(No Model.) 3 Sheets—Sheet 1.

W. FULLER.

VALVE MECHANISM FOR CONTROLLING HOT AIR BLASTS.

No. 548,636. Patented Oct. 29, 1895.

Witnesses.
E. B. Gilchrist
C. Edwards

Inventor.
Willard Fuller.
By M. D. Leggett & Co
his attorneys.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

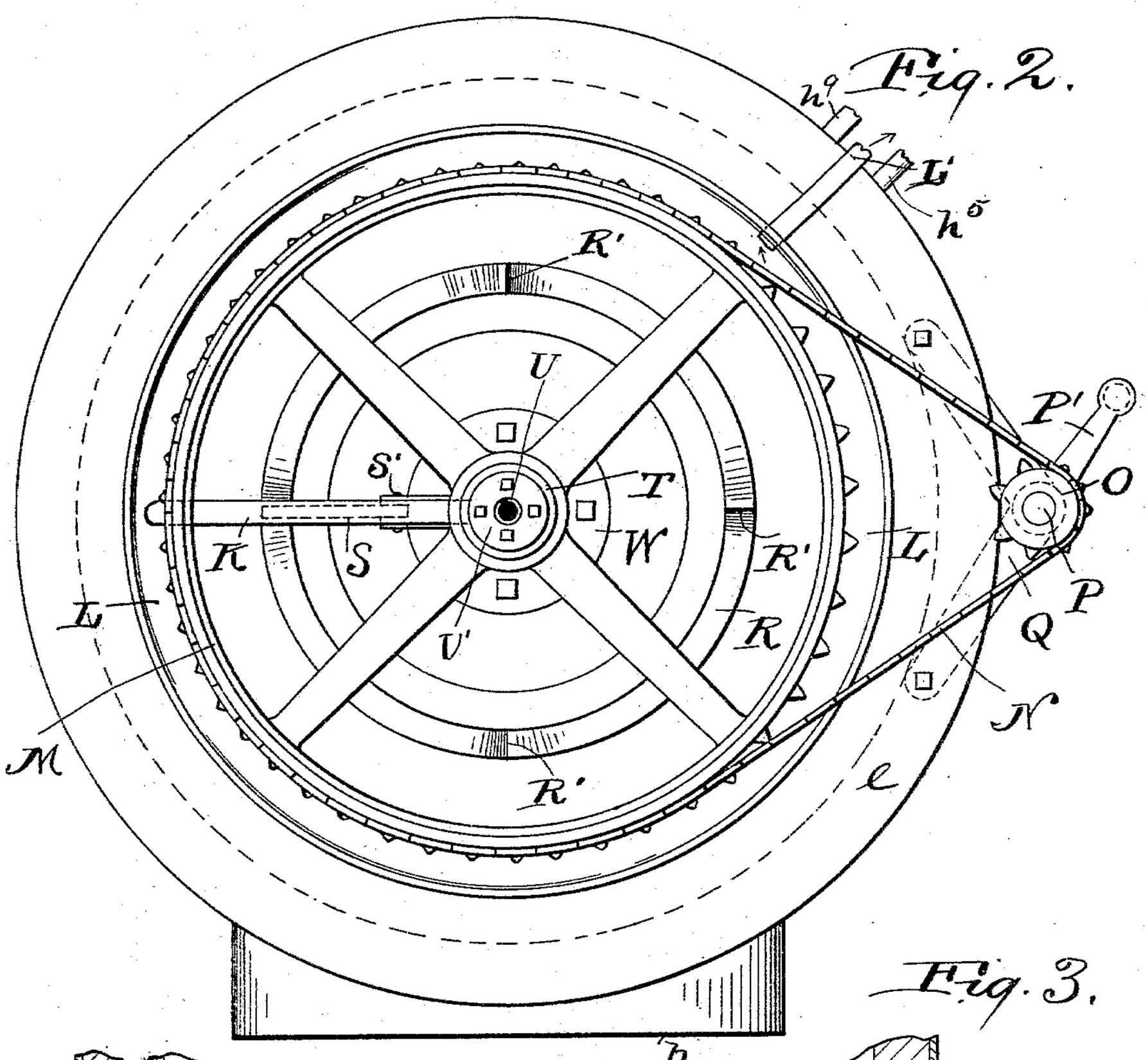
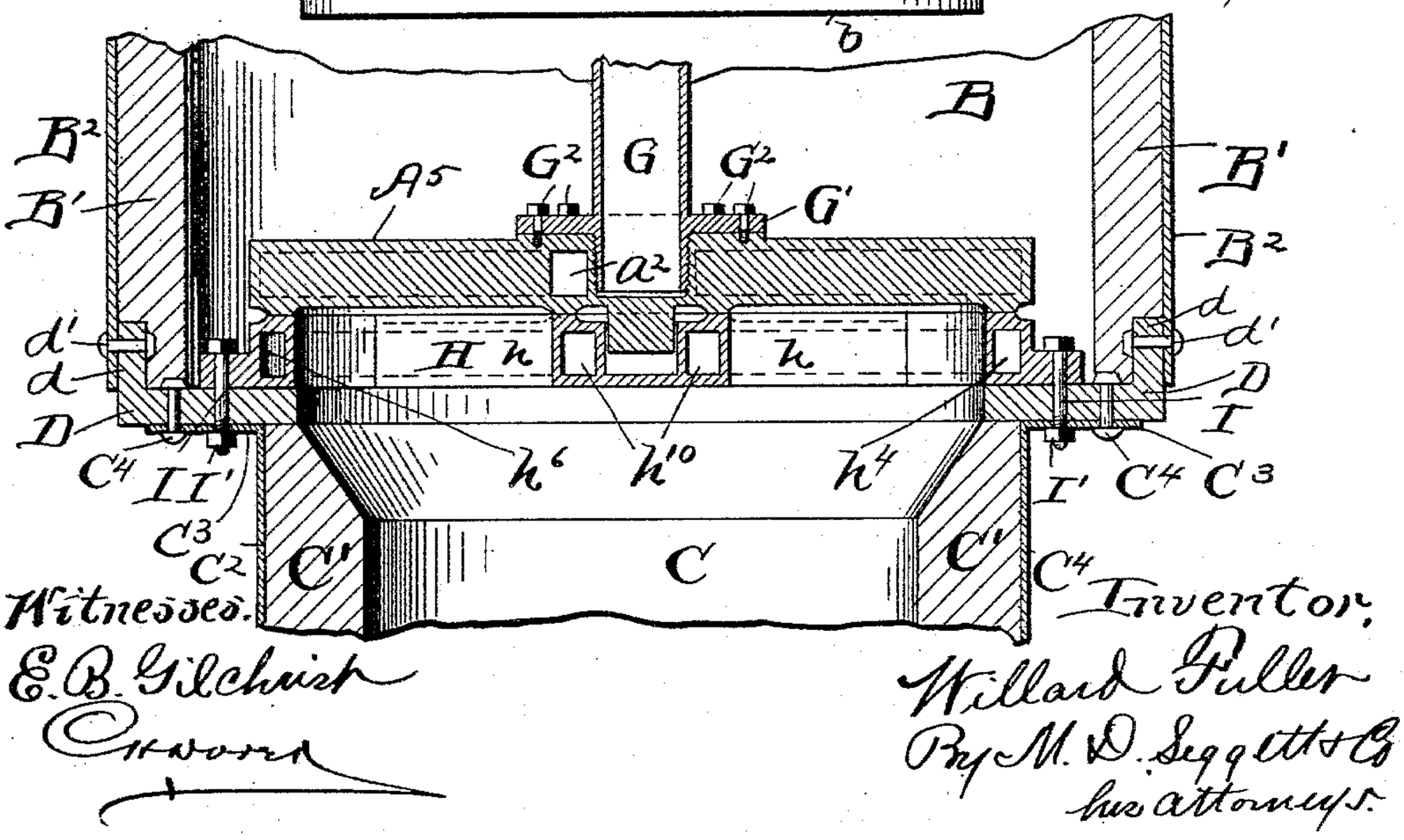


