No. 737,211. PATENTED AUG. 25, 1903.

C. A. DAIGH.

MULTIPORTED BALANCED VALVE.

APPLICATION FILED FEB. 15, 1902.

NO MODEL.

Fig 1

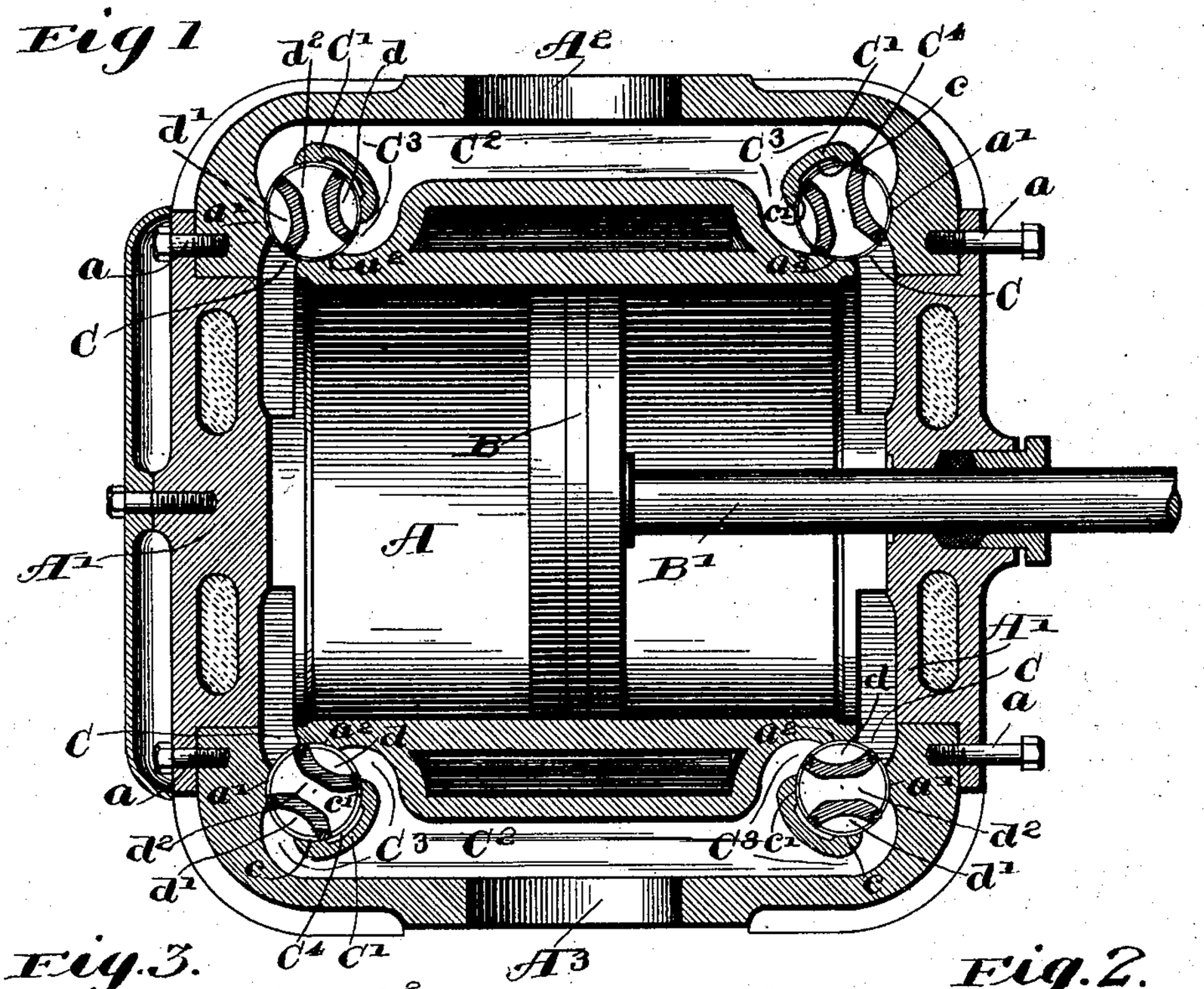


Fig. 3.

