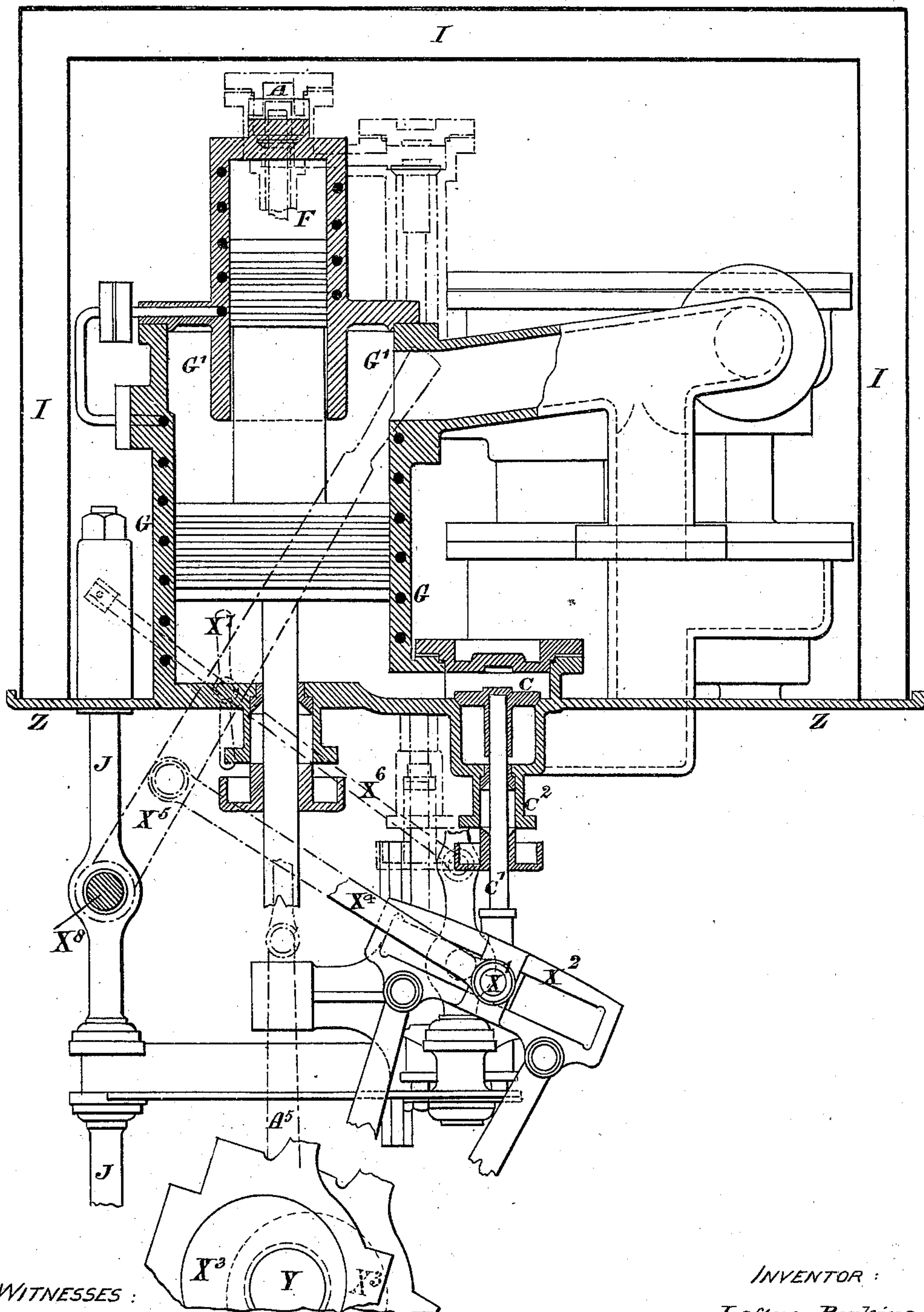


L. PERKINS.
Compound-Engine.
No. 226,416. Patented April 13, 1880.

Fig. 1.



WITNESSES:

Wm. A. Skunkle
Geo W. Breck

INVENTOR:

