

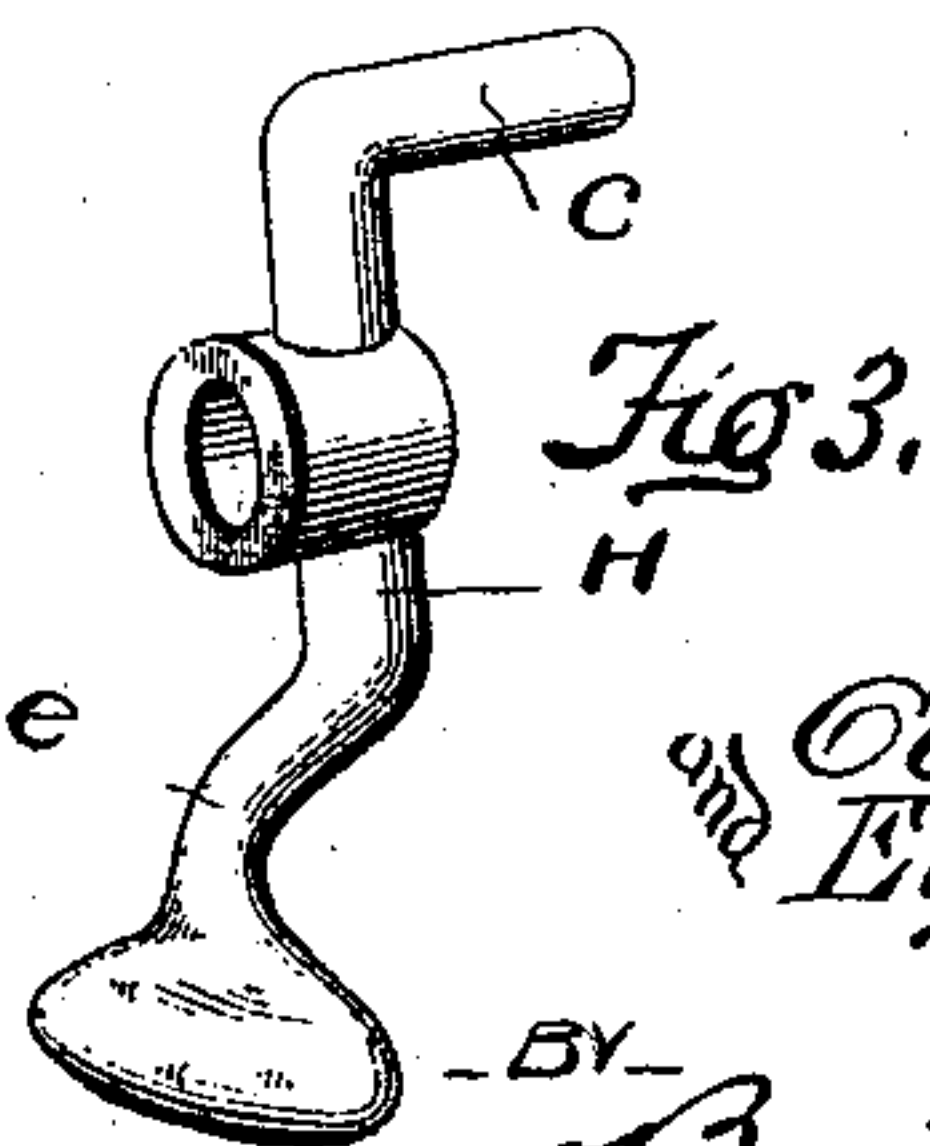
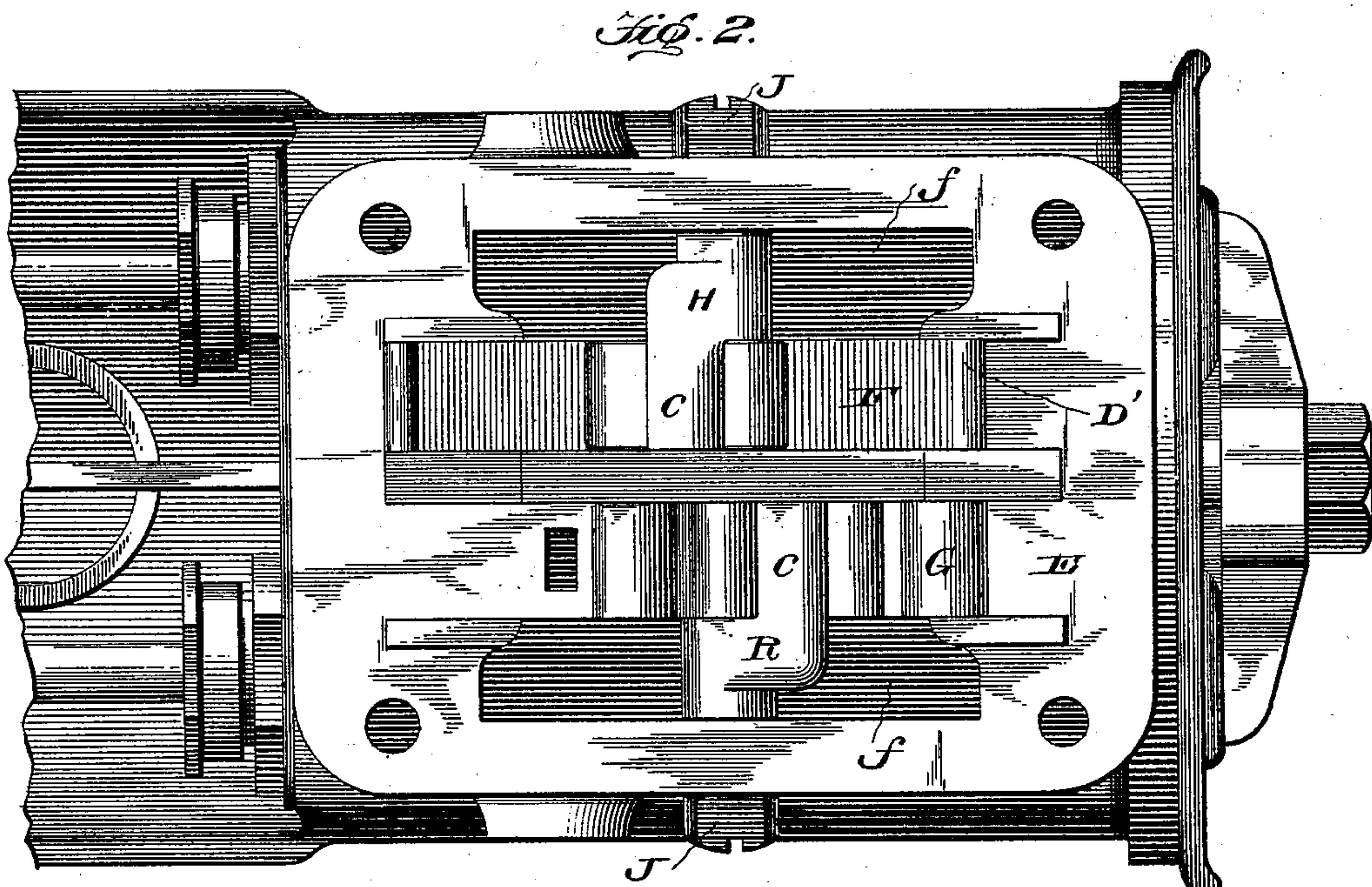
