

No. 650,971.

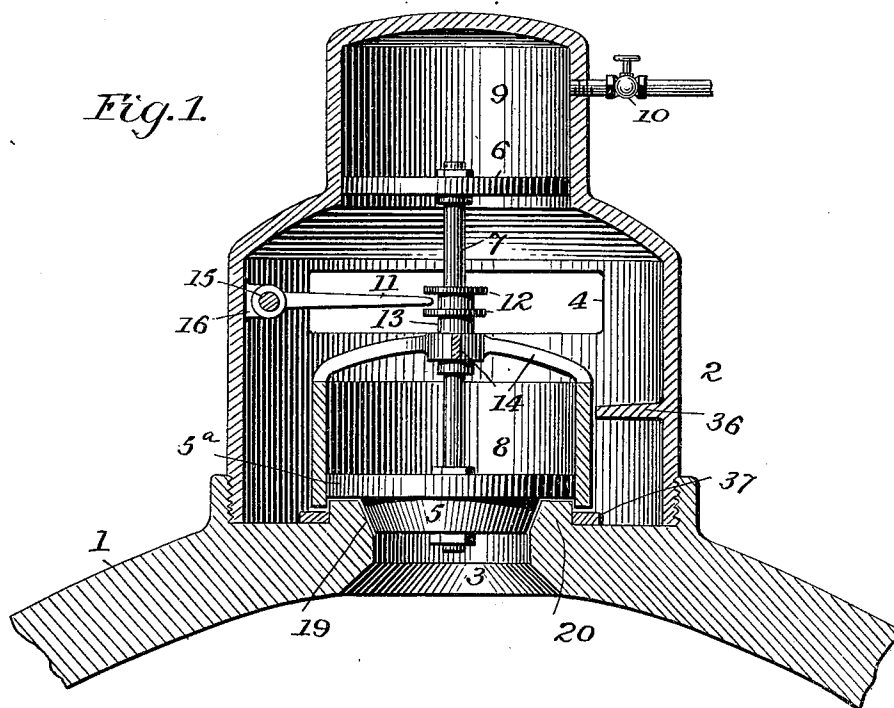
Patented June 5, 1900.

W. R. GREEN.  
INDUCTION VALVE.

(Application filed Dec. 14, 1898.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses

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2 Sheets—Sheet 2.

Fig. 2.

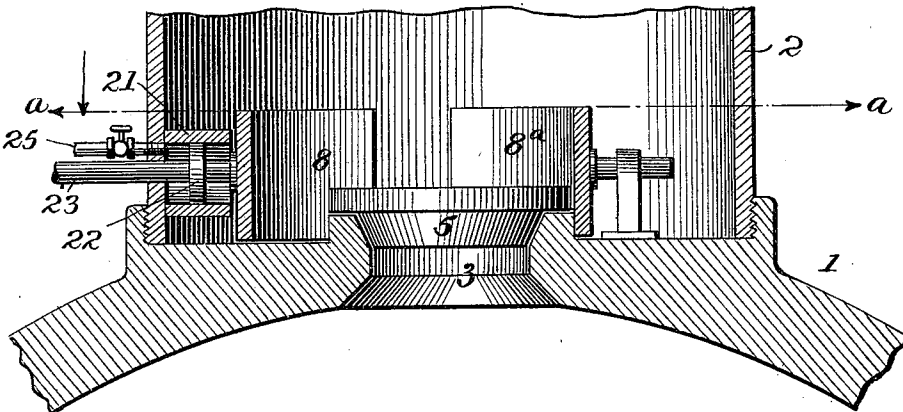
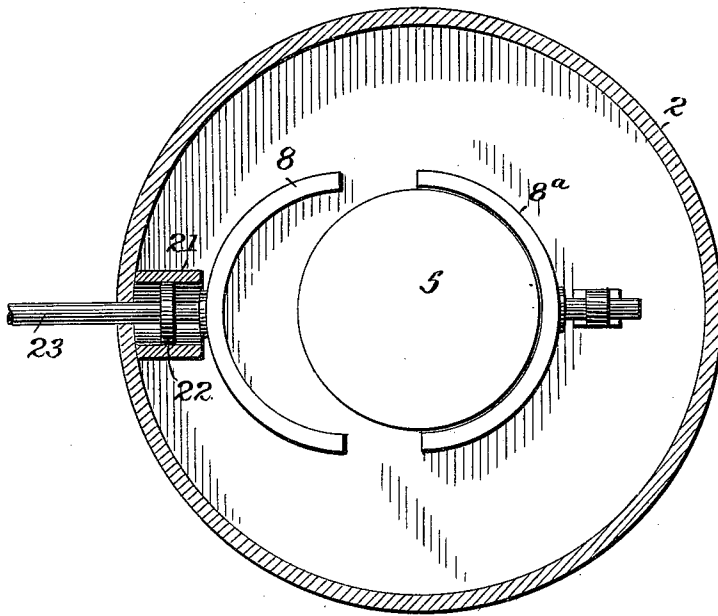


Fig. 3.



