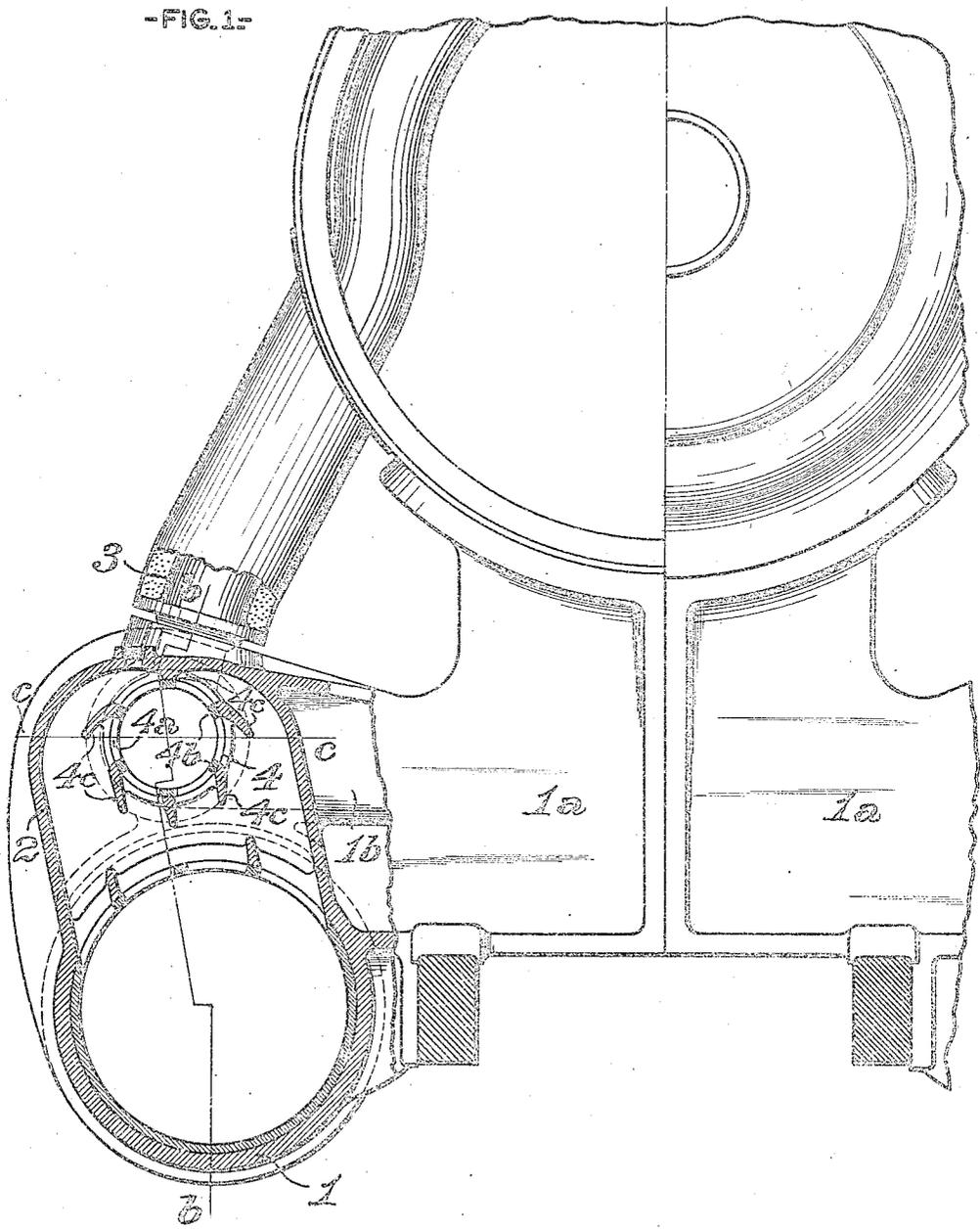


H. F. BALL & H. R. STAFFORD.
STEAM ENGINE CYLINDER.
APPLICATION FILED MAY 22, 1915.

1,151,237.

Patented Aug. 24, 1915.
3 SHEETS—SHEET 1.

