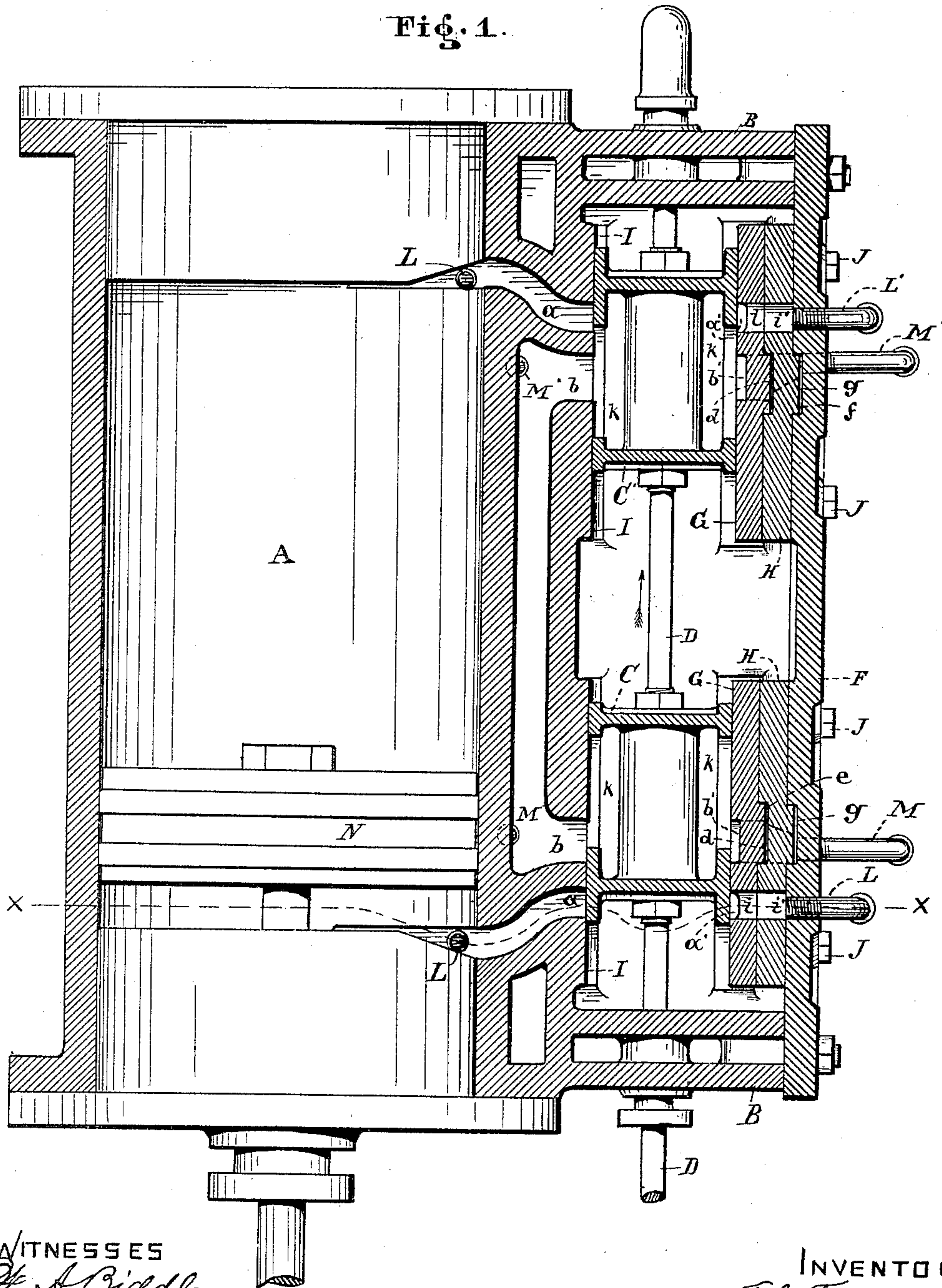


3 Sheets—Sheet 1.

STEAM BALANCED VALVE FOR STEAM ENGINES.

Patented Dec. 9, 1890.

Fig. 1.



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(No Model.)