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# UNITED STATES PATENT OFFICE.

WILLARD R. GREEN, OF DENVER, COLORADO.

## INDUCTION-VALVE.

SPECIFICATION forming part of Letters Patent No. 650,971, dated June 5, 1900.

Application filed December 14, 1898. Serial No. 699,281. (No model.)

*To all whom it may concern:*

Be it known that I, WILLARD REED GREEN, a citizen of the United States, residing at Denver, Arapahoe county, State of Colorado, have invented certain new and useful Improvements in Induction-Valves, of which the following is a specification.

My invention relates to improvements in valves for the transfer and control of gases or fluids under pressure, either for induction or eduction purposes, and in the manner of arranging and actuating such valves.

My invention makes use of the pressure of the medium to be transferred or the working medium or fluid employed in operating an engine to balance and actuate the valves and may be either with or without the assistance and coöperation of the weight or pressure of the atmosphere.

The invention consists in so using said pressure and of mechanical parts and arrangements for accomplishing that object, and I preferably employ parts or pistons of different areas or acting under different relative pressures of either the same or different mediums with means for alternately or successively applying said pressure to alternately or successively balance and unbalance said parts and the main or induction valve controlling the supply or passage of the working medium to an engine or other mechanism, whereby said valve is seated and unseated by the pressure of said medium controlled through the action of said mechanism.

One embodiment of my invention, and a preferable form, is set forth in the drawings forming a part of this specification, in which—

Figure 1 represents an elevation, partly in section, of said form. Fig. 2 represents another form of mechanism for actuating the cylinder 8, shown in Fig. 1. Fig. 3 is a plan view showing a cylinder 8 divided longitudinally, taken on the line *a a*, Fig. 2.

In the drawings, 1 represents a cylinder of an engine. 2 is a steam or other chest or closed pressure-chamber thereon for the admission of the working medium to said cylinder. 3 is the port connecting said chest with said cylinder.

4 is the port admitting the working medium to the chest 2.

5 is the induction-valve controlling the port

3. This valve may be of the piston form or may be a puppet or other form of valve. Either attached to the top of the valve 5 or placed in any desired relation thereto and connected therewith is a piston 5<sup>a</sup>, of larger area than the bottom or the seating area of said valve 5 in the port 3. It is obvious that the valve 5 and the piston 5<sup>a</sup> may be made integral or may be in two separate parts and that the top and bottom surfaces of said valve and said piston may be at any distance apart as desired.

6 is a piston connected with the valve 5 by the rod 7.

8 is a cylinder, open at both ends, adapted to fit around the top portion of the valve 5 and the piston 5<sup>a</sup> and to permit longitudinal movement of the piston 5<sup>a</sup> therein, so that said piston may slide independently of said cylinder longitudinally therein and said cylinder may move past said piston as desired and may be brought into contact with the walls of the chest 2 about the seat of said valve.

The upper portion of the chest 2 is formed to constitute or bears upon its wall a cylinder 9, in which the piston 6 moves. Said cylinder may be above or upon the chest and may be either independent thereof or integral therewith. The cylinder 9 is provided with a pipe connection 10 or other means, as desired, for regulating the volume and pressure of the air in the top of said cylinder, and the top of said piston 9 may have a connection open to the atmosphere, or the air therein may be confined or put under any degree of compression desired by any well-known means, and the air in said cylinder may be used to assist in actuating or causing longitudinal movement to the piston 6 and valve 5 or in cushioning or limiting the travel of said valve.

Any well-known means may be used to actuate or cause longitudinal movement of the cylinder 8—as, for instance, lever-arms 11, attached to the rod or shaft 15, having a bearing 16 and attached to means operatively connected with the engine-shaft for actuating or rocking said shaft. Said lever-arms engage with projections upon the collar 13, sliding on the rod 7 and having arms 14, attached to the cylinder 8, whereby the cylinder 8 is

caused to rise and fall by the turning of the rod 15. This may be operatively connected with the engine-shaft or with any other mechanism.