-FIG. 1-



WITNESSES
Edward Wright
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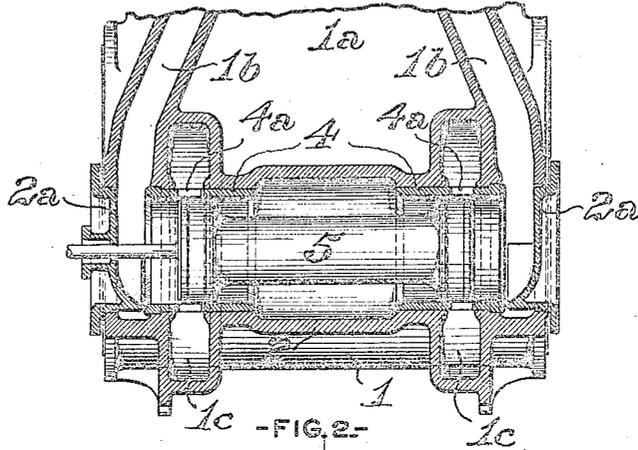
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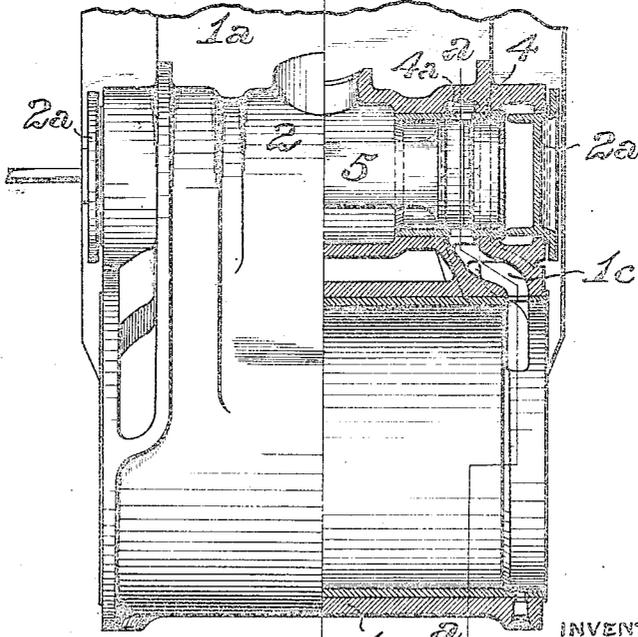
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 3 SHEETS—SHEET 2.

-FIG. 3-



-FIG. 2-



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WITNESSES

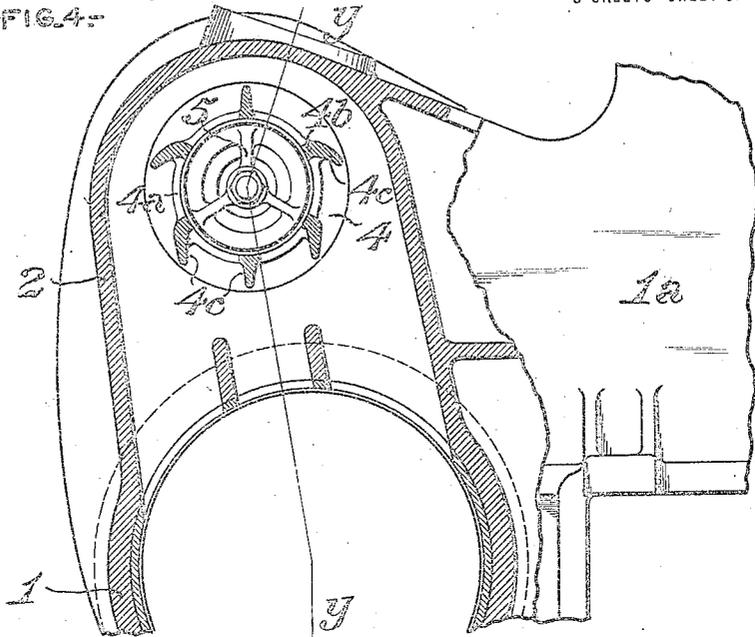
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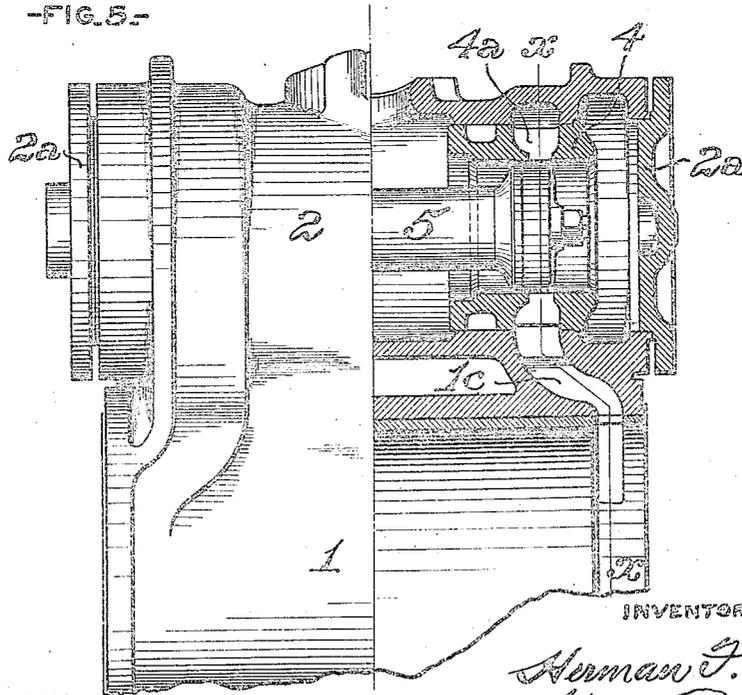
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3 SHEETS—SHEET 3.