Fig. 3.



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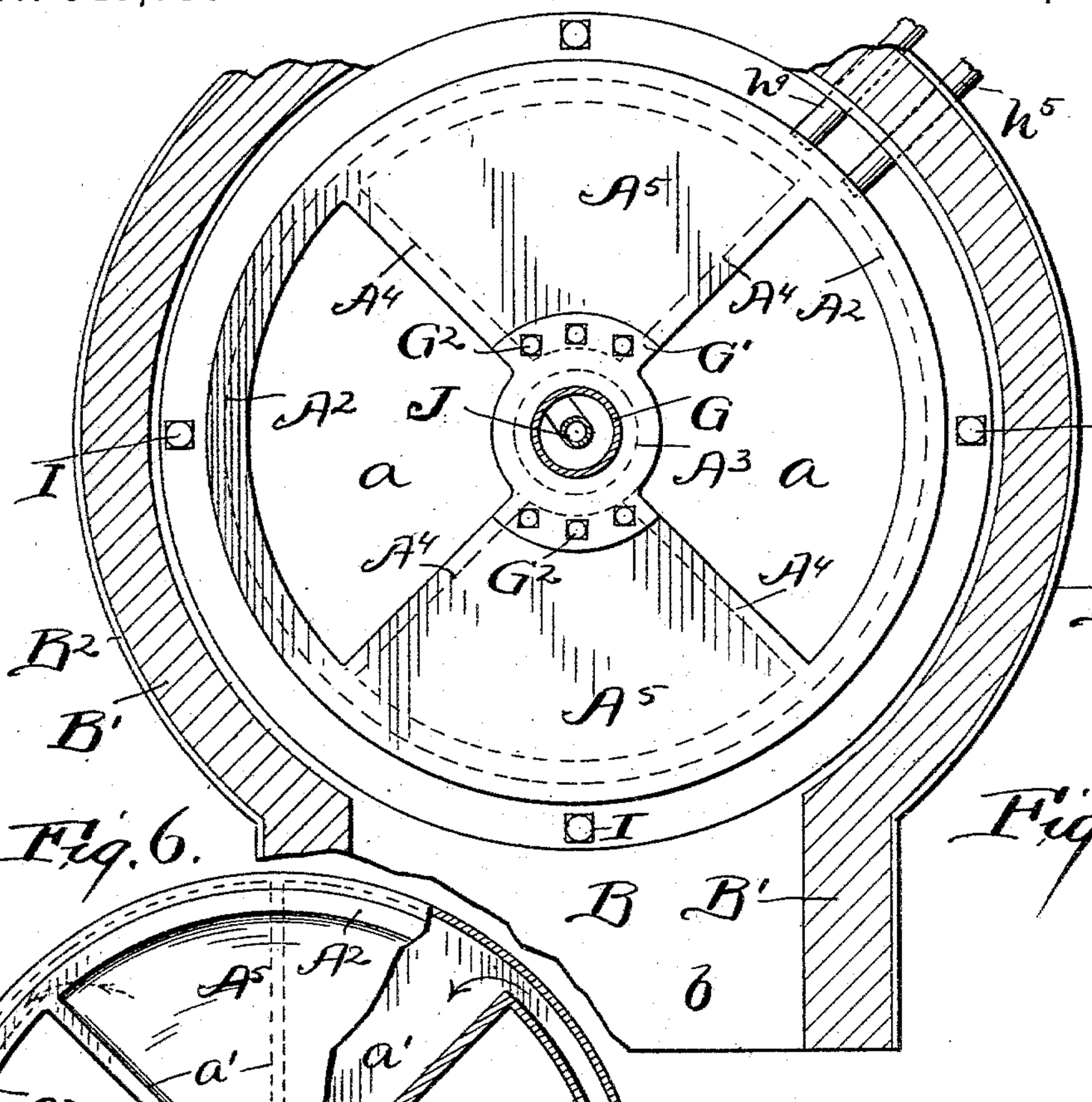


Fig. 6.

Fig. 4.