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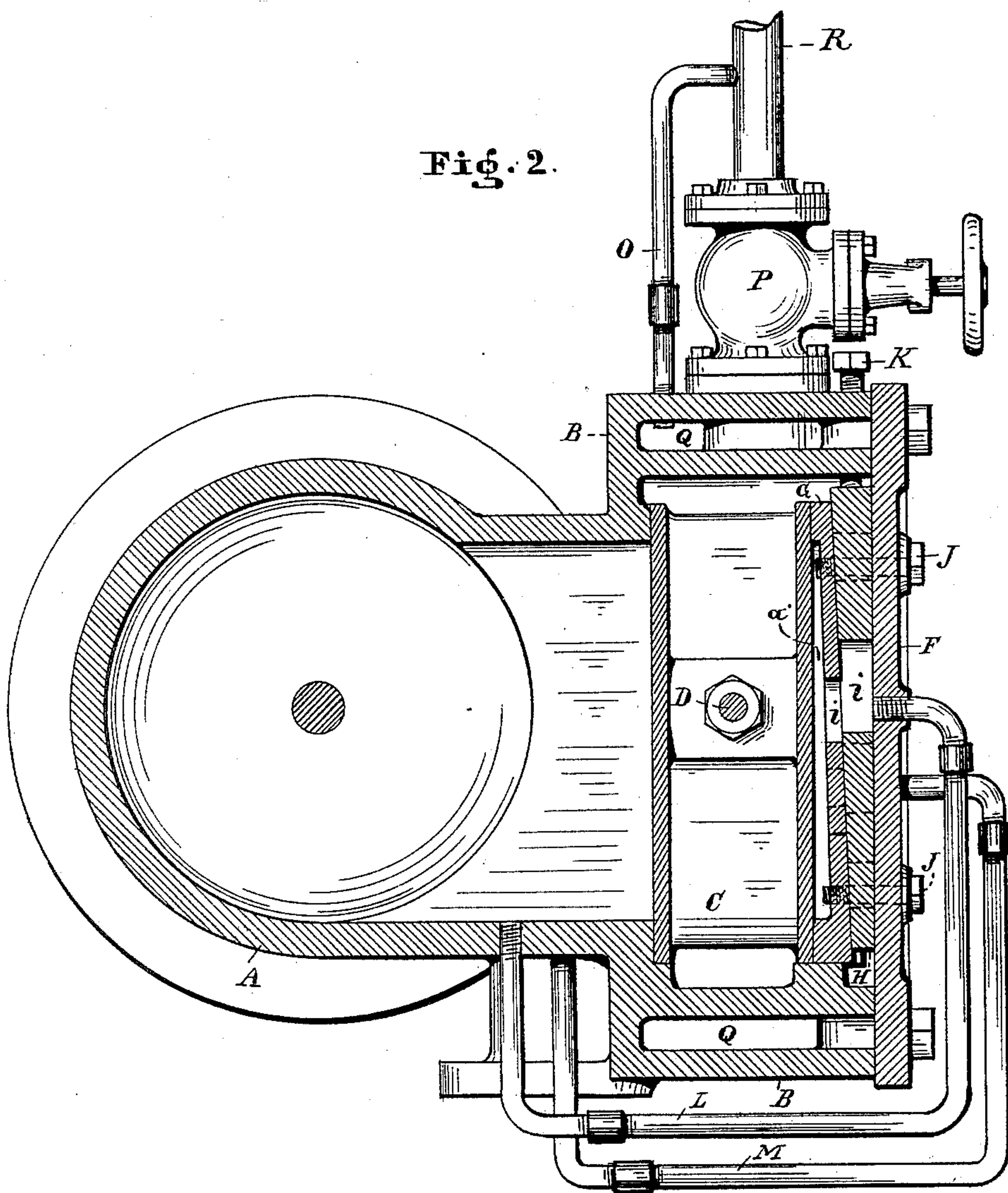
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STEAM BALANCED VALVE FOR STEAM ENGINES.

No. 442,368.

Patented Dec. 9, 1890.

Fig. 2.



