

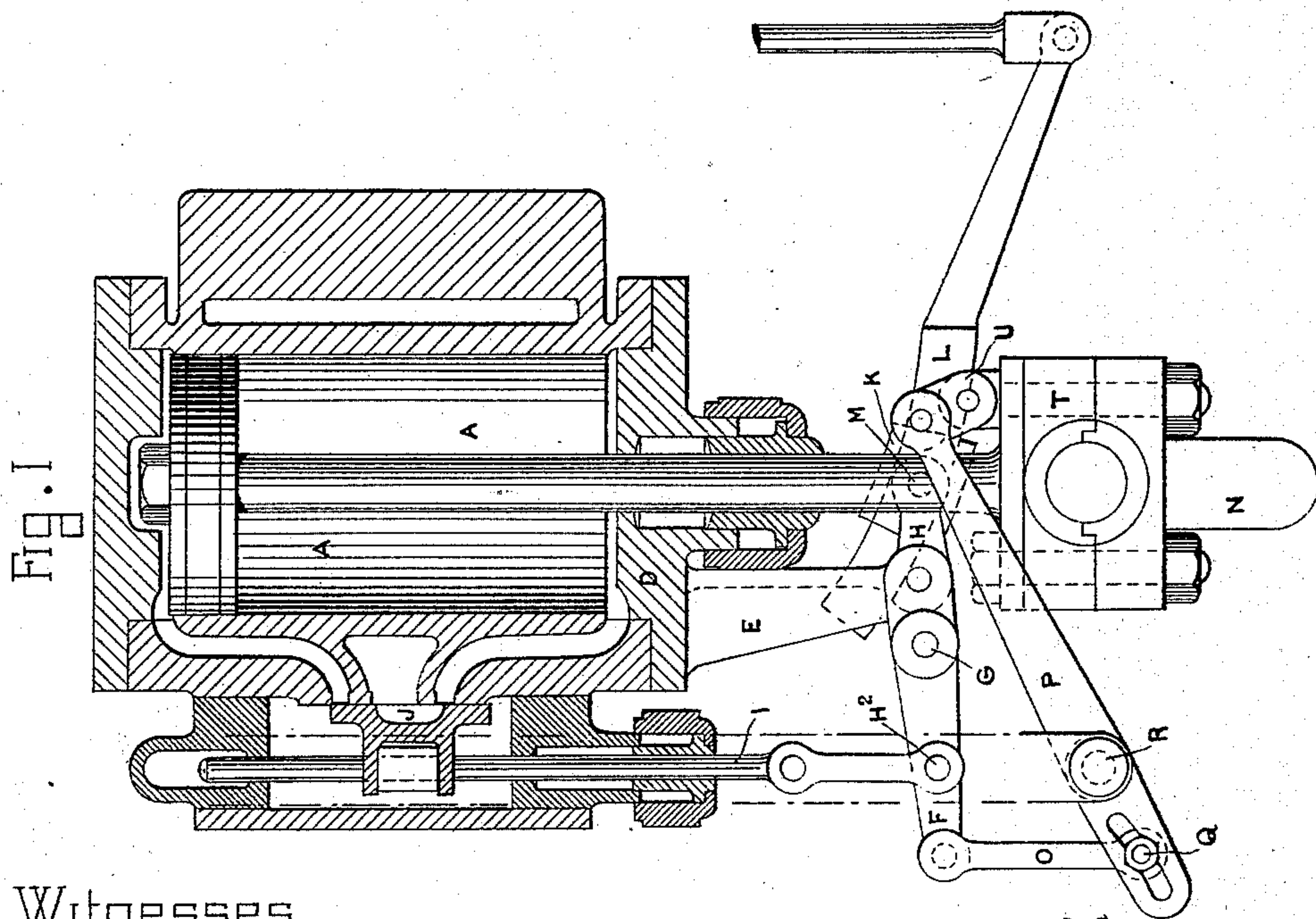
