W. Wright,

Steam Pump,

No. 26,138. Patented Nov. 15, 1859.

Fig. 4.

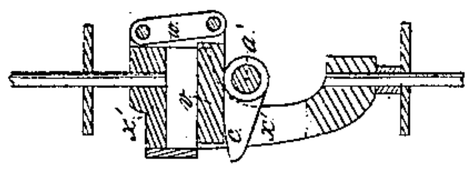


Fig. 3.

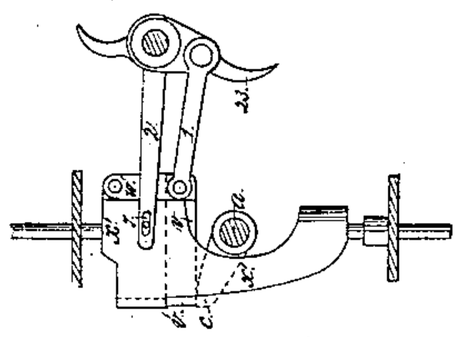


Fig. 2.

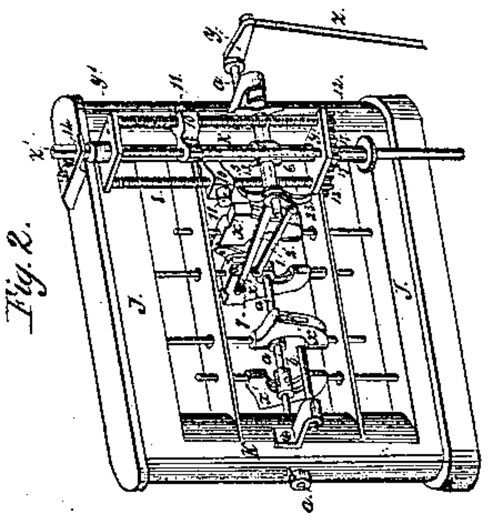


Fig. 6.

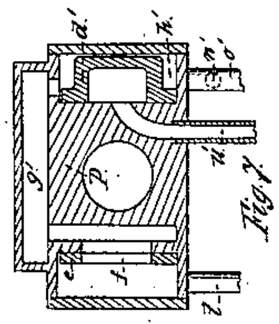


Fig. 7.

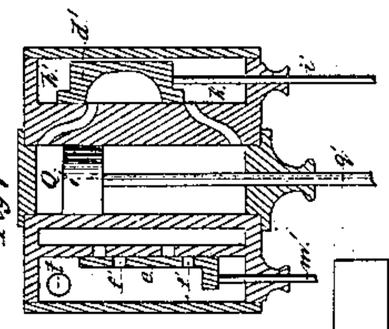


Fig. 5.

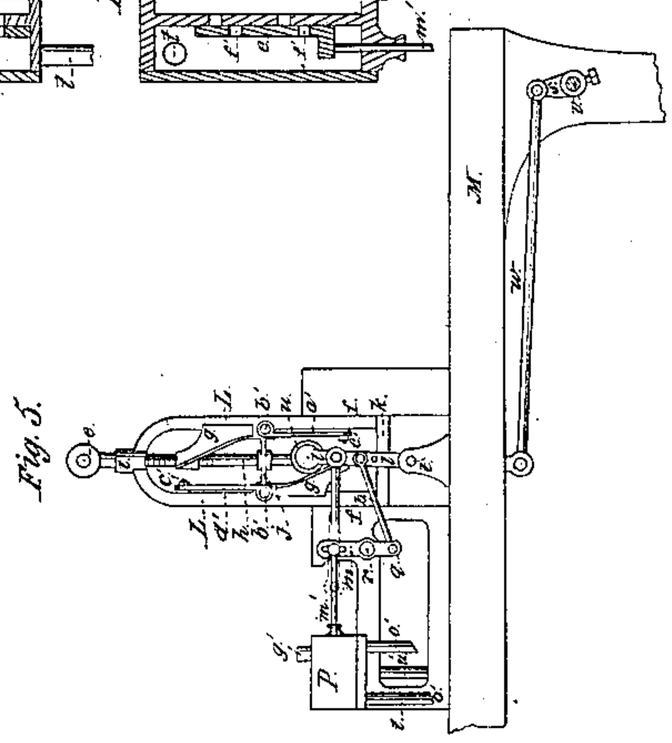
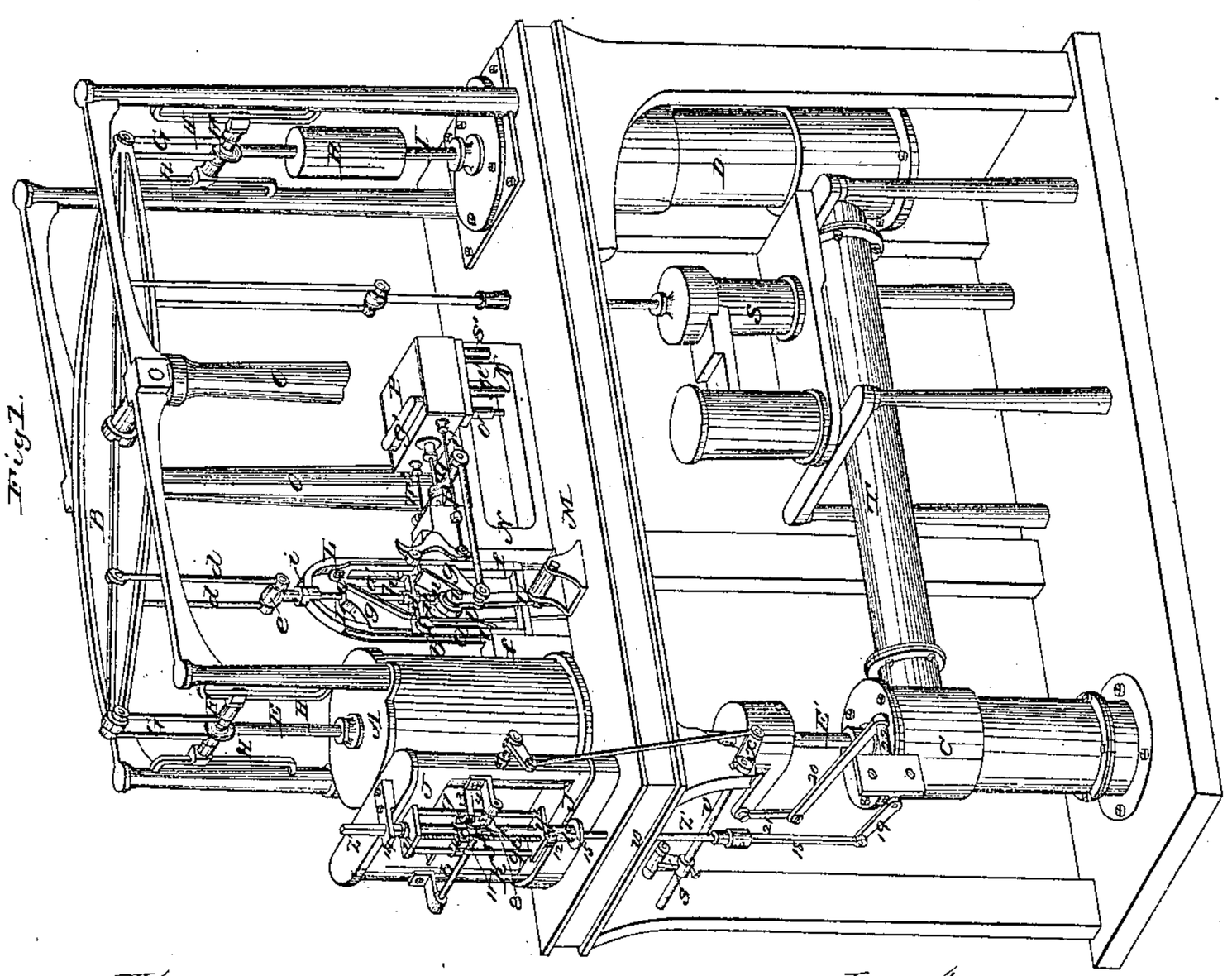


