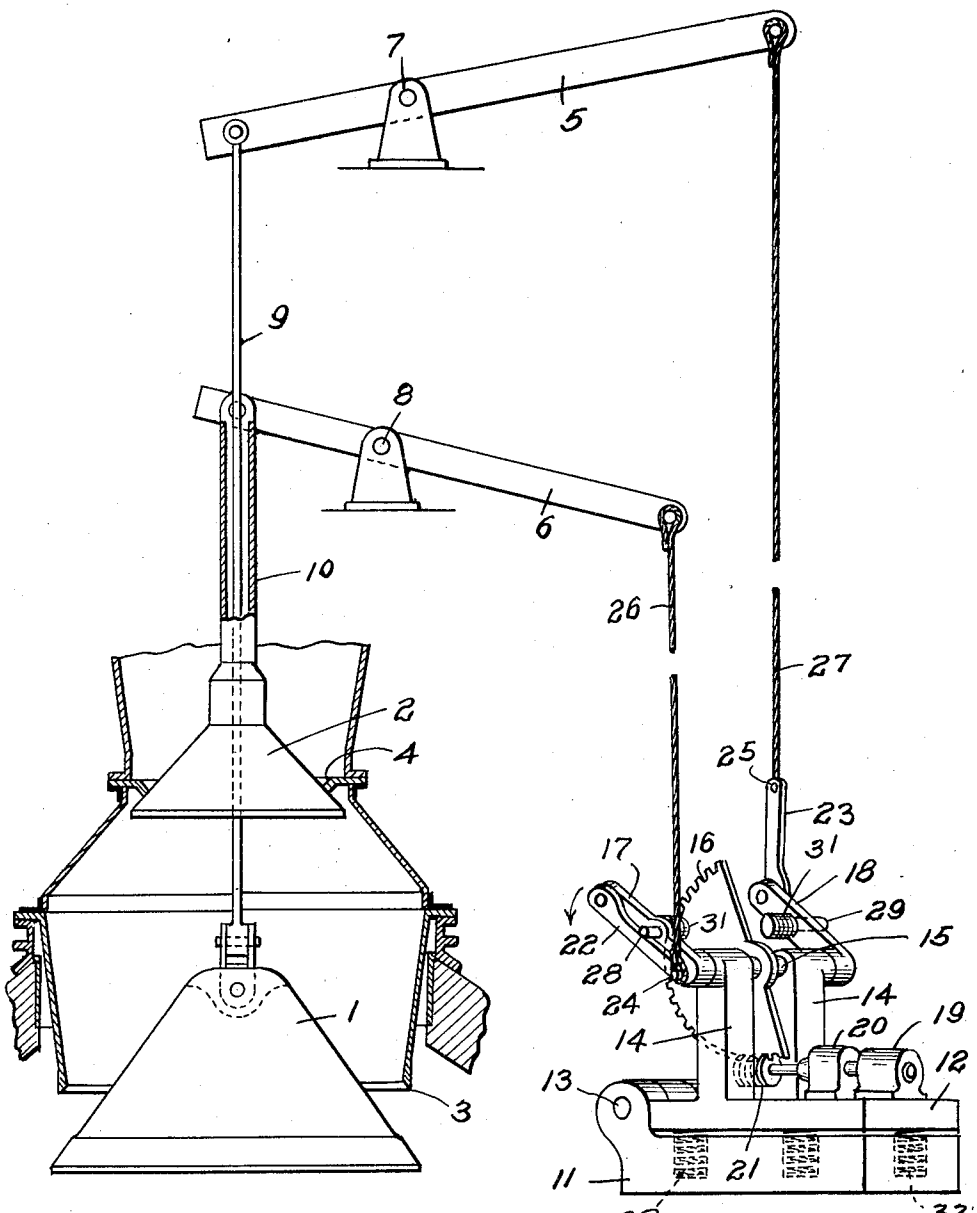
Nov. 25, 1924. 1,516,987

B. RAVITCH

OPERATING MECHANISM FOR FURNACE CHARGING APPARATUS

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FIG. 1.