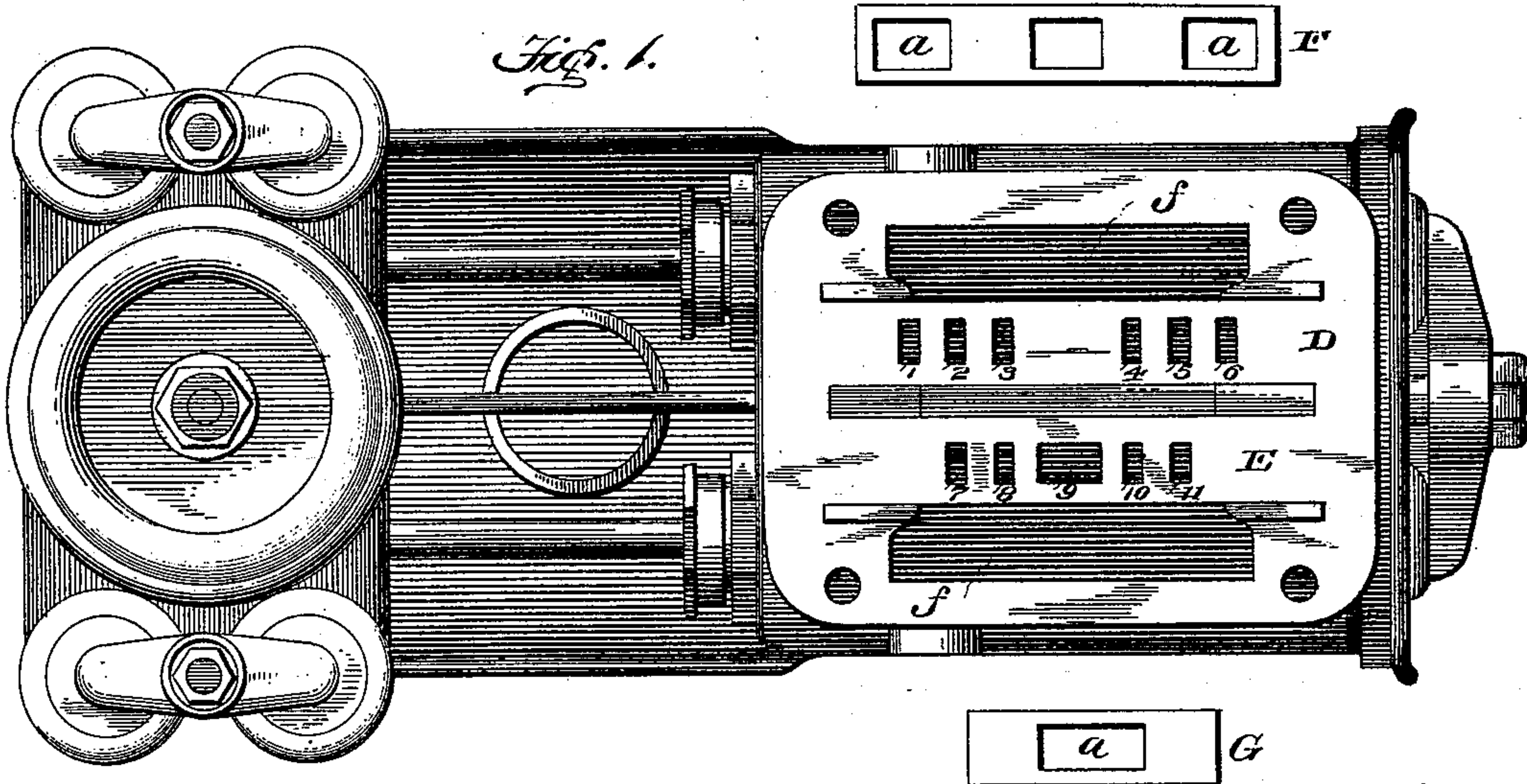
(No Model.)