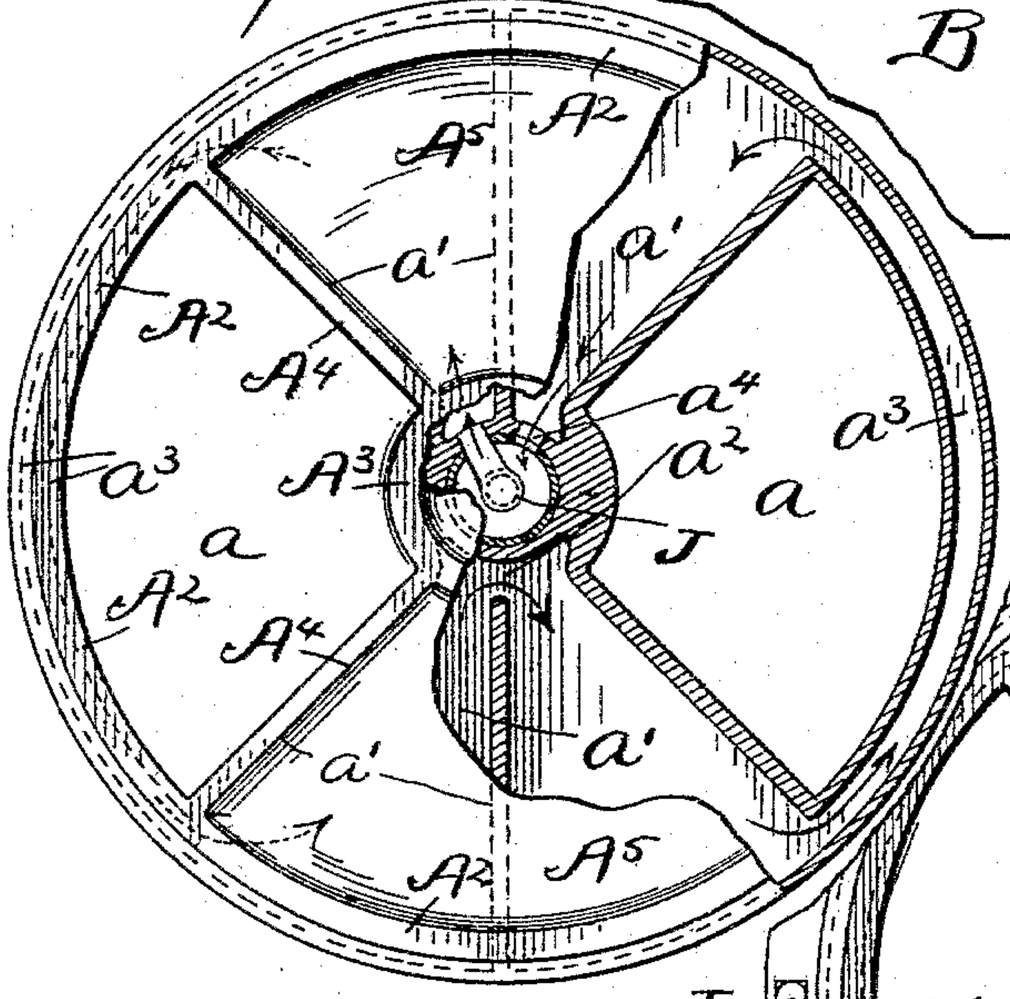
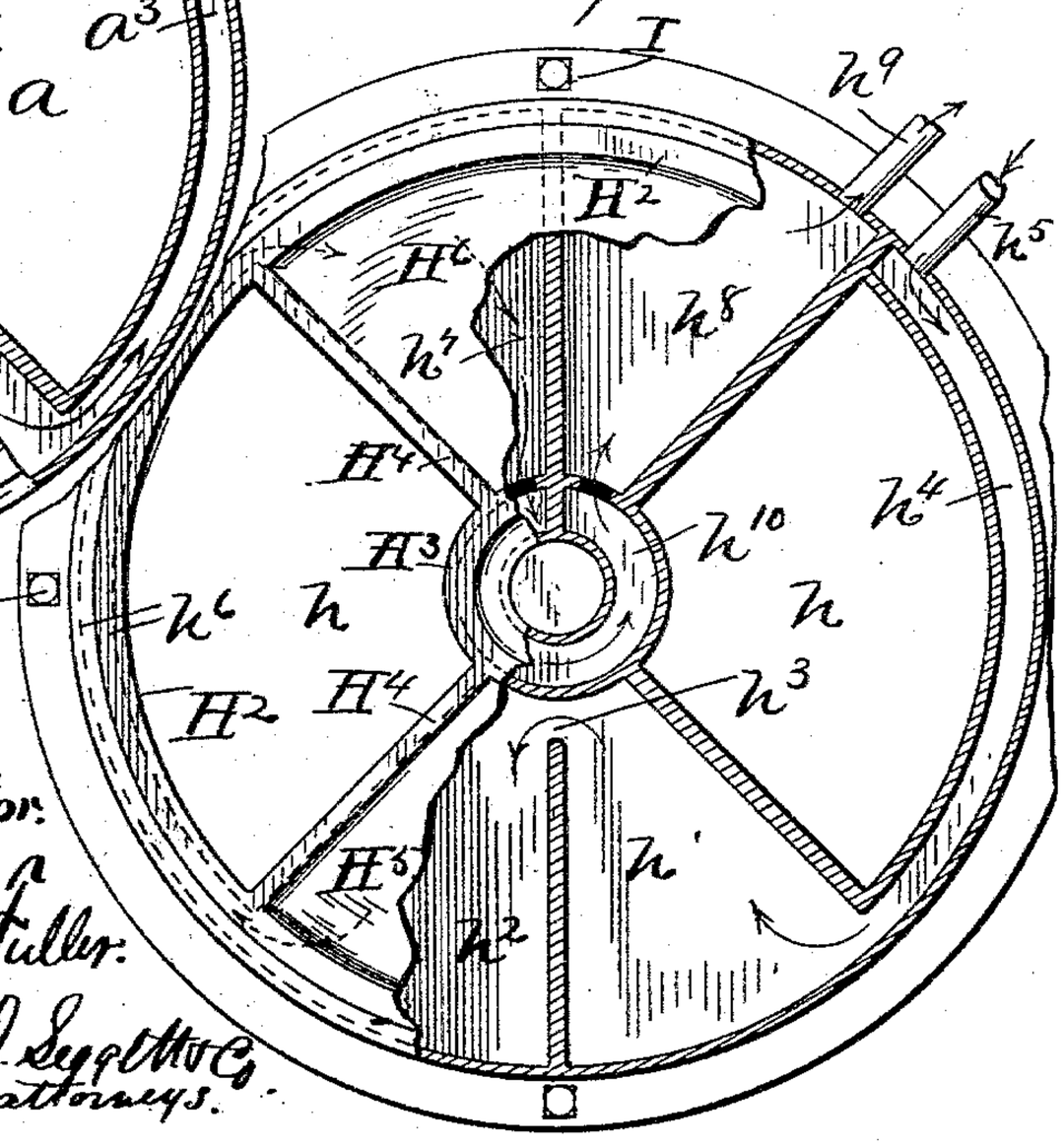


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLARD FULLER, OF CLEVELAND, OHIO.

