

J. W. Forbes,

Balance Valve.

No. 98755.

Patented Jan. 11. 1870.

FIGURE 1.

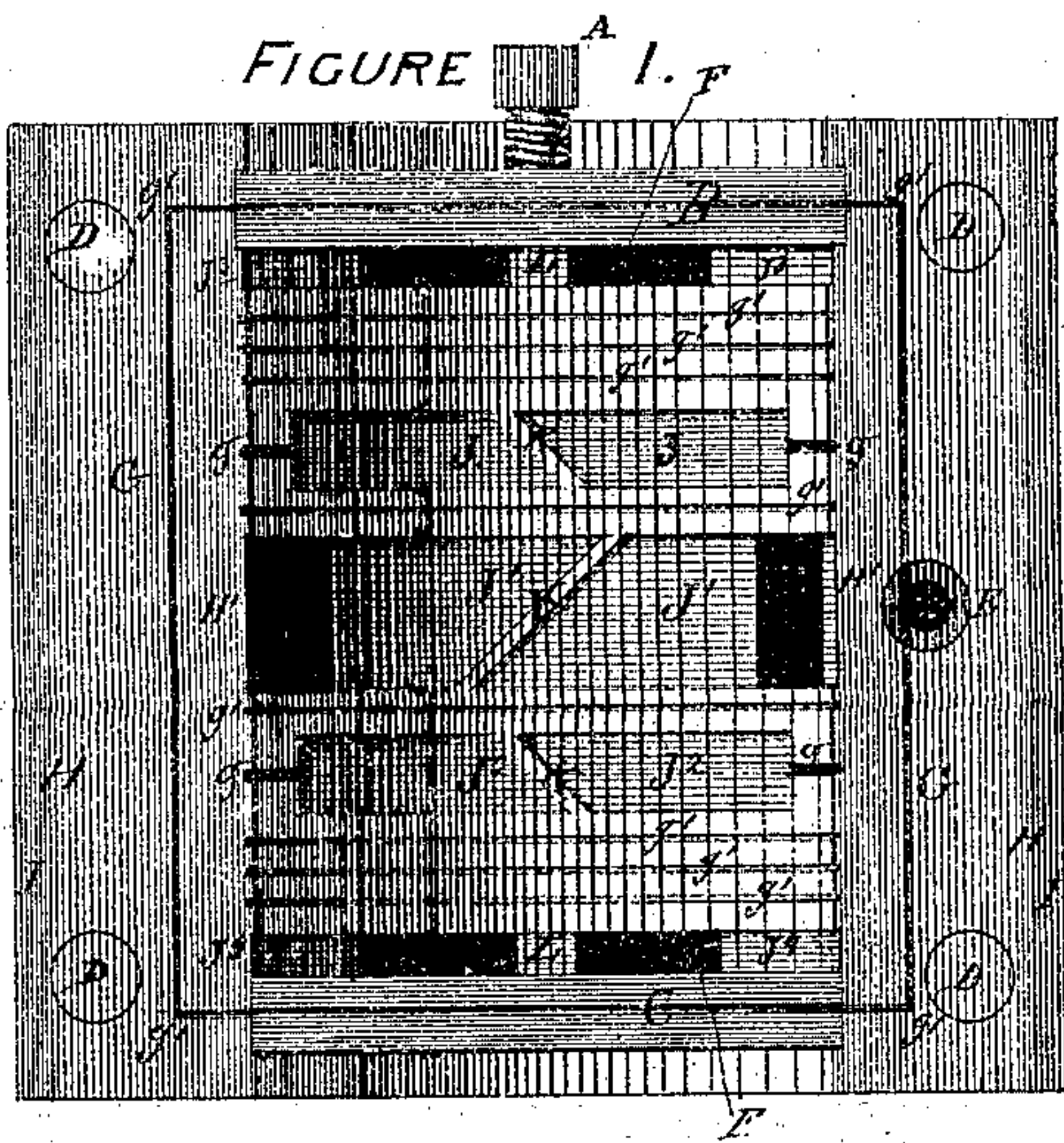


FIGURE 2.