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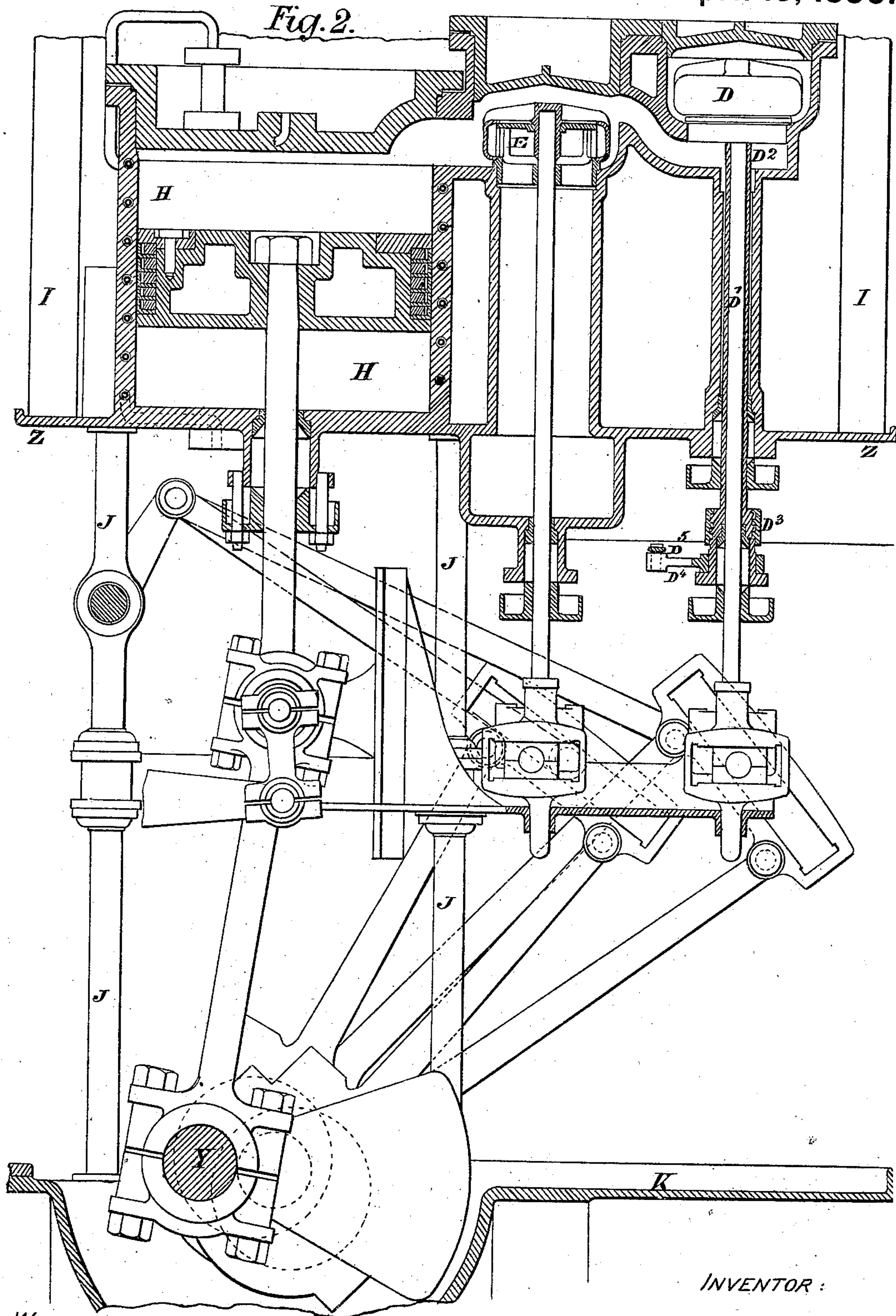
By his Attorneys