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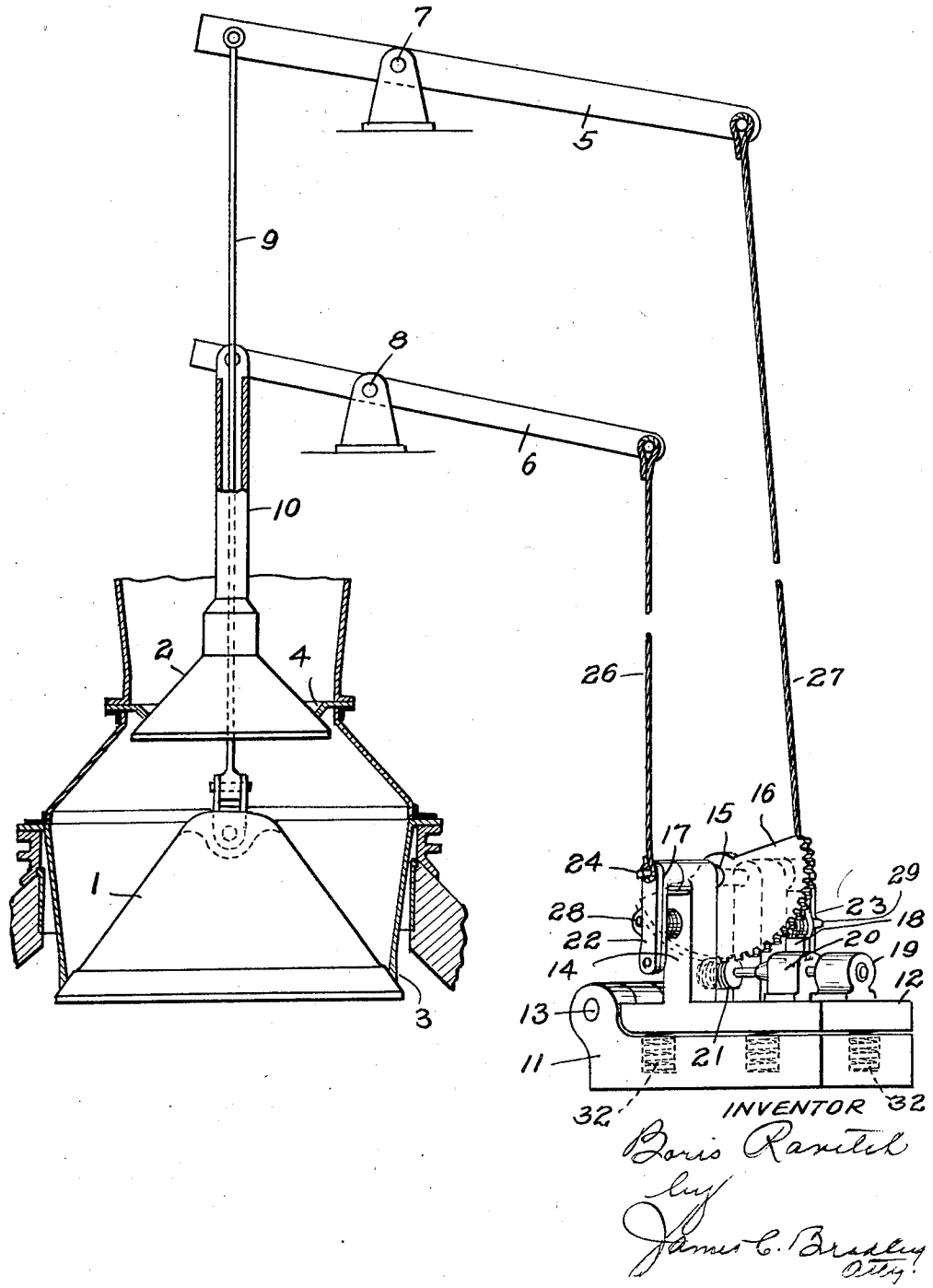
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OPERATING MECHANISM FOR FURNACE CHARGING APPARATUS

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FIG. 2.



