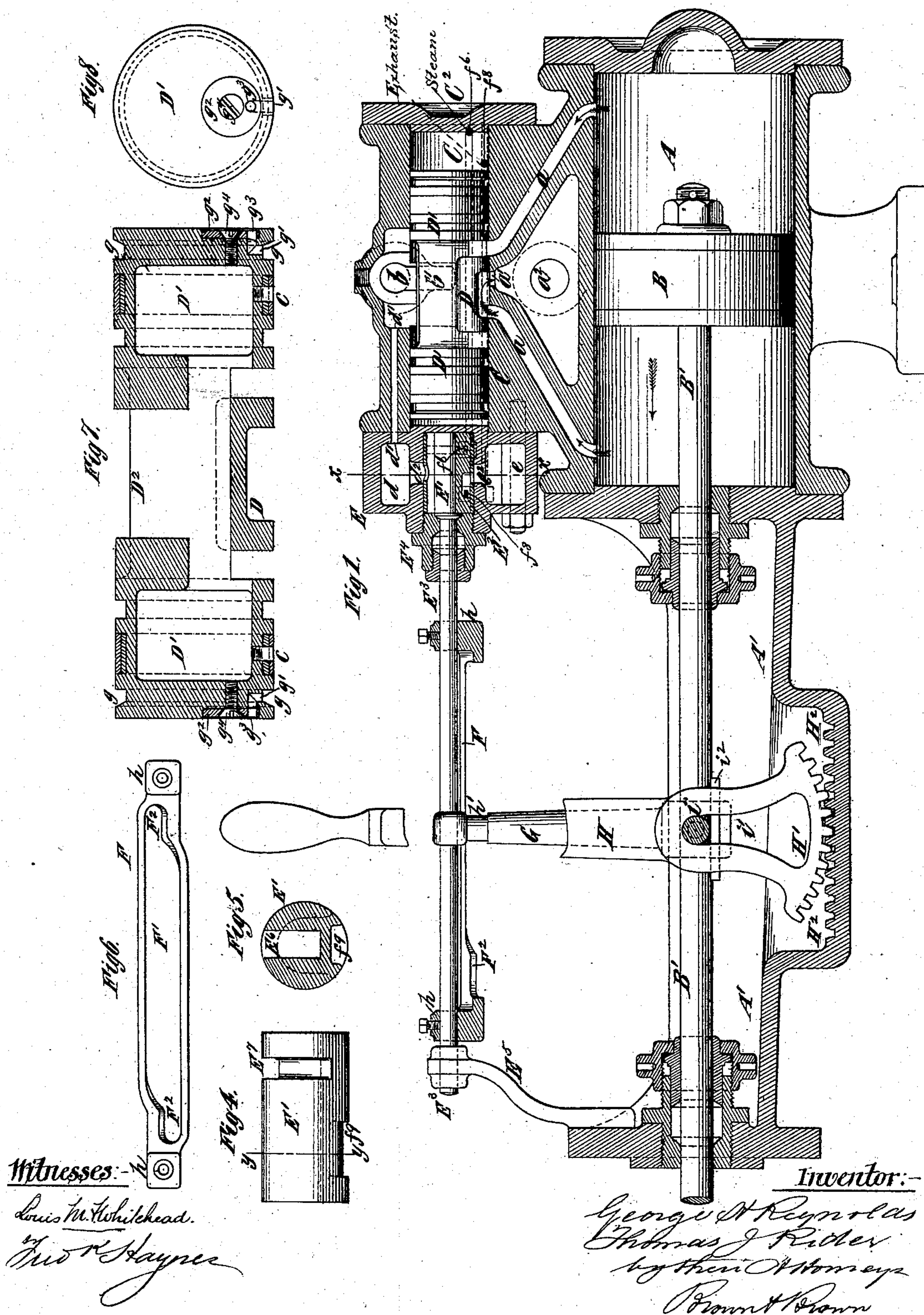


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