

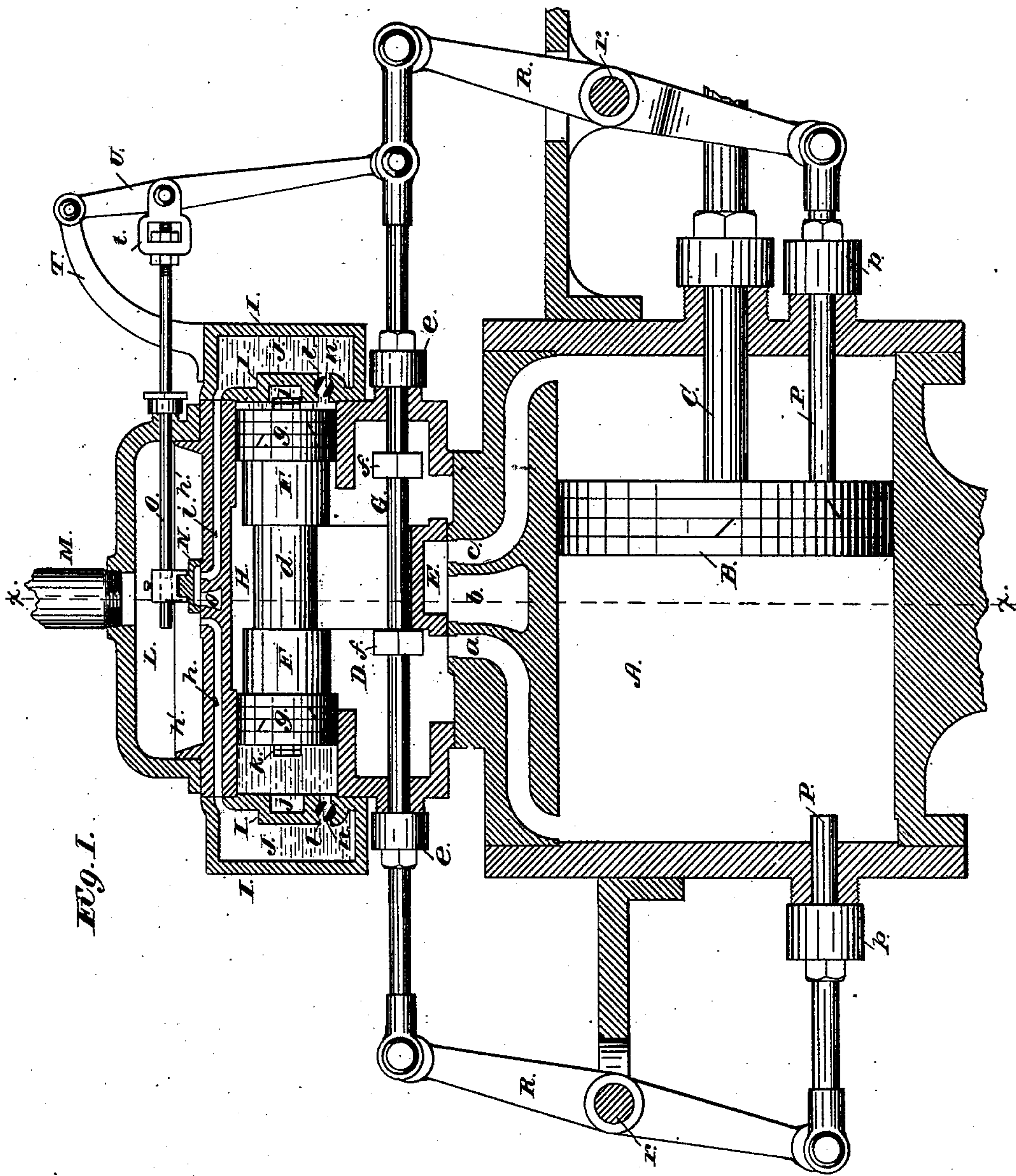
(No Model.)

4 Sheets—Sheet 1.

J. H. VAILE.  
Steam Engine.

No. 235,318.

Patented Dec. 7, 1880.