VALVE MECHANISM FOR CONTROLLING HOT-AIR BLASTS.

SPECIFICATION forming part of Letters Patent No. 548,636, dated October 29, 1895.

Application filed May 7, 1895. Serial No. 548,373. (No model.)

To all whom it may concern:

Be it known that I, WILLARD FULLER, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Valve Mechanism for Controlling Hot-Air Blasts; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in valve mechanism for controlling hot-air blasts, more especially designed for use in controlling the passage-way between a blast-heating oven and blast-furnace.

Valve mechanisms, heretofore devised for the purpose involved either a slide-valve or what is termed a "mushroom-valve," and the valves and valve-seats of said valve mechanisms, owing to their great exposure to the highly-heated blast and dust and grit would soon corrode and be destroyed. In fact, the construction in valve mechanisms employing a slide-valve or a mushroom-valve affords the greatest exposure of the valve and valve-seat to the hot air, and affords liberal ingress to dust and grit between the valve and valve-seat, which accumulation of grit or dust, together with the exposure of the valve-seat and valve to the highly-heated air-blast, results in an early destruction of the valve and valve-seat.

To provide valve mechanism that is comparatively long-lived, and to attain certain other advantages hereinafter referred to, my invention consists in certain features of construction and combination of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of my improved valve mechanism partly in section and portions being broken away to reduce the size of the figure and to more clearly show the construction. Fig. 2 is a top plan of the same. Fig. 3 is a central vertical section of a portion of the valve mechanism, showing the valve in its closed position. Fig. 4 is a transverse section on line 4 4, Fig. 1, looking in the direction of the arrow. Fig. 5 is a face view of the seat of the valve with portions broken away and in section. Fig. 6 is a face view of the valve with portions broken away and in section.

Referring to the drawings, A designates the rotary valve of my improved valve mechanism, said valve being supported and operated as will hereinafter appear. Valve A (see Fig. 1) is shown arranged horizontally within a chamber B, whose surrounding wall B′ is preferably composed of brick surrounded by a sheet-metallic shell or case B^2.

Chamber B at its lower end is adapted to communicate with the passage-way C that leads from the blast-heating oven. (Not shown.) The surrounding walls of passage-way C are also preferably composed of brick C′, surrounded by a sheet-metallic shell or case C^2, that at the discharging end of passage-way C is provided with an external flange C^3, riveted, as at C^4, to an annular metallic plate or casting D, that is flanged laterally and upwardly, as at *d*, and has its said flange overlapping the inner side of and riveted to shell or case B^2, as at *d′*. Chamber B, at its upper end, is closed by a wall composed, preferably, of brick E, and beams or girders E′ instrumental in supporting said brick, and said wall at its outer side is covered with sheet metal *e*, that is suitably secured to an annular section F of angle-iron that is shown riveted to shell or case B^2, as at *f*. The surrounding wall of chamber B is provided with an opening *b*, at which the hot air or blast escapes into the blast-furnace (not shown) or place where the hot blast is to be used.

Valve A, employed for controlling the passage of the hot blast to the blast-furnace or place where the same is to be used, is operatively connected with a shaft G in any approved manner. Shaft G extends upwardly through chamber B and through a corresponding hole E^2 in the top wall of said chamber. The shaft in the case illustrated is shown externally screw-threaded at its lower end, (see Fig. 1,) which threaded end of the shaft engages a correspondingly-threaded hole in the hub A′ of the valve, and the shaft at the upper end of said hub is shown provided with an external flange G′, that is bolted, as at G^2, to the valve-hub.

H represents the seat for the valve, said seat being composed, preferably, of a circular metallic block, of bronze or other metal, that will withstand high degrees of heat, and which block is bolted, as at I, to any station-

ary object, and preferably to plate D and case C^3, and bolts I are preferably so arranged that their heads engage the upper surface of block H with the securing-nuts I′ mounted upon the shanks of the bolts at the under side of flange C^3 of case C^2, by which construction the valve-seat can, when it requires repairs or renewal after comparatively long usage or service, be bodily lifted or removed upon removing nuts I′.