Nov. 25, 1924. **1,516,987**

B. RAVITCH

OPERATING MECHANISM FOR FURNACE CHARGING APPARATUS

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FIG. 3.

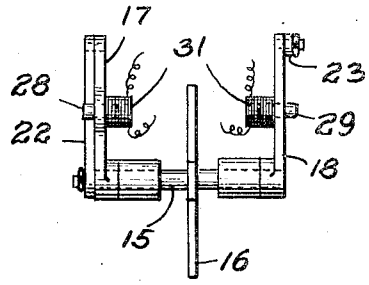
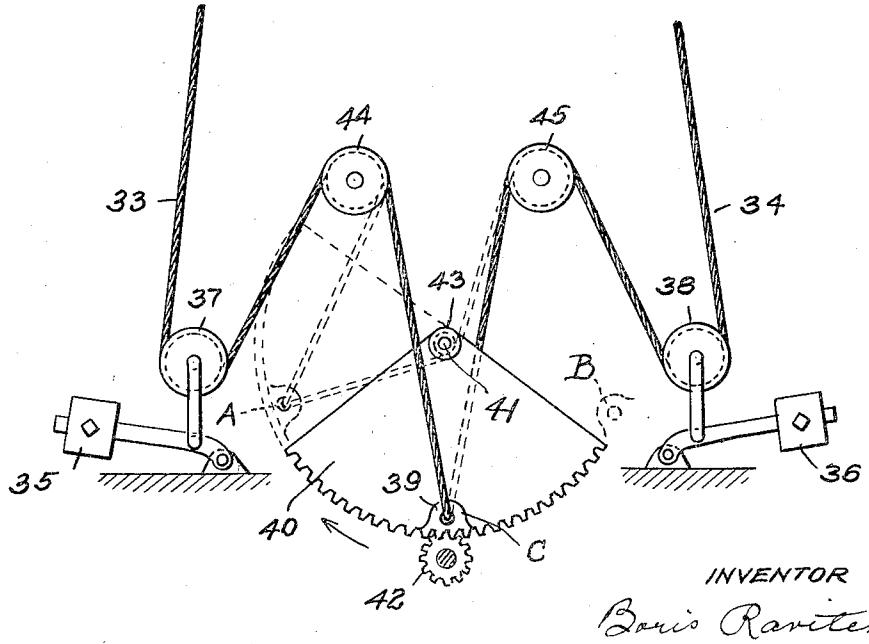


FIG. 4



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UNITED STATES PATENT OFFICE.

BORIS RAVITCH, OF PITTSBURGH, PENNSYLVANIA.

OPERATING MECHANISM FOR FURNACE-CHARGING APPARATUS.

Application filed December 29, 1923. Serial No. 683,343.

To all whom it may concern:

Be it known that I, BORIS RAVITCH, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have made a new and useful invention in Improvements in Operating Mechanism for Furnace-Charging Apparatus, of which the following is a specification.

The invention relates to charging apparatus, such as that employed in connection with blast furnaces, gas producers, and the like, in which the material is charged past a pair of "bells" or valves which open independently and are so arranged that one is always closed. The invention has for its principal objects the provision of an improved apparatus of the type specified, (1) which is of simple construction, requiring only a single operating motor; (2) which, in its preferred form, avoids the use of counterweights and the complications involved in the use of such devices, while still retaining the advantages incident to the use of such devices when obstructions prevent the seating of the bells or valves; (3) which provides for the seating of the valve or bell in such manner that the speed of closure decreases as the valve or bell approaches its seat, thus reducing the shock incident to the seating; and in general, (4) which is cheap in construction, efficient in operation, and easy to operate and keep in repair. Certain embodiments of the invention are illustrated in the accompanying drawings wherein:

Figure 1 is a diagrammatic view, partially in perspective, showing the application of the invention to the bells or valves of a blast furnace. Fig. 2 is a similar view, but with the parts in a different position. Fig. 3, is a partial plan view showing the method of operating the releasable stop members employed. And Fig. 4 is a perspective view showing a modification.