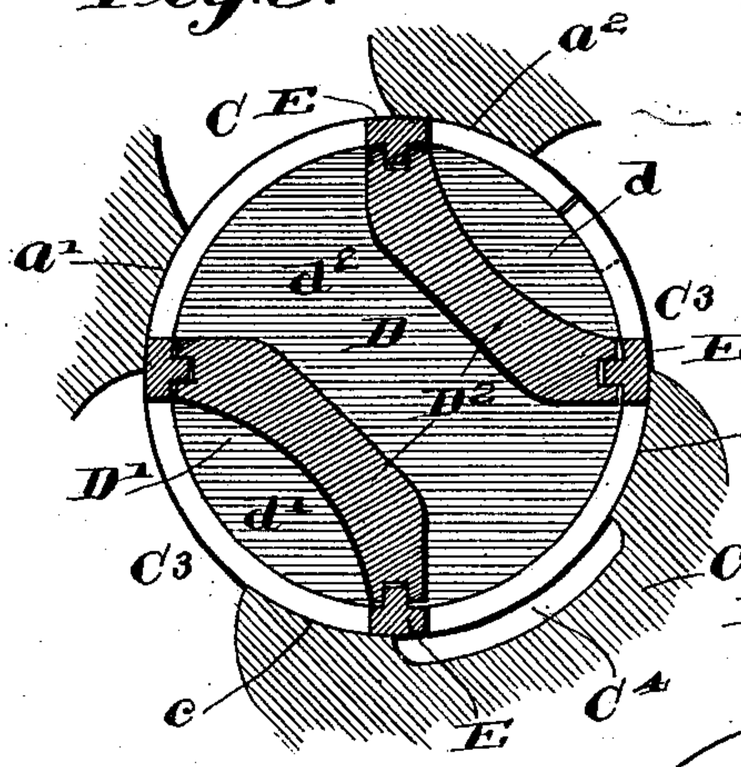


Fig. 2.

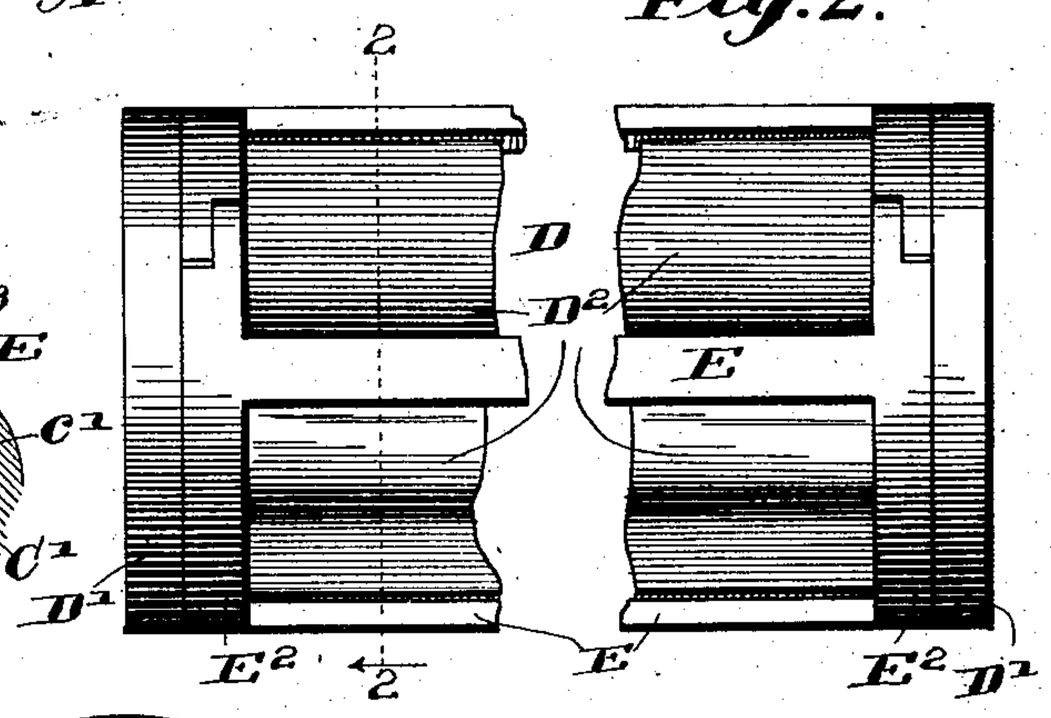
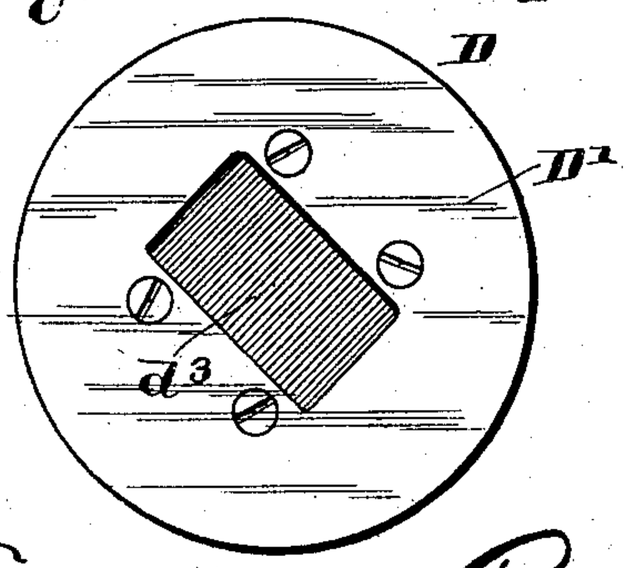


