W. F. GOULD.

BALANCED VALVE.

APPLICATION FILED MAY 19, 1909.

1,014,592.

Patented Jan. 9, 1912.

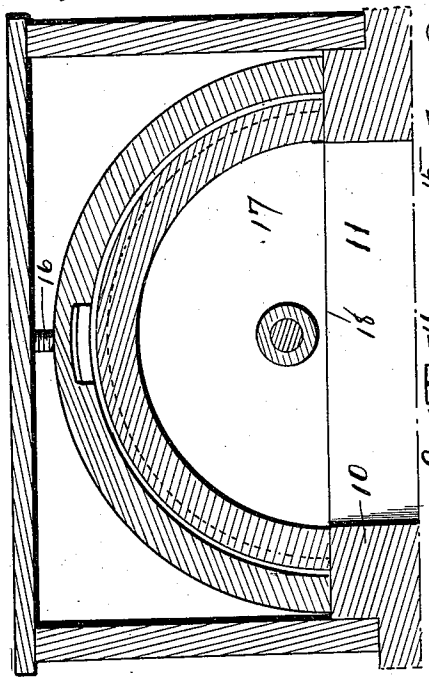

Fig. 2.

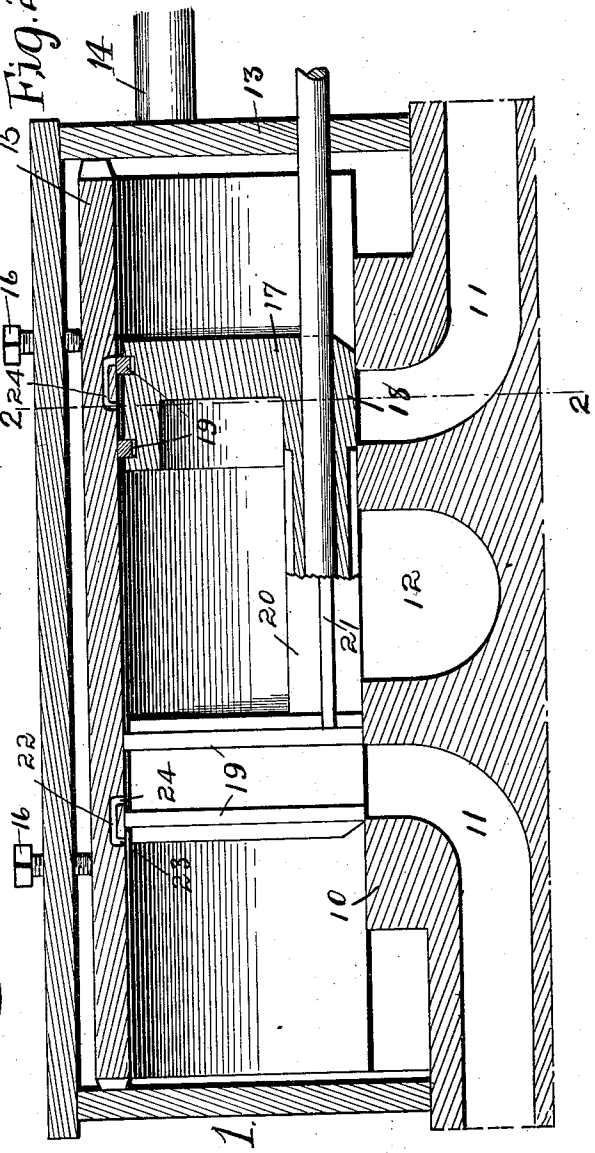

Fig. 1.

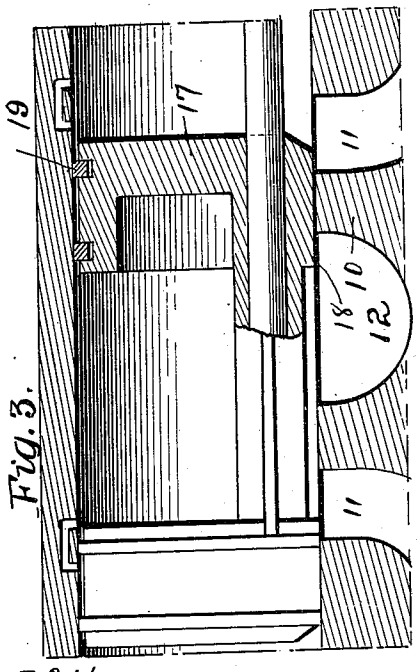

Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

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BALANCED VALVE.

