

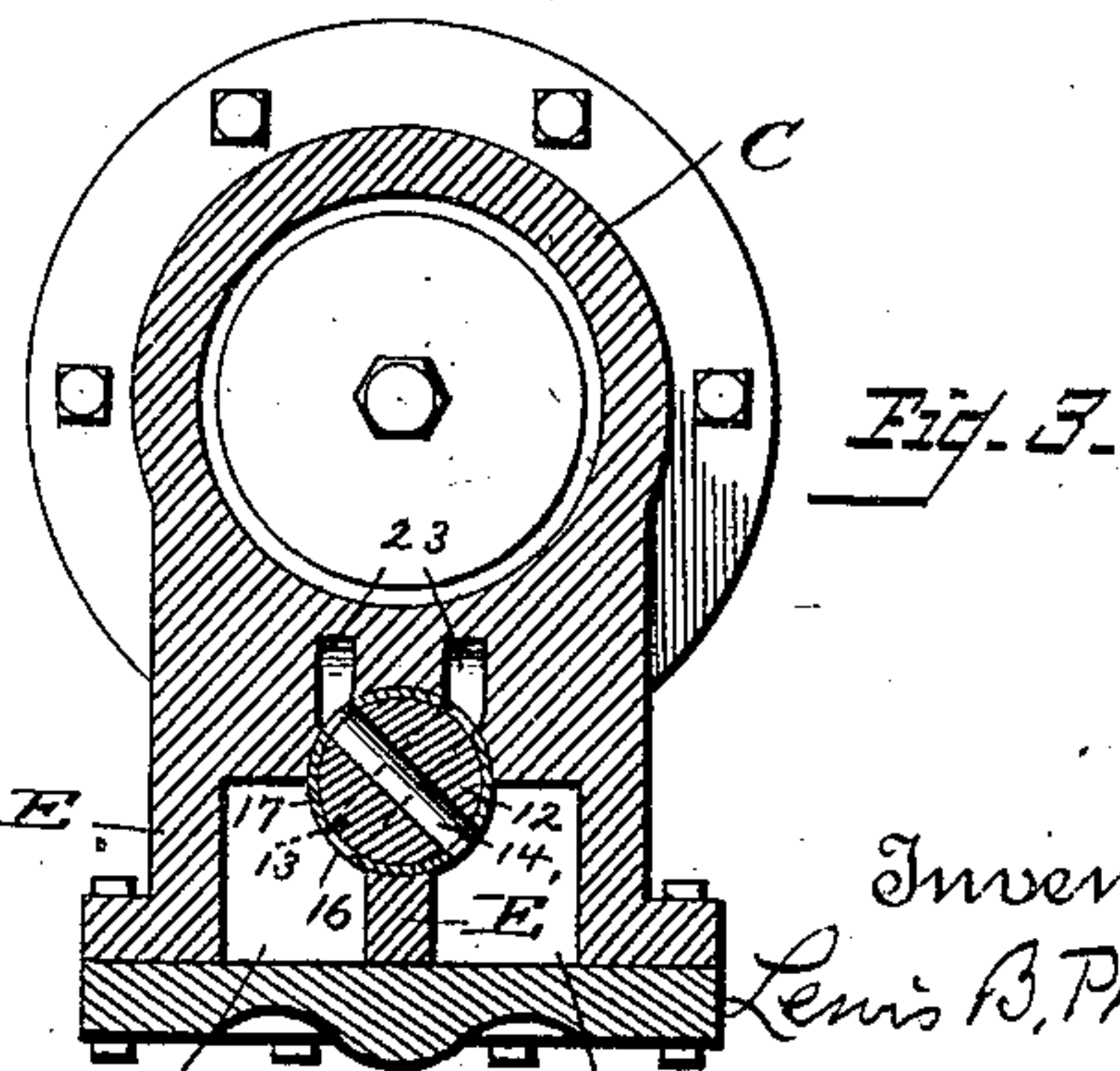