Fig 4



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No. 737,211. Patented August 25, 1903.

UNITED STATES PATENT OFFICE.

CHARLES A. DAIGH, OF CHICAGO, ILLINOIS.

MULTIPORTED BALANCED VALVE.

SPECIFICATION forming part of Letters Patent No. 737,211, dated August 25, 1903.

Application filed February 15, 1902. Serial No. 94,196. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. DAIGH, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Multiported Balanced Valves; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in rocking valves, the valve-seats, and packings therefor adapted to be applied to the well-known type of Corliss engines.

Among the objects of this invention are, first, to provide a construction whereby the speed of the engine may be considerably increased as compared with the valve mechanisms made under present practices; secondly, to provide a construction whereby the weight, size, and the cost of manufacture of the valve-gear may be largely reduced; thirdly, to make perfect steam-tight valve-faces and to reduce the friction to a minimum; fourthly, to produce a perfectly-balanced Corliss valve; fifthly, to provide a quick opening and a quick closing of the valve whereby a shorter cut-off may be effected and the expansion carried farther than with valve mechanisms of the prevailing type; sixthly, to provide a construction whereby the steam may be expanded lower, while at the same time a high efficiency will be obtained, and, seventhly, to provide a construction whereby the valve travel is greatly reduced as compared to a single-port unbalanced valve of the Corliss type.

These and other objects of the invention will be more fully comprehended by reference to the drawings, forming part of this specification, together with the subjoined description thereof, while the invention will be more fully pointed out in the appended claims.

In the drawings, Figure 1 is a vertical longitudinal-sectional view of a Corliss type of engine, showing my improved valves applied thereto. Fig. 2 is an outside view or elevation, enlarged, of one of the valves and its packing-ring removed from the engine. Fig. 3 is a transverse sectional view of the same, taken on line 2 2 of Fig. 2, with the valve-seats indicated in broken lines. Fig. 4 is an end elevation of the valve.

As shown in the drawings, A designates an engine-cylinder provided with front and rear heads A′ A′. B designates a piston within the cylinder, and B′ a piston-rod connected with the piston and extending through the rear cylinder-head. The cylinder-head A′ may be secured to the cylinder A in any suitable manner, as by bolts *a*. A^2 designates the steam-inlet, through which live steam is conveyed to the steam-valves from the source of supply adapted for communication with a supply-pipe, and A^3 designates the corresponding part of the exhaust-steam outlet, which is adapted to discharge into a pipe or other receptacle conveniently secured to the cylinder in the usual manner. These parts are of the usual construction and need not be further described or more fully illustrated, since they constitute in themselves no part of the present invention, excepting so far as they may coöperate with the valve proper.

D, Fig. 3, designates my improved valve. Four of said valves are shown in Fig. 1, the two upper valves being the steam-valves and the two lower the exhaust-valves. The seats for said valves are also alike, so that the description of one valve answers for all. Said valves are rotative and generally cylindric and engage cylindric seats formed partially in the cylinder-wall and partially in cover-plates C, attached to or forming part of the cylinder. The steam and exhaust openings A^2 A^3 communicate centrally with steam and exhaust passages C^2 C^2, which latter are formed at each end to constitute two branch steam passages or ports C^3, one leading to one side of the adjacent valve and the other to the opposite side thereof.