Witnesses;  
P. H. Lunckel  
E. H. Taylor.

Inventor;  
John H. Vaile  
by Peck & Ritchie  
his Atty;



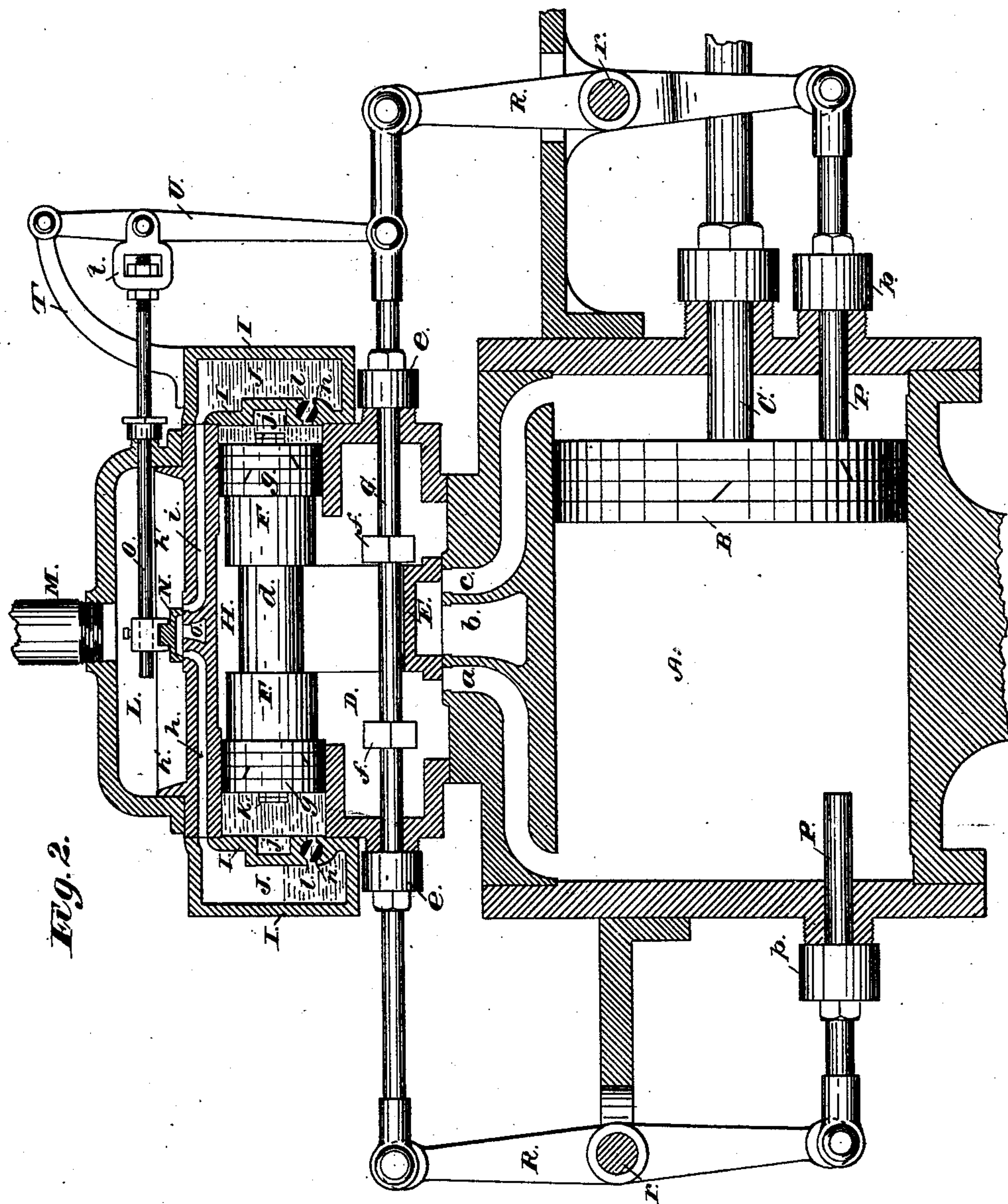
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4 Sheets—Sheet 2.

