

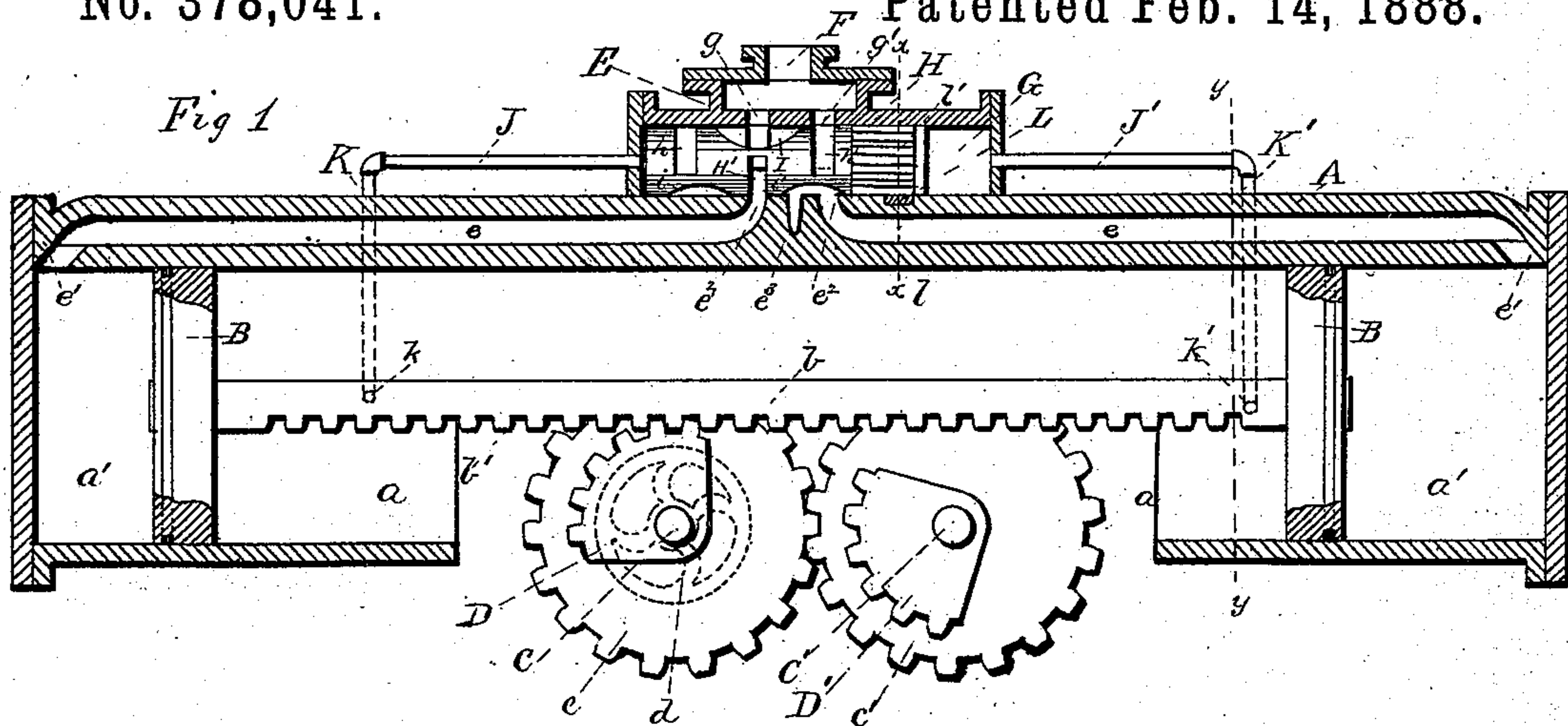
(No Model.)