Baldwin, Hopkins, & Peyton

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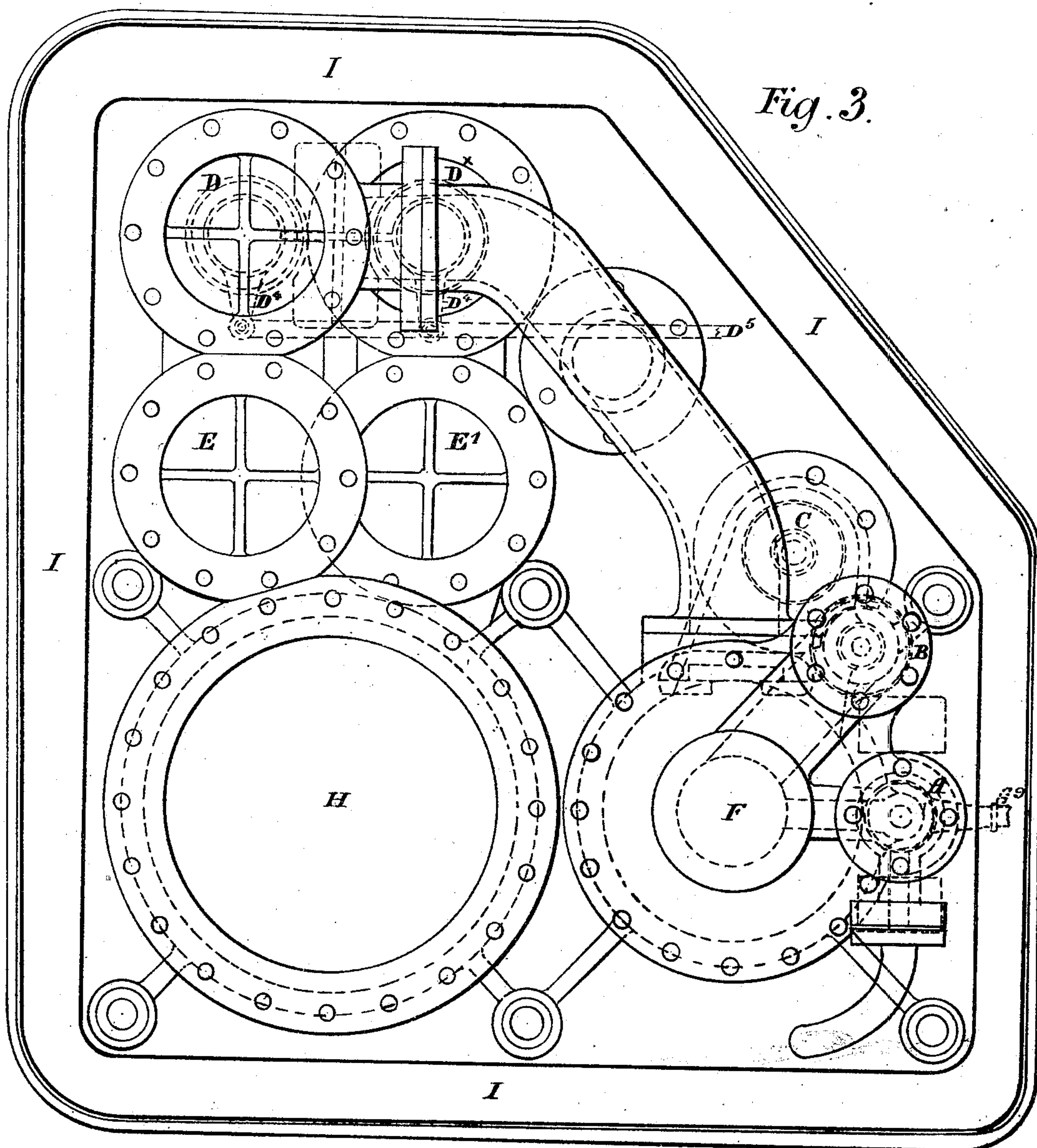
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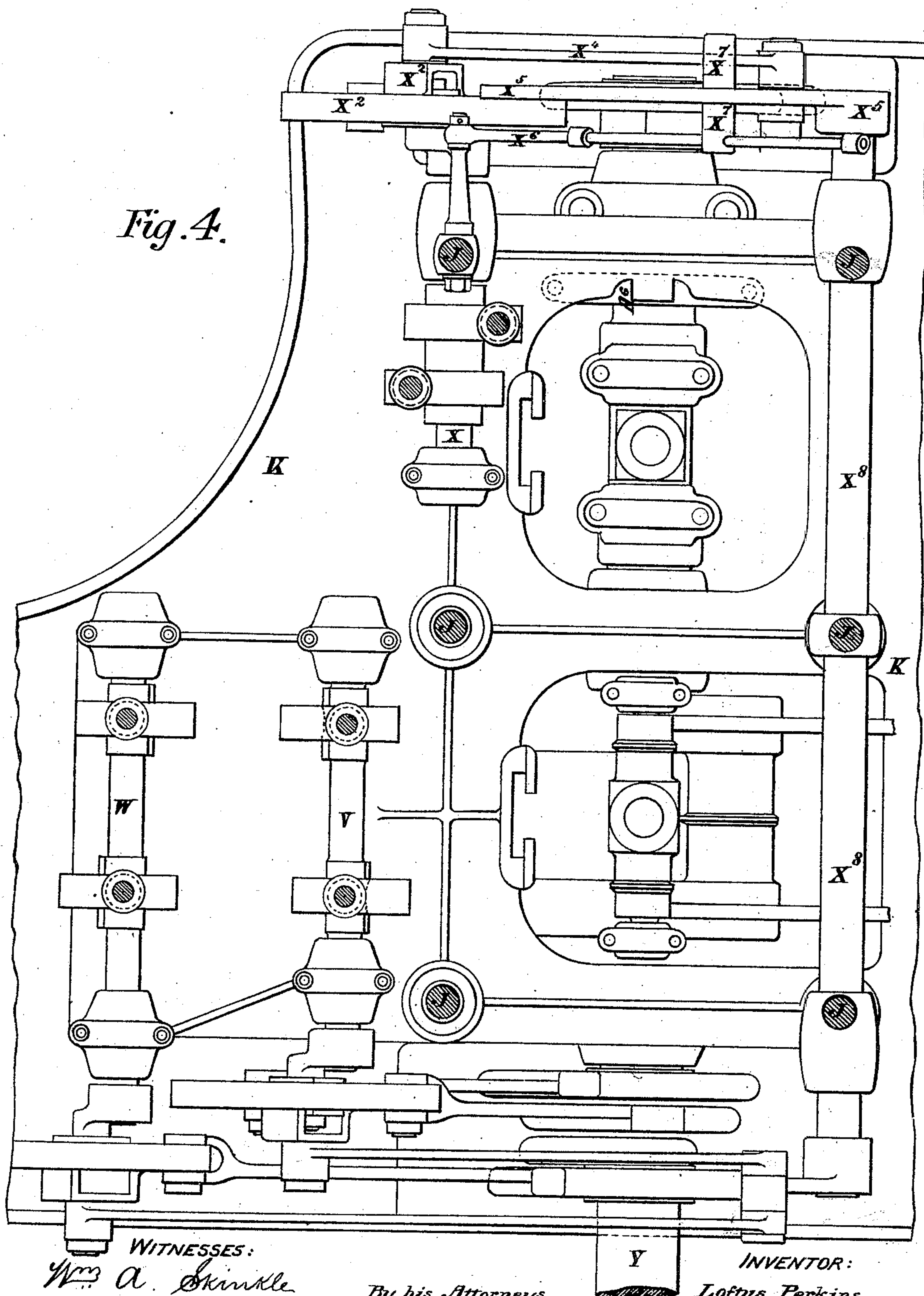
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Patented April 13, 1880.