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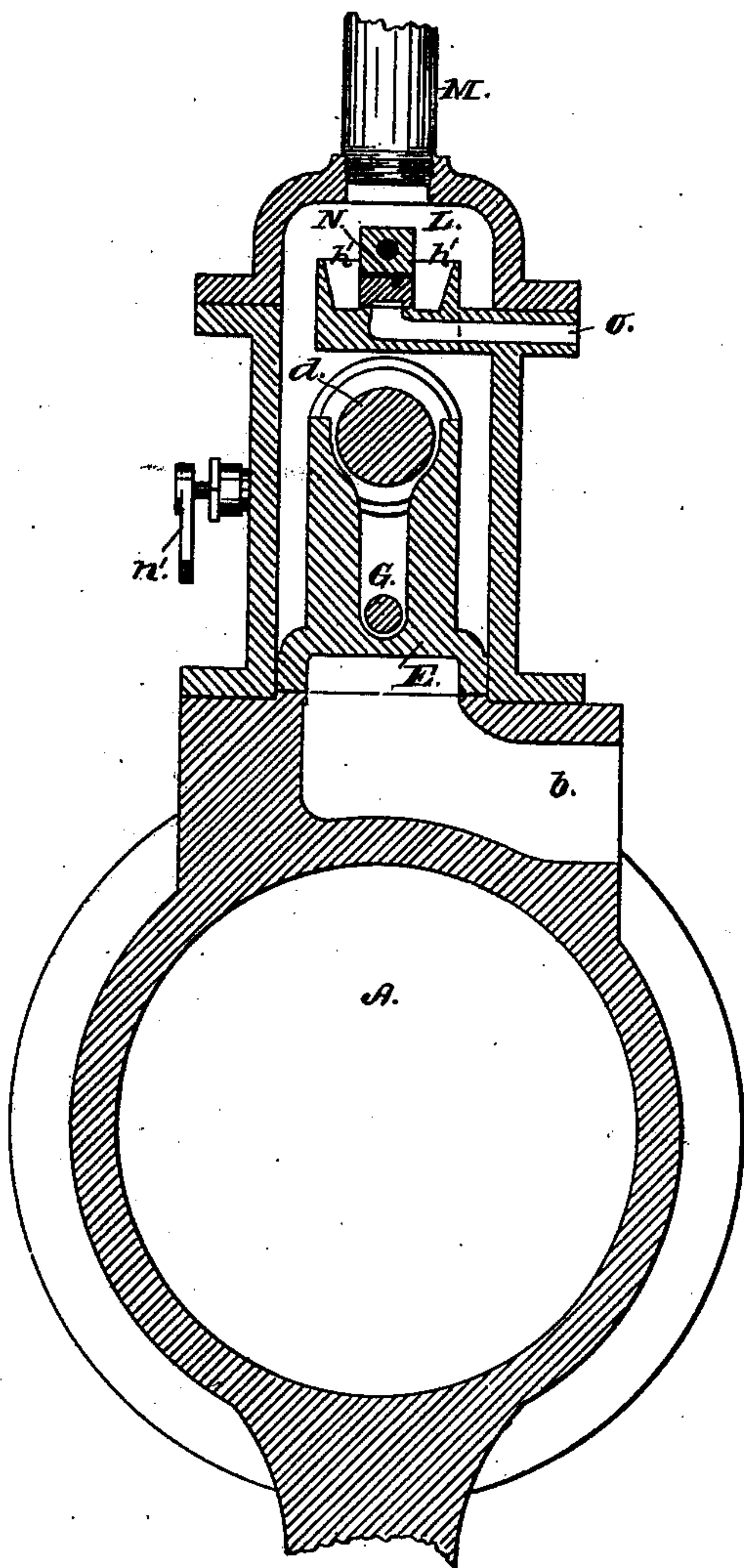
4 Sheets—Sheet 3.