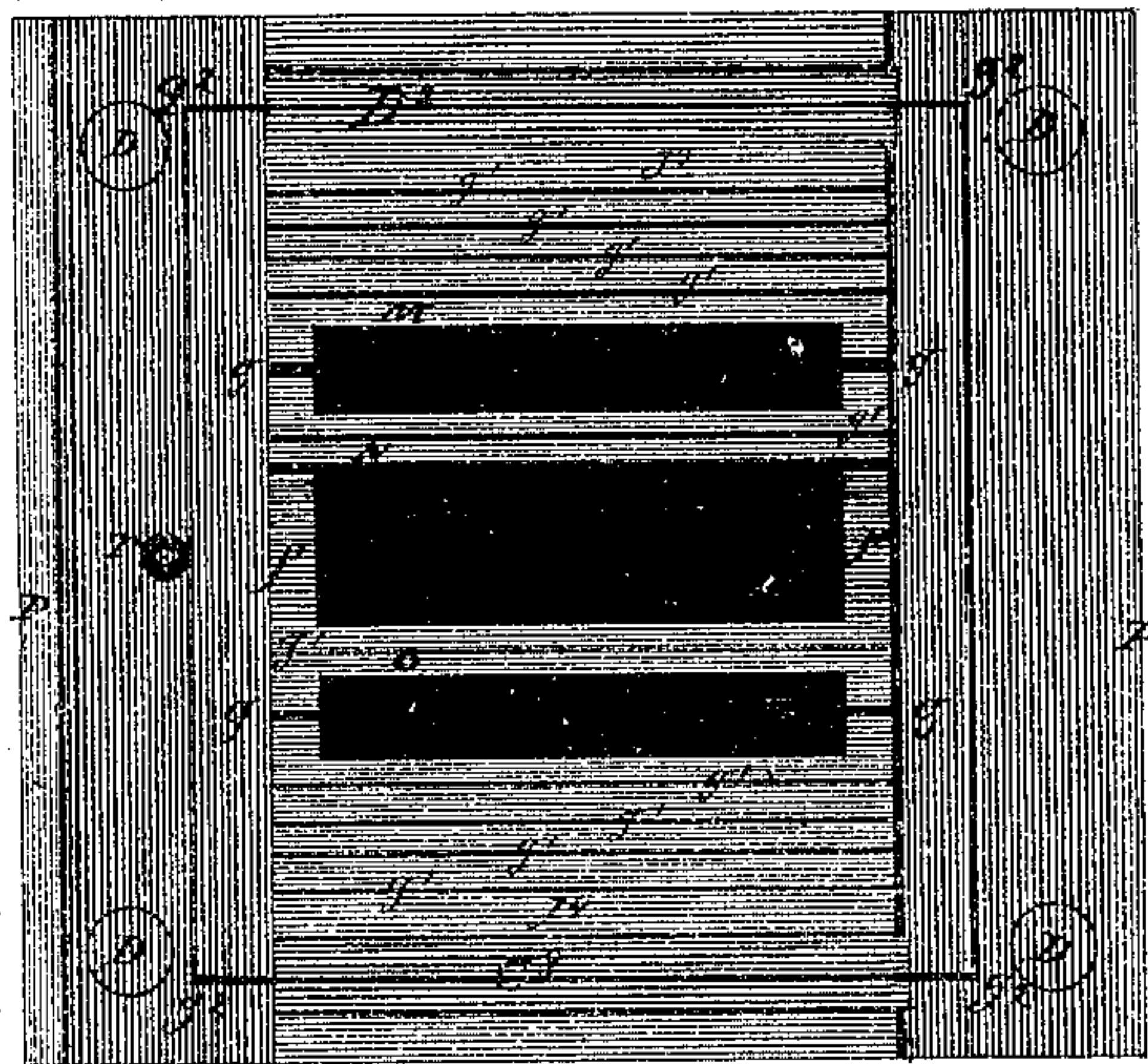


FIGURE 3.