2 Sheets—Sheet 1.

C. M. & E. E. MILLER.  
DUPLEX STEAM ENGINE.

No. 542,342.

Patented July 9, 1895.



Witnesses

*Wm. C. Dashiell*  
*Geo. H. Evans*

Inventors  
*Cassius M. Miller*  
*Edgar E. Miller*

BY

*Wm. E. Carl*

Asso. Attorney

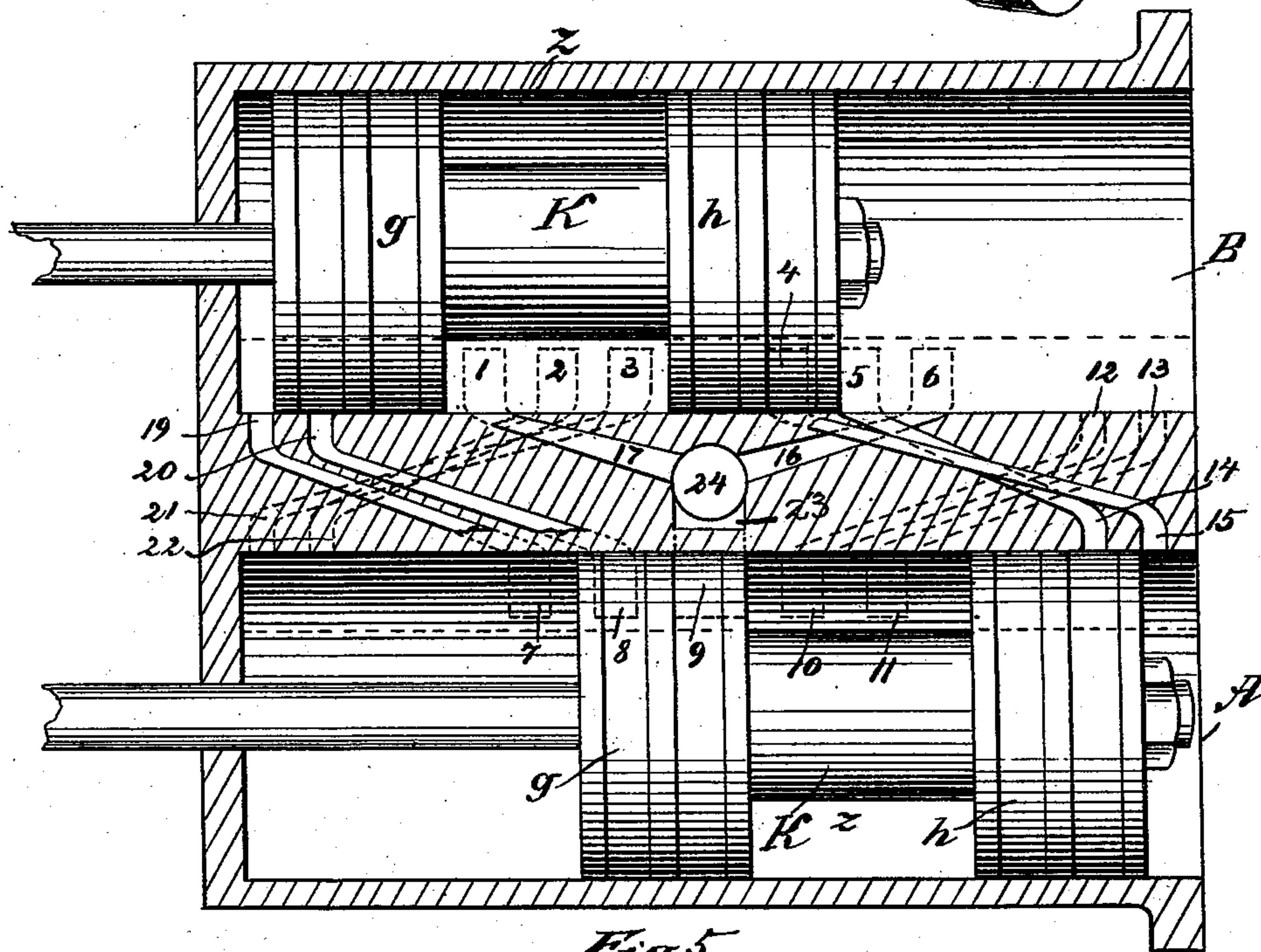
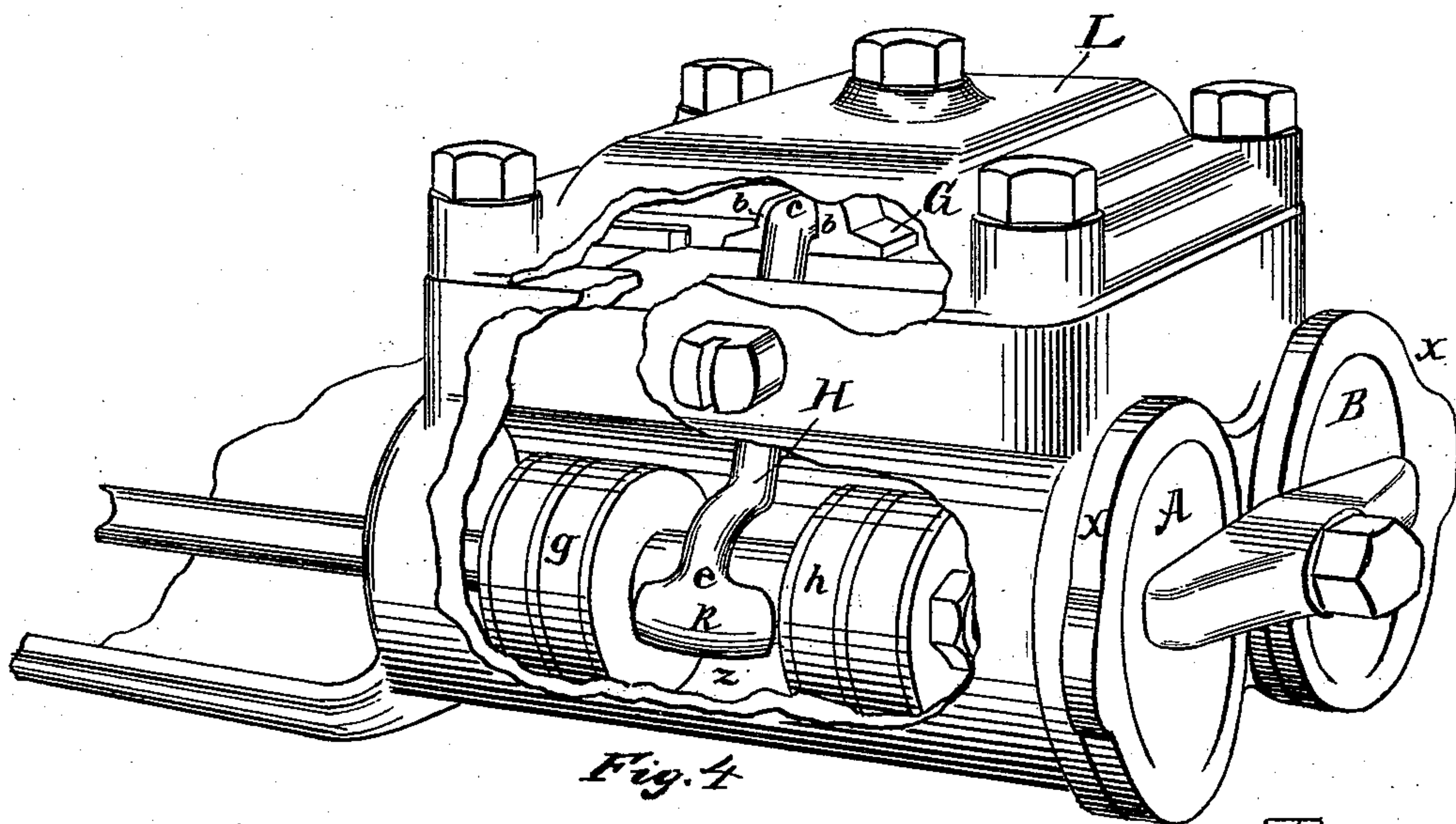
(No Model.)