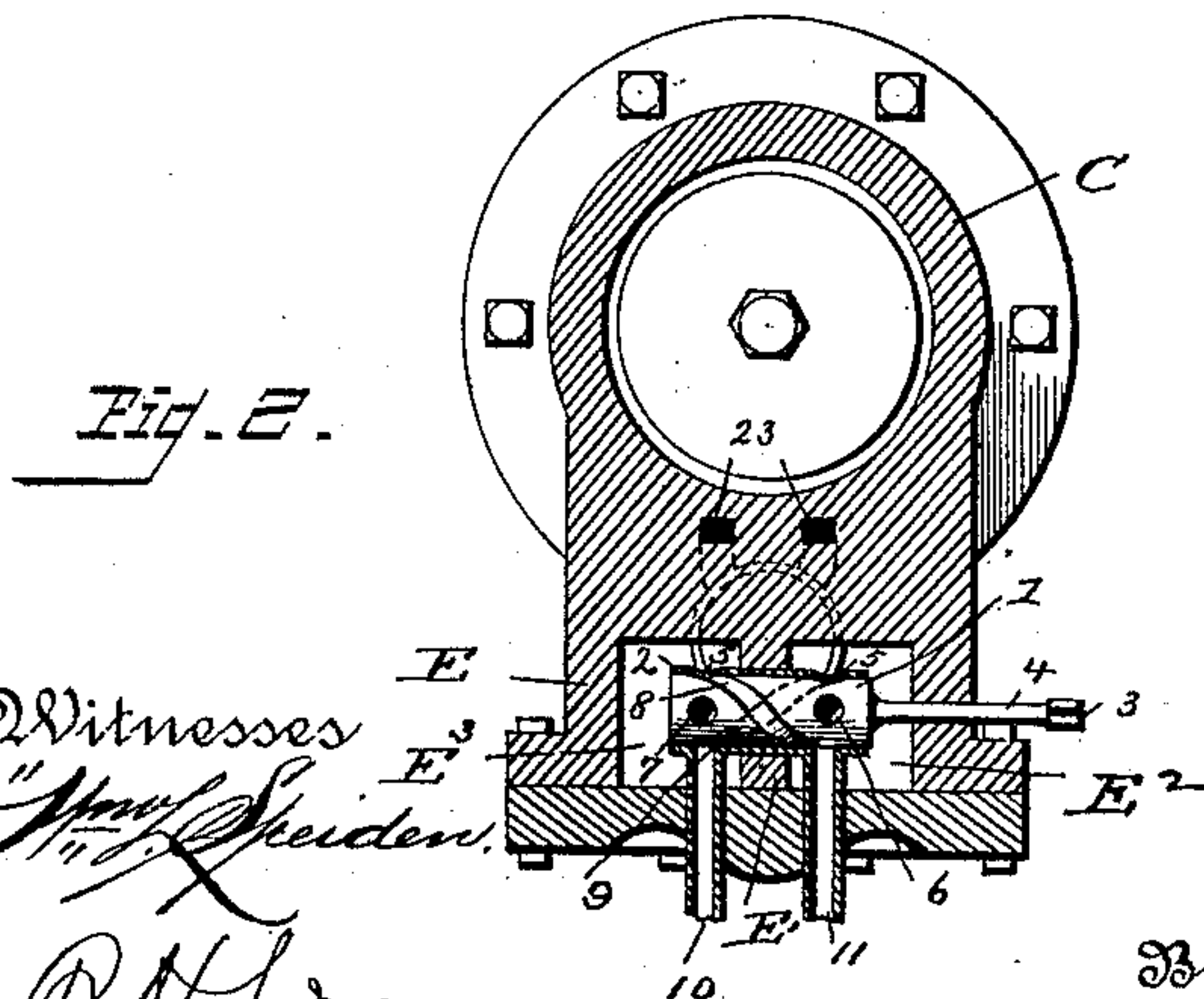