Valve A is shown provided with two comparatively large openings *a*, (see Fig. 1,) arranged diametrically opposite, respectively, of the axis of the valve, which openings are adapted to register with corresponding openings *h* in block H. The bearing-surfaces of the valve (see Fig. 6) are preferably formed by a comparatively narrow smooth surface A^2, extending circumferentially and near the periphery of the under side of the valve by a comparatively narrow annular surface A^3, formed upon the under side of the hub of the valve, and by comparatively narrow radially-arranged surfaces A^4, formed upon said side of the valve between and connecting surfaces A^2 A^3. Surfaces A^2 and A^3 engage corresponding surfaces formed upon the upper side of block H—that is, the valve-seat formed upon said block H is composed (see Fig. 5) of comparatively narrow annular surfaces H^2 and H^3, that are engaged by surfaces A^2 A^3, respectively, of the valve, and the seat furthermore comprises comparatively narrow radially-arranged surfaces H^4, adapted in the closed or full-open position of the valve to be engaged by surfaces A^4 of the valve. The arrangement of parts is preferably such that surfaces A^2 and A^3 of the valve shall be exactly coincident with surfaces H^2 H^3 of the valve-seat, and so that radially-arranged surfaces A^4 of the valve shall, in the closed or extreme open position of the valve, be exactly coincident with the correspondingly-arranged surfaces H^4 of the valve-seat, the object of said coincidence between the engaging surfaces of the valve-seat and valve being to reduce their exposure to the hot blast to a minimum.

I would also remark that the valve-seat and valve would soon be ruined or destroyed if means were not employed for maintaining said parts in a comparatively cool condition. I therefore provide each of the two sections A^5 (see Fig. 6) of the valve that are located at opposite sides, respectively, of the hub of the valve and between openings *a* with two chambers *a′ a′*, and make said chambers as large as the construction of the valve will admit and establish communication between the inner ends of chambers *a′* in one of said sections A^5 of the valve by means of an opening a^2, formed in the dividing wall between said chambers and establish communication between the two chambers *a′*, located next adjacent to each opening *a*, by means of a channel or passage-way a^3, formed in the rim of the valve.

Shaft G is hollow or tubular, as shown in Fig. 1. A pipe J extends centrally and longitudinally through shaft G and at its lower end communicates with the inner end of one of the chambers *a′* of one of sections A^5 of the valve, and the inner end of the other chamber *a′* in said valve-section A^5 is in open relation by means of a port or passage-way a^4 with the interior of the shaft.

By the construction hereinbefore described it will be observed that a circulation of the water or cooling agent supplied by pipe J is from said pipe through the chamber directly connected therewith, thence by way of one of passage-ways a^3 into one of those two chambers *a′* that are in open relation with each other at their inner ends, thence into the other one of said chambers, and thence by way of the other passage-way a^2 into that chamber *a′* that is in direct open relation with the chamber formed within the hollow or tubular shaft, and thence up said shaft into a pipe K, that is in open relation with the interior of and secured to the shaft a suitable distance above the valve-casing. Pipe K extends downwardly and is adapted to discharge into an annular trough L (see Figs. 1 and 2) that rests upon the valve-casing, into which trough the water or cooling agent is discharged by pipe K, said trough being provided with a drain-pipe or outlet L′.

The means employed for maintaining the valve-seat in a comparatively cool condition is substantially the same as that employed in connection with the valve, and is as follows: Each of the two sections H^5 H^6 of block or valve-seat H that are located at opposite sides, respectively, of openings *h* in said block is (see Fig. 5) provided with two chambers. The two chambers *h′* h^2 of one of sections H^5 are in open relation with each other at their inner ends by means of an opening h^3, formed in the dividing-wall between said chambers, and one *h′* of said chambers, at its outer end communicates with a channel or passage-way h^4, formed in the rim of block H at the outer side of one of openings *h*. Channel or passage-way h^4 extends as near to section H^6 as practicable, and at the end adjacent to said section H^6 is in open relation with a pipe h^5, that supplies the water or agent employed for preventing the valve-seat from becoming overheated. The other chamber h^2 of section H^5, at its outer end, is in open relation by means of a channel or passage-way h^6, formed in the rim of block H at the outer side of the other opening *h*, with one h^7 of the chambers in section H^6. The other chamber h^8 in section H^6 communicates, at its outer end, with an outlet or delivery-pipe h^9, and the two chambers h^7 h^8, at their inner ends, communicate by means of holes or ports in the inner end walls of said chambers with opposite ends, respectively, of a channel or passage-way h^{10}, formed in the central portion of block H between openings *h* and concentrically about the center of said portion of the block. The circulation of the cooling agent through block

H from supply-pipe h^5, is, therefore, along passage-way h^4 into and through chamber h', thence into and through chamber h^2, thence into and through passage-way h^6, and thence successively through chamber h^7, passage-way h^{10}, and chamber h^8 to pipe h^9.