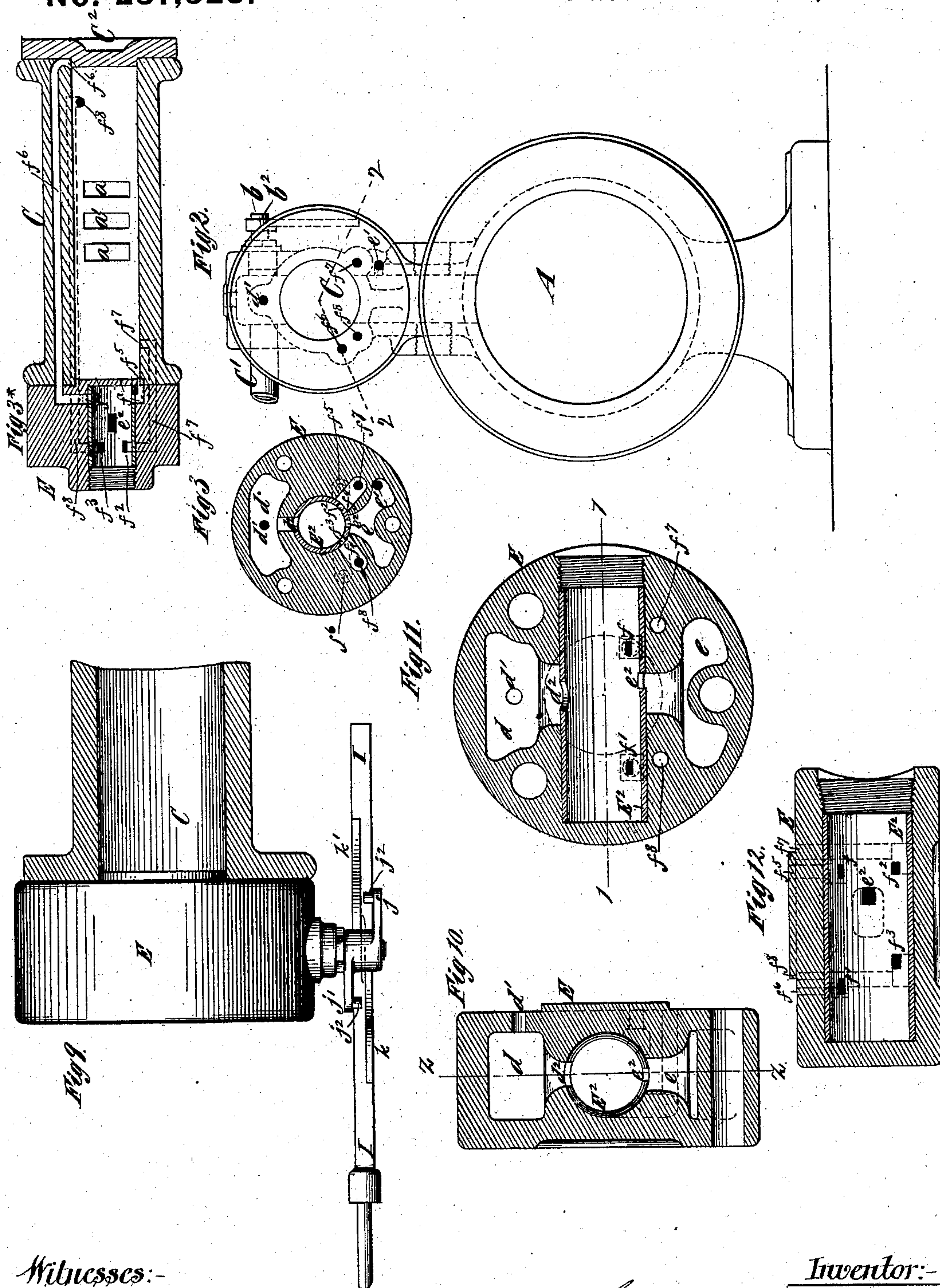
Patented Feb. 1, 1881.



3 Sheets—Sheet 2.

No. 237,323.

Patented Feb. 1, 1881.