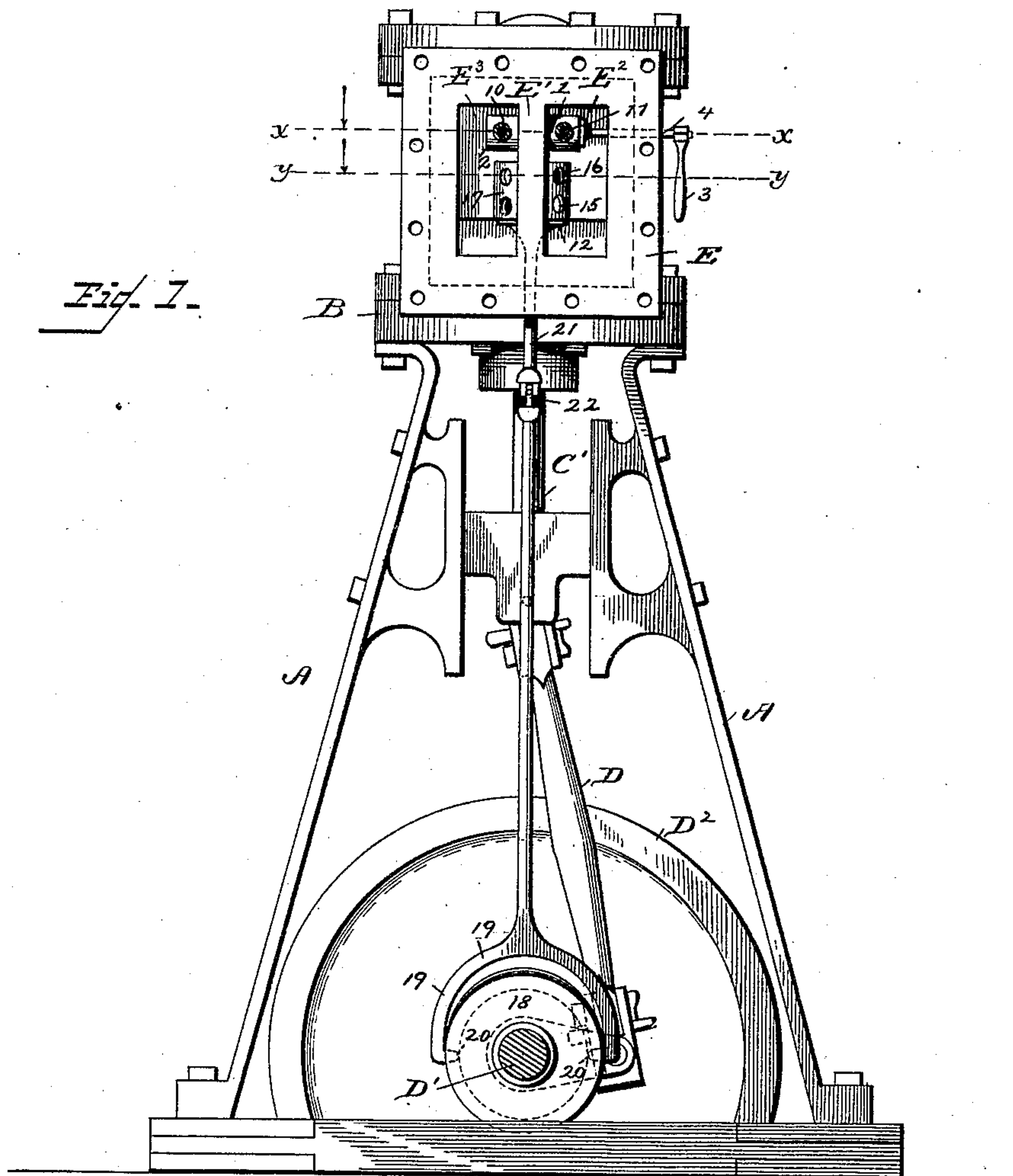
(No Model.)