The mechanism employed for operating shaft G is preferably as follows: A sprocket-wheel M (see Figs. 1 and 2) is operatively mounted upon said shaft a suitable distance above pipe J, which sprocket-wheel is operatively connected, by means of a chain N, with a sprocket-wheel O, operatively mounted upon a shaft P, that is suitably supported at one side of the valve-casing, preferably by means of brackets Q, suitably secured to said casing, and at its lower end is provided with a crank or lever P′ or means for turning the same. The arrangement of parts is preferably such that the valve shall be actuated from a closing to a full-open position, or vice versa, by actuating or giving the valve a quarter-turn, and to this end the two openings through the valve-seat are located at diametrically-opposite sides, respectively, of the axis of the valve, and the two openings through the valve are correspondingly arranged, so that the valve, either in its closed or full-open position, only requires a quarter-turn thereof to bring it into its other position. The valve, however, being inclosed within the valve-casing is invisible, and to inform the operator when the valve has been given a quarter-turn, and not more nor less than a quarter-turn, in actuating the same from a full open to a closed position, or vice versa, I provide an indicator at the upper end of the valve-casing, which indicator comprises, preferably, a ring R, suitably secured to the upper end of the valve-casing and arranged concentrically with the axis of the valve-actuating shaft, said ring upon its upper face being provided with four upright shoulders R′, arranged at equal intervals and in the path of the free extremity of a pawl S, preferably a gravity-pawl, that is pivoted, as at S′, to a collar S^2, rigidly or operatively mounted upon the aforesaid shaft. The arrangement of parts is such that pawl S in the closed and full-open position of the valve shall be in engagement with one of the four shoulders R′ formed upon the face of ring R, and the surface of said ring gradually slopes from the lower end of each shoulder upwardly in the direction in which said shoulder faces to accommodate the movement of the pawl from the lower end of one shoulder to the upper end of the next succeeding shoulder in actuating the valve a quarter-turn. If the operator in actuating the valve, will give the shaft somewhat more than a quarter-turn and thereby move pawl S somewhat beyond the next succeeding shoulder, which he is likely to do, he should reverse the movement of the parts until the pawl squarely engages said succeeding shoulder and thereby assure himself that the valve has been actuated exactly one-fourth of a rotation.

Pipe J, that turns with the shaft, extends upwardly through the shaft and into a cap T that closes the upper end of the hollow shaft. A stationary supply-pipe U also extends into said cap and communicates with pipe J, and a stuffing-box U′, in the formation whereof cap T is instrumental, is provided around pipe U where the latter extends into said cap.

It will also be observed (see Fig. 1) that my improved valve mechanism accommodates the provision of an adequate stuffing-box W around the valve-actuating shaft, where the latter extends into and externally of the valve-casing, and that the pawl-bearing collar S^2 is located such a distance above the valve-casing as not to interfere with the provision of said stuffing-box.

What I claim is—

1. The combination with a hot-blast passage-way, of a rotary valve adapted to control the blast and located in the line of said passage-way, a seat for said valve, said seat being formed upon a suitably-supported metallic block, said block having holes therethrough, and the valve being provided with holes therethrough adapted to register with the aforesaid holes in the block, means for preventing the valve and valve-seat from becoming overheated, and suitable means for turning the valve and thereby establishing or interrupting communication between the aforesaid holes in the valve-seat and valve, substantially as set forth.

2. In valve-mechanism of the character indicated, the combination of a suitably constructed valve-casing, rotary valve within said casing, seat for the valve and formed upon a suitably-supported metallic block that has holes therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block, a shaft operatively connected with the valve and extending outside of the valve-casing, another shaft suitably supported externally and at one side of the valve-casing and provided with means for turning the same, said last-mentioned shaft being operatively connected with the aforesaid valve-engaging shaft, all arranged and operating substantially as shown, for the purpose specified.

3. In valve-mechanism of the variety indicated, the combination with the valve-casing provided with an eduction-opening b and a passage-way C leading to the chamber of said casing, of a rotary valve within said casing for controlling communication between said chamber and passage-way, a seat for said valve, said seat being formed upon a metallic block that has holes h therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block and being provided internally with a series of cooling-chambers and channels so arranged and connected as to form a circuitous passage-way, a hollow shaft operatively connected with the valve and extending outside of the valve-casing, means for turning

said shaft, a cooling-agent-supply-pipe suitably supported within the shaft and in open relation with one end of the aforesaid circuitous passage-way, and the other end of said circuitous passage-way being in open relation with the interior of the shaft, and a pipe K outside of the valve-casing and in open relation with the interior of and suitably supported from the shaft, all arranged and operating substantially as shown, for the purpose specified.

4. In valve-mechanism of the variety indicated, the combination with the valve-casing provided with an eduction-opening *b*, and a passage-way C leading to the chamber of said casing, of a rotary valve within said casing for controlling communication between said chamber and passage-way, a shaft operatively connected with the valve and extending outside of the valve-casing, means for turning said shaft, a seat for the valve, said seat being formed upon a suitably-supported metallic block that has holes *h* therethrough and is provided internally with a series of cooling-chambers and channels so arranged and connected as to form a circuitous passage-way, a cooling-agent supply-pipe in open relation with one end of said circuitous passage-way, and a discharge-pipe in open relation with the other end of said passage-way, all arranged and operating substantially as shown, for the purpose specified.