Witnesses:-

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 Geo^y R. Wayne

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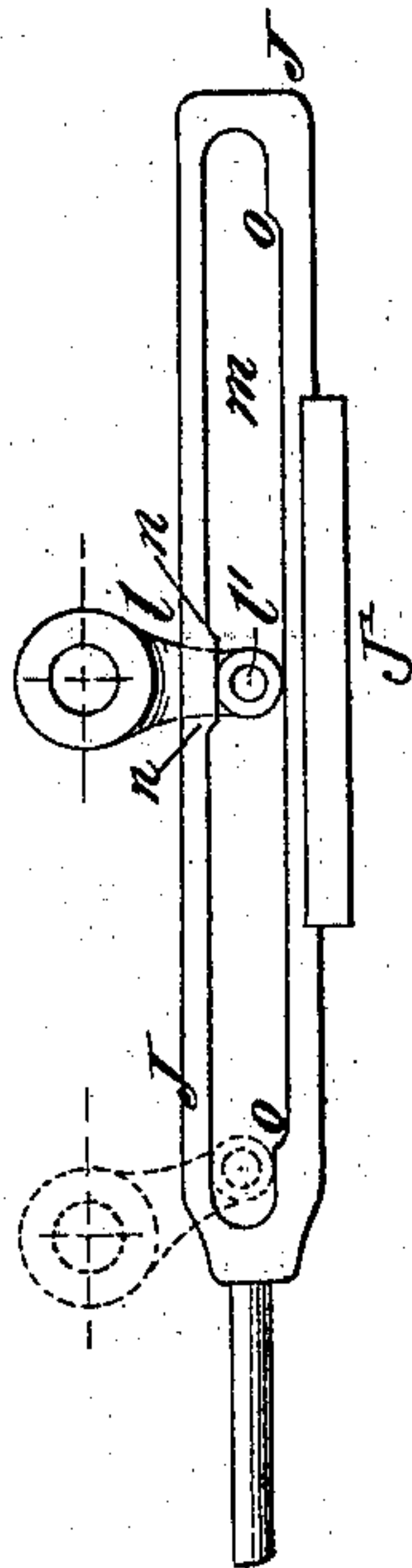
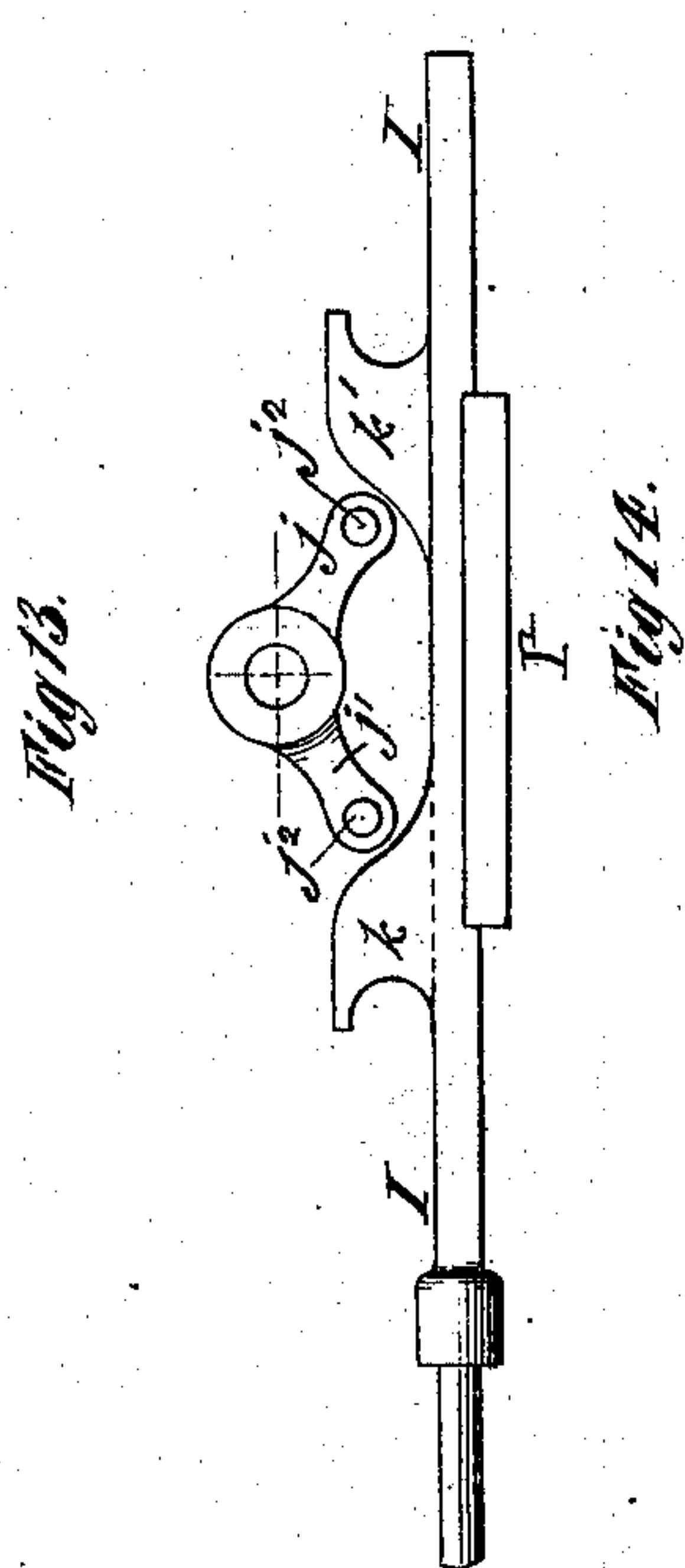
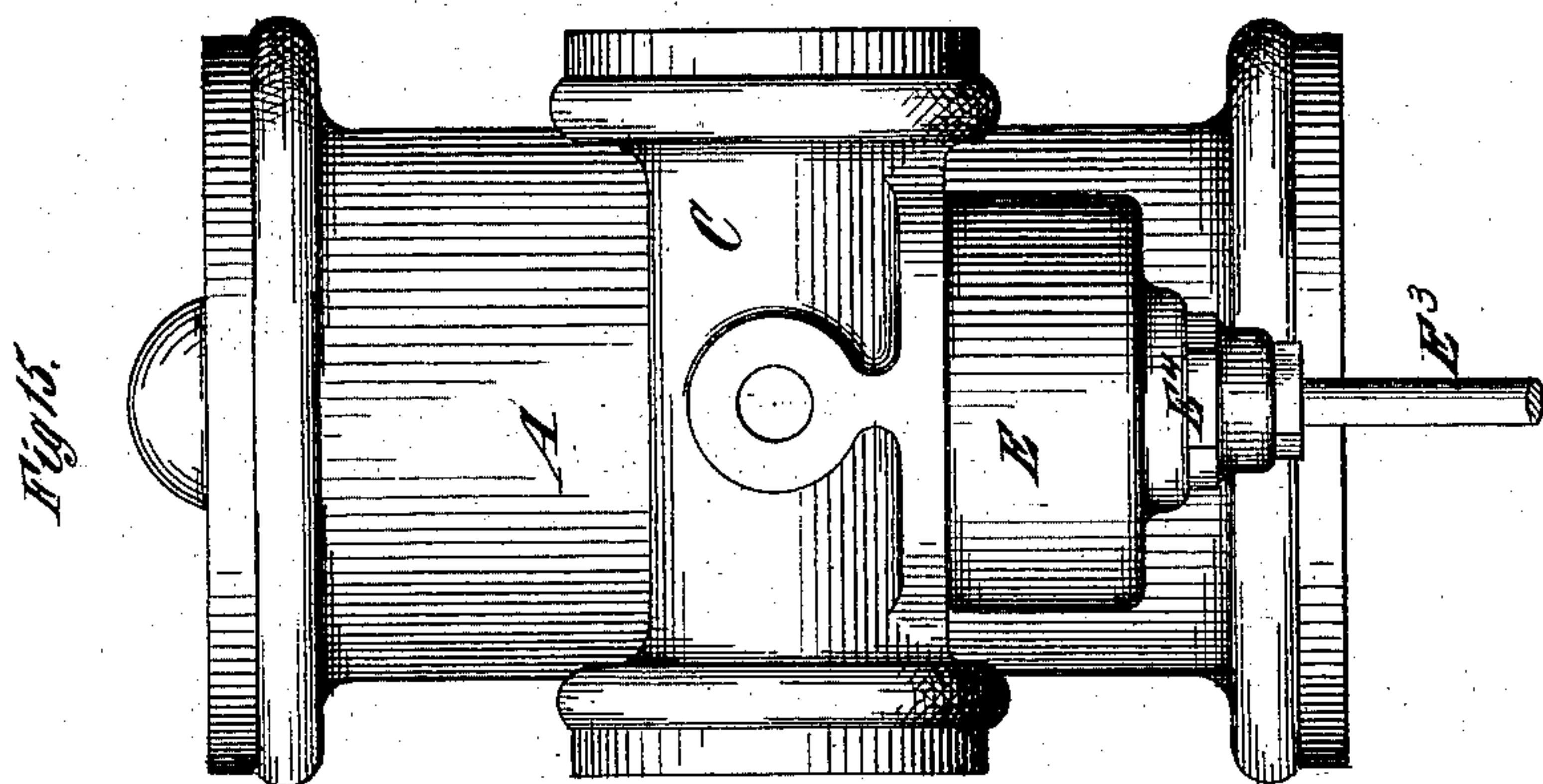
(No Model.)