2 Sheets—Sheet 1.

L. B. PHILLIPS.  
STEAM ENGINE.

No. 422,622.

Patented Mar. 4, 1890.



Witnesses  
"Amos" Seiden.

*W. L. Lock*

Inventor  
Lewis B. Phillips  
By his Attorney *Franklin A. Hough*

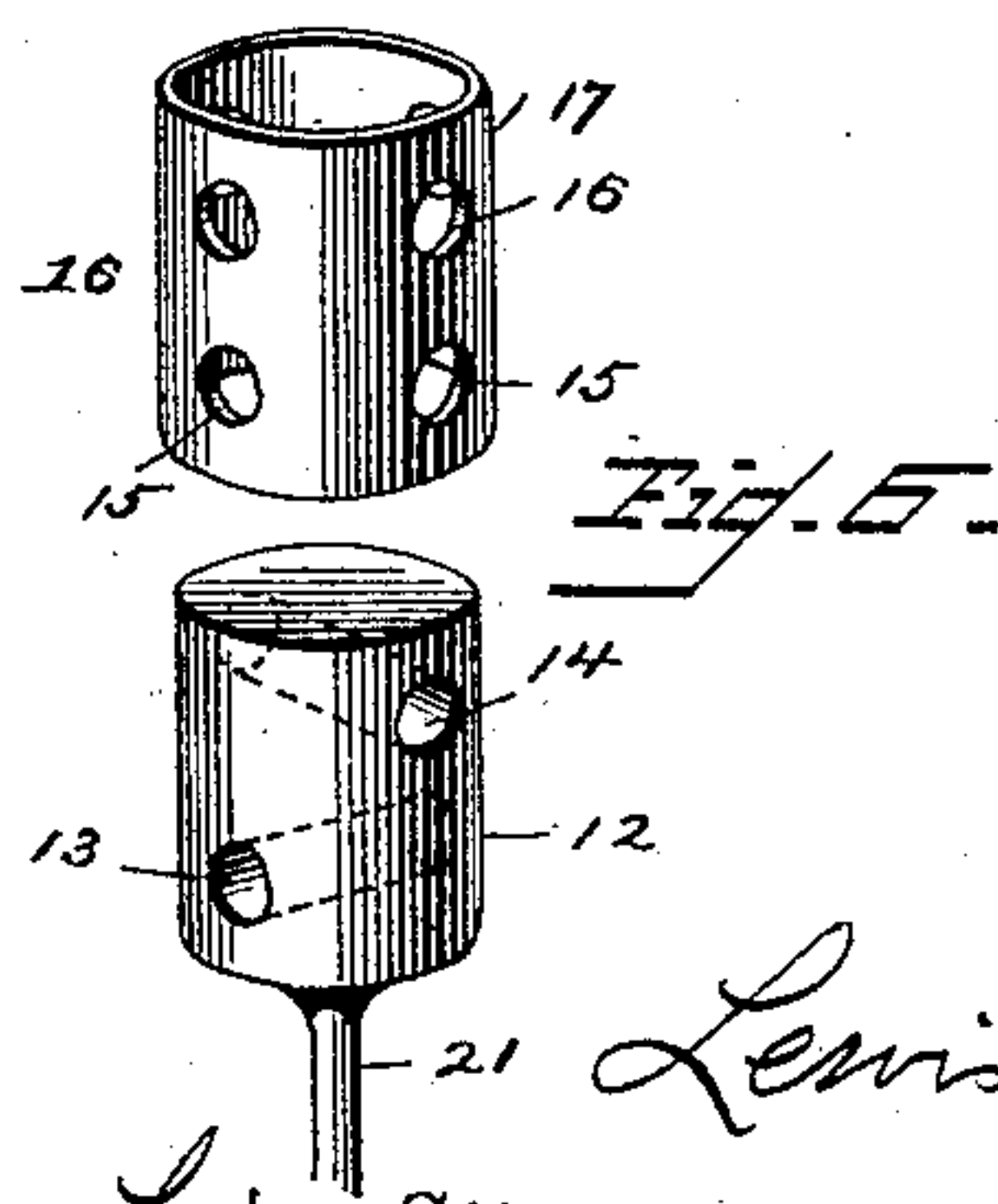
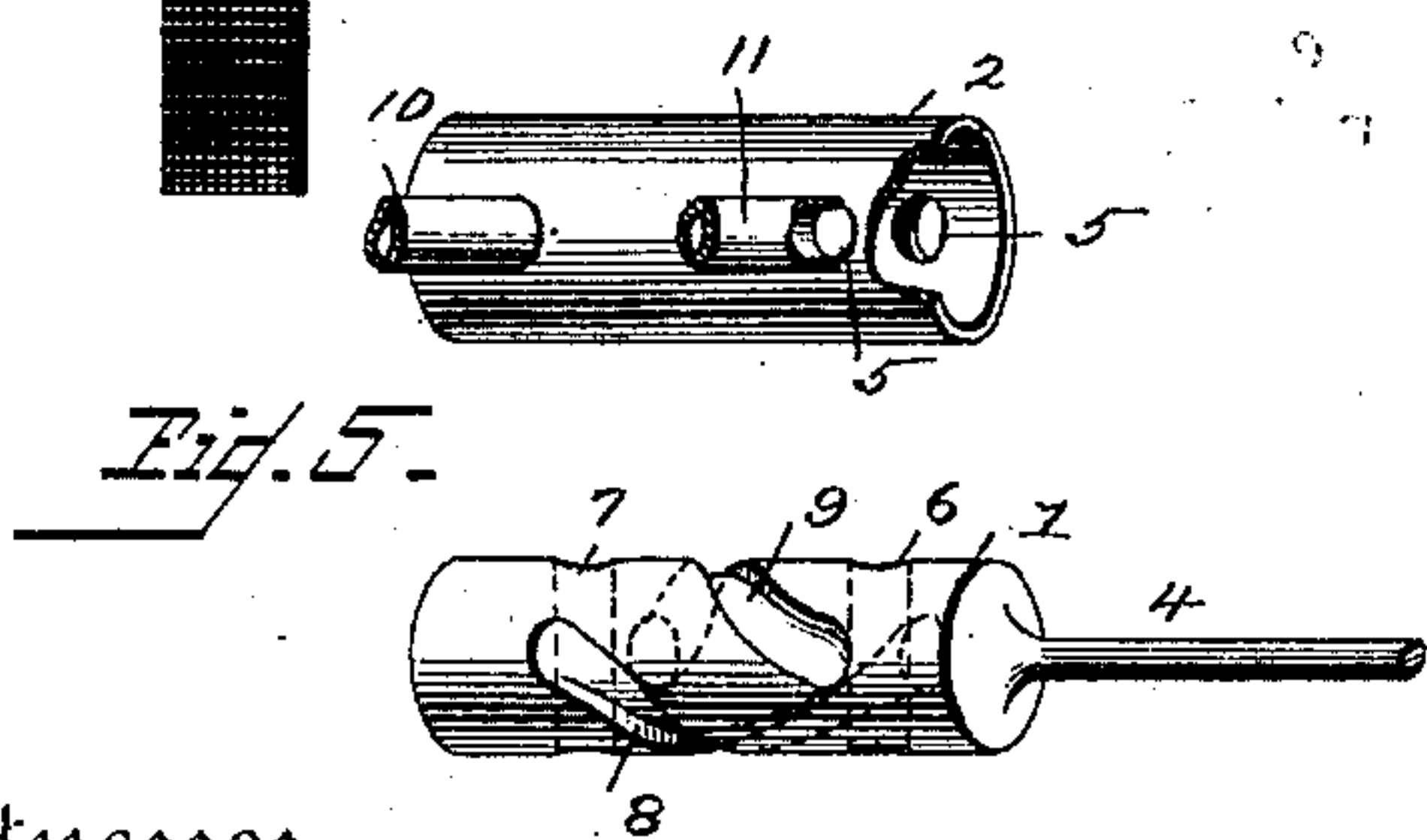