F. A. CRESSWELL.

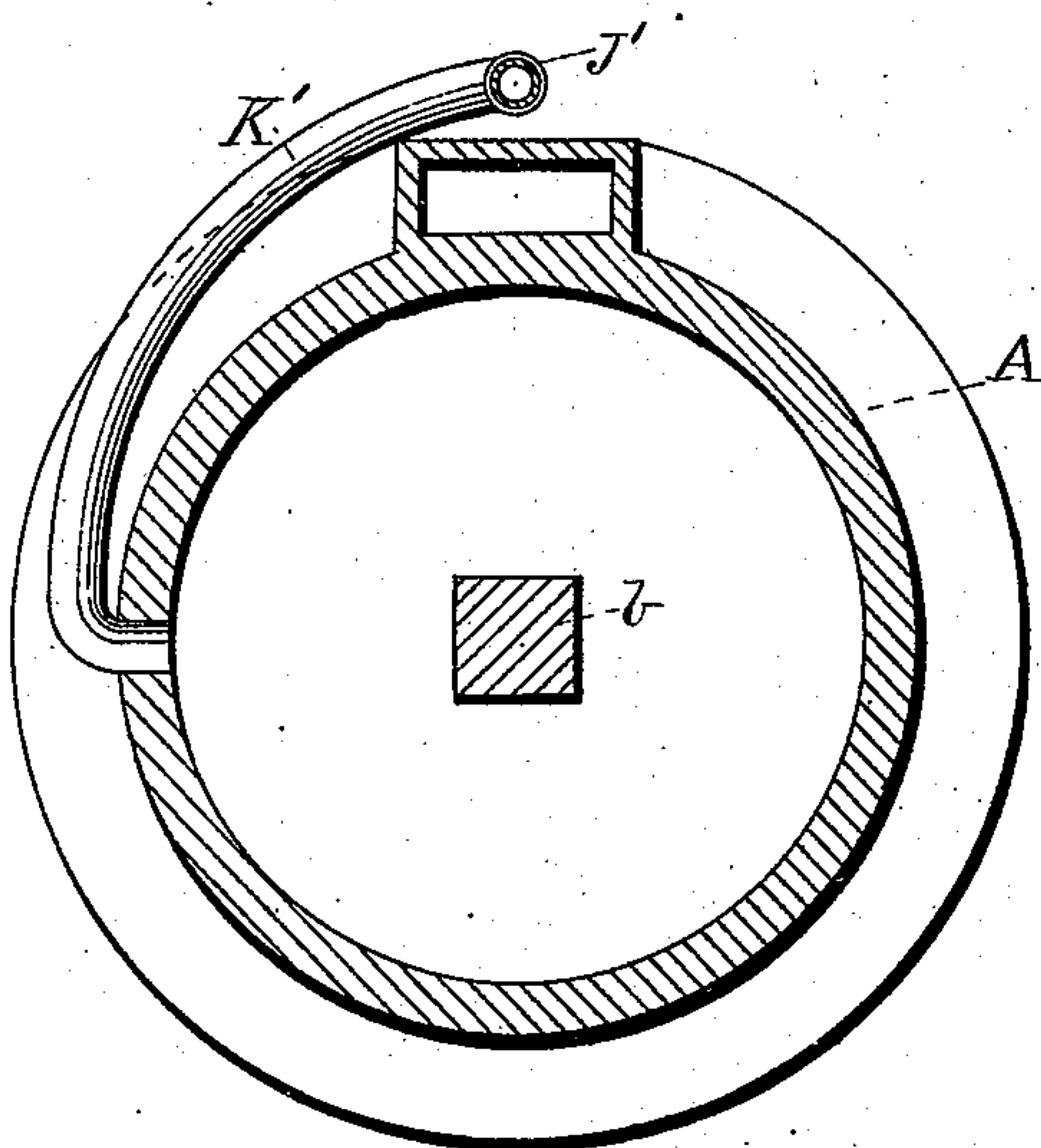
STEAM ENGINE.

No. 378,041.