The valves consist each of two end plates D′ and two longitudinal webs or wings D^2, extending between and made rigid with the end plates. Said webs are of generally concavo-convex cross-section, with their convex sides turned toward each other. The longitudinal margins of the webs D^2 may constitute valve-faces and bear directly against the valve-seat; but preferably said margins are provided with wearing-bars E, constituting the valve-faces.

The valve-seats are divided into a plurality of cylindric segments, hereinafter termed "valve-seats." Two of the seats for each

valve are formed on the cylinder-wall, one on each side of the cylinder-port, and are lettered a' a^2. Said seats a' a^2 are engaged by the wearing-bars of the webs or wings constituting two of the valve-faces. On the opposide side of each valve in the proximate face of the cover-plate are formed two other seats c c', against which the other two bars E, constituting valve-faces, bear. The cover-plate seats are separated by a longitudinal groove or depression C^4, formed on the inner face of the cover-plate.

The arrangement of the webs in the manner described is such as to form three valve-ports d, d', and d^2, the two parts d and d' being disposed longitudinally of the valve on opposite sides thereof and formed in the concave parts of the webs and the port d^2 being located between the webs and extending transversely through the same from end to end of the valve. The webs may be strengthened by suitably-located stiffening-flanges or other devices, if desired. Said central port is at all times in open communication with the adjacent cylinder-port and with the depression C^4 of the cover-plate C'. The side ports d d' of the valve communicate directly with the branch ports or passages C^3 of the passage C^2. When the valve is closed, the cylinder-port is cut off from the passage C^2 and the pressure on the opposite sides of the valve is equalized, it being understood that the steam areas of both concave sides of the valve are equal. It will be noticed, furthermore, that the valve-faces when the valve is closed overlap the seats a', a^2, c, and c' about half of the width of the faces, as shown in Fig. 1. The exposed overlapping faces of the valve are therefore added to the steam area of the concave sides of the valves; but the area added at one side at the seat a' is balanced by the overlap of the valve-face at the seat c'. Moreover, when the valve is closed the cylinder-pressure acts against the upper and lower sides of the valve equally. One of the valve-faces overlaps the seat a^2 at one side and is subject to the direct cylinder-pressure, and this pressure is balanced by reactionary pressure against the overlapping face of the valve at the seat c, which is transmitted through the central port d'. It will be seen, therefore, that when the valve is closed the exterior pressures equalize each other and that the interior pressures also equalize each other, these pressures acting to balance the valve notwithstanding differences between the inner and outer pressures. In other words, the forces acting against the several surfaces of the valve produce a force the resultant of which is *nil*.

The steam-valves at the upper side of the cylinder rotate inwardly at their bottoms to open the same, while the tops of the exhaust-valves at the lower side of the cylinder rotate outwardly to open said valves. Said valves are actuated by a suitable valve-gear mechanism, which is constructed to open the steam-valve at one end of the cylinder and at the same time open the exhaust-valve at the opposite end of the cylinder, and vice versa. In Fig. 1 the steam-valve at the front end of the cylinder is shown open, while the exhaust-valve at the rear end of the cylinder is open, the other steam and exhaust valves being closed.

When one of the steam-valves is open, the ports d and d' are open to the cylinder-port between the seats a' a^2 and the wings of the valve, and the central port d^2, which is in constant communication with the cylinder-port, is also open through the passage C^4 and by-passes between the seats c c' and the adjacent wings of the valve to the steam-passages C^3. In this manner steam is supplied to the cylinder simultaneously through three ports. It will be observed that the wings or webs of the valve are so disposed with respect to their seats that both the side ports and the by-passes to the central port are opened equally and at the same time, so that the steam is free to pass equally through all of said ports, whereby there is no tendency of the friction of the flowing steam producing an overbalancing of the valve. The action of the exhaust-valves is the same as that of the steam-valves described, with the exception that the direction of the passage of the steam throughout is reversed.

A steam-tight packing completely covers the working face of each valve D, the same embracing the bars E, as stated, which terminate at their ends in or are connected with expansion-rings E^2. Said rings surround the outside of the ends of the valve D and have overlapping connection at their ends, as shown in Fig. 2, this construction permitting a packing engagement of the rings with the valve-seats. The end plates of the valves are attached to the wings or webs or to the parts on which they are formed by means of screws, as shown in Fig. 4, and said plates are provided with angular sockets d^3 to receive the inner enlarged ends of the shafts on which the valve rocks.