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*Fig. 3.*



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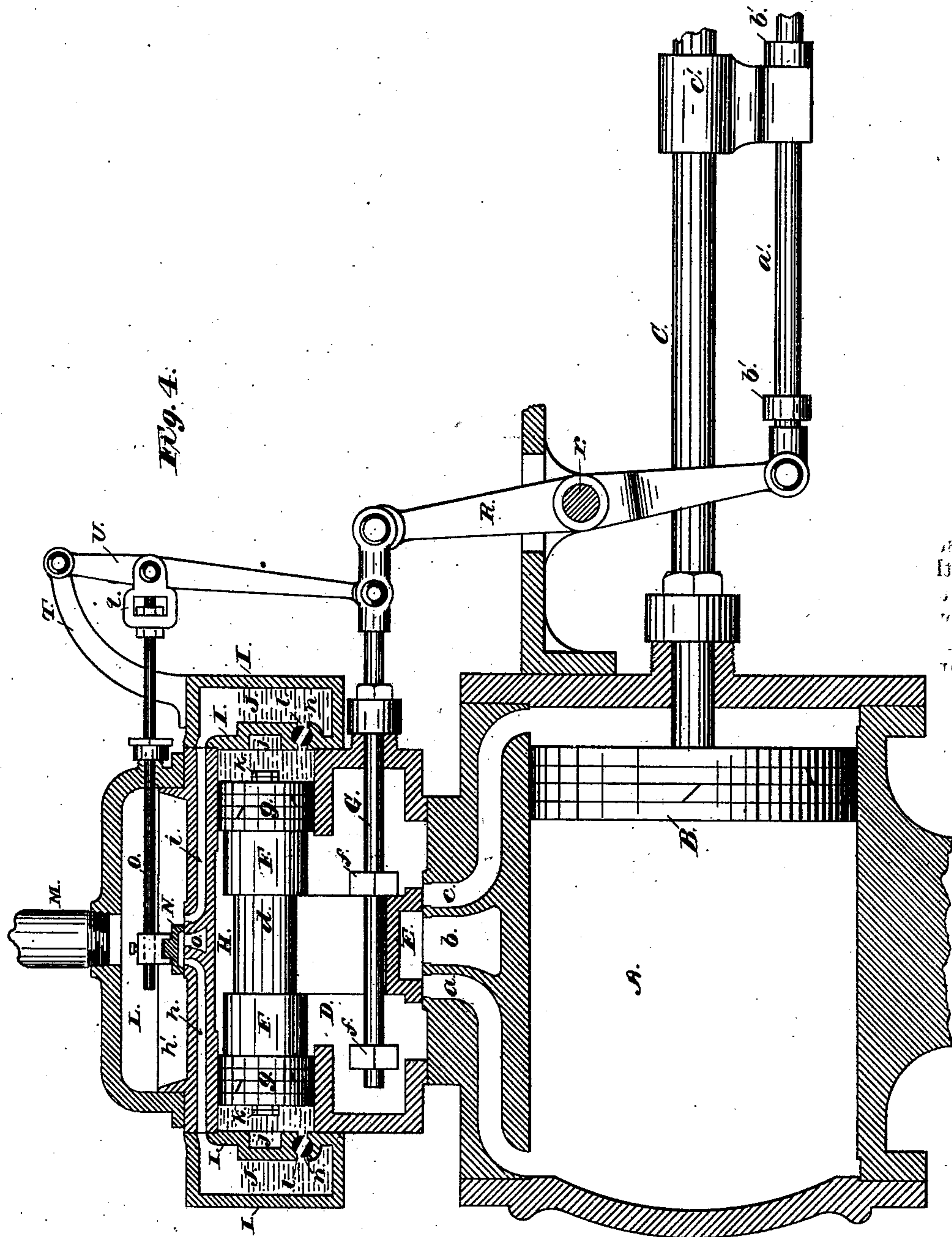
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4 Sheets—Sheet 4.

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# UNITED STATES PATENT OFFICE.

JOHN H. VAILE, OF DAYTON, OHIO.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 235,318, dated December 7, 1880.

Application filed May 15, 1880. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN H. VAILE, of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an improvement in steam-engines of that class employing supplemental valves for admitting steam to actuate the main valve.