1,014,592. Specification of Letters Patent. Patented Jan. 9, 1912.

Application filed May 19, 1909. Serial No. 496,894.

To all whom it may concern:

Be it known that I, WILLIAM F. GOULD, a citizen of the United States, residing at Des Moines, in the county of Polk and State of Iowa, have invented a certain new and useful Balanced Valve, of which the following is a specification.

My invention relates to that class of valves in which a valve cover is employed to prevent pressure of the steam chest steam upon the outer surface of the valve.

The object of my invention is to provide a valve of the class known as slide valves, with means whereby the valve will be yieldingly held by steam pressure from the steam chest against the valve seat at such times during the stroke of the valve as there is an outward pressure upon the inner surface of the valve caused by the induction port pressure of the engine.

My invention consists in the construction, arrangement, and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which—

Figure 1 shows a vertical, central sectional view of a portion of a valve seat with the induction and exhaust ports therein, a steam chest, a slide valve, and a valve cover embodying my invention. Fig. 2 shows a sectional view of same on the line 2—2 of Fig. 1, and Fig. 3 shows a view similar to Fig. 1 with the valve in a different position, the ends of the steam chest and valve cover being removed.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate the valve seat in which there are two induction ports 11 and an exhaust port 12. The steam chest is indicated by the numeral 13 and is provided with a steam supply pipe 14. Within the steam chest is a segmental valve cover 15 normally held downwardly by means of the set-screws 16. Arranged between the seat and the steam chest is a slide valve 17 of the ordinary construction comprising two similar end portions each having on its under surface a seating portion 18 to rest on the valve seat, and a segmental body portion provided with two parallel grooves in its outer surface and with two packing bars 19 in said grooves, said packing bars being spaced apart as far as practicable within the limits of the body portion of the valve to thereby form a steam chamber between the packing bars. These packing bars have their ends adjacent to the valve seat on both sides of the valve. The valve is also provided with two sides 20 connecting the valve ends, each of said sides being provided with a packing bar 21 to engage the inner packing bars 19 on the valve ends, as shown in Fig. 1.

The parts before described are substantially similar to valves now in general use and said parts operate in the ordinary manner of valves of this class, hence a detailed description of the operation of same is deemed unnecessary.

I have provided simple and inexpensive means for providing a steam pressure upon the outer surface of the valve, with steam from the steam chest, that will be applied to the outer surface of the valve at the same time that the outward pressure upon the valve is applied from the induction port, which steam pressure upon the outer surface of the valve will be relieved at the same time that the port pressure is relieved and will be also applied at the same time that the port pressure is applied on both ends of the valve; that is to say, when one end of the valve is being subjected to outward port pressure, it will, at the same time, be subjected to an inward steam pressure by steam from the chest and the other end of the valve will be relieved from said steam pressure from the steam chest.

My improved means for admitting steam from the steam chest to the steam chambers on the outer surface of the valve comprises a steam chamber 22 formed in the valve cover and provided with two passageways 23 and 24 both leading to the under surface of the valve cover and being spaced apart from each other. The distance to which said passageways 23 and 24 are spaced apart is preferably slightly less than the distance between the packing bars 19 on one end of the valve, and the space between said passageways 23 and 24 is somewhat greater than the width of one of the packing bars. Said steam passageways are arranged in the valve cover substantially in the manner shown in Fig. 1, so that they will co-act with the valve and the packing bars thereon in admitting steam to the steam chamber be-

tween the packing bars 19 and discharging it from said steam chamber in the manner hereinafter described. It is to be understood in this connection, that there are two kinds of port pressure against which the valve must be balanced. First, when the end of the valve that is adjacent to the induction port through which steam is being delivered to the cylinder is in position partly covering the induction port, the live steam within the induction port will press outwardly upon that part of the valve that overlaps the induction port. This kind of steam pressure outwardly on the valve, I have termed hereinafter as "live steam pressure"; second, when the piston approaches one end of the cylinder, it will compress the steam therein and force it out through the adjacent induction port, and this compressed steam will exert an outward pressure upon the part of the valve that overlaps said port, and for convenience in the description, I have termed this kind of steam pressure as "compressed steam pressure".