Fig. 4.



WITNESSES:
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No. 226,416.

Patented April 13, 1880.

Fig. 5.

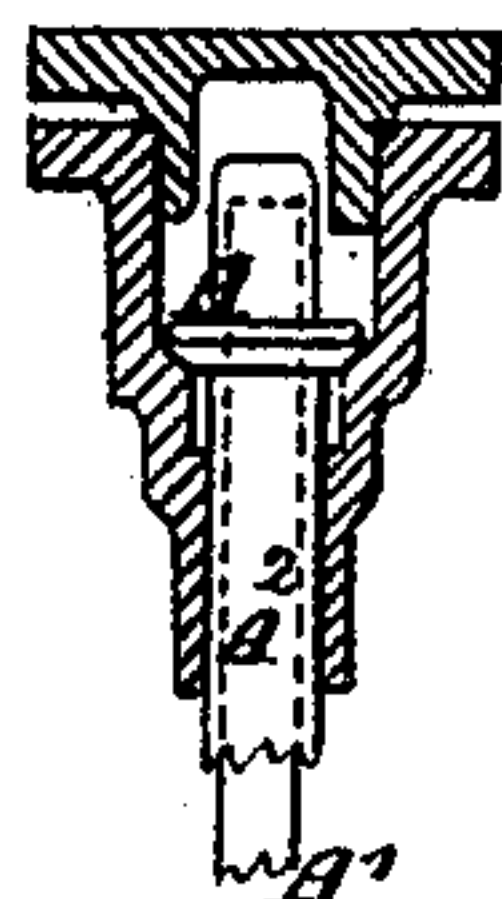


Fig. 6.