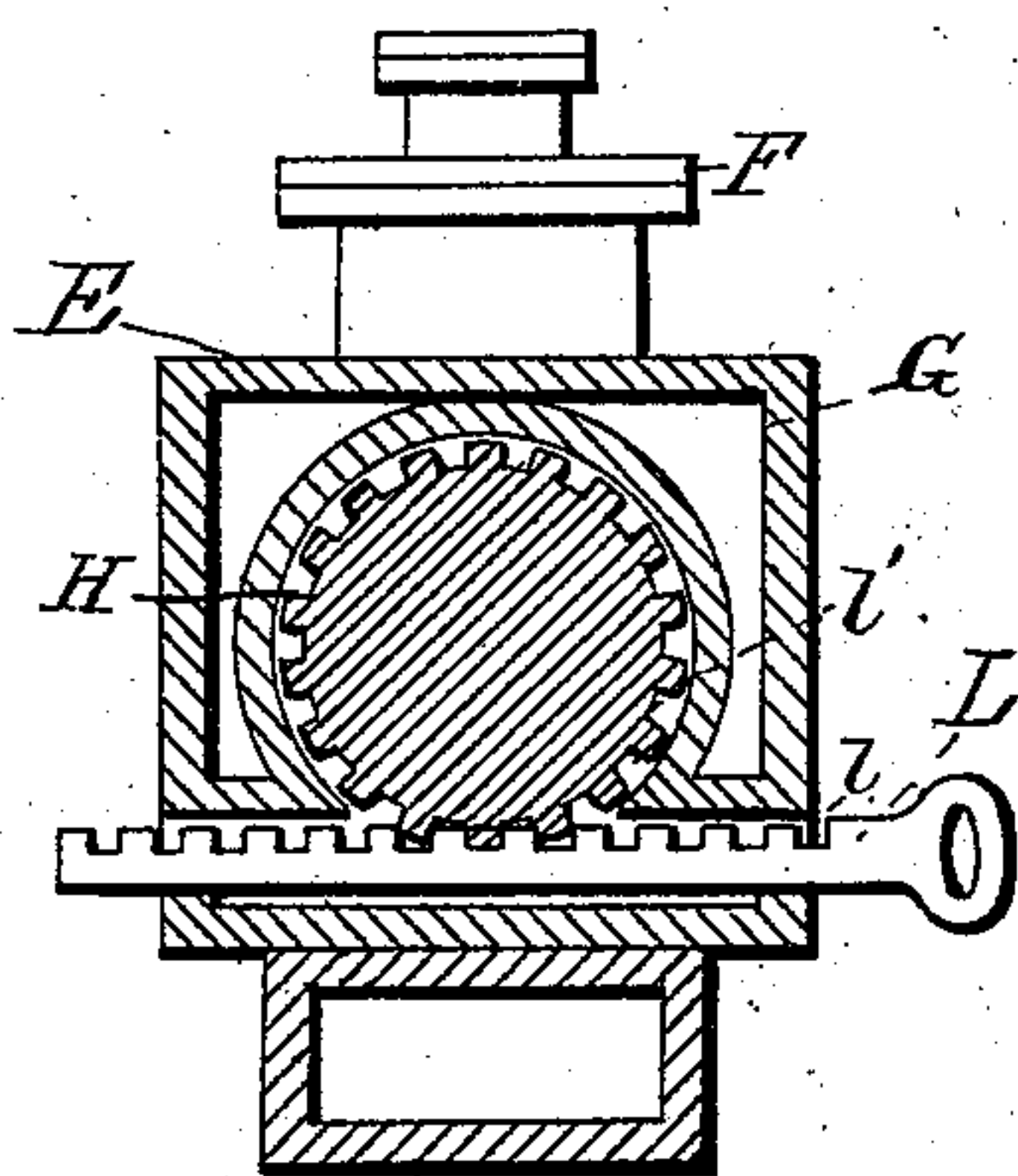
Patented Feb. 14, 1888.



*Fig 2*



*Fig 3*



WITNESSES

W. B. Harris  
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INVENTOR.

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by E. W. Anderson.  
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# UNITED STATES PATENT OFFICE.

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## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 378,041, dated February 14, 1888.