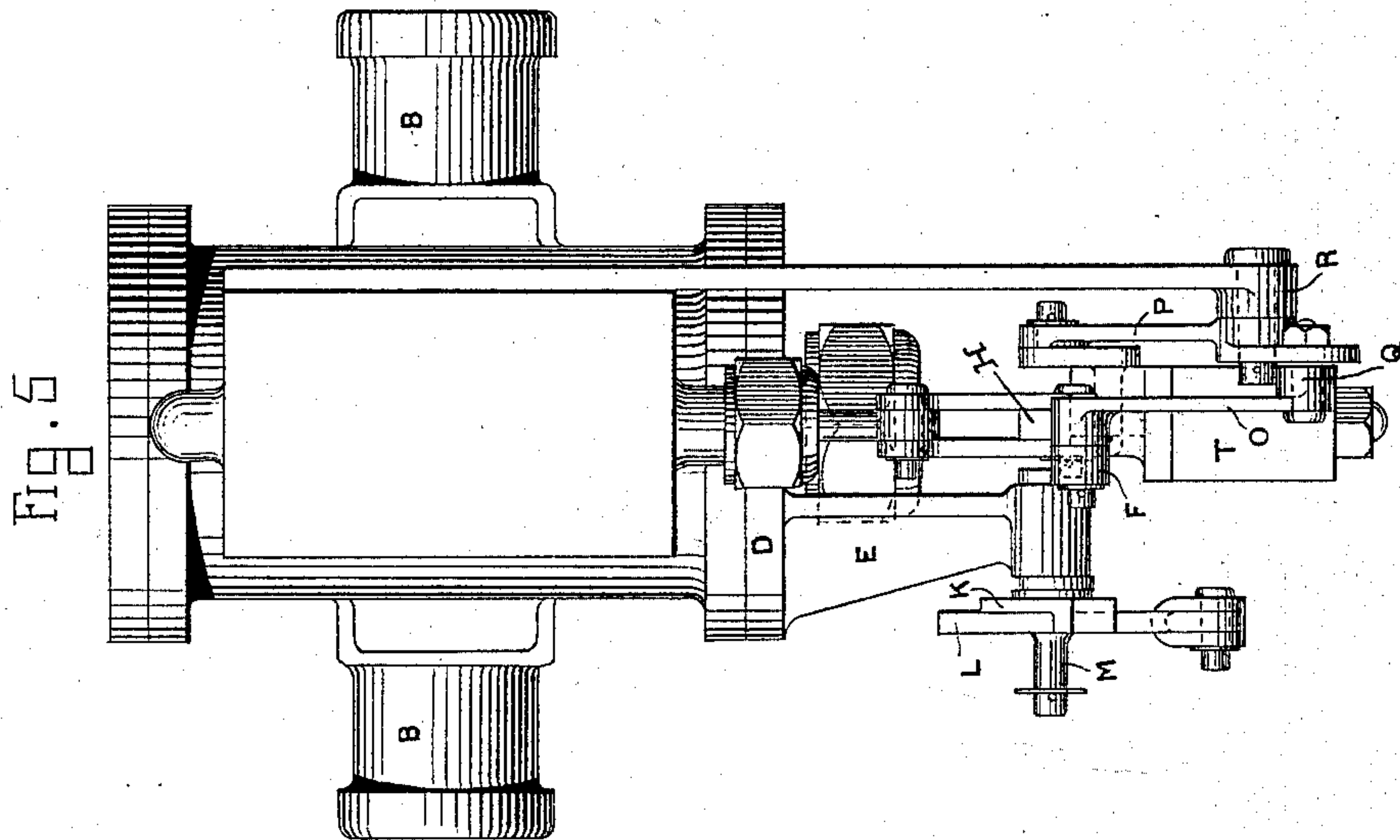
(No Model.)