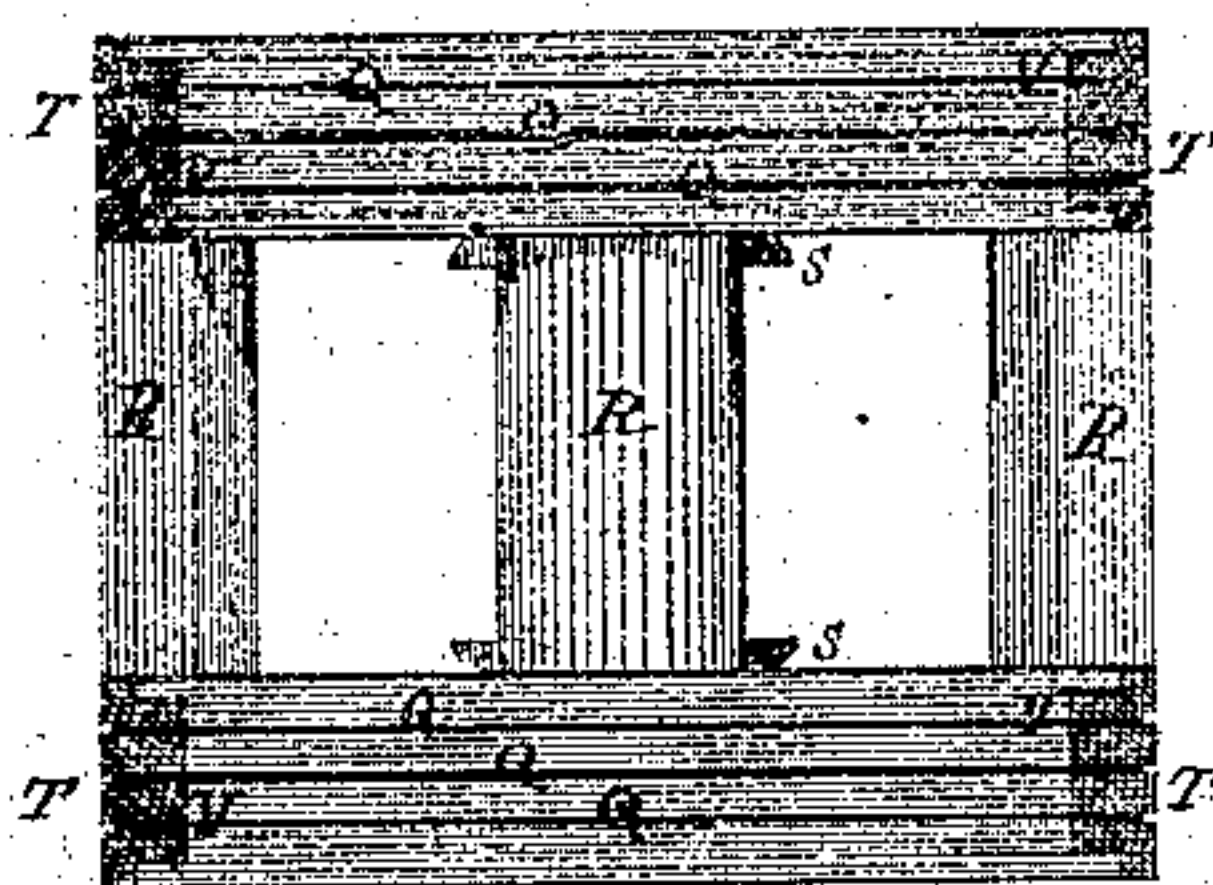


FIGURE 6.

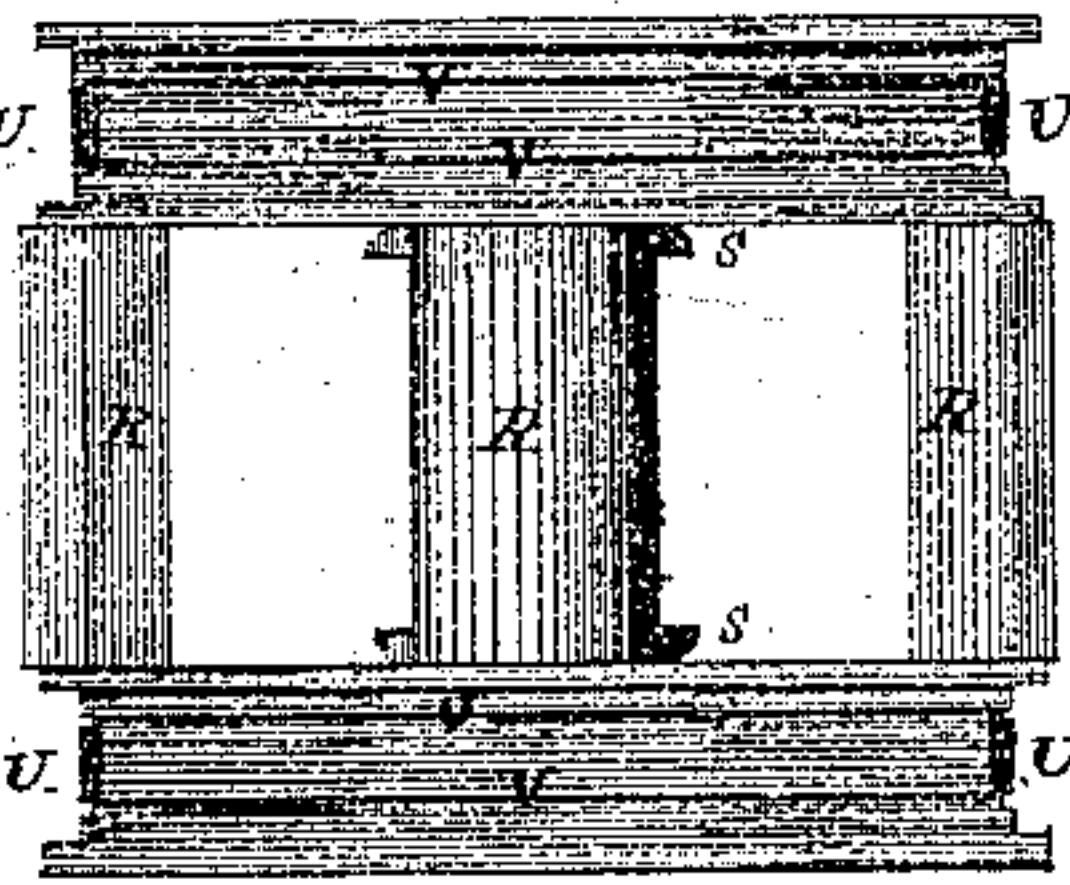


FIGURE 9.