Referring to Fig. 1 of the drawings and assuming that the valve is moving toward the left, it is obvious that there is no port pressure on the right end of the valve from the adjacent induction port, and, therefore, there is no need for applying pressure to the outer surface of the valve. Assuming, however, that the valve moves toward the left a slight distance, it is obvious that the passage-way 24 will be opened to permit live steam from the steam chest to enter the steam chamber on the outer surface of the valve, and as the valve moves a slight distance farther toward the left, the steam from the steam chest will enter the adjacent induction port. This will cause a pressure upon the under surface of the valve in a direction away from the valve seat, which pressure will be counter-balanced by the live steam pressure within the steam chamber on the outer surface of the valve. As soon as the valve moves far enough to the left so that there will be no outward steam pressure upon it from the induction port, then the right one of the packing bars 19 will move beyond the passage-way 23 to prevent further admission of steam into said steam chamber from the steam chest. After the supply of steam from the chest to the steam chamber between the packing bars 19 is cut off in the manner described, the pressure of the steam in said steam chamber on the outer surface of the valve will gradually diminish substantially in proportion to the decreased pressure upon the under surface of the valve as the valve moves away from the induction port. In Fig. 3 of the drawings, the valve is shown in position where it substantially uncovers the right induction port and when in said position, the steam chamber between the packing bars 19 is some distance away from the passage-way to supply steam to it from the steam chest.

Referring again to Fig. 1 of the drawings, particularly to the left end of the valve, and assuming that the valve is moving toward the left, it is obvious that the valve has just cut off the flow of steam from the steam chest into the left induction port and that, therefore, the pressure within the left induction port is substantially equal to that within the steam chest, hence the passage-way into the steam chamber on the outer surface of the valve is open to balance the pressure upon the valve. As the valve travels toward the left a short distance, it will soon cut off the passage-way 23. This will occur at about the time when the left end of the valve passes beyond the left induction port far enough to permit the exhaust to commence, and the pressure upon the outer surface of the valve will gradually decrease by means of the condensation and leakage around the packing bars as the left end of the valve passes beyond the left induction port, and by the time the left end of the valve reaches the position shown in Fig. 3, at the right of the figure, any steam left in the steam chamber on the outer surface of the valve will also pass into the exhaust. Then as the left end of the valve begins to move toward the right, the piston will begin to approach the adjacent end of the cylinder and it will begin to compress the steam in the left end of the cylinder, thus causing a pressure outwardly upon the valve. The time when this compression pressure is greatest is just before the left end of the valve moves to position for commencing to admit steam into the left steam induction port, and it is at the same time that the left passage-way in the valve cover admits steam into the steam chamber on the back of the valve. In other words, each end of a valve is subjected first to an outward compression steam pressure and then immediately following same, it is subjected to an outward steam pressure by live steam from the steam chest, which continues for a greater part of its stroke than does the compression steam pressure. The passage-ways in the valve cover are so arranged that they will admit steam from the steam chest to the steam chamber between the packing bars when said compression steam pressure begins and will continue to admit steam until after the live steam pressure begins, and said steam pressure upon the outer surface of the valve will be cut off before the valve uncovers the induction port that is admitting live steam. However, the pressure of steam within the chamber between the packing bars will gradually diminish by leakage and condensation during the time that the induction port is being uncovered and then when the induction port is wholly uncovered as shown

to the left in Fig. 3, any steam remaining in the chamber between the packing bars may pass into the exhaust. It is obvious that there is practically no steam chest pressure upon the valve tending to hold it toward its seat because the valve cover prevents same, and the valve would be perfectly balanced by means of the cover alone if it were not for the port pressure.

By my improved arrangement, I have provided for admitting steam from the steam chest to the chambers between the packing bars on the valve at such times and in such quantities as to approximately counter-balance the port pressure upon the under surface of the valve during the times when said pressure exists.

I claim as my invention—

1. The combination of a steam chest, a valve seat having induction ports, a slide valve on the valve seat, a steam chamber formed on the outer surface of the slide valve and closed from communication with induction ports at all positions of the slide valve, a valve cover within the steam chest being provided with a passageway designed to admit steam from the steam chest into said steam chamber during a portion of the valve stroke.

2. The combination of a steam chest, a valve seat having induction ports, a slide valve on the valve seat having a steam chamber on the outer surface of each end, said chambers being closed from communication with induction ports at all positions of the slide valve, a valve cover being provided with two passageways, each being designed to admit steam from the steam chest to the steam chamber on the adjacent end of the valve during a part of the valve stroke.