2 Sheets—Sheet 2.

C. M. & E. E. MILLER.  
DUPLEX STEAM ENGINE.

No. 542,342.

Patented July 9, 1895.



WITNESSES  
Theo. Hilley  
Ben H. Miller

INVENTORS  
Cassius M. Miller  
and  
Edgar E. Miller  
By W. H. Miller, Attorney



# UNITED STATES PATENT OFFICE.

CASSIUS M. MILLER AND EDGAR E. MILLER, OF CANTON, OHIO.

## DUPLEX STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 542,342, dated July 9, 1895.

Application filed August 27, 1894. Serial No. 521,417. (No model.)

*To all whom it may concern:*

Be it known that we, CASSIUS M. MILLER and EDGAR E. MILLER, citizens of the United States, and residents of Canton, county of Stark, State of Ohio, have invented a new and useful Improvement in Duplex Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification.

Our invention relates to certain improvements in duplex engines for duplex pumps or other purposes; and it consists of certain features of construction and combination of parts, as will be hereinafter described and claimed.

Figure 1 of the drawings is a plan view showing the steam-cylinder in connection with a pump, the valve-seats exposed, and the valves inverted at the sides of the cylinder. Fig. 2 is a similar view of the steam-cylinders, showing the valves in operative position. Fig. 3 is a perspective of the valve-actuating lever. Fig. 4 is a similar view of the steam-cylinders, having a portion of the side cut away to disclose the interior, showing parts in operative position. Fig. 5 is a section through the steam-cylinder, showing the cylinder and the steam-passages in section.

A represents the left and B the right hand cylinders. In the web portion C, that connects the cylinders, are provided ports 1 2 3 4 5 6 7 8 9 10 11 and passages 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, and 23, Nos. 14 15 21 22 leading from cylinder A to cylinder B, and Nos. 12, 13, 19, and 20 from cylinder B to cylinder A. Passages 16 and 17 are exhausts leading from cylinder B to a central exhaust 24, leading down and out at the lower side. Passage 23 is an exhaust leading from cylinder A into exhaust 24. Passages Nos. 12 and 20 are exhaust or cushion ports leading from cylinder B to ports 8 and 10. Under valve G and passages 14 and 22 are similar passages leading from cylinder A to ports 3 and 5 under valve F.

Valve-seats D and E are provided on the upper face of the web D, in which are provided the ports designated by Nos. 1 to 11, inclusive, as shown, Nos. 1 to 6 in valve-seat D, and Nos. 7 to 11 in valve-seat E.

F represents a double valve adapted to slide

on valve-seat D and to cover the ports numbered 1 to 6, inclusive.