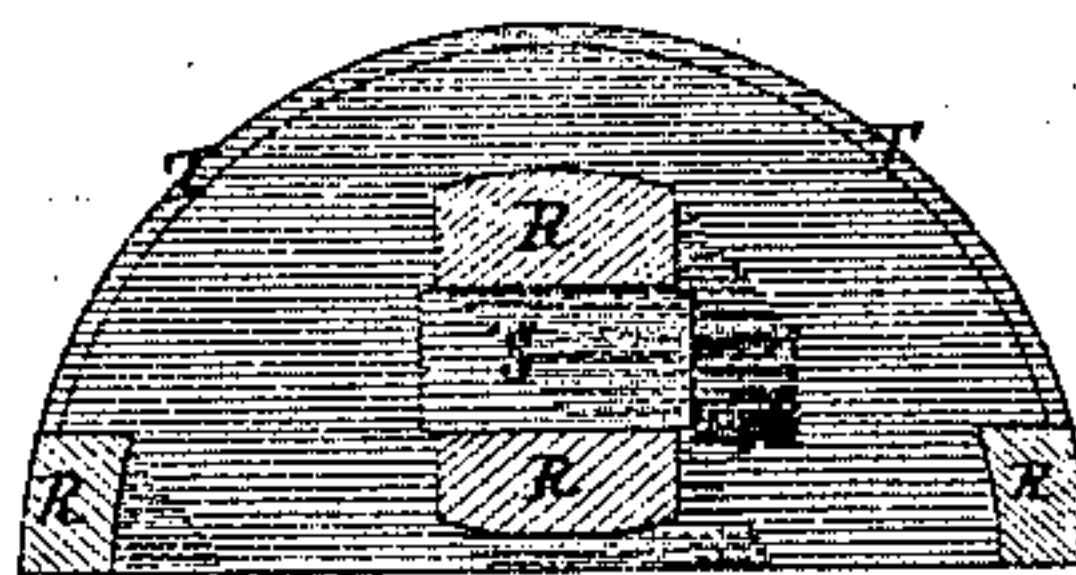


FIGURE 4.

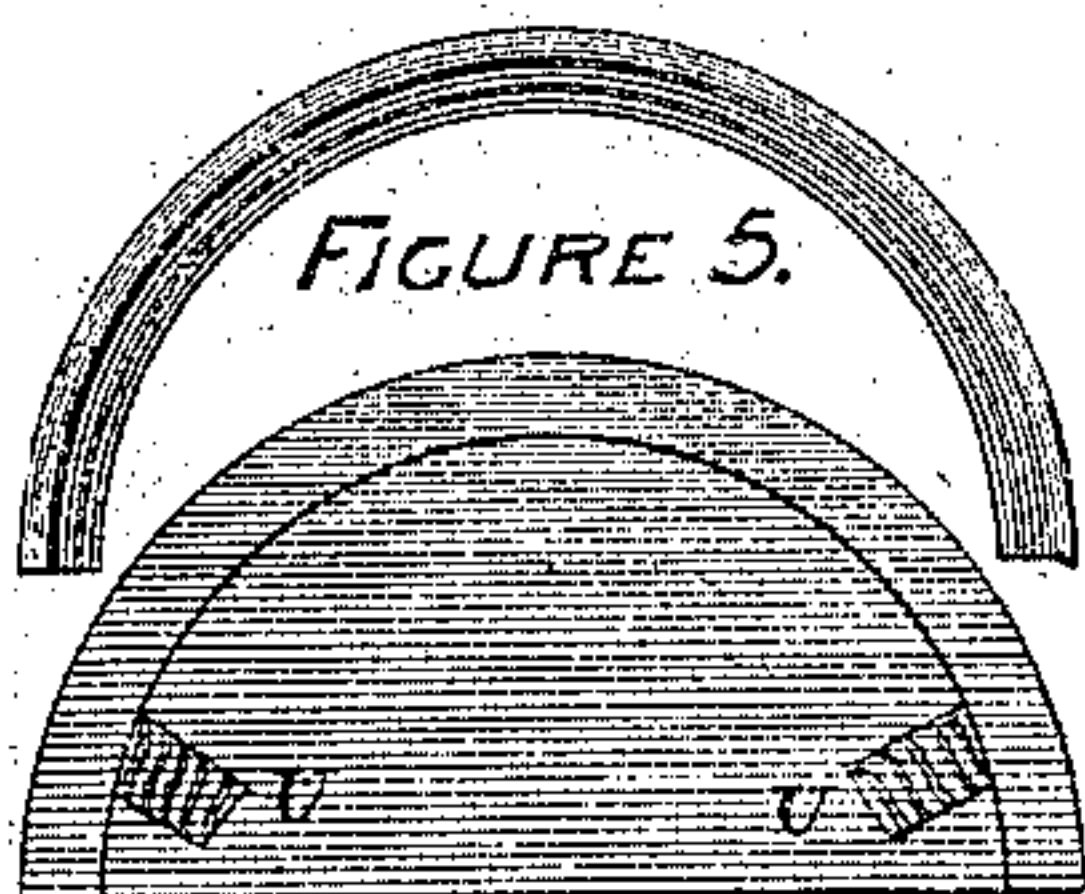


FIGURE 7.



FIGURE 8.



FIGURE 12.