3 Sheets—Sheet 1.

J. W. HARTLEY.
VARIABLE EXPANSIVE AND REVERSING MOTION FOR OSCILLATING
CYLINDER ENGINES.

No. 388,558.

Patented Aug. 28, 1888.



Witnesses,

W. R. Kennedy.
F. T. Chapman.

Inventor,
J. W. Hartley.
By *his atty*
Phil T. Dodge.

(No Model.)

3 Sheets—Sheet 2.

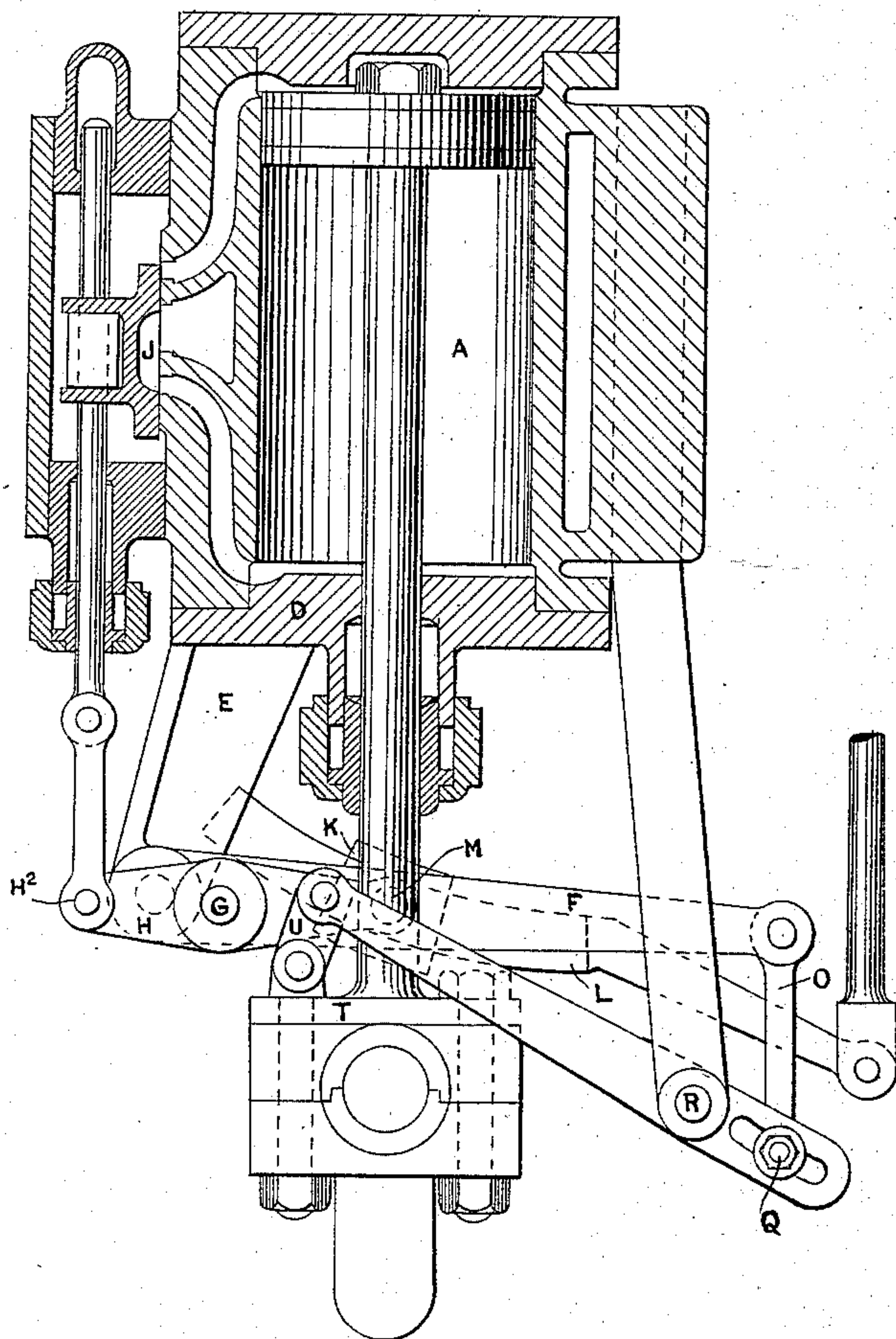
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Fig 2