Briefly stated, the apparatus in its preferred form, comprises a pair of cranks operated from a single motor and connected to the valves in such manner that either valve may be opened and closed independently of the other and so that one valve is always maintained closed when the other is opened. The operating mechanism is preferably placed to one side of the valves and at a lower level, and pivoted beams and connecting rods or cables are employed between the cranks and valves, but this arrangement may be changed to suit conditions. The operating cranks may be connected to the valves by cables passing over sheaves instead of by the beams and rods, or may be located above the valves and connected directly by means of vertical rods or cables. Instead of a single operating motor, the cranks may, if desired, be operated by two independent motors, although this increases the cost, without any compensating advantage.

Referring to the drawings, 1 and 2 are a pair of charging valves or bells, such as are employed at the upper end of a blast furnace or gas producer, and 3 and 4 are the seats against which the valves engage when in closed position, the arrangement being such that one of the valves is always closed during the charging operation to prevent the escape of gas or products of combustion. The valves are operated from the beams or levers 5 and 6, fulcrumed in the customary way at 7 and 8 upon suitable superstructure, not shown, which beams carry the connecting rods 9 and 10 secured at their lower ends to the valves.

Mounted in any convenient position on a platform or other support at one side of the furnace is the base 11, which carries the operating mechanism, and carried by the base is a supplemental base plate or support 12, hinged to the base as indicated at 13. The base plate 12 carries a pair of standards 14, in which is mounted a shaft 15. The shaft has keyed to it intermediate the standards, the segmental worm wheel 16, and on the outer sides of the standards, the shaft carries the two cranks 17 and 18 in parallel position and also secured to the shaft. The worm wheel is oscillated back and forth by means of the electric motor 19, preferably through the intermediary of reduction gearing in the casing 20 and the worm 21.

The cranks 17 and 18 have pivoted to their outer ends the arms 22 and 23, and the other ends of these arms are in turn pivoted at 24 and 25 to the cables 26 and 27, which are connected at their upper ends to the beams 6 and 5. The cranks are provided with the stops 28 and 29 adapted to arrest the swinging movements of the arms 22 and 23 when they arrive in parallelism with the cranks. The arms are of the same length as the cranks, so that when they are in folded position engaging the stops, the

pivotal connections at 24 and 25 lie in alignment with the shaft.