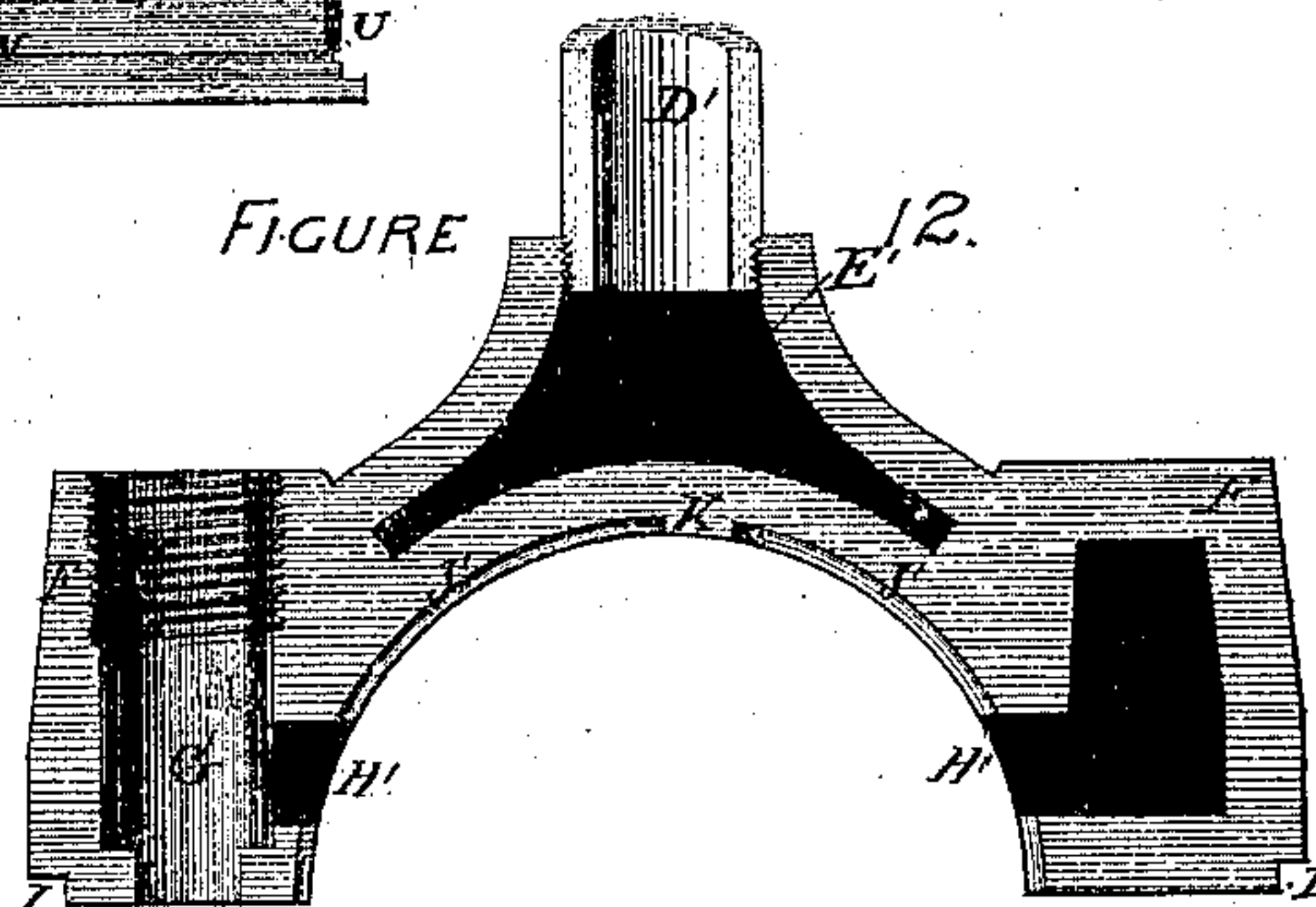


FIGURE 10.