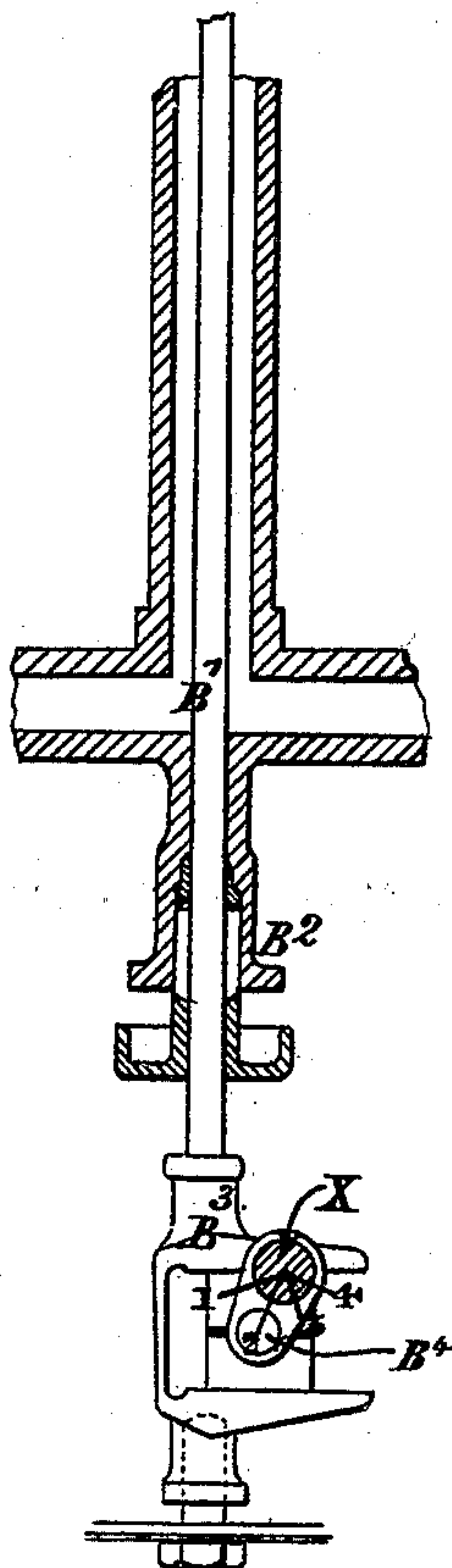
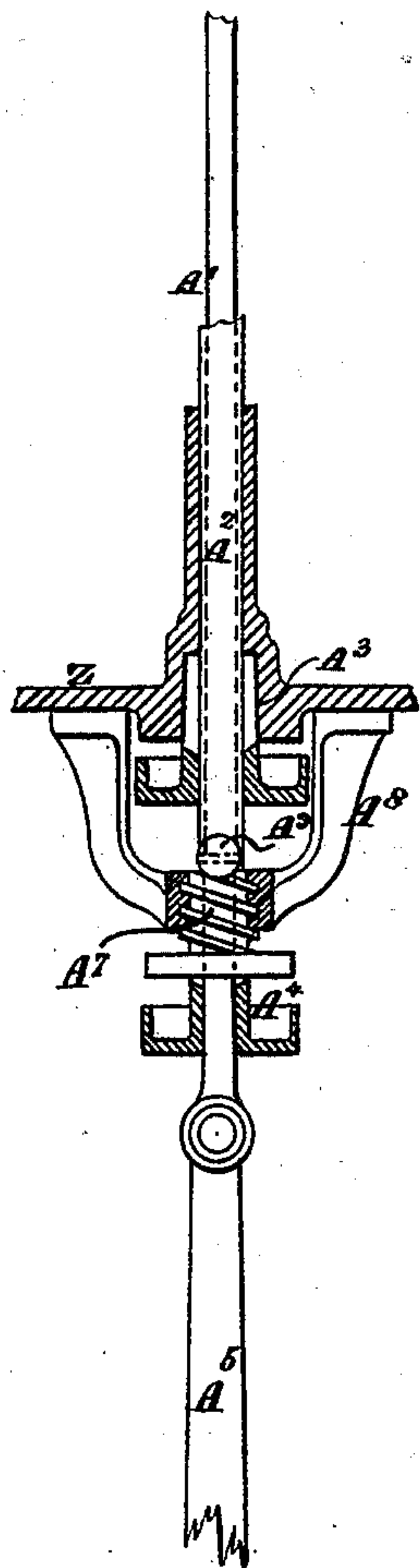