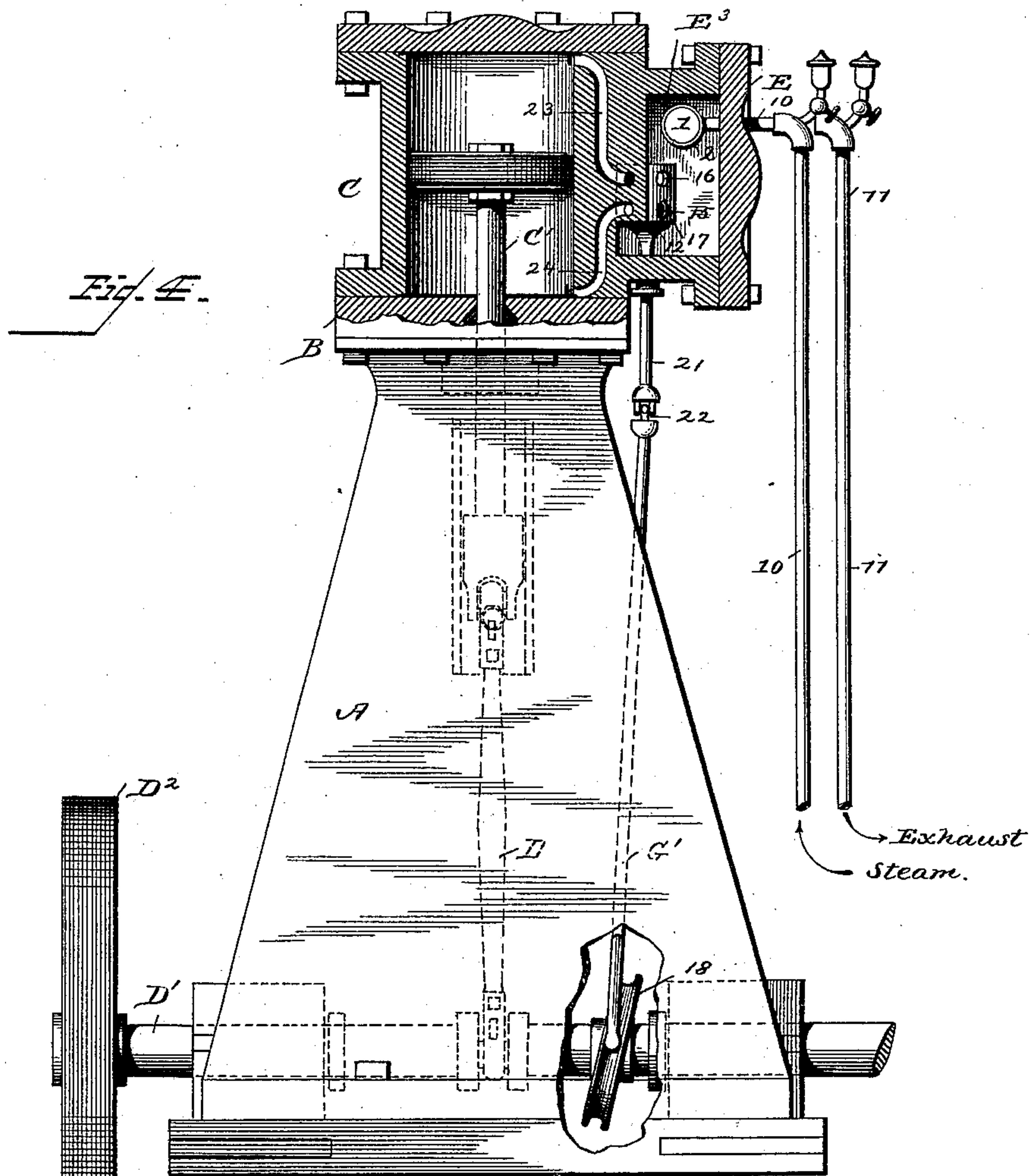
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Witnesses  
*Wm. H. Leitch*  
*W. H. Leitch*