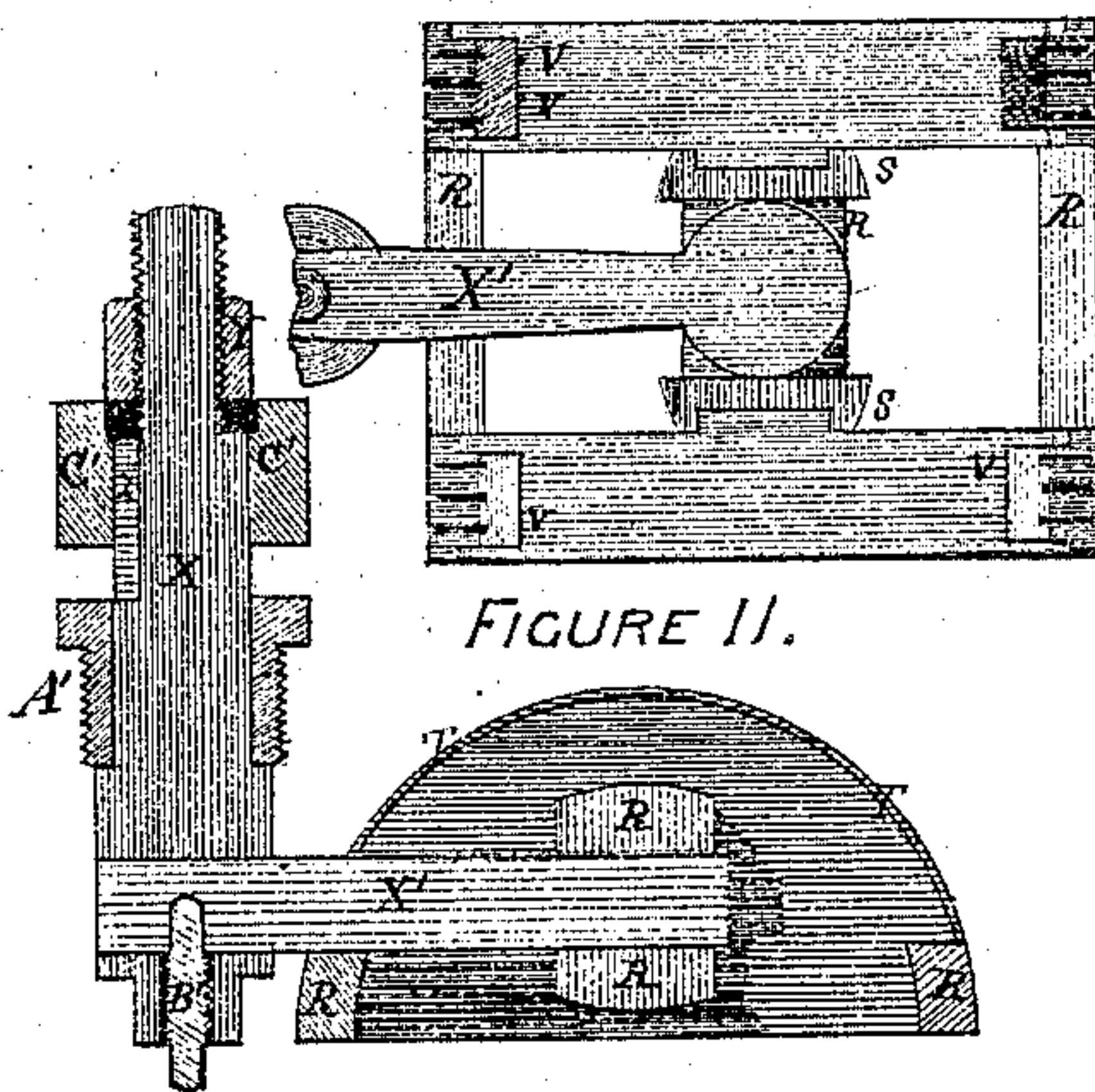
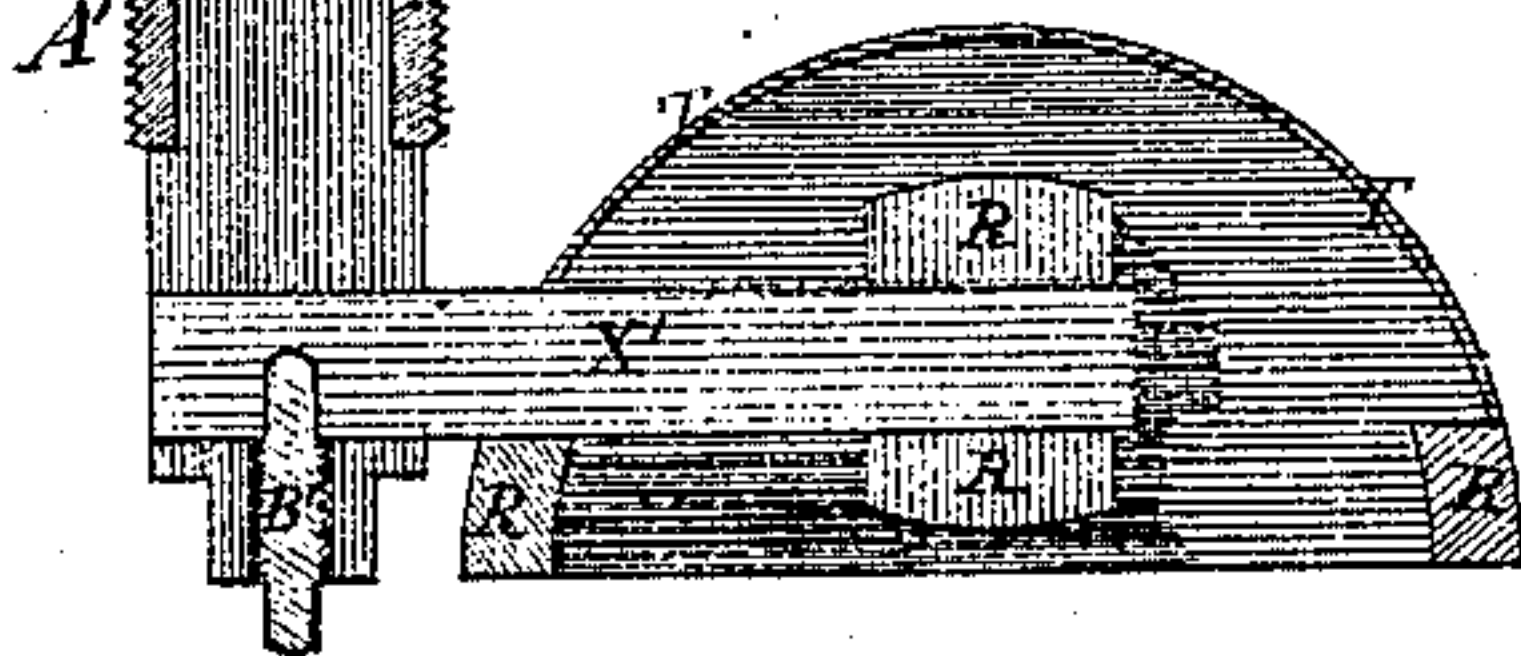


FIGURE 11.



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Witnesses:

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ISAAC W. FORBES, OF LA PORTE, INDIANA.

Letters Patent No. 98,755, dated January 11, 1870; antedated December 14, 1869.