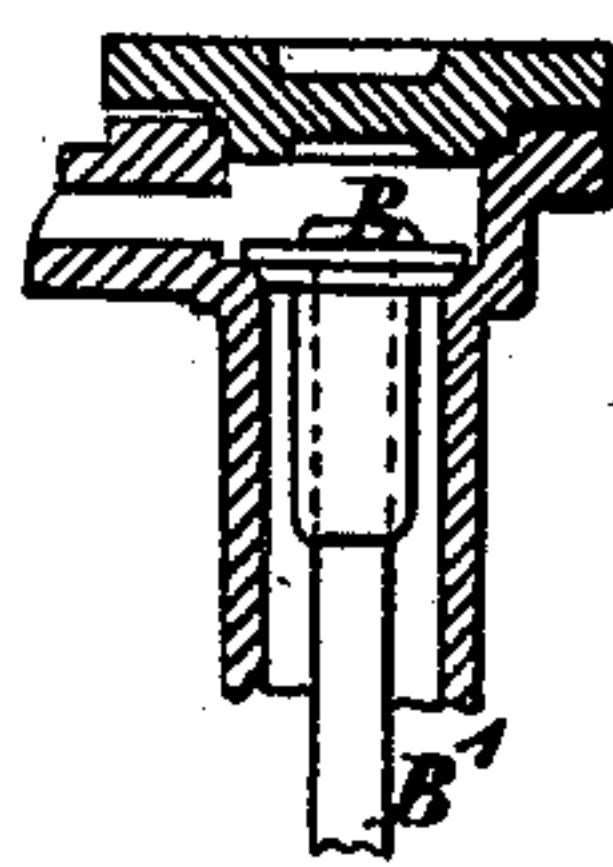
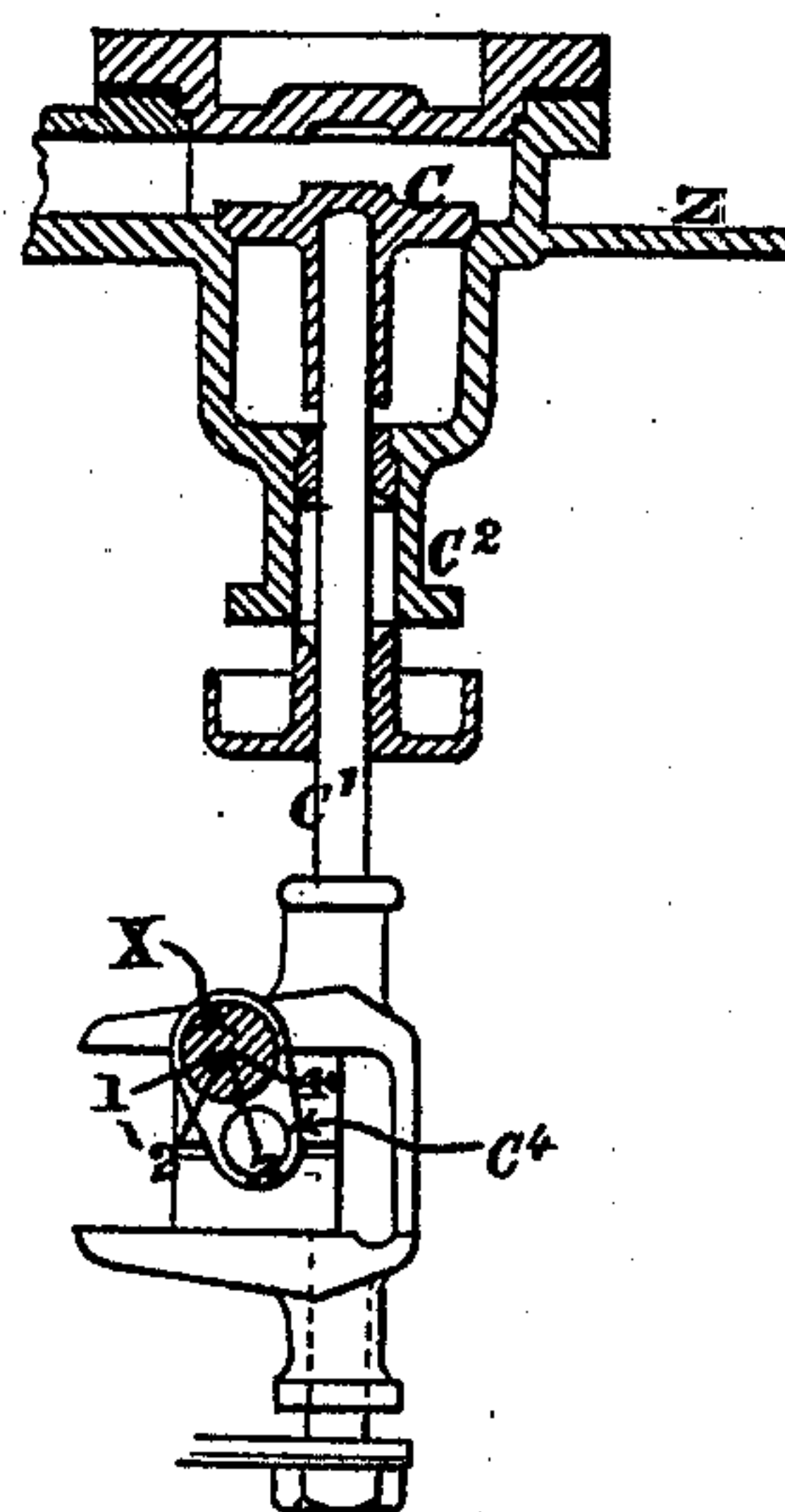