WITNESSES

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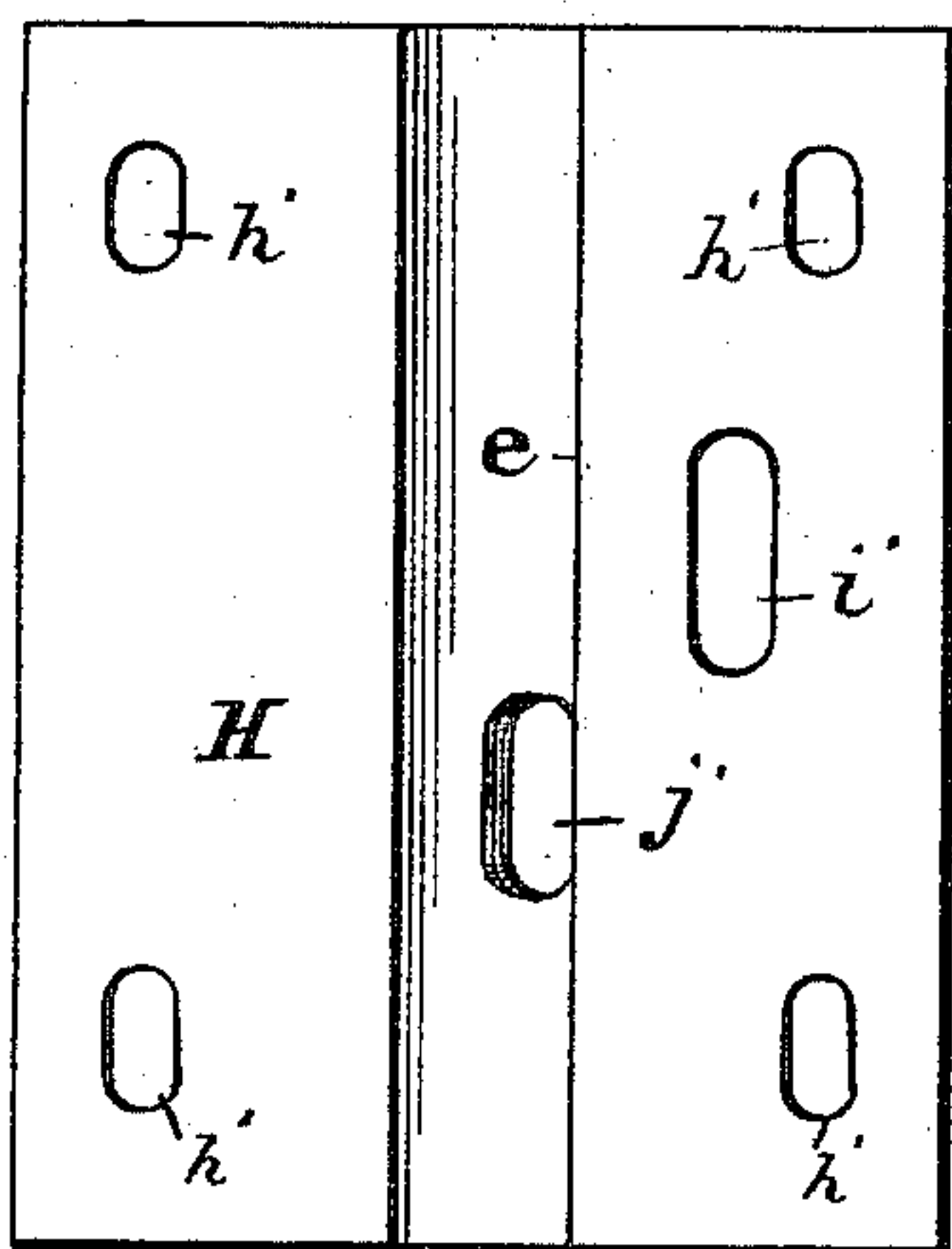
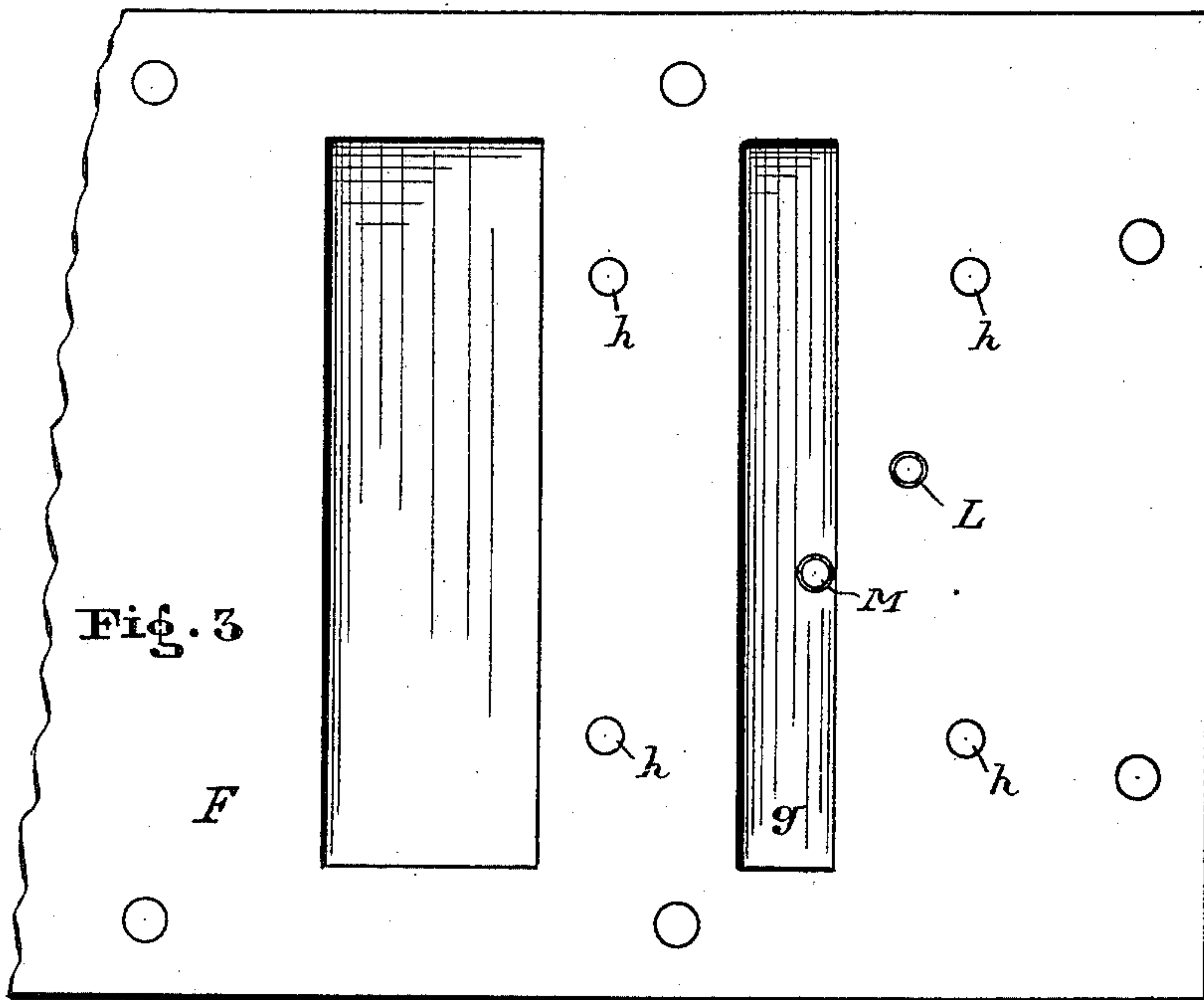