3. The combination of a steam chest, a valve seat having induction ports, a slide valve on the valve seat, a steam chamber formed on the outer surface of the slide valve and closed from communication with induction ports at all positions, a valve cover within the steam chest being provided with a passageway designed to admit steam from the steam chest into said steam chamber during a portion of the valve stroke, and also being designed to permit steam to exhaust from the steam chamber during a part of the valve stroke.

4. The combination of a steam chest, a valve seat having induction ports, a slide valve on the valve seat having a steam chamber on the outer surface of each end, said chambers being closed from communication with induction ports at all positions of the valve, a valve cover being provided with two passageways, each being designed to admit steam from the steam chest to the steam chamber on the adjacent end of the valve during a part of the valve stroke, said passageways being also designed to permit steam to exhaust from the chambers on the ends of the valve during a part of the valve stroke.

5. The combination of a steam chest, a slide valve therein having a steam chamber on its outer surface, a valve cover being provided with a steam chamber having passage-ways at its ends leading to the surface of the valve cover adjacent to the valve, said passage-ways being spaced apart slightly less than the width of the steam chamber on the outer surface of the valve.

6. The combination of a steam chest, a slide valve therein having grooves on its outer surface, packing bars in said grooves to form a steam chamber between them, a valve cover being provided with a steam chamber having passage-ways at its ends leading to the surface of the valve cover adjacent to the valve, said passage-ways being of less width than the width of the packing bars so that the packing bars will cut off each passage way when in position adjacent to it.

7. The combination of a steam chest, a slide valve therein having grooves on its outer surface, packing bars in said grooves to form a steam chamber between them, a valve cover being provided with a steam chamber having passage-ways at its ends leading to the surface of the valve cover adjacent to the valve, said passage-ways being of less width than the width of the packing bars so that the packing bars will cut off each passage way when in position adjacent to it, and said passage-ways in the valve cover being spaced apart from each other slightly less than the distance between the two packing bars.

8. The combination of a steam chest, a slide valve therein having a steam chamber on its outer surface, a valve cover, a steam chamber therein having passage-ways at its ends leading to the surface of the valve cover adjacent to the valve, a valve seat having an induction port, said parts being so arranged that when the valve is in position to partially uncover the induction port to permit steam from the chest to enter the induction port, the steam chamber on the outer surface of the valve will be in such position that steam from the chest may enter one of said passage-ways and discharge through the other into the steam chamber on the outer surface of the valve.

9. The combination of a valve seat having an induction port therein, a valve mounted on the seat, two packing bars spaced apart on the valve to form a steam chamber between them, a valve cover in engagement with the packing bars, a steam chest, said valve cover being provided with a steam chamber having passage-ways at its ends leading to the surface of the valve cover adjacent to the valve, and said passage-ways

being so arranged relative to the induction port that steam will be admitted from the steam chest into the steam chamber on the outer surface of the valve during that portion of the valve stroke in which there is a compression steam pressure on the under surface of the valve and also when there is a live steam pressure on the under surface of the valve.

10. The combination of a valve seat having an induction port therein, a valve mounted on the seat, two packing bars spaced apart on the valve to form a steam chamber between them, a valve cover in engagement with the packing bars, a steam chest, said valve cover being provided with a steam chamber having passage-ways at its ends leading to the surface of the valve cover adjacent to the valve, and said passage-ways being so arranged relative to the induction port that steam will be admitted from the steam chest into the steam chamber on the outer surface of the valve during that portion of the valve stroke in which there is a compression steam pressure on the under surface of the valve and also when there is a live steam pressure on the under surface of the valve, said passage-ways being also so arranged that they will permit steam to exhaust from the chamber between the packing bars during that portion of the valve stroke in which the exhaust is passing outwardly through the induction port.

11. The combination of a valve seat having induction ports at its ends, and an exhaust port at its central portion, a slide valve mounted thereon having two end portions and open at its center, two packing bars at each end of the valve spaced apart to form steam chambers between them, a valve cover, a steam chest, said valve cover being provided with two steam chambers each having two passage-ways leading to the surface of the valve cover adjacent to the valve, and said passage-ways being so arranged as to admit steam from the steam chest to the adjacent steam chamber on the outer surface of the valve during that portion of the valve movement in which there is a compression steam pressure in the adjacent induction port upon the valve and during the time that there is a live steam pressure from the induction port upon the valve, said passage-ways being also arranged to permit the steam in said steam chambers between the packing bars to exhaust into the space between the ends of the valve during that portion of the valve stroke in which the induction port is in communication with the exhaust port.

Des Moines, Iowa, April 16, 1909.

WILLIAM F. GOULD.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."