Fig. 7.



WITNESSES:

Wm. A. Sample.
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INVENTOR:

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UNITED STATES PATENT OFFICE.

LOFTUS PERKINS, OF SEAFORD STREET, GRAY'S INN ROAD, COUNTY OF MIDDLESEX, ENGLAND.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 226,416, dated April 13, 1880.

Application filed April 8, 1879. Patented in England February 6, 1877.

To all whom it may concern:

Be it known that I, LOFTUS PERKINS, of Seaford Street, Gray's Inn Road, in the county of Middlesex, England, have invented new and useful Improvements in Compound Engines, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

In steam-engines constructed according to this invention one single-acting high-pressure cylinder is employed, placed on the top of a single-acting medium-pressure cylinder, with the pistons carried by one piston-rod, and in addition I employ one double-acting low-pressure cylinder. The high-pressure steam first acts in the outer end of the high-pressure cylinder, then exhausts into the opposite end of the medium-pressure cylinder, and from there into the space between the two pistons and to one or the other end of the low-pressure cylinder. The cylinders are all carried by a bed-plate, over which is placed a cover formed with double sides, filled in with non-conducting material. Thus the cylinders, valve-chambers, and steam-passages in connection therewith are all inclosed in a hot-air chamber.

To control the admission of steam to the cylinders I use lifting-valves. Heretofore when such valves have been used they have been attached to a rod passing downward through a stuffing-box from the chamber containing the valve, and have been lifted at the times required by a cam acting upon an arm fixed to the rod before mentioned. This arrangement is, however, only applicable to engines running at comparatively slow speeds, owing to the friction of the stuffing-box around the valve-rod, as the closing of the valve is effected only by the weight of the valve and rod and by the small amount of pressure on the top of the valve in excess of that on the bottom.

According to my invention I mount the valve loosely upon the top of the valve-rod. The valve-rod I carry down through a stuffing-box, as before, and I give to it a positive motion in both directions—that is, both when rising and falling—in such manner that the first part of the upward movement of the valve-rod shall take place slowly until the valve-rod has come

against the valve and lifted it, and that the remainder of the lift shall then be effected quickly. By this means all noise in the lifting and closing of the valves is avoided, and the valves can be used with quick-running engines equally as well as with slow-running engines.

The lifting and lowering of the valve-rod may be effected by a rocking crank so arranged that the crank-arm is downward when commencing to move the valve-rod upward, and moves toward a horizontal position as it completes the lifting of the valve. When closing the valve the crank-arm will move toward a vertical position, and when it has moved through half its traverse it will leave the valve resting on its seat. In the remaining half of its traverse it will move beyond the vertical position, but not to such an extent as to again lift the valve at the end of the back stroke. One advantage of this arrangement is that the ordinary link-motion may be employed for giving the rocking motion to the axis of the crank. A rocking or revolving cam may also be used for giving a similar movement to the valve-rod.

Around the rod for lifting the valve for controlling the admission of steam to the high-pressure cylinder I place a tubular sleeve, and carry this sleeve up through the stuffing-box, through which the valve-rod passes, so that its end may come just below the valve. When starting the engine the sleeve is, by a screw and nut or otherwise, shifted upward along the valve-rod, and the valve is thereby continuously held open. So soon as the engine has been started the sleeve is again drawn down, allowing the valve to perform its regular duty of controlling the admission of steam to the high-pressure cylinder; or, in place of a movable sleeve, the rod itself may be lengthened or shortened.

The mechanism for opening and closing the valves is applicable to other motive-power engines.

Having thus described the nature of my invention, I will proceed to describe more fully the manner of performing the same.

At Figures 1, 2, 3, and 4 of the drawings hereunto annexed I have shown various views of an engine constructed as above described.

Figs. 1 and 2 are vertical sections, taken at right angles to one another, of the engine. Fig. 3 is a plan view with the top of the cover which incloses the cylinder and valve-chambers removed. Fig. 4 is a horizontal section of the engine, taken below the cylinders.

A, Fig. 1, is the valve for admitting steam to the top of the high-pressure cylinder. It is shown in dotted lines, as it is situated in front of the line in which the section is taken. The mechanism for lifting and lowering this valve is shown separately at Fig. 5.

A' is the rod by which the valve is lifted. Around this rod is a tube, A², for lifting the valve A at the time of starting the engine. The rod and tube pass down through a tubular casing to below the bed Z, upon which the cylinders are carried, and pass out from the bottom of the tubular casing through a stuffing-box, A³. At the lower end of the tube A² is also a stuffing-box, A⁴, through which the rod A' passes, and the lower end of the rod is coupled by a link, A⁵, to an eccentric, A⁶, (see Fig. 4,) on the crank-shaft Y of the engine, and the rod is by it lifted and lowered to open and close the valve at the times required. On the lower end of the tube A² is a screw-thread, A⁷, screwing through a fixed bracket, A⁸. When it is desired to keep the valve A lifted a partial turn is given to the tube A² by a lever-arm, A⁹, (see Figs. 3 and 5,) at its lower end. The tube is thereby caused to rise, and its upper end lifts the valve.

B is the valve for exhausting steam from the high-pressure cylinder and allowing it to pass to the under side of the piston in the medium-pressure cylinder. The mechanism for lifting and lowering this valve is shown separately at Fig. 6. B' is the rod for lifting this valve. It passes out through a stuffing-box, B², and carries at its lower end a fork, B³, carrying a sliding block which embraces a crank-pin, B⁴, carried by an arm on the rocking shaft X. This shaft receives a rocking motion by an ordinary link-motion, as shown, a crank-pin, X¹, on another arm on the shaft entering a sliding block carried by the slide X², which is coupled at its end by links to eccentrics X³ on the main crank-shaft Y. X⁴ is a link coupling the slide X² to the starting and reversing lever X⁵, which can be locked in any position to a rod, X⁶, by a clamp, X⁷. The crank-pin B⁴ is oscillated through an arc of about ninety degrees, as shown by the lines 1 3. While it is moving in the upper half of this arc—that is, between the lines 1 and 2—it is lifting or lowering the valve; but as it descends below the line 2 the valve is left on its seat, and the rod B' moves down away from it while the crank-pin B⁴ is moving through half the distance between the lines 2 and 3. Afterward the crank-pin as it comes up to the line 3 again lifts the rod, but not sufficiently to lift the valve. The crank-pin, then moves back in the opposite direction, and as it passes beyond the line 2 it again lifts the valve.