Fig. 4.

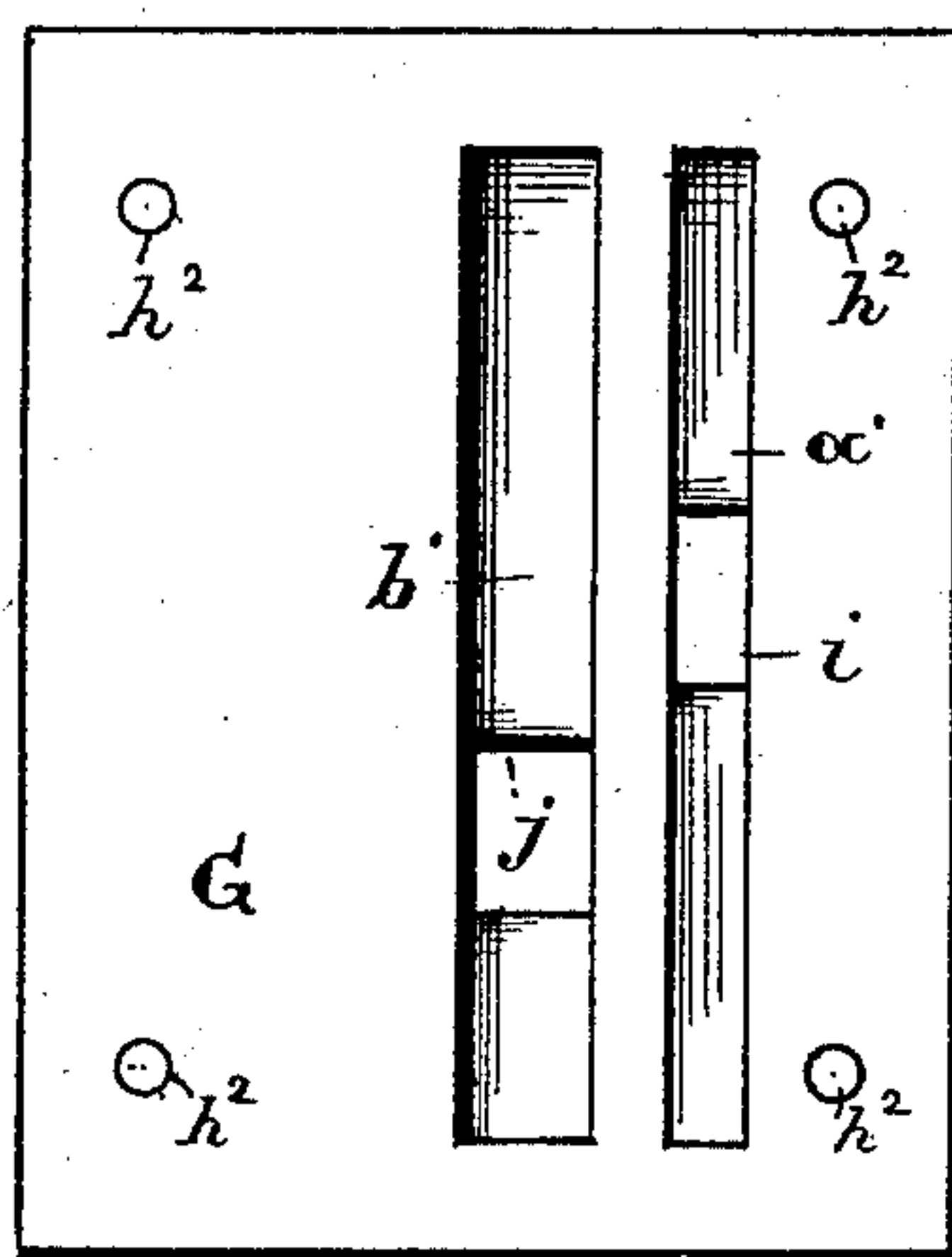


Fig. 5.

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UNITED STATES PATENT OFFICE.

FRANCIS I. FREEMAN, OF WARREN, OHIO.

STEAM-BALANCED VALVE FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 442,368, dated December 9, 1890.

Application filed February 19, 1890. Serial No. 341,069. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS I. FREEMAN, a resident of Warren, in the county of Trumbull and State of Ohio, have invented a new and useful Improvement in Balanced Slide-Valves, of which the following is a full, clear, and complete description.

My invention relates to slide-valves for steam-engines; and the improvement consists of the means and contrivances for arranging said valve in (technically) a steam-balanced state during any and every part of the reciprocating movements thereof.

That the improvement may be seen and fully understood, reference will be had to the following specification and accompanying drawings, in which—

Figure 1 is a longitudinal section of a steam-cylinder, improved chest, and valve constructed and arranged in connection with the means and contrivances, above referred to. Fig. 2 is a transverse section of the same on line *xx* of Fig. 1. Fig. 3 is a partial inner face view of the steam-chest cover, and Figs. 4 and 5 are detached face views of parts interposed between said cover and the valves.

Like letters of reference designate like parts throughout the specification and drawings.

As shown in Fig. 1, A indicates the steam-cylinder, and B the chest, which is arranged to one side thereof.

C C' are the valves, and D is the rod by means of which said valve or valves are connected and operated. In function each valve controls the openings of the steam and exhaust ports over which it slides for alternate admission and exhausting of steam to and from said cylinder A. Interposed between said valves and the cover F of the steam-chest are tapering plates G G and the wedges H H, as seen in Figs. 1 and 2. The face-sides of the plates represent the identical counterparts of the valve-seats I I, so that the valves, the opposite faces of which are also symmetrical, are virtually double or counter seated.

The openings *a a* and *b b* of the seats I I are reproduced by means of cavities *a' a'* and *b' b'* in the face of the plates G G, as seen in Figs. 1, 4, and 5. The wedges H H upon the rear side of said plates serve as adjustable means for obtaining a steam-tight contact of

the valves between their actual seats and counter-seats. The projection *d* of the plates engages in the recess *e* of the wedges, and the projection *f* of said wedges continues the engagement in the recess *g* of the cover F. A displacement in longitudinal direction of the parts mentioned is thus prevented.