IMPROVED BALANCE SLIDE-VALVE.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, ISAAC W. FORBES, of La Porte, in the county of La Porte, and State of Indiana, have invented a new and useful Improvement in Steam-Balance Valve; and I do hereby declare that the following is a full, clear, and exact description thereof, sufficient to enable others skilled in the art to which my invention appertains, to make and use the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a view of the inside of valve-case.

Figure 2 is a front view of valve-seat.

Figure 3 is a view of the lower side valve.

Figures 4 and 5 are views of detached parts.

Figure 6 is a view of the back of the valve.

Figure 7 is a view of pack-ring.

Figure 8 is a view of the inner surface thereof.

Figures 9, 10, and 11, are sectional views of the valve.

Figure 12 is a plan view in line $x x$, fig. 1.

My invention consists in an improvement in slide-balance valves, as will be hereinafter more fully described.

In fig. 1, A is a screw, which is used for closing hole used for measuring the height of the valve-heads, and for lubricating-purposes.

B, upper head of valve-case, capable of being moved.

C, bottom of valve-case, forming part of the casting.

D D, bolt-holes, for fastening valve-case to cylinder.

E, hole for rock-shaft.

F F, passage-ways for steam from outer to inner chamber of valve-case.

g g, passages for conveying steam around the valve-heads, when they cover the ports, to produce equal pressure on the valve-heads, laterally.

g' g', channel or groove on the face of valve-case, to prevent leakage of steam extending entirely around the face of valve-case.

H H, flanges of valve-case.

H' H', mortise-holes for rock-shaft arm.

I I, depression in outer edge of flange, fitting into projecting rim on flange of valve-seat, for preventing the spreading of the valve-case, by pressure of steam, and for holding the packing and preventing the leakage of steam.

J¹ J¹ J² J², recesses, chambered out of valve-case, corresponding, in area, with ports of engine, about one-sixteenth part of an inch deep.

J J corresponds with upper port.

J¹ J¹ corresponds with exhaust-port, and extends entirely around the case.

J² J² corresponds with lower port.

J³ J³ J⁴ J⁴, recesses, chambered out, of the same depth as those opposite steam-ports, about one-sixteenth part of an inch deep, and the same width as the ports in the valve-case.

K K, separations between chambers, corresponding

to ports in cylinder, in order to prevent wearing of head-rings.

L L, portions of valve-case left between the passages, to strengthen the valve-case.

In fig. 2, B² is a recess in valve-seat for upper head of case.

C², depression in valve-seat, for lower head of case.

D D, bolt-holes in flanges of valve-seat, for fastening valve-case to cylinder.

g¹ g¹, fine grooves in valve-seat, corresponding to those in valve-case, represented by g' g', &c., in fig. 1.

g g, channels in valve-seat, corresponding to g g in fig. 1.

g² g², channel around valve-seat, to prevent leakage of steam, corresponding to g' g' in fig. 1.

j¹ j¹, recesses at the ends of exhaust-port, corresponding to it in width, for allowing the passage of steam around the head.

j³, recess, corresponding with J³, in fig. 1, to allow steam to pass entirely around upper head of valve.

j⁴, recess, corresponding with J⁴, in fig. 1, to allow steam to pass entirely around lower head of valve.

M, upper steam-port.

N, exhaust-port.

O, lower steam-port.

P P, rims, cast on flange of valve-seat, fitting into recesses, I I, fig. 1, to prevent spreading of valve-case by force of steam, and for holding the packing, to prevent the leakage of steam.

r, hole to receive the end of set-screw in rock-shaft.

Fig. 3. Q Q are small grooves, chambered out of face of valve-heads, to prevent leakage of steam.

R R, supports of valve.

S S, upper and lower gibs.

T T, ends of valve-packing rings.

V V, ends of grooves chambered out of valve-heads, to prevent leakage of steam between rings and heads.

Fig. 4, half ring fitted on to valve-head, used as packing-ring.

Fig. 5, section of valve-head, showing springs for pressing ring against valve-case, in which U U are the springs.

In fig. 6, V V are grooves, to prevent steam leaking between rings and head.

R R, supports of valve-heads.

S S, gibs.

U U, holes for springs.

In fig. 7, Q Q are small grooves, chambered out of outside of valve-packing ring, for preventing leakage of steam.

Fig. 8 is a view of the concave or inner surface of the valve-packing ring.

Fig. 9, section of the valve, showing the lower valve-head, the position of the supports, and the lower gib, in which S is the gib; R R, supports of valve-heads; T T, valve-packing ring.

In fig. 10, S S are gibs.

X', inner rock-shaft arm.

R R, supports of valve-heads.

In fig. 11, X is rock-shaft.

Y, nut, holding outer arm of rock-shaft in its position.

Z, key, fastening outer arm to rock-shaft.

A' A', stuffing-box, also used for keeping rock-shaft in position.

B', set-screw, holding arm to rock-shaft.

R R, valve-head supports.

T T, valve-packing ring.

C' C', outer arm of rock-shaft.

X', inner arm of rock-shaft.

In fig. 12, D, is a receiving-steam pipe.

E, steam-chamber in valve-case.

F' F', projections, cast on valve-case, to admit rock-shaft.

G', hole, completed, to receive rock-shaft and stuffing-box.

H' H', chambers, cast in valve-case, to receive rock-shaft arm.