The object of my improvement is to insure the steady and complete action of the driving-piston and actuating parts without jar, and without liability of damage should the engine "run away," by the breaking or sudden removal of the working tension.

The novelty consists in, first, the combination, with the supplemental valve, of a main valve controlled by a piston cushioned on water, whereby the throw of said main valve is rendered steady and gradual; secondly, in the combination, with the main-valve rod and the supplemental-valve rod and connecting mechanism, of tappets actuated by the piston or its rod, whereby at each full stroke of the main piston the throw of the main and supplemental valves is positively assured, and whereby, should the working strain be suddenly removed under a full head of steam by breakage of any of the parts—as a pipe, for instance, in pumping, or a belt in driving heavy machinery—the piston would be caught before it could touch the cylinder-heads and the valves be reversed, thus always catching the piston upon live steam and preventing any damage; thirdly, in details of construction and combinations of the parts, all as will be herewith set forth and specifically described.

In the accompanying drawings, Figure 1 is a side elevation, in central section, through the cylinder and chests of an engine embodying my improvements. Fig. 2 is a corresponding view with the operating parts in different position. Fig. 3 is a sectional view in end elevation through the line *xx* of Sheet 1. Fig. 4 represents a modification in the construction of the engine.

Corresponding letters of reference indicate like parts in all the sheets.

The main cylinder A, piston B, and rod C may be of the usual or any suitable construction. Upon the cylinder A is fitted a chest, D, containing the main valve E, which is seated and travels over the ports *a c* and exhaust *b*. This valve only differs from ordinary valves in that it has an upper extension or yoke, into which the stem *d* of the double piston F fits, thus practically locking the valve to this piston. The main-valve rod G works through stuffing-boxes *e*, and projects from each end of the chest, as represented. It passes freely through an aperture in the valve, and is provided with collars or swells *f* on each side of the valve to allow lost motion. The double piston F, with its packing-heads *g*, is fitted into a cylinder or chest, H, opening into the chest D. The heads I of this cylinder are double, forming chambers J, into which the ports *h* and *i* respectively open, as represented. The recesses *j* in the division-walls of the heads I are simply to accommodate the attaching-projections *k* of the piston-packings. Communication is effected between the cylinder H at each end and the chamber J by channel-ways *l*, provided with graduating-cocks *n*, regulated by handles *n'*, Sheet 3. Upon the top of the cylinder H is secured the supplemental-valve chest L, into which steam from the boiler is admitted through the pipe M. This chest contains the supplemental valve N, which is seated and travels over the ports *h i* and exhaust *o*, as represented.

As seen in Sheet 3, open steamway is provided around the cylinder H to the chest D.

As represented in Figs. 1, 2, and 3, the seat of the supplemental valve has its sides and ends extending up to form a basin, *h'*. As before stated, the purpose of this basin is to catch the water of condensation and direct it through the ports *h i* into the chambers J. The only essential of this basin is, that its mouth or open end should be opposite the induction steam-pipe to catch any water that might enter with the steam. The valve-rod O of the supplemental valve projects from the chest, as shown.

In each head of the main cylinder A, Sheets 1 and 2, are fitted and packed by stuffing-boxes *p* tappets P, which are short cylindrical rods, projecting through the heads, as represented in Sheets 1 and 2. These tappets are connected



at their outer ends to the main-valve rod by lever-arms R, centrally pivoted at *r* to any suitable part of the frame-work, and connecting one end of said valve-rod with a bracket-arm, T, is a lever-arm, U, to which the end of the supplemental-valve rod is connected adjustably by the pivoted connection *t*, as shown.