Inventor  
*Lewis B. Phillips*  
By *Franklin H. Hough* Attorney



# UNITED STATES PATENT OFFICE.

LEWIS B. PHILLIPS, OF DIANA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO HIMSELF AND CALVIN V. GRAVES, OF WILNA, NEW YORK.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 422,622, dated March 4, 1890.

Application filed July 19, 1889. Serial No. 318,060. (No model.)

*To all whom it may concern:*

Be it known that I, LEWIS B. PHILLIPS, a citizen of the United States, residing at Diana, in the county of Lewis and State of New York, 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 the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to certain new and useful improvements in steam-engines; and it has for its object to generally improve upon the construction, to cheapen, and at the same time render more efficient, durable, and serviceable in operation this class of devices.

The invention has for its further objects the lessening of friction and weight, the dispensing with the rocking arm, link, and lever heretofore used, and the providing of a simple reversing-valve mechanism, by means of which the engine may be at any time instantly reversed or started when desired.

To the above ends and to such others as the invention may relate the same consists in the peculiar combinations and in the novel construction, arrangement, and adaptation of parts, all as more fully hereinafter described, shown in the accompanying drawings, and then specifically defined in the appended claims.

The invention is clearly illustrated in the accompanying drawings, which, with the letters and figures of reference marked thereon, form a part of this specification, like letters and figures of reference indicating like parts throughout the several views, and in which drawings—

Figure 1 is a side view of an engine constructed in accordance with my invention, the head of the steam-chest being removed. Fig. 2 is a section on line *xx* of Fig. 1. Fig. 3 is a section on line *yy* of Fig. 1. Fig. 4 is a side view with parts broken away and the steam-chest and cylinder shown in section. Fig. 5 is a detail perspective view of the ro-

tary or reversing valve and its surrounding case, the valve being shown as removed from the case. Fig. 6 is a detail view of the vertical rotary valve and its case.

Reference now being had to the details of the drawings by letter, A represents the upright or frame of the engine, securely bolted to the upper plate B of which frame is the cylinder C. The piston-rod C' passes through a central hole in the bottom of the cylinder, and is connected by means of the link or rod D with the transverse shaft D', which shaft carries at one of its ends the pulley D<sup>2</sup>, from which power may be transmitted, as will be readily understood.

E is the steam-chest, which is securely bolted upon one side of the cylinder, as shown, and is divided by means of a central partition E' into two compartments E<sup>2</sup> and E<sup>3</sup>.

1 is a valve arranged to extend horizontally through the partition E' within the stationary shell or case 2, and adapted to be rotated therein by means of a lever or handle 3, secured to the end of the neck or extension 4, which is extended through the side wall of the steam-chest. This valve is the reversing-valve. The shell 2 is provided upon opposite sides near its ends with openings 5 for the passage of the steam.

The valve 1 is provided with ports 6 and 7, which extend directly through the body of the valve, the open ends of the ports registering with the holes 5 in the shell 2.

8 and 9 are ports in the valve 1, which ports consist of grooves formed in the face of the valve and extend obliquely one-half the circumference of the valve, the ends of the grooves being at points upon the face of the valves at right angles to the ports 6 and 7, so that the entrances to the ports will register with the holes 5 in the shell when the valve has been given one-fourth of a revolution.

10 and 11 are inlet and exhaust pipes, respectively, the which pipes communicate with the holes in shell 2, as shown. It will be seen that when the valve 1 has been turned so as to cause the ports 6 and 7 to register with the holes in the shell 2 the steam from the inlet-pipe will pass directly through the port 7 into the compartment E<sup>2</sup> of the steam-chest, and at the same



time the exhaust-steam will pass through the port 6 of the valve into the exhaust-pipe. When the valve has been given a one-fourth revolution, the steam will enter the port 8, and, following the same obliquely one-half way round the valve, will enter the compartment  $E^3$  of the steam-chest, while the exhaust-steam will return through the port 9.

12 is a rotary valve vertically placed within the steam-chest, the same being adapted to rotate within an aperture formed for its reception in the central partition of the steam-chest, the sides of the valve projecting upon either side into the chamber of the steam-chest. The valve 12 is provided with ports 13 and 14, which ports extend directly through the valve one above the other, the upper port 14 being extended at right angles to the port 13, as is clearly shown in Fig. 6.

17 is a case or shell surrounding the valve 12. This shell is provided with holes 15 and 16 upon four of its sides, these holes being placed in such horizontal planes as to register with the ports 13 and 14 in the valve when the said valve is rotated.

18 is a wabbling wheel secured upon the shaft  $D'$ , and 19 is a yoke, the bifurcated arms of which are provided at their free ends with internally-extended projections or points 20. The bifurcated arms of the yoke 19 embrace the wabbling wheel, and the points 20 are fitted within the groove upon the periphery of said wheel. The upper end of the body of the yoke 19 is connected with the shaft 21, attached to the valve 12 by a universal joint 22.

23 and 24 are steamways connecting the steam-chest with the cylinder at the top and bottom of the same, respectively, as best shown in Fig. 4 of the drawings. These steamways extend through the wall or partition, separating the steam-chest from the cylinder at such points as will insure their entrance to the steam-chest, registering with the ports in the valve 12 when said valve has been rotated to the proper point.