3 Sheets—Sheet 3.

G. H. REYNOLDS & T. J. RIDER
Steam Actuated Valve.

No. 237,323.

Patented Feb. 1, 1881,



Witnesses:-

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UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS AND THOMAS J. RIDER, OF NEW YORK, N. Y., ASSIGNORS TO CORNELIUS H. DELAMATER AND GEORGE H. ROBINSON, OF SAME PLACE.

STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 237,323, dated February 1, 1881.

Application filed October 16, 1880. (No model.)

To all whom it may concern:

Be it known that we, GEORGE H. REYNOLDS and THOMAS J. RIDER, both of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Steam-Actuated Valves and Valve-Gear for Direct-Acting Engines, of which the following is a specification.

Our invention relates to direct-acting engines, which are most commonly used for steam-pumps, in which the main valve is moved by an auxiliary piston or pistons, and in which is employed an auxiliary valve operated by the movement of the piston-rod for admitting steam or other motive agent to act upon the auxiliary piston or pistons.

Our invention consists in the combination, in a direct-acting engine, of a main valve, auxiliary pistons for moving said main valve, an auxiliary cylinder containing both said main valve and said pistons, and an auxiliary valve adapted to be oscillated or turned to admit steam to act upon the auxiliary pistons, and preferably arranged in line with the auxiliary pistons. The chest of the auxiliary valve may be constructed to form a head to the auxiliary cylinder, thus dispensing with a separate head therefor.

It also consists in the combination, with the above-named main valve, auxiliary cylinder, auxiliary pistons, and auxiliary valves, of novel arrangements of ports for admitting steam to the auxiliary cylinder to act upon the auxiliary pistons, and for exhausting the steam from said cylinder.

It also consists in a novel arrangement of ports for effecting the cushioning of the auxiliary pistons as they approach the ends of the auxiliary cylinder, to prevent any violent shock or jar by the pistons striking the cylinders' heads.

It also consists in a novel means for regulating the exhaust of steam from the auxiliary cylinder, so that the cushioning may be regulated or graduated to a nicety.

It also consists in the combination, with a main valve, an auxiliary piston or pistons for moving the same, an auxiliary valve for admitting steam to act upon said piston or pis-

tons, a reciprocating piston-rod and an auxiliary valve-stem, of an arm fixed to and projecting from said piston-rod, and a bar attached to the valve-rod and having in it a slot of novel form, by means of which the said arm turns or oscillates the valve-rod as the piston-rod approaches the end of its stroke.

It also consists in the combination, with a reciprocating piston-rod, of a stationary rack and a hand-power lever having a pivotal connection with said piston-rod, which serves as a fulcrum, and comprising a toothed sector for engagement with said rack, whereby a very convenient means is afforded for working the piston-rod by hand-power.

It also consists in various novel details of construction and combinations of parts, which are hereinafter fully described.

In the accompanying drawings, Figure 1 represents a central longitudinal section of a steam-pump embodying our invention, the water end of the pump being omitted. Fig. 2 represents an end view thereof. Fig. 3 represents a transverse section of the auxiliary valve-chest upon the dotted line *xx*. Fig. 3* represents a horizontal section of the auxiliary cylinder and valve-chest upon the plane of the irregular dotted line 2 2, Fig. 2, the auxiliary pistons and valve being removed. Fig. 4 represents a side view of the auxiliary valve detached from other parts. Fig. 5 represents a transverse section of said valve upon the dotted line *yy*, Fig. 4. Fig. 6 represents a plan of the slotted bar which is attached to the auxiliary valve-stem. Fig. 7 represents a longitudinal section of the main valve and auxiliary pistons upon a larger scale. Fig. 8 represents an end view of an auxiliary piston. Fig. 9 represents a plan of the auxiliary cylinder with the auxiliary valve-chest arranged at right angles thereto, and a modified arrangement of mechanism for turning or oscillating the auxiliary valve. Fig. 10 represents a vertical section through the auxiliary valve-chest shown in Fig. 9. Fig. 11 represents a section of said auxiliary valve-chest upon the dotted line *zz*, Fig. 10. Fig. 12 represents a horizontal section of said auxiliary valve-chest upon the dotted line 1 1, Fig. 11. Fig. 13

represents a detail side view of the form of valve-gear shown in Fig. 9. Fig. 14 represents a detail side view of a modified form of valve-gear applicable to the arrangement of auxiliary valve shown in Fig. 9; and Fig. 15 represents a plan of a main cylinder, an auxiliary cylinder arranged transversely thereto, and an auxiliary valve with its axis at right angles to the axis of said auxiliary cylinder but parallel with the axis of the main cylinder.

Similar letters of reference designate corresponding parts in all the figures.

A designates the main steam-cylinder of a direct-acting steam-pump. B designates the piston, and B' the piston-rod thereof. The cylinder A is to be connected, by a brace or trunk, A', with a water-cylinder and valves, (not here shown,) but which may be of any desirable construction and arrangement.

C designates an auxiliary cylinder, arranged above, and preferably cast in one and the same piece with, the main cylinder A, as here shown. The auxiliary cylinder C is supplied with live steam by means of a pipe, C', (see Fig. 2,) which may be inserted in either side thereof, and it communicates, by means of ports a , with the main cylinder A, and by means of a port, a' , with the exhaust-opening a^2 , as seen in Fig. 1. The auxiliary cylinder C is closed at the back end by a head, C², but no head is necessary at the front end, it being closed in a novel manner, as hereinafter fully explained.