Having thus shown the construction of my improved engine, I would describe its operation as follows, supposing the chambers J to be filled with water and the cocks *n* open: By referring to Fig. 2 it is observed that the ports *h* of the supplemental valve and *a* of the main valve are full or wide open, and the piston B is almost at the end of its stroke and just touching the tappet. The remaining parts occupy the positions shown, and the left-hand end of the cylinder H is full of water. Now, as the piston continues to advance, the tappet is projected by it—thus, through the medium of the arms R and U, reversing the motion of the main and supplemental valve rods. The reversing of the supplemental-valve rod acts immediately on its valve and changes the ports before the lost motion of the main-valve rod is taken up. The parts now occupy the relative positions shown in Sheet 2, and steam begins to enter the port *i* and forces or acts upon the water in the chamber J. This pressure forces the water through the channel-way *l* and graduating-cock *n* against the head of the piston F, causing it to travel back and impart a reverse motion to the main valve. All this is done before the main piston B has finished the stroke above referred to. The piston F continues its backward travel against the water-cushion at its left-hand end, and thereby its gradual and steady motion is insured, for the water in the cylinder can only escape into the chamber J through the communicating channel. When the piston F has traveled half-way the port *a* is entirely closed, and just at the moment the piston B has reached its full stroke the port *c* commences to take steam and the piston B is reversed. As the main valve and piston F continue their travel the port *c* gradually opens wider until it reaches full port, when the piston B has nearly made its return-stroke. In the meantime the left-hand tappet has been projected into the cylinder ready to receive the piston, and the same operation is repeated.

The adjustment of the parts is such that should the working strain be suddenly removed from any cause, the piston would strike the tappet and throw both supplemental and main valve ports open on that side, as shown in process in Sheet 4, and thus be caught on live steam before it could touch the cylinder-head or do any damage.

By this construction I insure a positive and gradual working of the valves and entire stroke of the piston under steady working strain, and provide for their absolute and positive throw by the piston itself in case of accident.

It will be observed that the location of the chambers J is such that any water of condensation will flow into them from the supplemental-valve ports, and thus insure their being always full.

While steam might also be employed, instead of water, as a cushion for the piston F, yet I prefer the latter. The graduating-cocks *n* enable me to retard the motion of the piston F in either direction desired, to accommodate the engine to any irregular strain.

Instead of employing the tappets in the cylinder A, the construction shown in Sheet 4 may be substituted, in which a rod, *a'*, pivoted to the lever-arm R, has collars or swells *b'* *b'* upon it, which are adjusted at a distance from each other to insure the full stroke of the main piston. A head-block or link, *c'*, securely attached to the main-piston rod, and encompassing and sliding along the rod *a'* between the collars, as shown, actuates the levers R and U at each stroke, in the same manner as before described with the employment of the tappets in the cylinder.

Having thus fully described my invention, I claim—

1. The combination, with the supplemental valve, of a main valve controlled by a piston permanently cushioned at all parts of its stroke on water at each end, whereby the throw of said main valve is rendered steady and gradual.

2. The combination, with the supplemental and main valve rods and connecting-levers, of the main piston and connecting mechanism, whereby at each full stroke of the main piston the throw of the supplemental valve is caused and the main valve reversed thereby, and whereby, should the working tension be suddenly removed, the main valve would be thrown directly, by the piston or its rod, to receive the piston directly upon live steam, and prevent its touching the cylinder-heads.

3. The combination, with the main valve, of a piston and a double cushioning chamber having division-heads provided with channel-ways, whereby the throw of the main valve is caused by said piston in a steady and even manner, as specified.

4. The combination, with a supplemental valve, of a subjacent double-headed cylinder with chambers formed between the heads, having communication with the supplemental-valve ports, as specified.

5. The supplemental-valve seat, with upwardly-extending sides to form a basin, as set forth.

6. The combination, with the division-heads of double cushioning cylinder, of channel-ways provided with graduating-cocks, whereby the motion of the piston may be accelerated or retarded in either direction, as desired.

7. The combination, with the main and supplemental valve rods and connecting-levers, of tappets entering the heads of the main cylinder, whereby the main piston, by striking



said tappets, reverses the ports of both supplemental and main valves.

5 8. The combination, with the main-valve rod, united by levers to tappets projecting within the main cylinder, of the supplemental-valve rod, connected to said main-valve rod by a lever, whereby the motions of the speci-

fied parts are regulated the one by the other, as specified.

In testimony whereof I have hereunto set to my hand.

Witnesses:

JOHN H. VAILE.

JOSEPH WERTHNER,

CHAS. M. PECK.