C is the exhaust-valve from the medium-pressure cylinder. The mechanism for lifting and lowering this valve is shown separately at Fig. 7, and C' is the rod by which it is worked. The rod passes down through a stuffing-box, C², and at its lower end has a rising-and-falling motion given to it in the same way as above described by another crank-pin, C⁴, carried by the rocking shaft X. This crank-pin oscillates through an arc between the lines 2 and 4, as shown, and it will act to open and close the valve C in the same way as described with reference to the valve B, and consequently both of these exhaust-valves will be opened and closed quietly, as hereinbefore explained.

D, Figs. 2 and 3, is the valve for admitting steam which has passed from the medium-pressure cylinder to pass to the top of the low-pressure cylinder. There is a similar valve at D^x (see Fig. 3) for admitting steam to the bottom of the low-pressure cylinder. The rods D', which lift these valves, are each surrounded by a tube, D², by which either of the valves can be lifted, so as to be able to admit steam in any position of the engine, either to the top or bottom of the low-pressure cylinder, at the time of starting.

The tube D², surrounding one rod, has a right-hand screw-thread upon it, and the other a left-hand thread. These screw through corresponding fixed nuts D³. On the lower end of each tube is an arm, D⁴. (See Figs. 2 and 3.) These are coupled together by a rod, D⁵, and by moving this rod in one or other direction either the valve D or the valve D^x can be lifted.

The rods by which the valves D D^x are opened and closed after the engine has been started have a rising-and-falling motion given to them at their lower ends in the same way as just described with reference to the valves B and C by crank-pins carried by a rocking shaft, W, which is rocked, as shown, through a link-motion by eccentrics on the main crank-shaft Y. The slide of the link-motion is connected by a connecting-rod to an arm on the axis X⁸ of the stopping and reversing lever X⁵.

E is the exhaust-valve for allowing steam to pass from the top of the low-pressure cylinder to the condenser, and E' the exhaust-valve for the bottom of the cylinder. The rods which open and close these valves are in the same way as the other valves raised and lowered by crank-pins on a rocking shaft, V.

The high-pressure cylinder is marked F, the lower part of the medium-pressure cylinder is marked G, and the steam-space above the piston of this cylinder G'. H is the low-pressure cylinder.

It will be seen that the cylinders are all carried by a bed-plate, Z, and that this plate also carries the valve-chambers and steam-passages, and the plate is formed all around its edge to receive a cover, I, by which the whole of these parts of the engine may be covered in. By preference I form this cover with double sides

and fill in the sides with non-conducting material.

The bed-plate Z is, as shown, carried by up-rights J from the lower bed-plate, K, of the engine. In some cases, especially where the bed-plate Z is not horizontal, the valves are constantly pressed by springs against their seats, or, when lifted, are held by the springs against the ends of the lifting-rods.

10 Having thus described the nature of my invention and the manner of performing the same, I would have it understood that I claim—

1. The combination, with a cylinder of a steam or other motive-power engine, of a lift-
15 ing-valve for controlling the passage of the steam or fluid, a rod upon the end of which the valve is loosely mounted, and mechanism for positively actuating said rod throughout its movements, and by which the rod is moved
20 slowly independently of and until it begins to lift the valve and then quickly for the balance of its upward or forward movement, and on the reverse part of its stroke is moved at first quickly and then slowly, substantially as and
25 for the purpose hereinbefore set forth.

2. The combination, substantially as hereinbefore set forth, of the valve-operating rod, positively actuated throughout its movements, the lifting-valve loosely mounted on the end
30 thereof, and means, essentially such as described, for holding the valve open.

3. The combination of the valve-operating

rod, the lifting-valve loosely mounted on the end thereof, and the adjustable tube surrounding said rod, substantially as and for the purpose hereinbefore set forth. 35

4. The combination of the high-pressure cylinder, the medium-pressure cylinder, their piston-rod and pistons, the steam-space between the pistons of said cylinders, and the double-
40 acting low-pressure cylinder to which the steam passes from said space, substantially as and for the purpose hereinbefore set forth.

5. The combination, substantially as hereinbefore set forth, of the single-acting high-
45 pressure cylinder, the single-acting medium-pressure cylinder beneath it, the single piston-rod carrying the pistons for said cylinders, the passage conducting the steam from the high-pressure cylinder to the medium-pressure cylinder, the steam-space between the pistons of said
50 cylinders, and the double-acting low-pressure cylinder supplied with steam from said space.

6. The combination of the several cylinders, the valve-chambers and steam-passages there-
55 of, the supporting bed or table, and the cover inclosing them, substantially as and for the purpose hereinbefore set forth.

LOFTUS PERKINS.

Witnesses:

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