5 The cylinder 8 may be caused to come in contact with the floor or wall of the chest 2, or a rim or shoulder 20 may be formed or made around the seat 19 of the valve 5, adapted to fit the inner walls of the cylinder 8 and  
10 to be inclosed or surrounded by said cylinder and when so inclosed to close such cylinder at the end so in contact with said rim, whereby the working medium in the chest 2 can only enter said cylinder and exert pressure upon the piston 5<sup>a</sup> through the opposite  
15 or open end of the cylinder 8. The rim or shoulder 20 may be made independent of or integral with the walls of the chest 2 and preferably projects sufficiently from said wall to permit the cylinder 8 to pass over and encircle the end or edge of said rim without coming into contact with the wall of the chest  
20 2 proper, so that said cylinder remains substantially a floating cylinder balanced at all times in the working medium.

25 Arms or guides 36 may be formed upon or attached to the chest 2 with suitable bearings to act as guides to the cylinder 8, and lugs or stops 37 may be placed upon the walls  
30 of the chest 2 or elsewhere to limit the travel of the cylinder 8 or to serve as bearings for the thrust thereof.

The operation is as follows: Assuming the engine to be working under a pressure of one  
35 hundred pounds, there will exist a pressure of one hundred pounds in the chest 2. Assuming the area of valve 5 at the seat 19 thereof to be equal to one square inch, it will therefore have a pressure of one hundred  
40 pounds thereon. Assuming the piston 6 to be of larger area than the seat of valve 5 and to have a pressure of, say, one hundred and ten pounds of said working medium thereon, the pressure of the working medium will  
45 therefore cause an upward movement of the piston 6 in the cylinder 9, thereby lifting the valve 5 from its seat through the action of the rod 7, connecting said piston with said valve. Hence, so far as the action of valve 5 and piston  
50 6 alone is concerned, valve 5 would always stand open under the pressure of the working medium upon piston 6. Steam or other working medium will therefore be admitted from the chest 2 to the cylinder 1  
55 through the port 3. When desired to close said port, the cylinder 8, inclosing the piston 5<sup>a</sup>, is caused by the movement of the arms 11 to move to a contact with the floor of the chest 2 or with the rim 20, surrounding the seat of  
60 valve 5, thus forming a chamber in the lower portion of cylinder 8. Thus the piston 5<sup>a</sup>, moving in cylinder 8, is open to the further action of the working medium only upon the top of said piston through the open end of  
65 cylinder 8. As the area of the piston 5<sup>a</sup> is greater than the area of valve 5 or than that of the piston 6, it will carry a greater pres-

sure thereon than piston 6 and will cause the valve 5 to be seated in the port 3 against the resistance of the pressure upon piston 6. This  
70 will occur whenever the action of the cylinder 8 by coming in contact with the walls of the chest transfers the controlling area and pressure to the piston 5<sup>a</sup> and alternately to piston 6 when moving from contact with the  
75 walls of said chest.

For a new charge of working medium or steam the operations are repeated. The admission of the working medium to the engine-cylinder 1 is permitted by raising the cylinder  
80 8 through the operation of mechanism actuating the arm 11 and operatively connected with the engine-shaft, whereby the movement of the cylinder 8 is regulated to be at any point of cut-off desired. Upon moving  
85 cylinder 8 away from contact with the floor or parts of the chest surrounding the seat of valve 5 the piston 5<sup>a</sup> is balanced by the equal pressure of the working medium upon its two sides, and the piston 6 being of  
90 greater area than the seat of valve 5 at once lifts valve 5, permitting the inflow of the working medium below the end of cylinder 8 and through valve 5. This continues so long as cylinder 8 remains raised and to any  
95 point of cut-off desired. It will thus be seen that the action of the valve 5 through the pistons 5<sup>a</sup> and 6 results from and is controlled by the movement of the cylinder 8, which may be regulated to be in any relation  
100 to the movements of the engine-shaft desired and at any point of cut-off. As the cylinder 8 is substantially balanced in the working medium, relatively small power will be required to actuate said cylinder. The friction  
105 thereof may be reduced to a minimum. As the efficiency of cylinder 8 depends upon the completion of its circuit around piston 5<sup>a</sup> and the closing of its contact at one end with the walls of the chest, it will be seen that any  
110 means employed to accomplish these objects will fall within the invention. One method of actuating said cylinder and of applying the functions thereof, which may offer some advantages, is set forth in Fig. 3. In this instance the cylinder 8 is shown cut in halves  
115 longitudinally. The half 8<sup>a</sup> may be fixed upon the floor of the chest 2 and the half 8<sup>b</sup> be arranged to move laterally away from and to the half 8<sup>a</sup>, or both parts may be moved, if  
120 desired. By this means the same operation and effect are produced upon the piston 5<sup>a</sup> as in the instance mentioned of moving said cylinder longitudinally. Any known means  
125 may be used to move the parts of said cylinder into and out of contact with each other. Mechanism for the lateral movement is set forth in Figs. 2 and 3, 21 being a cylinder placed longitudinally with the movement of  
130 said parts of cylinder 8, to which it is operatively connected through the piston 22, moving in cylinder 21, and the rod 23 connected with said part of cylinder 8 and passing through the piston 22 and the wall 24 of chest