In operation, the motor 19 oscillates the worm wheel back and forth and the cranks and connections alternately open and close the valves 1 and 2. In blast furnace work, the upper valve 2 will be opened and closed several times to each opening and closing movement of the lower valve 1. The timing of the oscillation, and the extent of opening of the valves may be controlled by hand or by any suitable motor control operating automatically, as by the use of cams or other devices well known in the art. Starting with the parts in the positions illustrated in Fig. 2 (both valves being closed) the cycle of operation involved in opening and closing the valve is as follows: The shaft 15 is rotated clockwise, which movement causes the cranks 17 and 18 to move upward, and allows the arm 23 to straighten out and the valve 1 to open, as shown in Fig. 1. During this time the valve 2 remains closed and the arm 22 is folded along the crank 17 and is engaged with the stop 28. The point of connection 24 remains in alignment with the shaft 15. After reaching the position of Fig. 1, the motor reverses and the shaft 15 is rotated in a counterclockwise direction, as indicated by the arrow in Fig. 1, which movement causes the crank 18 to swing downward, thus moving the valve 1 toward closed position. This closing movement of the valve continues until the crank 18 has reached a vertical position as shown in the position of Fig. 2, at which time the valve is closed and the arm 23 folded along the crank and in engagement with the stop 29. During this movement, the valve 2 remains closed since the point of connection 24 is in alignment with the shaft 15. The valve 2 thus remains completely closed until the valve 1 becomes closed. The motor then stops. This completes one cycle of opening and closing valve 1. A further movement of the cranks in a counterclockwise direction from the position of Fig. 2, permits the valve 2 to open, since the arm 22 now begins to swing from folded to open position, and this rotation is continued until the valve 2 is fully open. During this last upward movement from the position of Fig. 2, the valve 1 remains closed, since the point of connection 25 lies in alignment with the shaft. The motor then reverses to turn the gear 16 and cranks in a clockwise direction, this movement being continued until the parts again arrive at the position of Fig. 2, by which time both valves become closed. The motor then stops and this completes the second cycle. By continuing the movement further in a clockwise direction, the valve 2 is closed and the valve 1 opened again, thus starting again the first cycle. The stops 28 and 29 are preferably made releasable, as indicated in Fig. 3. As here shown, the stops are in the form of pins mounted for sliding movement through the cranks and operated by solenoid windings 31. This permits of the ready disconnection of the arms from the cranks, such as might become desirable to permit of the quick opening of one of the valves, as for instance, the valve 2 when the parts are in the position of Fig. 1.

In case an obstruction, such as a hard lump of material, prevents the seating of either valve, damage to the operating mechanism is avoided by reason of the mounting of the base plate 12 so that it may swing upward, the weight of such base plate and parts carried thereby being such as to counterbalance the upward pull of the rods 26 and 27 so that the plate normally remains seated. This arrangement avoids the use of counterweights or other devices, as heretofore employed, for giving a yielding resistance in the line of connection to the valves to avoid the danger of breakage in case the closure of valves is obstructed. The plate or support is preferably guided in its up and down movements by reason of its pivotal connection at 13 with the base 11, but, if desired, the base plate might be otherwise guided in such movements. Spring buffers 32 are also preferably employed to relieve the shock when the plate 12 strikes the base after being moved upward, but any other desired yielding means might be here substituted. It will also be understood that various types of releasable stops, other than the ones shown as operated electrically, might be employed, as well as other means for turning the cranks, the illustration and description being directed to the preferred means, but such means being shown in a very simple diagrammatic way to more clearly illustrate the broad features to which the invention particularly relates rather than to matters of detail design. It is also to be understood that for the cranks could be substituted a direct attachment of the folding arms 22 and 23 to the rim of the segmental gear, thus combining the gear and the cranks in one, and that, if desired, the segmental gear might be changed to a complete gear.

The advantages of the construction, already referred to will be apparent to those skilled in the art. The single operating mechanism reduces the cost as compared with systems requiring two motors, and the expense of upkeep is less. The avoidance of counterweights also lessens the cost and makes the apparatus more compact and simple. The use of the crank closure means, arranged to close the valves when the cranks approach a position of alignment with the rods 26 and 27, give the advantage of a slow seating of the valves,

reducing the impact incident to such seating and increasing the life of the parts to which the impact and strain apply. Other minor advantages will also be apparent to those skilled in the art.