Any preferred form of mechanism for actuating said valves may be employed; but such mechanism forms no part of the present invention and is too well understood in the art to require illustration. It may be observed, however, that the valve-gear mechanism required for my improved construction may in practice be made from fifty to eighty per cent. lighter than the ordinary form of Corliss valve-gear, because of the accurate balance of the valve. In this manner a great saving of power to operate the valve is effected, as well as considerable saving in expense in the manufacturing of the valve-gear mechanism.

As before stated, inasmuch as the area of the opposite sides of each valve D, which communicate with the passages C^3 and cylinder-ports, are of equal areas, they are perfectly balanced when the valves are closed against steam-pressure in the steam-valves

and against air and steam or condenser vacuum in the exhaust-valves. It will be also observed that when each valve is opened the entire valve is filled inside and out with steam of equal pressure, and during the process of supplying or of exhausting the cylinder the pressure on all parts of the valve will be equal regardless of any variation in steam-pressure. Furthermore, the parts are so fashioned that the equalization of pressure against opposite sides of the valves will not vary in different parts of the travel of the valve.

An advantage of providing four seats against which the parts of the valve bear and between which and the valve steam passes to the cylinder when the valve is rocked is that thereby the travel of the valve is greatly reduced over one having a less number of seats. The cut-off is shorter and the expansion is carried farther than with any other type of valve, because there are four openings and four closings for each valve. The valve being practically frictionless and the travel greatly reduced, the valve-gear can be much lighter, and will consequently cost much less to construct.

Practical tests of this invention have demonstrated that not only a saving in cost will be effected in the construction of engines equipped with my invention, but that also in locomotive-engines a higher speed may be obtained, the start may be made quicker, a more nearly correct indicator-card will be seen, an equivalent reduction of steam for the same load and grade proximating twenty per cent. will be obtained, and that the reverse-lever can be handled at any point under two hundred pounds pressure with one-fifth the power of any of the so-called "balanced valves" on other type of engines now known, while in marine engines a reduction of clearance, a more nearly correct card, a better speed with the same amount of steam and pressure, or a greater economy of steam at the same speed will be obtained over marine engines now in use.

Modifications may be made in the construction and adaptation of my improved valve to engines designed for different uses, such as will suggest themselves to engine-builders having the foregoing description and illustration at hand, all of which I desire to be included within the scope and spirit of my invention.

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

1. The perfectly-balanced multiported Corliss valve shown and described, two opposite sides of which communicate with steam-passages which approach from opposite sides of the valve.

2. A balanced valve and its seat, the former, when open, forming three ports or openings, each of which communicates at the same time with the cylinder, the steam being conducted to the valve from opposite sides thereof.

3. The combination with a Corliss valve and its seat, said valve having two opposite side ports having equal steam areas and subject to equal pressures supplied from two separate passages, the remaining sides of the valves having equal steam areas with respect to each other and communicating with a central port which extends transversely through the valve and is in constant communication with the cylinder-port.

4. The combination with a Corliss valve and its seat, said valve having two opposite side ports which extend from end to end of the valve, and having equal steam areas and subject to equal pressures supplied from opposite sides of the valve, the remaining sides of the valves having equal steam areas with respect to each other and communicating with a central port which extends transversely through the valve from end to end thereof and communicating constantly with the cylinder-port.

5. The combination with a Corliss valve and its seat, said valve embracing two longitudinal webs which engage seats formed two at each side of the cylinder-port and two in a cover-plate located opposite to said cylinder-port, said seats in the cover-plate being separated by a port or passage, said valve being provided with two longitudinal side ports which are adapted to communicate with the cylinder-port and with said port of the cover-plate, and provided also with a central port which communicates with said plate-port and the cylinder-port.

6. In an engine comprising a cylinder, and steam inlet and exhaust passages, the valve-seats $c\ c'\ a'\ a^2$, the oscillating valve D having openings or passage-ways $d\ d'$ of equal area, and a central opening or passage-way d^2, and the ports C C^3 C^3 C^4, arranged and operating substantially as described.

7. A multiported balanced valve, provided exteriorly near each end with an expansion-ring and a plurality of bars connecting said rings and constituting a steam-tight packing, the outer surfaces of the bars and rings being adapted for engagement with the valve-seat.

8. A multiported balanced valve D provided with expansion-rings E^2 connected by bars E and the packing-plate D', substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 12th day of February, A. D. 1902.

CHARLES A. DAIGH.

Witnesses:
TAYLOR E. BROWN,
GERTRUDE BRYCE.