-FIG. 4-



-FIG. 5-



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UNITED STATES PATENT OFFICE.

HERMAN F. BALL, OF NEW YORK, N. Y., AND HAL R. STAFFORD, OF PLAINFIELD, NEW JERSEY.

STEAM-ENGINE CYLINDER.

1,151,237.

Specification of Letters Patent.

Patented Aug. 24, 1915.

Application filed May 22, 1915. Serial No. 29,744.

To all whom it may concern:

Be it known that we, HERMAN F. BALL, of the borough of Manhattan, in the city of New York, and HAL R. STAFFORD, of Plainfield, in the county of Union and State of New Jersey, have jointly invented a certain new and useful improvement in Steam-Engine Cylinders, of which improvement the following is a specification.

Our invention relates to steam engine cylinders, the supply and exhaust of steam to and from which is controlled by distribution valves of the piston type, and, more particularly, to cylinders of locomotive engines, and its object is to so construct the ports or passages through which the ingress and egress of steam is effected, as to facilitate the traverse of steam through the same, and avoid retardation, acceleration, or eddying of the currents of steam, and to admit of the application of piston valves of smaller diameters than heretofore.

A further object of the invention is to so form the ports that in molding, fins or obstructions ordinarily presented at the junction cores will be eliminated from the ports proper, and so located that they will be cut away by the ordinary operation of boring the chamber for the valve bushing.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a front view, in elevation, of a pair of locomotive cylinder saddles, the right hand cylinder, which illustrates an embodiment of our invention, being in vertical transverse section on the line *a a* of Fig. 2; Fig. 2, a view of said cylinder, the left hand half of which is in side elevation, and the right hand half in longitudinal section on the line *b b* of Fig. 1; Fig. 3, a horizontal section on the line *c c* of Fig. 1; Fig. 4, a transverse section, on the line *x x* of Fig. 5, illustrating a structural modification; and, Fig. 5, a view of a cylinder so structurally modified, the left hand half of which is in side elevation, and the right hand half in longitudinal section on the line *y y* of Fig. 4.

As is familiar to constructors and operators of locomotive engines having piston distribution valves, said valves are ordinarily fitted in bushings which are fixed in valve chests cast integral with the cylinders, said bushings having ports communicating with the induction and eduction ports of

the cylinders, the ports of the bushing each comprising, and being divided into, a plurality of circumferential openings, by bridges connecting the portions of the bushings on opposite sides of the ports. The steam passes into and out of the induction and eduction ports of the cylinders, through said circumferential openings, but not being guided or divided into currents leading into and out of them, it is not equally distributed among them, and with the large diameters of piston valves now applied on locomotives, a considerable portion of the peripheries of the bushings are not fully effective for the ingress and egress of steam. Our invention is designed to overcome this objection, by providing for a substantial equalization of the avenues for the admission and delivery of steam to and from the several circumferential openings of the bushing ports, as well as to facilitate the fitting of the bushings in the cylinders.