The bolts J J and one or more set-screws K K enable proper adjustment of said plates and wedges in relation to the valves and the cover F—that is, said bolts and set-screws serve conjointly in setting and retaining the plates and wedges in secure connection with said cover. The bolts J J extend from the outside of the cover F through the wedges H and are threaded in the plates G, as seen in Fig. 2, whereas the set-screws K are threaded in the side of the steam-chest B and bear upon the wedges H only to adjust the latter according to the distance between valves and cover.

In Figs. 3, 4, and 5, *h h*, *h' h'*, and *h² h²* respectively represent the holes in the cover, the slots in the wedge, and the threaded holes in the taper plate, through which said bolts J J pass for securing the plates G to said cover, the slots *h' h'* extending in line with the taper of the wedges to admit of adjusting said wedges between the plates and cover by the means and for the purpose as above stated. By the means herein described the openings *i i* and *j j* of the said wedges and plates are continued in open relation between the pipes L L' M M' and the cavities *a' a'* and *b' b'*, as seen in Figs. 1 and 2 (in Fig. 1, however, only dotted lines indicate the openings *j j*) of the drawings. Said pipes L L' connect with the inlet-ports *a a* and M M' with the exhaust-ports *b b*, to lead the steam from said ports to the cavities *a' a'* and *b' b'*, so that the outer faces of the valves C C' at all times are subjected to the pressure prevailing in the steam and exhaust ports, and it is for the same object that the exhaust-cavities *k* of said valves have an opening in the outer face of the valve which corresponds in size with that of or in their inner face side. In the operation of the valves these provisions and described devices are essential for attaining steam-balanced valves in whatever position they may be when properly adjusted, as presently ex-

plained. For example, if the piston N is near one end of its stroke, as shown in Fig. 1, and the valve C yet covers the steam-port, then compression takes place at that end, and it is during this period that the communication of the steam-port a' by means of the pipe L exerts the required influences in exposing the outer face of said valve to an equal amount of pressure as that which is prevailing in the steam-port a of that end of the cylinder. The valves, being moved in the direction indicated by the arrow, will admit steam before the piston has come to the extreme end of the stroke and force it toward the opposite end, while in front thereof exhaustion of the expanded steam takes place. While the inlet-port of the valve C is receiving a full passage of steam it closes its exhaust-port b , and it is in that instance that the pipe M is relied upon for conveying the pressure in the exhaust-port at one side of the valve to the cavity b' , facing its opposite side. At all times the valve C is thus exposed to pressures, which counteract each other, in consequence whereof preventing undue frictional contact of the valves between their seats. The pipes L' M' accomplish the same results in relation to the valve C', as above set forth in the case of the valve C.

The valves, being comparatively much lighter in structure than the walls of the steam chest or cylinder, would, when live steam enters the steam-chest, expand more rapidly than the surrounding heavier parts were it not for the double-walled steam-chest having a chamber between said walls which receives steam therein for heating and expanding the walls of the chest before starting the engine. As seen in Fig. 2, the pipe O extends from a point above the inlet or throttle valve P to the space Q, which is formed by the double walls of the steam-chest B, and conveys the

steam to said space as soon as steam is prevailing in the steam-pipe R. Owing to this steam-space Q the expansion of the parts above mentioned is so influenced as to promote that of the steam-chest, while that of the valves is retarded. Thus injuries to the valves are prevented as from the foregoing will be seen and understood.

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

1. In combination with the cylinder and chest, the slide-valve, the wedge forming the seat for the valve on one side, said wedge having openings, and pipes L M, communicating with the supply and exhaust ports $a b$ and with the rear valve-seat through the openings in the wedge, substantially as described.

2. In combination, the steam-chest having a steam-space in its walls, a valve within the steam-chest, an inlet-pipe R, communicating with the interior of the chest and having a valve P, and a pipe O, leading to the space within the steam-chest walls and communicating with the steam-inlet pipe beyond the valve P, substantially as described.

3. In the chest of a steam-engine, the cover F thereof, provided with plates G, wedges H, and pipes L and M, leading from the steam and exhaust ports, the said plates and wedges having cavities and openings in communication with said pipes, in combination with the valve or valves C, having front and rear face uniform and fitted steam-tight between said plates and valve-seats, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCIS I. FREEMAN.

Witnesses:

HOMER E. STEWART,
J. L. HERZOG.