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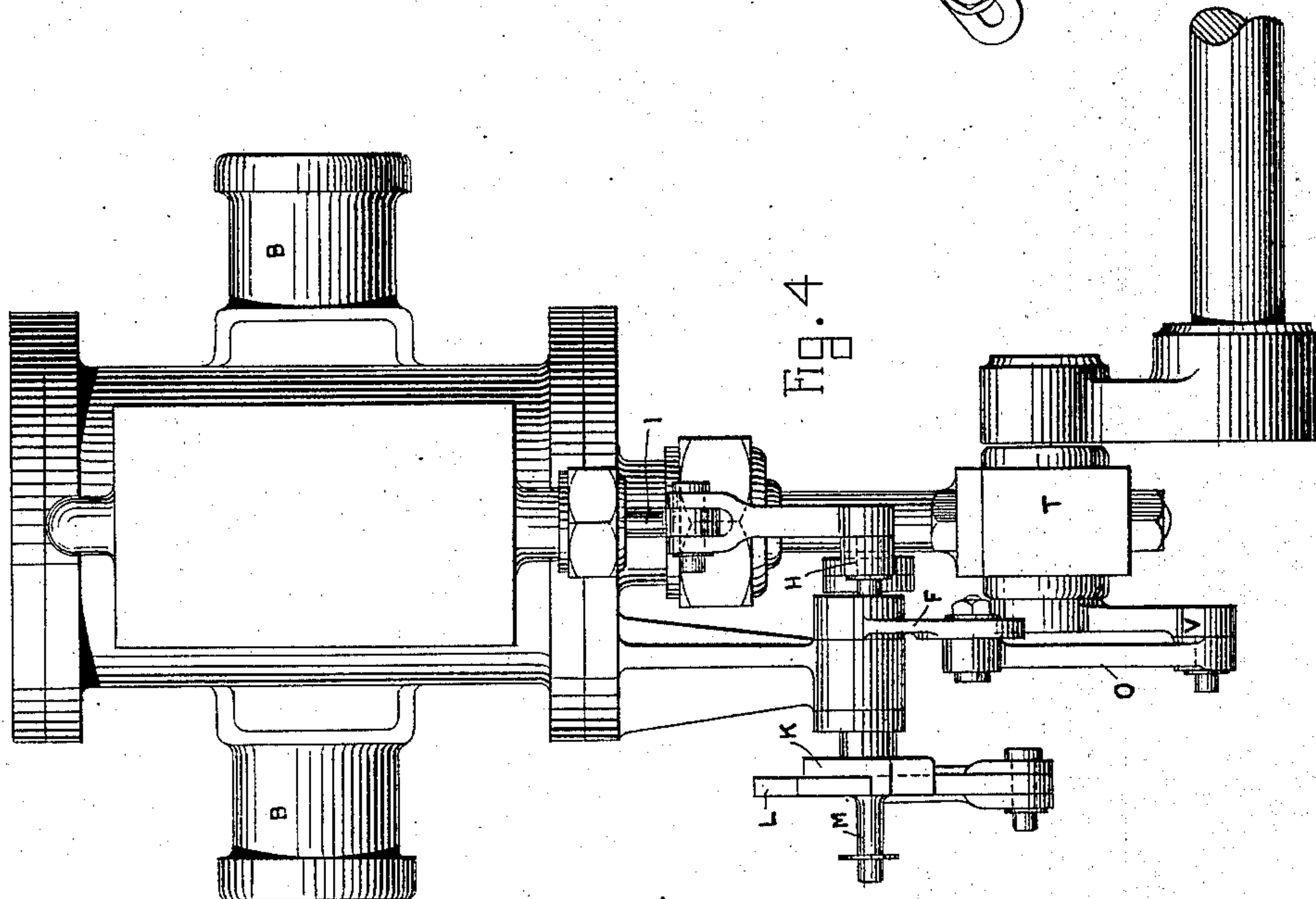