In operation we will suppose in the first instance that the handle has been turned so as to cause the entrances of the straight ports 6 and 7 in the valve 1 to register with the holes in the surrounding case. The steam will enter the chamber  $E^3$  through the pipe 10 and corresponding straight port in the valve. The steam from this chamber will enter the port in the valve 12, which may be open at the time—as, for instance, the lower one, which registers with the hole 15 in the shell surrounding the valve. Passing through said port in the valve 12 the steam will enter the lower end of the cylinder C through the steamway 24, and acting upon the lower face of the piston-head will force the same upward, and during the upward movement of the piston the exhaust-steam in the upper part of the cylinder passes out through the steamway 23, which communicates with the chamber  $E^2$  of the steam-chest through the open port in the valve communicating there-

with and passes out through the exhaust-pipe 11. The upward movement of the piston will through its connections with the shaft  $D'$  cause the said shaft to revolve, and the piston 12 will by reason of its connection with the wabbling wheel upon the shaft be given the one-fourth revolution, thus closing the port in the valve which admits steam to the cylinder from the chamber  $E^3$  and opening the steamway leading from the lower end of the cylinder to the chamber  $E^2$ . The outlet from the upper end of the cylinder to the chamber  $E^2$  is at the same time closed, and the inlet from the chamber  $E^2$  to the upper end of the cylinder is opened. The steam will then enter the upper end of the cylinder through the steamway opening thereto from the upper port in the valve 12, and the exhaust-steam will escape through the steamway and open lower port in the valve to the chamber  $E^2$ , and thence through the exhaust-port in the valve 1 and exhaust-pipe 11. By turning the reversing-lever 3 so as to impart a one-fourth revolution to the valve 1 the straight ports 6 and 7 in said valve and the spiral ports 8 and 9 are opened. The steam will thus enter the spiral port 9 and, traversing the same, will enter the chamber E of the steam-chest, and will be supplied to the cylinder through the ports in the cylinder 12, which were formerly the exhaust-ports. The steam will be exhausted in this case into the chamber  $E^3$ , and will pass to the exhaust-pipe 11 through the spiral port 8 of the valve 1, as will be readily understood.

It will thus be seen that by simply turning the reversing handle or lever 3 the course of the steam to the cylinder may be changed from one to the other of the chambers of the steam-chest, and the engine thus instantly reversed.

Having thus described my invention, what I claim to be new, and desire to secure by Letters Patent, is—

1. In a steam-engine, a cylinder, a two-chambered steam-chest, said chambers serving alternately as steam and exhaust chambers, steamways connecting said chambers with the cylinder, a rotary valve arranged within the steam-chest and provided with ports, as described, and mechanism, substantially as described, for rotating the valve so as to admit the steam at alternating intervals into the upper and lower ends of the cylinder, substantially as described.

2. In a steam-engine, the combination, with the main frame, a transverse shaft journaled therein, a cylinder secured to the upper part of the frame, a two-chambered steam-chest adjacent to the cylinder, said chamber serving alternately as steam and exhaust chambers, steamways connecting the said chambers in the steam-chest with the interior of the cylinder, a rotary valve within the steam-chest having ports arranged to register with the steamways when properly rotated, and connections between the shaft and valve



whereby said valve is rotated by the turning of the shaft, substantially as shown and described, and for the purpose described.

3. The combination, with a cylinder and a double-chambered steam-chest with passages connecting the same, said two chambers serving alternately as steam and exhaust chambers, of a horizontal reversing-valve and an intermittingly-operating valve at right angles to the reversing-valve, substantially as described.

4. The combination, with the cylinder and the double-chambered steam-chest having separate communication with said cylinder, the chamber of said chest serving alternately as steam and exhaust chambers, of a horizontal reversing-valve having ports, as described, and a vertically-arranged valve having ports at right angles to each other, substantially as and for the purpose specified.

5. In a steam-engine, the combination, with the cylinder, the double-chambered steam-chest, the chambers of which serve alter-

nately as steam and exhaust chambers, and the horizontal reversing-valve in said steam-chest, of the vertical valve, the horizontal shaft, and a swivel-connection between said shaft and the stem of the vertical valve, substantially as described.

6. In a steam-engine, the combination, with the cylinder, the double-chambered steam-chest, and the horizontal reversing-valve in said steam-chest, the chambers of said chest serving alternately as steam and exhaust chambers, of the vertical valve, the horizontal shaft, the wabbling wheel on said shaft, the connecting-rod G', and a swivel-connection between said rod and the stem of the vertical valve, substantially as described.

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

LEWIS B. PHILLIPS.

Witnesses:

CALVIN V. GRAVES,  
JOHN MILLER.