5. In valve-mechanism of the character indicated, the combination of the valve-casing, horizontally-arranged rotary valve within said casing, a seat for the valve, said seat being formed upon a suitably supported metallic block that has holes therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block, the seat and valve, upon their opposing faces, being each provided with two annular bearing-surfaces, arranged at suitable distance apart and concentric with the axis of the valve, and radially arranged bearing-surfaces connecting said annular bearing-surfaces, a shaft operatively connected with the valve and extending outside of the valve-casing, and means for turning the shaft, all arranged and operating substantially as shown, for the purpose specified.

6. In valve-mechanism of the variety indicated, the combination with the valve-casing provided with an eduction-opening *b* and a passage-way C leading to the chamber of said casing, of a horizontally-arranged rotary valve within said casing for controlling communication between said chamber and passage way, a seat for said valve, said seat being formed upon a metallic block that has holes therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block and being provided internally with a series of cooling-chambers and channels so arranged and connected as to form a circuitous passage-way, an upright tubular shaft suitably secured to the valve and extending outside of the valve-casing, a cooling-agent-supply-pipe suitably supported within said shaft and in open relation with one end of the aforesaid circuitous passage-way, the other end of said circuitous passage-way being in open relation with the interior of the shaft, a pipe K outside of the valve-casing, said pipe K being in open relation with the interior of and suitably supported from the shaft, means for turning the shaft, a cap T closing the upper end of the tubular shaft, a stationary pipe U extending into said cap and communicating with the pipe in the shaft, and a stuffing-box U′ formed about said stationary pipe where said pipe extends into the cap, substantially as shown, for the purpose specified.

7. In valve-mechanism of the variety indicated, the combination with the valve-casing provided with an eduction-opening *b* and a passage-way C leading to the chamber of said casing, of a horizontally-arranged rotary valve within said casing for controlling communication between said chamber and passage-way, a seat for said valve, said seat being formed upon a metallic block that has holes *h* therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block and being provided internally with a series of cooling-chambers and passage-ways so arranged and connected as to form a circuitous passage-way, a hollow shaft operatively connected with the valve and extending upwardly outside of the valve-casing, means for turning the shaft, a cooling-agent supply-pipe suitably supported within the shaft and in open relation with one end of the aforesaid circuitous passage-way, the other end of said circuitous passage-way being in open relation with the interior of the shaft, an annular trough L suitably supported on top of the valve-casing and arranged concentrically with the axis of the shaft, and a pipe K outside of the valve-casing, and in open relation with the interior of and suitably supported from the shaft, said pipe K being arranged to discharge into the aforesaid trough, substantially as set forth.

8. In valve-mechanism of the character indicated, the combination of the valve-casing, horizontally-arranged rotary valve within said casing, seat for said valve, said seat being formed upon a suitably supported metallic block that has holes therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block, an upright shaft operatively connected with the valve and extending outside of the valve-casing, means for turning said shaft, a ring R suitably supported on top of the valve-casing and arranged concentrically with the axis of the shaft, said ring, upon its upper surface, being provided with four upright shoulders R′ arranged at equal intervals, the upper surface of the shoulder-bearing ring sloping from the lower end of

each shoulder upwardly in the direction in which said shoulder faces, and a pawl S pivotally supported from the shaft and engaging the upper surface of said ring, all arranged and operating substantially as shown, for the purpose specified.

9. In valve-mechanism of the character indicated, the combination of the valve-casing, horizontally-arranged rotary valve within said casing, seat for said valve, said seat being formed upon a suitably supported metallic block that has holes therethrough, the valve having holes therethrough adapted to register with the aforesaid holes in the seat-forming block, an upright shaft operatively connected with the valve and extending outside of the valve-casing, means for turning said shaft, a ring R suitably supported on top of the valve-casing and arranged concentrically with the axis of the shaft, said ring, upon its upper surface, being provided with four upright shoulders R′ arranged at equal intervals, the upper surface of the shoulder-bearing-ring sloping from the lower end of each shoulder upwardly in the direction in which said shoulder faces, a collar S^2 operatively connected with the shaft a suitable distance above the valve-casing, pawl S pivotally supported from said collar, and stuffing-box W provided about the shaft where the latter extends into the valve-casing, all substantially as shown, for the purpose specified.

In testimony whereof I sign this specification, in the presence of two witnesses, this 29th day of March, 1895.

WILLARD FULLER.

Witnesses:
C. H. DORER,
L. WARD HOOVER.