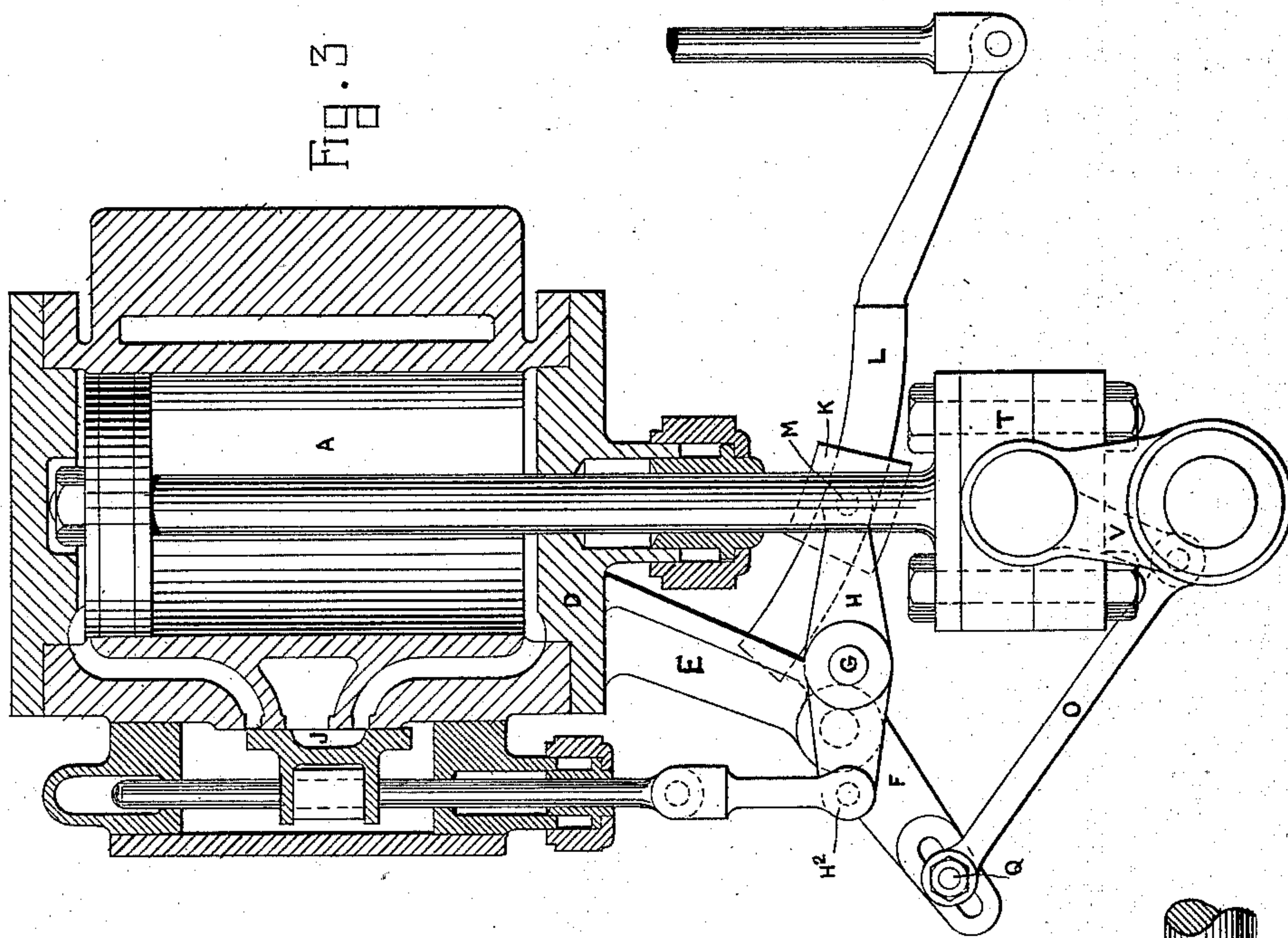
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UNITED STATES PATENT OFFICE.