2. One side of the cylinder 21 may be exhausted of air, or the air therein may be put under any desired compression, and the other end of said cylinder may be under the pressure of the operating medium in chest 2, so that the power of the mechanism applied to actuate the rod 23 may be reduced to a minimum and the pressure of the working medium or of the atmosphere may be used to cushion the contact of the parts of cylinder 8.

I claim and desire to secure by Letters Patent—

1. The combination of a valve, a cylinder, a piston fitting said cylinder and connected with said valve, a port closed and opened by said valve, a chest above the piston and cylinder, and means for admitting a working medium continuously thereto, and means whereby to control the flow of the working medium to said cylinder below the piston, substantially as set forth.

2. In valves, a valve made integral with or attached to a piston of larger area than the face of said valve, a seat for said valve, a cylinder adapted to fit and cooperate with said piston, and means for applying the pressure of the working medium constantly to one side and alternately to both sides of said piston, for either actuating or for balancing said piston and said valve, substantially as set forth.

3. A valve, a piston attached to the stem of said valve a cylinder adapted to fit and to cooperate with said piston and means for applying the pressure of the working medium alternately to one and to both sides of said piston, for actuating and also for balancing said piston and said valve, substantially as set forth.

4. A valve, a piston attached to said valve, a movable cylinder adapted to fit and cooperate with said piston, in combination with means for moving said cylinder longitudinally in directions parallel with the movements of said valve, whereby the end of said cylinder is alternately closed and opened and the pressure of the working medium is applied to actuate and to balance said piston and to move said valve.

5. A valve, a piston attached to the stem of said valve a cylinder adapted to fit and cooperate with said piston, means for applying the pressure of the working medium to one or to both sides of said piston for either balancing or varying the pressure to produce one of the reciprocating movements of said piston, in combination with mechanical means for producing one of the reciprocating movements of said piston, whereby said valve is seated and unseated, substantially as set forth.

6. A valve, a piston attached to the stem of said valve a seat for said valve, a piston operatively connected with said first piston, independent cylinders adapted to fit and cooperate with said pistons respectively, in combination with means for varying the effect of the pressure of the working medium alter-

nately upon said two pistons, whereby said pistons are given a reciprocating movement and said valve is seated and unseated, substantially as set forth.

7. A valve, a piston attached to the stem of said valve a seat for said valve, a movable cylinder adapted to fit and cooperate with said piston, a second piston operatively connected with said first piston, a fixed cylinder adapted to fit and cooperate with said second piston, and a valve-chest in combination with means for moving said movable cylinder longitudinally into and out of contact with a wall of the chest, whereby the end of said movable cylinder is alternately closed and opened and the pressure of the working medium is applied alternately to balance and to actuate the piston therein alternately with and against the resistance of said second piston and said pistons cooperate to seat and unseat said valve.

8. A valve, a piston attached to the stem of said valve a cylinder adapted to fit and receive the movement therein of said piston, said cylinder being closed at its upper end and containing in said upper end an elastic medium, as a gas or fluid, for cushioning or limiting the movement of said piston therein, in combination with means for regulating or partially releasing the pressure of said piston upon said elastic medium; whereby the opening or upward movement of said valve is cushioned.

9. The combination of a valve, made integral with or attached to a piston of larger area than the face of said valve, a seat for said valve, a movable cylinder adapted to fit and cooperate with the movements of said piston and to be moved to a contact with or to surround said seat; whereby a chamber is formed below the piston and the working medium admitted to or excluded therefrom, substantially as described.

10. A valve, a piston attached to the stem of said valve, a seat for said valve, a movable cylinder adapted to fit and cooperate with said piston, a second piston operatively connected with said first piston, a fixed cylinder adapted to fit and cooperate with said second piston, in combination with means for moving said movable cylinder; whereby the chamber inclosed by said cylinder and below the first piston is alternately closed and opened and the pressure of the working medium is applied alternately to balance and to actuate the piston therein alternately with and against the resistance of said second piston and said pistons cooperate to seat and unseat said valve.

In witness whereof I have hereunto set my hand, in the presence of two witnesses, this 28th day of November, 1898.

WILLARD R. GREEN.

Witnesses:

LEE D. CRAIG,  
JOHN WARD NYE.