Application filed April 11, 1887. Serial No. 234,376. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS A. CRESSWELL, a citizen of the United States, residing at Strongtown, in the county of Indiana and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engines; and I do 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Figure 1 of the drawings is a vertical longitudinal section of my improved steam-engine. Fig. 2 is a transverse section on line *y y*, Fig. 1. Fig. 3 is a transverse section on line *x x*, Fig. 1.

My invention relates to improvements in piston-valve engines, the objects being to actuate the valve by steam that has passed there-through into the cylinder and to substitute for the usual crank and pitman mechanism that will produce no dead-points. These objects I accomplish by the construction and novel arrangement of parts hereinafter described, and embraced in the appended claims.

Referring to the accompanying drawings by letter, A designates the cylinder, closed at both ends, but open at *a* on its side opposite the steam-chest.

B B are two similar pistons reciprocating in the similar complete end portions, *a' a'*, of the cylinder and secured to the ends of a piston-rod, *b*, a suitable distance shorter than the cylinder from head to head, and provided with a rack, *b'*, on the side opposite the steam-chest.

C C' are two similar shafts passing through the space *a* in the cylinder, and provided on one side of the latter with the equal-sized intermeshing gear-wheels *c c'*.

D D' are equal-sized segmental gears secured, respectively, on the shafts C C' and arranged to mesh alternately with the rack *b'*, one becoming engaged therewith just before the other disengages. As the piston-rod moves in one direction, the rack *b'* engages the segmental gear D and rotates the shaft C, which, by means of the intermeshing gears *c c'*, rotates the shaft C' in the opposite direction. When the piston-rod reverses its reciprocation, the gear D disengages from the rack *b'*, and the gear D'

engages therewith and is moved thereby in the direction opposite to that of the gear D, so that the opposite rotations of the shafts C C' are kept up continuously. On either shaft is secured a pulley, *d*, which can be belted to a pulley on any machine it is desired to operate.

The steam is admitted to the closed ends *a'* of the cylinder behind the pistons B B by the following means:

E is the steam-chest, and *e e* are the steam-ports having the orifices *e' e'* at the ends of the cylinder, and the orifices *e'' e''* entering the steam-chest, between which latter orifices is the exhaust-port *e'''*. The steam-chest is provided with the entrance-port F from the steam-pipe, and has forming part of it the valve-cylinder G, provided with the two ports *g g'*, a suitable distance apart, cut transversely through it for a little more than half its diameter, and which register with the orifices *e'' e''* of the steam-ports *e e*.

H is a hollow piston-valve, closed at the ends, reciprocating in the cylinder G, provided on one side with the steam-port H', cut transversely through it for a little more than half its diameter, and on the opposite side with the similar steam-ports, *h h'*, equally distant from the port H', toward the opposite ends of the cylinder G. Between the ports *h h'* is the concave exhaust space or chamber I, closed in so as to have no communication with the interior of the valve, and *i i'* are similar, but shorter, exhaust-spaces an equal distance on each side of the port H'.

J J' are steam-tubes which run outward from the opposite ends of the valve-cylinder G, the said tubes having coupling-pieces at the outer ends, connecting them, respectively, with the tubes K K', which open into the ends *a' a'* of the cylinder A, at equal distances from the head thereof, at the respective points *k k'*.

L is a straight rack-bar running through a suitable opening or groove, *l*, on the side of the steam-chest and engaging a toothed portion, *l'*, of the peripheral surface of the valve. By means of the said portion and the rack the valve is reversed; but as this mechanism is shown and described in a former patent granted to me no broad claim is made to it in the present application.

The operation of the rack *b'*, segmental gears,



meshing gear-wheels, and shafts has been described.