D designates a main valve, which, as here represented, is cast in one and the same piece with two auxiliary pistons, D', which are fitted to reciprocate in the auxiliary cylinder C. The main valve D controls the entrance of steam into the cylinder A through the ports a , and the exhaust of steam therefrom through said ports a and the port a' to the exhaust-opening a^2 . The main valve D has in its upper side an opening, D², (see Fig. 7,) and b designates a rock-shaft projecting through the auxiliary cylinder C, and carrying at its inner end an arm, b' , which enters the opening D² in the main valve. At its outer end the shaft b is provided with a hand-lever, b^2 , by means of which the rock-shaft may be oscillated and the main valve shifted by hand. The auxiliary cylinder has in its sides opposite openings, in either of which the steam-pipe C' may be inserted to suit the circumstances of the case, and the rock-shaft b may be inserted through the opposite opening. The auxiliary pistons D' may be provided with suitable ring-packing, which may be prevented from turning thereon by means of screws c , inserted at the meeting edges of the rings, as shown in Fig. 7.

E designates an auxiliary valve-chest, and E' designates an auxiliary valve adapted to turn therein, for the purpose of admitting steam to the auxiliary cylinder C, to act upon the auxiliary pistons D'. As here represented, the auxiliary valve E' is arranged in line with the auxiliary pistons D', and the auxiliary valve-chest E forms a front head to the aux-

iliary cylinder C, thus dispensing with a separate head therefor. In the auxiliary valve-chest E are two chambers, one a steam-chamber, d , which is supplied with live steam by a port, d' , from the auxiliary cylinder C, and the other, e , an exhaust-chamber, communicating by a port, e' , with the exhaust-opening a^2 of the main cylinder.

In order to provide for renewing the valve-seat in the auxiliary valve-chest E, as well as to insure the proper position of the several ports, we drive or force into the auxiliary chest a brass or other metal lining or bush, E², in which is a hole or aperture, d^2 , for admitting live steam from the steam-chamber d , a hole or aperture, e^2 , communicating with the exhaust-chamber e , two holes or apertures, $f f'$, in one transverse plane, and two holes or apertures, $f^2 f^3$, in another transverse plane. (See Fig. 3*.) The holes or apertures $f f' f^2 f^3$ open into chambers or cavities f^4 , which are cored in the auxiliary chest, and from these chambers or cavities the steam and exhaust ports extend to each end of the auxiliary cylinder C. From the chambers or cavities of the holes or apertures $f f'$ extend ports $f^5 f^6$, one to each end of the cylinder C, and from the chambers or cavities of the holes or apertures $f^2 f^3$ extend exhaust-ports $f^7 f^8$, which also communicate one with each end of said cylinder. The ports $f^5 f^7$, which communicate with the left-hand end of the auxiliary cylinder, have to be drilled in the auxiliary chest, from the inner end, into the cavities f^4 , and the latter part somewhat into the cylinder, while the ports $f^6 f^8$, which communicate with the right-hand end of the cylinder C, must be drilled both through the chest E and the auxiliary cylinder.

The auxiliary valve E', which is shown in Figs. 4 and 5, is of somewhat peculiar form, and has connected with it a stem, E³, passing through a stuffing-box, E⁴, in the auxiliary chest, and fitting in a guide, E⁵, projecting from the water end of the pump.

The top of the valve E' has an opening, E⁶, throughout the whole or a greater part of its length, so that the steam entering through the hole or aperture d^2 will be conducted to a transverse peripheral annular groove or recess, E⁷, and by the oscillation of the valve the steam will be supplied alternately to each of the ports $f^5 f^6$, and thence to each end of the auxiliary cylinder, the said ports entering said cylinder close to the ends thereof, so as to permit steam to act upon the pistons whether the latter are close to the cylinder-heads or not.

In the bottom of the valve E' is a cavity, f^9 , which is always in communication with the hole or aperture e^2 , and which, by the oscillation of the valve, brings alternately the holes or apertures $f^2 f^3$ in communication with the hole or aperture e^2 , and permits the exhaust from the two ends of the auxiliary cylinder into the exhaust-chamber e , and thence through a port, e' , into the exhaust-opening a' .

It will be observed that the ports $f^7 f^8$ communicate with the auxiliary cylinder at some

little distance from the end, and we provide a novel and simple device for cushioning the auxiliary pistons upon the steam at the ends of their strokes.