J' J', recesses, (J' J', in fig. 1.)

K, separation between recesses. (See K, fig. 1.)

I I, depressions in outer edge of flange. (See I I, fig. 1.)

The valve-case is made so that the valve may be moved up or down, at will, and with ease, by means of an arm, the head of which plays in the mortise of the valve, on the steel-hardened gibs, the other end being firmly secured to a rock-shaft, or the arm may pass directly through the rock-shaft and bearing, for receiving power to move the same, the head of which may be a ring instead of being solid, there being room in the outside of the bearing to allow the arm to play.

The bearing may be divided in the centre, and bolted together, with loose bearings at each side, with small grooves at each end of the bearings, and corresponding ones in the rock-shaft, to prevent the leakage of exhaust steam.

The valve-case is made in two castings, with one of the ends movable, and the other fixed.

The round or rotund of the case is cast hollow, so that a chamber is formed within it. Into this chamber, steam is admitted through an opening in a boss, placed about the middle of the rotund. The steam is permitted to pass from this chamber, into the valve-chamber, by ports or openings, formed through the inside wall of the rotund, at each end of the case, and thence the steam passes into cylinder, as permitted by the valve.

The chambers, and these openings at each end, are respectively of the same area as the steam-pipe.

There are three recesses cut in the inside wall of the case, each of them about one-sixteenth part of an inch in depth, (fig. 1, J J' J''). Of these, J and J'' correspond exactly, in width and area, to the steam-ports opposite to them. J' J' corresponds also in width, but extends entirely around the case and seat to the port represented by J' J' in fig. 2.

Each of these recesses has a division-bar crossing it diagonally, so as to prevent the ring of the valve from catching upon the edges of the recesses of the inner valve-case, thereby preventing it from wearing, represented by K K, with several fine grooves cut in the case, with corresponding ones cut in the valve-seat, represented by g' g', &c., in figs. 1 and 2, to prevent the passage of steam by the valve.

At each side of the case is a hole, covered by a boss on the outer casing, which may be bored out for the purpose of admitting the rock-shaft, in which the inner arm, or that which moves the valve, is secured.

Through the end of the case is made a hole, used for measuring the height of the valve, and for lubricating-purposes, which may be closed by a screw.

The whole case, with the valve adjusted, with the arm secured in the rock-shaft, is firmly bolted to the cylinder by studs or bolts.

Mode of Operation.

When the valve is moved downward, by means of the rock-shaft acting upon the arm attached to it, and playing in the mortise of the valve, steam passes at once into the cylinder, and upon the top of the follower-head, driving the piston down, the steam under the follower-head exhausting, in the usual way, through the exhaust-port, placed midway in the cylinder.

Again, upon the valve being moved upward, by means of force applied to the rock-shaft, steam is permitted to pass into the cylinder below the follower-head, driving the piston upward, the steam above the follower-head exhausting, in the usual way, through the exhaust-port of the cylinder, as before.

In the movement of the valve, either upward or downward, the arm by which it is moved permits the head of the valve to approach the surfaces of the top or the bottom of the valve-case not nearer than one-sixteenth part of an inch, and the passages for the induction of steam from the chambers in the rotund, being cut nearly even with these surfaces, there will remain a column of steam of about one-sixteenth part of an inch upon the valve-head, when moved to its utmost extent upward, and in like manner, a similar column of steam upon its lower head, when moved to its utmost extent downward.

This column of steam, pressing upon an area equal to that upon which the steam acts, which is admitted through the disclosed passages in the chamber of the case, an equilibrium of pressure upon opposite ends of the valve is thereby maintained.

As the valve is moved either upward or downward, the recesses, which have been described as cut to a proper depth in the inside part of the valve-case, in turn in steam, and these recesses, being constructed so as to be exactly equal, in area and width, to the ports of the cylinder opposite, as in the case of the valve-heads, the pressure of the column of steam being exercised upon the convex part of the valve, upon an area exactly equal to the area upon which the larger column of steam passing through the ports of the cylinder acts, an equilibrium of steam-pressure is maintained thereby upon the opposite sides of the valve.

Small channels (see g g, in fig. 1,) convey the steam from the steam-ports directly to the recesses opposite, when the valve-heads cover the ports.

In effect, by these means, the valve is placed in *equilibrium* by an equal pressure of steam, both at its ends and upon its sides, and offers no resistance, arising from the pressure of steam upon power being applied to move it either in an upward or in a downward direction.

In the drawings referred to, and in the explanation above given, I have described the application of the means I employ to overcome the pressure of steam to a valve of a semi-cylindrical shape. I have chosen that particular shape as being the one most readily and most cheaply made in the way I have mentioned, two valves being, in fact, made in one casting, but I do not confine myself to any particular shape for the valve, nor do I confine myself to the mode of moving the valve upward or downward, by means of an arm, working in a rock-shaft, as described. Any power attached to either end of the valve, by means of a rod or lever, worked by an eccentric or otherwise, may be used to effect that purpose.

What I claim as my invention, and desire to secure by Letters Patent, is—

The sliding-balance valve, constructed substantially as herein described.

The above signed by me, this 27th day of August, 1869.

I. W. FORBES.

Witnesses:

PHIL. F. LARNER,
ADOLPHE ROCKE.