G represents a single valve adapted to slide on and cover the ports, as shown, and numbered from 7 to 11, inclusive. The valves, as shown in Fig. 1, are inverted.

In the valves F and G are provided the usual recesses *a* to provide a passage for steam from inlet to exhaust ports. In valve F, between the exhaust-recesses *a*, is provided a recess or opening to admit live steam under the central portion of the valve to the inner end portion of the D valves.

On the top side of the valves F and G, a distance from the center thereof, are provided upwardly-projected lugs *b*, between which is placed the upper end portions *c* of the valve-actuating levers H, which are supported on pivots J, the free ends *e* passed down through apertures *f* into the cylinders and into the recesses *z*, between the end portions *g* and *h* of the piston-heads K, the lower portions of apertures *f* to be limited to the space between the end portions *g h* of the piston-head, the apertures *f* forming open channels or communications between the central portions of the cylinders and the steam-chest formed by the cap L. To recapitulate: The valve-actuating levers are pivotally secured to the sides of the cylinders to swing on pivots J, the upper end portions *c* resting between the lugs *b* on the valves, the lower ends projected down in the cylinders and into the spaces *z*, between the end portions *g h* of the piston-heads K. At the lower ends of the levers H are provided arms or heads *k*, extending outwardly from each side of the body of the lever, the end portions of the arms to engage the end portions *g* and *h* of the piston-heads. It should be remembered that those parts of the apertures *f* entering the cylinders should be no longer than the distance between the head portions *g* and *h* of the piston-heads. The return of stroke or point of reversal is determined by the length of the arm *k* on the lever H and the length of the recess *z* in the piston-head.

For the purposes of this application we will refer to Fig. 5, which illustrates a piston adapted for a stroke of one and one-half inch, the recess *z* in piston-head one and one-fourth



inch long, and in that case the arm *k* or head of the lever *H* should be one inch long. This arrangement of parts would turn the pistons at the point of a three-fourths stroke—  
 5 that is, the piston that had completed its stroke will be started on the reverse movement when the other or moving piston has reached a point covering three-fourths of its stroke, thus providing for a continuous piston movement.

10 In operation, steam is admitted through port 3 and passage 21 to the rear end of cylinder A and drives the piston-head to the front end, carrying the lower or head end of lever *H* with it, the upper end engaging valve  
 15 *G*, and moving it rearwardly to open or uncover port 11, through which steam is admitted to the front end of cylinder B, by way of passage 13, which has driven its piston to the rear with the lower end of the lever, the  
 20 upper end moving the valve *F* to the front to uncover or open port 4, through which steam is admitted to the front end of cylinder A to reverse the stroke, the steam from the rear end of cylinder passing out through passage  
 25 22 to ports 2 and 1 and passage 17 to 24 and out. The exhaust from the rear end of cylinder B is through passage 20, ports 8 and 9, passage 23, to exhaust 24, and out. The exhaust from the front end of the cylinders is made  
 30 in a similar manner and through ports and passages shown and hereinbefore mentioned.

A particular feature of our invention relates to the open way or channel connecting the steam-chest with the cylinders, and placing  
 35 therein a valve-actuating lever, one end of which engages the piston-head and the other end the steam-directing valves.

Having thus fully described the nature and object of our invention, what we claim is—

1. The combination with the two cylinders 40 placed side by side and provided with live and exhaust steam passages leading from one cylinder to the other, of the valve seats provided with ports communicating with said passages, the valves for opening and closing the ports, 45 the pivoted oscillating arms connected with said valves, and the pistons in said cylinders operating said arms by impact, to operate said valves, substantially as described.

2. The combination with the cylinders A 50 and B placed side by side and provided with valve seats, one of said valve seats being provided with ports 1, 2, 3, 4, 5 and 6 and the other with ports 7, 8, 9, 10 and 11, the valve *F* having recesses *a*, *a*, and a central live 55 steam passage and the valve *G* having a central recess *a*, of the web connecting said cylinders provided with passages 12, 13, 14, 15, 19, 20, 21, 22 leading from one cylinder to the valve seats in the other cylinder and with ex- 60 haust passages 16, 17 and 23 and exhaust port 24, the pivoted oscillating arms connected with said valves, and the pistons located in said cylinders and operating said arms by impact therewith, substantially as described. 65

In testimony whereof we have hereunto set our hands this 20th day of August, A. D. 1894.

CASSIUS M. MILLER.  
 EDGAR E. MILLER.

Witnesses:

W. K. MILLER,  
 BURT A. MILLER.