JOHN WILLIAM HARTLEY, OF STOKE-ON-TRENT, COUNTY OF STAFFORD,
ENGLAND.

VARIABLE EXPANSIVE AND REVERSING MOTION FOR OSCILLATING-CYLINDER ENGINES.

SPECIFICATION forming part of Letters Patent No. 388,558, dated August 28, 1888.

Application filed October 14, 1887. Serial No. 252,325. (No model.) Patented in England March 20, 1886, No. 3,927; in France December 15, 1886, No. 180,295, and in Germany December 31, 1886, No. 40,138.

To all whom it may concern:

Be it known that I, JOHN WILLIAM HARTLEY, a subject of the Queen of Great Britain, residing at Stoke-on-Trent, in the county of Stafford, in the Kingdom of England, have invented certain new and useful Improvements in Variable Expansive and Reversing Motion for Oscillating-Cylinder Engines, (for which Letters Patent have been issued in England, dated March 20, 1886, No. 3,927; in France, dated December 15, 1886, No. 180,295, and in Germany, dated December 31, 1886, No. 40,138,) of which the following is a specification.

My invention consists of an improved variable expansive and reversing motion for oscillating-cylinder engines, which I obtain without the use of eccentrics as usually applied. For the purpose of my invention I use the following apparatus: Through a suitable arm or bracket attached to the cylinder of an oscillating engine I pass a pin, which serves as a fulcrum for a rocking lever. Upon said rocking lever and at a suitable distance from the fulcrum I fix a pin, which acts as a fulcrum for another lever, one end of which is attached to the slide-valve rod. The other end I attach to a block, which slides in a curved slotted link as the cylinder oscillates. Said link is supported upon a fulcrum fixed to engine-frame, its center being in a direct line between the center of oscillation and the center of crank-shaft. The center line of curved link is at all points equidistant from center of oscillation when in mid-position. I make said curved link to vibrate upon its center when moved from mid-position, and as the cylinder oscillates motion is given to the sliding block, and from thence to the slide-valve, by means of the before-named levers. By moving the curved link upon its fulcrum in either direction from its mid-position the engine is reversed. To enable me to employ lap and lead in order to use the steam expansively, I fit a suitable bracket or arm upon the valve box or cylinder, and to the end of this bracket or arm I fix a pin, which acts as a fulcrum to a lever. One end of said lever I connect to before-named rocking lever by means of a rod or link, and the other end I connect to the piston-rod by a short link or by other suitable means. When

the piston-rod reciprocates, a corresponding vibratory motion is communicated to the said lever, and by means of the rod or link to the before-named rocking lever, which in its turn transmits the motion to the valve. By properly proportioning the levers I obtain the additional movement required to enable lap and lead to be added to the valve.

The accompanying drawings illustrate my invention and methods of applying same.

Figure 1 is a sectional view. Figs. 2 and 3 are also sectional views showing different methods of arranging the levers. Fig. 4 is an elevation at right angles to Fig. 3; Fig. 5, an elevation at right angles to Fig. 1.

The same letters refer to the corresponding parts in each figure.

Referring to Fig. 1, A represents the cylinder of an ordinary oscillating engine; B, (shown in other figures,) the trunnion or center of oscillation. Upon cylinder-cover D, I attach bracket E, acting as a fulcrum for lever F, and upon lever F, I fix a pin, G, forming a fulcrum to lever H.

One end of said lever H, I attach to valve-rod I, which gives motion to the slide-valve J. To the other end of said lever H, I attach a shoe, K, which is slotted out to fit upon a curved rocking bar or link, L, or, if preferred, a block and slotted link of the ordinary construction. The said shoe K is flanged up to fit the curved rocking bar or link L and slides upon it as the cylinder oscillates. The said curved bar or link works upon a pin, M, fixed in a suitable position upon stationary portion of frame, and is in this instance in a direct line between the centers of oscillation B and crank-shaft N. When curved rocking bar or link L is in mid-position, its center line is at all points equidistant from center of oscillation B, and when the cylinder oscillates with link in this position no motion is communicated to shoe K and slide-valve J. Upon moving curved rocking bar or link L upon its center either way according to the direction the engine is desired to rotate, motion is transmitted to the slide-valve through lever H as the cylinder oscillates, thereby causing the engine to rotate in one direction, and when the curved bar or link L is moved in the opposite direc-

tion the engine will be reversed by admitting steam to the opposite end of the cylinder. From the foregoing it is obvious that this motion could be obtained with the curved link only, and the fulcrum G fixed to the cylinder, as is frequently the case in cheap types of oscillating engines; but it will also be seen that no motion can be communicated to the shoe K and from thence to the valve J as the crank is passing the dead-centers. Thus neither lap nor lead can be used, so that with engines constructed as described steam cannot be used expansively.