Referring first to Figs. 1 to 3 inclusive, our invention is exemplified as applied in a locomotive cylinder, 1, which is cast integral with a half saddle, 1^a, and with a valve chest, 2, to the central portion of which steam is supplied from the boiler by an outside steam pipe, 3, and from the ends of which, steam is discharged through exhaust passages, 1^b, in the saddle, leading to an ordinary exhaust pipe. Bushings, 4, which are bored out to receive the heads of a piston distribution valve, 5, are fitted in the valve chest, adjacent to its ends, which are closed by removable heads, 2^a. The traverse of steam from the valve chest to each end of the cylinder, and from that end of the cylinder to the adjacent exhaust passage, 1^b, is effected through a circumferential port, 4^a, one of which is formed in each of the bushings. Each of the bushing ports, 4^a, is in continuously open communication with an induction and eduction port, 1^c, leading into the adjacent end of the cylinder, and the bushing ports are divided into circumferential spaces or openings, by bridges, 4^b, which connect the portions of the bushings located on the opposite sides of the ports.

In the construction above described, which is that ordinarily applied prior to our invention, it will be seen that by reason of the relation of the bushing port spaces or openings to the walls of the inclosing valve chest, the steam supply pipe, and the cylin-

der ports, and the absence of any means for equalizing the flow of steam to and from the several openings of each bushing port, the effective area for the traverse of steam through the same is diminished, and a tendency to retardation and eddying of the current of steam, as divided by the port bridges, is resultant.

In the practice of our invention, and for the purpose of effecting the flow of currents of steam of substantially equal volume to and from each of the openings between the bridges, 4^b, of the bushing ports, each of said bridges is extended outwardly from its port by an equalizing bridge, 4^c, which projects into the adjacent cylinder port, 1^c, and may, as shown in Figs. 1 and 2, be formed integral with the cylinder and valve chest casting which incloses said cylinder port. The angular relation of the several equalizing bridges, 4^c, to the bushing port bridges which they respectively adjoin, is such as to cause the volume of steam passing through the cylinder ports to be divided, before passing through the bushing ports, into currents of, as nearly as may be, equal volumes, these currents being given proper direction, at equal velocities, and prevented from interference, one with another, by the dividing action of the equalizing bridges, so that, when joining in the cylinder port, 1^c, they have a uniform flow in a common direction.

The structural modification shown in Figs. 4 and 5 conforms, in all essential particulars, with the construction first described, differing therefrom only in that the equalizing bridges, 4^c, are formed integral with the bushings, 4, instead of, as in the former instance, integral with the inclosing casting. Our invention enables piston distribution valves of smaller diameters to be substituted for larger ones in existing engines, the advantages of which, such as reduction of strain on valve gear, and of wear on valve packing rings, due to unbalanced pressure under the rings, have been recognized in practice.

We claim as our invention and desire to secure by Letters Patent:

1. The combination, with a steam engine

cylinder having induction and eduction ports adjoining its ends, of a valve chest having ports continuously open to the cylinder ports, piston valve bushings each having a port comprising a plurality of circumferential openings communicating with a valve chest port, and means for effecting the traverse of steam in substantially equal currents into and out of all of the several openings of the bushing ports.

2. The combination, with a steam engine cylinder having induction and eduction ports adjoining its ends, of a valve chest having ports continuously open to the cylinder ports, piston valve bushings each having a longitudinally bridged circumferential port communicating with one of the valve chest ports, and a plurality of equalizing bridges, each extending laterally from one of the bushing port bridges into the surrounding steam space.

3. The combination, with a steam engine cylinder having induction and eduction ports adjoining its ends, of a valve chest having ports continuously open to the cylinder ports, piston valve bushings each having a longitudinally bridged circumferential port communicating with one of the valve chest ports, and a plurality of equalizing bridges, extending laterally from each of the bushing port bridges into the surrounding steam space and varying in relative angular disposition to said bushing port bridges.

4. The combination, with a steam engine cylinder having induction and eduction ports adjoining its ends, of a valve chest having ports continuously open to the cylinder ports, piston valve bushings each having a longitudinally bridged circumferential port communicating with one of the valve chest ports, and a plurality of equalizing bridges, each formed integral with one of the piston valve bushings and extending from a port bridge thereof into the surrounding steam space.

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