Fig. 4 illustrates a modification which, although not so desirable as the preferred form, presents a number of the same advantages. In this construction, the cables or chains 33 and 34 are either connected to the beams 5 and 6, so as to operate the valves, or pass around sheaves and are directly connected to the valves. The counterweights 35 and 36, connected to the sheaves 37 and 38, provide the necessary give in the line of connection to the valves, so that in case an obstruction prevents the seating of one of the valves, the counterweights will lift, and undue strain upon the operating parts will be avoided, this being a feature well known in the art. The cables or chains are connected at their ends to the lug 39 on the segmental gear 40, so that such gear acts as a crank for the cables or chains. The gear is mounted for rotation on the axle 41 and is oscillated back and forth by a pinion 42 driven from a suitable motor. The axle 41 also carries a small guide sheave 43 and the cables engage this sheave on opposite sides and pass around the sheaves 44 and 45. If the valves connected to the cables are both closed when the parts are in the position illustrated with the lug 39 at C, and the gear 40 is moved in a clockwise direction until the lug 39 arrives at the dotted line position A, the valve connected to the cable 33 is opened, while the one connected to the cable 34 remains closed. If now the direction of rotation of the gear is reversed and the lug 39 is moved until it reaches the dotted line position B, the valve operated by the cable 33 is closed as the gear moves to central position C, after which it remains closed as the lug is moved to position B, while the valve operated by the cable 34 is opened during such movement of the gear from position C to position B. A strain is imposed on the cable 34 as the spur wheel moves the lug 39 from position C to position A, but this strain is relieved by the use of the counterweight 36. The counterweight 35 performs a similar function in the movement of the lug 39 from C to B. If desired, the operating mechanism may be mounted for vertical movement, as in the Fig. 1 construction, thus avoiding the use of the counterweights 35 and 36. In that case, the sheaves 37, 38, 44, and 45 are dispensed with and the cables extend straight up to the operating beams for the valves or up to and over sheaves above the valves. The construction as shown, serves to illustrate the simplified construction made possible by the expedient shown in Fig. 1 of mounting the base plate for vertical movement and thus eliminating the counterweights and sheaves.

What I claim is:

1. The combination with a pair of charging valves arranged in series, of means for opening and closing the valves independently, comprising a pair of parallel cranks, power means for operating the cranks, and connections between the cranks and valves, such cranks and connections being arranged so that one valve is opened after the other is closed.

2. The combination with a pair of charging valves arranged in series, of means for opening and closing the valves independently, comprising a pair of cranks, arranged to move together and maintain their relative positions, power means for operating the cranks, and connections between the cranks and valves arranged so that normally when the cranks are in one position, one valve is closed and the other open, and when the cranks are in reverse position, the valve which was open is closed and the valve which was closed is open, such connection being provided with a release means so that both valves may be opened or closed at the same time.

3. The combination with a charging valve, of means for opening and closing it, comprising a crank, an operating member connected to the crank for reciprocating the valve and means for turning the crank, the parts being arranged so that the operating member is in alignment with the crank when the valve is closed.

4. The combination with a charging valve, of means for opening and closing it, comprising a crank, an arm pivoted to the outer end of the crank and adapted to swing into parallelism therewith, stop means between the crank and arm for stopping the swinging movement of the arm relative to the crank when the crank and arm arrive at parallelism, and a connecting means between the other end of the arm and the valve.

5. The combination with a charging valve, of means for opening and closing it, comprising a crank, an arm pivoted to the outer end of the crank and adapted to swing into parallelism therewith, stop means between the crank and arm for stopping the swinging movement of the arm relative to the crank when the crank and arm arrive at parallelism, and a connecting means between the other end of the arm and the valve, said other end of the arm, where said connecting means is attached, lying on the axis of rotation of the crank when the crank and arm lie along side each other in parallelism.

6. The combination with a charging valve, of means for opening and closing it, comprising a crank, an arm pivoted to the outer end of the crank and adapted to swing

into parallelism therewith, stop means between the crank and arm for stopping the swinging movement of the arm relative to the crank when the crank and arm arrive at parallelism, and a connecting means between the other end of the arm and the valve, the said stop means being movably mounted so that it may be moved out of engaging position.

7. The combination with a pair of charging valves, of means for opening and closing them independently, comprising a pair of cranks, a shaft on which the cranks are mounted, means for turning the shaft, an arm pivoted to the outer end of each crank and adapted to swing into parallelism therewith, stop means between each crank and the arm pivoted thereto for stopping the swinging movement of each arm relative to its crank when the crank and arm arrive in parallelism, and a connecting means between the other end of each arm and one of the valves.