In order to use lap and lead and give the necessary additional travel to the valve at each end of the piston's stroke, I attach to outer end of lever F a connecting-rod, O, the other end of which I attach by a pin, Q, to vibrating lever P, which vibrates upon fulcrum R. I carry fulcrum R upon a suitable bracket extending from any convenient part of cylinder or valve-chest, and which oscillates therewith. The other end of said lever P, I connect to piston cross-head T by means of a short link, U, or to piston-rod, in other convenient manner. Lever P vibrates to and fro with reciprocating motion of piston cross-head, giving motion through connecting-rod O to lever F and fulcrum G, and thence to lever H. Accordingly it will be seen that the center of shoe K, which at this point may be near its dead-center and almost stationary, becomes the fulcrum for this motion, and thus the end H² of lever H is given an increased throw, which it communicates to the slide-valve J. I proportion these levers so as to give to the slide-valve an amount of travel at each stroke of the engine equal to the sum of the lap and the lead, and this, be it observed, is a constant quantity independent of the position of the curved bar or link L.

To obtain a variable expansive motion, I employ a lever and quadrant of ordinary construction, attached by a suitable rod to end of curved bar or link L, so that I can move said curved bar therewith and fix it in any desired position. I then move said curved bar out of its central position in either direction to a greater or less degree, which correspondingly increases or decreases the travel of the valve, consequently cutting the steam off earlier or later, varying the expansion accordingly.

In the end of lever P, I form a slot, wherein the pin Q is fitted, and by moving this pin farther from fulcrum R, I increase the throw of lever F, thus compensating for any wear or slackness in the joints of the levers.

Fig. 2 shows an arrangement with lever P carried upon opposite side of cylinder to that shown at Fig. 1.

Figs. 3 and 4 show arrangement of levers where I obtain the desired movement of lever F from a return-crank, V, instead of piston-rod, as in Figs. 1 and 2.

I would also have it understood that I do not confine myself to the exact details hereinbefore described, as the same admit of modification without departing from the essential features of my invention.

I claim as my invention—

1. In combination with an oscillating cylinder, A, the reversing-lever X, curved link L, slide-block K, and lever H, linked or jointed to the block K and to the valve-rod I, and pivoted on a fulcrum oscillating with cylinder A, substantially as described.

2. The combination of reversing-link L, slide-block K, and lever H, connecting same to the valve-rod with fulcrum G, having motion taken from the piston-rod, but reduced in amount.

3. The combination, in an oscillating engine, of the fulcrum G of the lever H, (whereby the slide-block is connected to the valve-rod,) with lever F, fulcrumed on a point rigidly fixed to the cylinder, and devices O P U, for transmitting a reduced motion from the piston-rod, substantially as and for the purposes described.

4. The combination, in an oscillating engine, of the lever H, that gives motion to the valve-rod, with a fulcrum, G, having a motion corresponding to that of the piston-rod, but reduced, whereby the necessary additional travel of the valve is obtained to allow for lap and lead and to work expansively.

5. The combination, in a valve-gear for eccentric engines, of the lever F, carrying the fulcrum of the valve-rod-actuating lever H, link O, slotted lever Q, and link U, connecting Q to the piston-connections, whereby the motion of the piston in a reduced form is transmitted to the valve-rod actuating lever H.

6. The mechanism for regulating the lead in oscillating engines, consisting of a lever, F, carrying the fulcrum of the valve-rod-actuating lever H, a lever, P, oscillating on a point, R, oscillating with the cylinder and linked to the piston-rod connections, with a rod, O, capable of being attached to lever P at any required point between limits by means of a linking device, Q.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN WILLIAM HARTLEY.

Witnesses:

A. E. HARRISON,
EDWARD SCRAGG.