5 As clearly shown, we make in each piston D' , near the end thereof, an annular groove, g , which communicates, by means of an irregular port or passage, g' , with the end of the pistons D' .

10 In the ends of the two pistons D are circular recesses in which are fitted washers or plates g^2 , which have in them a hole or aperture, g^3 , corresponding with the port g' , and which are secured in place by screws g^4 , upon which they may be adjusted to bring the holes g in coincidence, or more or less out of coincidence, with the ports g' , and by which they may be securely locked in place after adjustment. The plates g^2 might have several holes of different sizes.

When the pistons D' move toward the right or left hand of the cylinder the steam in front of them is freely exhausted, through the port f^3 , until the front edge of the piston cuts off said part. As soon as the annular groove g in the piston comes opposite said port the steam is exhausted, through the irregular port g' , until the inner edge of said groove passes the port f^3 , whereupon the steam is trapped in the auxiliary cylinder and the pistons properly cushioned.

The washers g^2 , by first loosening the screws g^4 , may be adjusted to effect cushioning to a nicety, and by tightening the said screws are held when so adjusted. In a steam-pump, the proper cushioning of the valve at the end of its stroke is very important, and as this feature of our invention enables this to be done and the cushioning to be easily adjusted, it is of great importance.

We will proceed now to a description of the means whereby the auxiliary valve E' may be turned or oscillated, premising, however, that other suitable means may be employed for the same purpose.

By reference to the several figures it will be understood that all the valves' openings are below the center of the auxiliary pistons D' and the auxiliary valve E' , and that therefore there is little liability of leakage resulting from wear.

F designates a slotted bar, having at each end a lug, h , by which it may be adjusted upon the valve-stem, and a set-screw, whereby it may be secured in proper place when so adjusted. The slot F' is slightly longer than the stroke of the piston-rod of the pump, and near each end has a cam-shaped portion, F^2 .

G designates an arm rigidly fixed upon the piston-rod B' , having at its outer end an eye E^3 , and also having at its outer end a neck, h' , which is received in the slot F' and is free to move longitudinally therein. As the arm G approaches one end of the slot F' it engages with the cam-shaped portion F^2 of said slot and causes a partial turning of the valve-stem and valve in one direction, admitting steam to

one end of the auxiliary cylinder and opening the exhaust to the opposite end. When the arm G approaches the other end of the slot F' it engages with the other cam-shaped portion, F^2 , and causes a partial turning or oscillation of the valve-stem and valve in the opposite direction, admitting steam and opening the exhaust to the other ends of the auxiliary cylinder.

The ordinary hand-power levers which are employed to work direct-acting steam-pumps of small size by hand-power have a fixed fulcrum in the trunk or brace connecting the steam and pump cylinders, and a sliding connection with the piston-rod, to enable the lever to be moved in either direction from a vertical position.

A lever having a fixed connection with the piston-rod is much more effective and mechanical, and to enable this to be done we employ a hand-power lever, H , (see Fig. 1,) having a pivoted connection with the piston-rod through a pin or stud, i , projecting outward from the arm G , and forming a fulcrum, and comprising a toothed sector, H' , which is adapted to engage with a stationary toothed rack, H^2 . Though the connection of the lever H with the piston-rod may be of any suitable character, a simple form of connection is here shown. The lever has in it a large opening, i' , the upper part of which is fitted to the pin i , and after the lever has been placed over the pin and pushed down to put its sector H' in engagement with the rack H^2 , a pin, i^2 , may be inserted transversely across the opening i' , as shown, thus preventing the lever from accidentally rising and disengaging its sector from the rack H^2 .

The foregoing description is all confined to that form of our invention in which the axis of the auxiliary valve is in line with the auxiliary cylinder C and pistons D' ; but, if desirable, the auxiliary valve might be arranged with its axis at right angles to said cylinder and pistons, as shown in Figs. 9 to 14, inclusive. In this example of our invention the same letters of reference are used to designate the various ports and openings as are used in the previous description; hence a detailed description thereof is unnecessary, the operation being as previously described.

When the auxiliary valve is arranged with its axis at right angles to the main piston a longitudinal movement imparted from the piston-rod is needed to turn or oscillate the valve, and one arrangement of mechanism for this purpose is shown in Figs. 9 and 13, while another arrangement is shown in Fig. 14.