8. The combination with a pair of charging valves, of means for opening and closing them independently, comprising a pair of cranks, a shaft on which the cranks are mounted, means for turning the shaft, an arm pivoted to the outer end of each crank and adapted to swing into parallelism therewith, stop means between each crank and the arm pivoted thereto for stopping the swinging movement of each arm relative to its crank when the crank and arm arrive in parallelism, and a connecting means between the other end of each arm and one of the valves, said other ends of the arms, where said connecting means are attached lying on the axis of rotation of said shaft.

9. The combination with a charging valve, of power operating means, a support for said operating means mounted for vertical movement, and a connection between the operating means and the valve, the weight of the support and the operating means carried thereby being such that the support will remain seated in the normal operation of the valve, but will lift and prevent injury to the operating means in case an obstruction prevents the seating of the valve.

10. The combination with a charging valve, of power operating means, a support for said operating means mounted for vertical movement, a connection between the operating means and the valve, and a yielding buffer beneath the support, the weight of the support and the operating means carried thereby being such that the support will remain seated in the normal operation of the valve, but will lift and prevent injury to the operating means in case an obstruction prevents the seating of the valve.

11. The combination with a pair of charging valves, of means for opening and closing them independently comprising a pair of cranks, a shaft on which the cranks are mounted, a gear for turning the shaft, a second operating gear meshing therewith, a motor for rotating said second gear, an arm pivoted to the outer end of each crank and adapted to swing into parallelism therewith, stop means between each crank and the arm pivoted thereto for stopping the swinging movement of each arm relative to its crank when the crank and arm arrive in parallelism, and a connecting means between the other end of each arm and one of the valves.

12. The combination with a pair of charging valves, of means for opening and closing them independently comprising a pair of cranks, a shaft on which the cranks are mounted, a worm wheel for turning said shaft, a worm engaging said wheel, a motor for rotating the worm, an arm pivoted to the outer end of each crank and adapted to swing into parallelism therewith, stop means between each crank and the arm pivoted thereto for stopping the swinging movement of each arm relative to its crank when the crank and arm arrive in parallelism, and a connecting means between the other end of each arm and one of the valves.

13. The combination with a charging valve, of a crank and motor for operating said valve, a connection between the valve and crank to which the crank applies a downward pull to close the valve, and a support for the crank and motor mounted for vertical movement, the weight of the support and operating parts carried thereby being such that the support will remain seated in the normal operation of the valve, but will lift and prevent injury to the operating parts in case an obstruction prevents the seating of the valve.

14. The combination with a pair of charging valves arranged in series, of means for opening and closing the valves independently, comprising a pair of parallel crank operating means, power means for actuating said means, and a connection from each of said valves to said crank means arranged to open and close the valves independently and to maintain one valve closed until the other is closed.

15. The combination with a pair of charging valves arranged in series, of means for opening and closing the valves independently, comprising a pair of parallel crank operating means, a single motor for actuating said means, and a connection from each of said valves to said crank means arranged to open and close the valves independently and to always maintain one of the valves in full closed position.

16. The combination with a pair of charging valves arranged in series, of means for opening and closing the valves independ-

ently, comprising a pair of parallel crank operating means, power means for actuating said means, and a connection from each of said valves to said crank means arranged to open and close either of the valves without opening the other and to maintain one valve closed until the other is completely opened.

17. The combination with a charging valve, of means for opening and closing it, comprising a crank, a connecting member for operating the valve attached to the crank and adapted to lie in parallelism therewith when the crank is on dead center and the valve is closed, stop means for maintaining the portion of the connecting means in parallelism with the crank in such position after the crank passes dead center, and means for oscillating the crank.

In testimony whereof, I have hereunto subscribed my name this 24th day of December, 1923.

BORIS RAVITCH.