The following is the operation of the valve mechanism: In Fig. 1 the steam is passing 5 within the hollow valve through the port  $g$ , and thence through the port  $H'$ , which overlaps the port  $g$ , into the corresponding steam-port,  $e$ , whence it passes into one end portion  $a'$  of the cylinder A and drives the corresponding piston B inward. The piston-valve 10 H is now adjacent to the steam-tube J, and the steam-port  $e$  on the opposite side communicates with the exhaust-port  $e^3$  through the exhaust-space  $i'$ . When the inwardly-moving 15 piston B passes the orifice  $k$ , some of the steam behind it passes through the tube K and drives the corresponding end of the valve H inward, the opposite end of the cylinder G exhausting through the tube K' and orifice  $k'$ , 20 which is inward from the corresponding piston B and can communicate with the open air through the space  $a$ . The steam from the tube K moves the valve till the port  $H'$  registers with the port  $g'$ , and the exhaust-space  $i$  connects the corresponding steam-port,  $e$ , with 25 the exhaust-port  $e^3$ . The movement of the pistons B B is then reversed. Each orifice  $k$   $k'$  is so situated as to admit steam to the corresponding tube, K or K', and turns to move 30 the valve before the opposite piston B has reached the end of its stroke, so that the corresponding end,  $a$ , of the cylinder takes steam and cushions said piston. To reverse the engine, the piston-valve H is one-half rotated 35 by means of the rack and toothed portion of said valve. Then, if the ports are in position shown in Fig. 1, the port  $h'$  will open into the orifice  $e^2$  of the steam-port  $e$ , with which it registers, and the exhaust-space I will connect the opposite steam-port,  $e$ , with the exhaust-port  $e^3$ , so that the flow of steam, as indicated by arrows in the said figure, will be reversed.

Having described my invention, I claim—

45 1. The combination of the main cylinder open centrally on one side, the similar pistons moving in the complete ends of said cylinder, the piston-rod connecting said pistons and having a rack formed upon it, the similar 50 shafts provided with equal-sized intermeshing gear-wheels, the similar segmental gears secured to their respective shafts in such positions that one engages with the rack on the piston-rod as the other disengages therewith,

and that the said change of engagement occurs at the end of each stroke of the pistons, substantially as specified. 55

2. The combination, with the main cylinder having the steam-ports  $e e$  and exhaust-port  $e^3$ , the two similar pistons and the rod 60 connecting the latter, of the steam-chest having the steam-ports  $g g'$  in its cylindrical portion, the hollow piston-valve provided with the port  $H'$  and exhaust-spaces  $i i'$ , and the steam-tubes J J' and K K', respectively opening 65 into the cylinder at the points  $k k'$ , substantially as specified.

3. The combination, with the main cylinder having the steam-ports  $e e$  and exhaust-port  $e^3$ , the two pistons and connecting piston-rod 70 of the steam-chest having the ports  $g g'$  in its cylinder, the piston-valve provided with the steam-ports  $H', h$ , and  $h'$ , and exhaust-spaces I,  $i$ , and  $i'$ , the tubes J J' and K K', opening into the main cylinder at the points  $k k'$ , and mechanism, substantially as described, to half rotate the piston-cylinder. 75

4. The combination, with the main cylinder having the steam-ports  $e e$  and exhaust-port  $e^3$ , and the two pistons and connecting piston-rod, 80 of the steam-chest having the steam-ports  $g g'$  on its cylinder G, the piston-valve provided with the steam-ports  $H', h$ , and  $h'$ , and exhaust-spaces I,  $i$ , and  $i'$ , the steam-tubes J J' and K K', the toothed portion L of the piston-valve, 85 and the straight rack-bar  $l$ , engaging therewith, substantially as specified.

5. The combination, with the main cylinder having the open part  $a$ , complete end parts,  $a'$ , steam-ports  $e e$  and exhaust-port  $e^3$ , the two pistons B, and piston-rod  $b$ , having the rack  $b'$  90 formed upon it, the two shafts CC', connecting the intermeshing gear-wheels  $c c'$ , and the segmental gears DD', secured, respectively, in said shafts, of the steam-chest provided with the steam-ports  $g g'$  on its cylinder G, the piston-valve provided with the port  $H'$  and steam-spaces  $i i'$ , and the steam-tubes J J' and K K', opening into the end ports,  $a'$ , of the main cylinder at the points  $k k'$ , substantially as 100 specified.

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

FRANCIS A. CRESSWELL

Witnesses:

J. W. CLARK,  
S. J. TELFORD.