Referring, first, to Figs. 9 and 13, I designate a bar arranged to reciprocate in a bearing or support, I' , and receiving a longitudinal reciprocating movement by a suitable connection with the piston-rod of the pump, said connection not being here shown. Upon the stem of the auxiliary valve E' are secured arms j, j' , projecting at opposite angles and provided with pins or studs j^2 , which extend over the bar I

from opposite sides, as shown clearly in Fig. 13. The bar I is formed with, or has attached to its opposite sides, inclines k k' , which, as the said bar is reciprocated, act upon the studs j^2 of the arms j j' , to shift or turn the auxiliary valve first in one direction and then in the other. When the bar I moves toward the right the incline k acts upon the stud j^2 projecting from the arm j , and turns or oscillates the valve toward the right; but when said bar is moved toward the left the incline k' acts upon the stud j^2 projecting from the arm j' , and turns or oscillates the valve toward the left.

In the diagram shown in Fig. 14 the stem of the auxiliary valve has fixed upon it a single arm, l , carrying a roller, l' , which engages with a slot, m , in a reciprocating bar, J, arranged to be moved, like the bar I, Figs. 9 and 13, in a support or bearing, J' . At the middle of the length of the slot m are two opposite inclines, n n , and near each end is a single incline, o . When the bar J completes half its stroke one of the inclines n acts upon the roller l' , shifting the arm l into the central position shown in Fig. 14, and when the bar approaches the end of its stroke one of the inclines o acts upon said roller and moves said arm the remaining distance.

If desirable, for any reason, the auxiliary cylinder C might be arranged transversely of the main cylinder A, as shown in Fig. 15, with the auxiliary valve arranged with its axis at right angles to the auxiliary cylinder and parallel with the piston-rod. In this modification the arrangement of ports would be the same as previously described, and the mechanism for turning the auxiliary valve might be the same as shown in Fig. 1.

Although D' D are described as two pistons for moving the main valve, they may be considered as the two heads of a single piston.

It will be observed that in all the examples of our invention here shown are the reciprocating auxiliary pistons and the oscillating auxiliary valve, and that the arrangement of ports is substantially the same in all cases.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination, in a direct-acting engine, of a main valve, auxiliary pistons for moving said main valve, an auxiliary cylinder containing both said main valve and said pistons, and an auxiliary valve adapted to be turned or oscillated to admit steam to act upon said pistons, substantially as specified.

2. The combination, in a direct-acting engine, of a main valve, an auxiliary cylinder, auxiliary pistons for moving said main valve, and an auxiliary valve adapted to be turned or oscillated to admit steam to act upon the auxiliary pistons, and arranged with its axis in line with said pistons, substantially as specified.

3. The combination, in a direct-acting en-

gine, of a main valve, an auxiliary cylinder, auxiliary pistons for moving said main valve, an auxiliary valve to admit steam to act upon said auxiliary pistons, and an auxiliary valve-chest arranged at the end of said cylinder and forming a head therefor, substantially as specified.

4. The combination of an auxiliary cylinder, C, a main valve, D, auxiliary pistons D' , an oscillating auxiliary valve, E' , an auxiliary valve-chest, E, comprising steam and exhaust chambers d e and the ports d' e' f^5 f^6 f^7 f^8 , all arranged substantially as specified.

5. The combination, in a direct-acting engine, of a main valve, an auxiliary cylinder having an exhaust-port at some distance from its end, and an auxiliary piston constructed with an annular groove near its end, and with a port or passage leading from said annular groove through the end of the piston, whereby said piston is cushioned by the exhaust-steam at the termination of its stroke, substantially as and for the purpose specified.

6. The combination, in a direct-acting engine, of a main valve, an auxiliary cylinder having an exhaust-port at some distance from its end, an auxiliary piston constructed with an annular groove near its end, and with a port or passage leading from said annular groove through the end of the piston, and a plate or washer having a hole or aperture corresponding to said port or passage, and adapted to be adjusted to more or less close said port or passage, substantially as and for the purpose specified.

7. The combination, in a direct-acting engine, of a main valve, an auxiliary piston or pistons for moving the same, an independent auxiliary valve for admitting steam to act upon said piston or pistons, a valve-stem for said auxiliary valve, a reciprocating piston-rod, a bar attached to said valve-stem and constructed with a slot having a cam-like face at each end, and an arm fixed to said piston-rod and engaging with the slot in said bar, substantially as and for the purpose specified.

8. The combination, in a direct-acting engine, of a piston-rod, a stationary rack, and a hand-lever having a pivotal connection with said piston-rod, which forms a fulcrum for said lever, and comprising a toothed sector for engaging with said rack, substantially as and for the purpose specified.

9. The combination of a piston-rod, B' , having a projecting pin or stud, i , a stationary rack, H^2 , and a lever, H, comprising a toothed sector, H' , and having an opening, i' , and a pin, i^2 , inserted transversely across said opening, substantially as specified.

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