Fig. 1.



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UNITED STATES PATENT OFFICE.

WILLIAM WRIGHT, OF HARTFORD, CONNECTICUT.

STEAM PUMPING-ENGINE.

Specification of Letters Patent No. 26,138, dated November 15, 1859.

To all whom it may concern:

Be it known that I, WILLIAM WRIGHT, of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Double-Acting Pumping-Engines; and I do hereby declare the following to be a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, and in which—

Figure 1, represents in perspective a view of the engine with all its parts, and as connected to a pair of pumps, which it is designed to drive or operate. Fig. 2, represents in perspective on an enlarged scale the mechanism for operating the valves of the engine. Fig. 3, represents on a still larger scale a side view of a portion of the cut off mechanism. Fig. 4 represents a similar side view of other portions of the cut off and valve mechanism. Figs. 5, 6 and 7 represent portions of an auxiliary hydraulic engine and its several operating parts, and which is designed for operating the valves of the steam engine, as will be explained.

Similar characters of reference where they occur in the different figures denote like parts of the apparatus in all of them.

My engine may be constructed and used without a crank, crank-shaft or fly wheel. It is designed for a pumping engine, and one of its leading features consists in using an independent auxiliary hydraulic engine for working the steam valves properly, opening and closing them, and effecting the cut-off at the proper points, and performing all the offices and obtaining all the useful results of a well regulated and effective valve gearing.

To enable those skilled in the art to make and use my invention, I will proceed to describe the same with reference to the drawings.

The steam cylinder A, is placed under one end of the beam B; and below said cylinder and in the same center line is placed a pump C. Upon the other end of the beam is placed another pump D, of the same capacity as that at C, and equidistant with the cylinder from the center of the beam.

The upper part of the steam piston rod E, is connected to the beam B, in the ordinary manner by a crosshead F, and links G, and the perpendicularity of its movement is controlled by the guides H H. The lower part of the steam piston rod, extends down through a stuffing box in the bottom of the cylinder A, and is connected below to the piston rod E′, of the pump C. The piston rod I, of the other pump D, is connected to the other end of the beam by links and crosshead and guided in its vertical motion, in the same manner as the steam piston rod E.

In front of the steam cylinder, are placed, as in ordinary condensing engines, the steam chests J J, side pipes K, valves, rock shaft *a*, trip shaft *b*, steam and exhaust toes *c*, as, and for the purposes to be hereafter explained.

About midway between the centers, of the steam cylinder and beam, is placed a forked yoke or frame L which receives motion from the beam B, to which it is connected by rods *d* through the cross head *e*, and this frame works in slides *f f* affixed to the bed or frame of the engine. On each fork of this frame L, is arranged one of a pair of adjustable planes *g*, *g*, having their faces parallel to each other, and both connected to or operated by a rod *h*, having a right and left hand screw thread thereon, and turning in the hubs, at each extremity of the said planes. The upper end of this screw rod turns in a step made in the upper part *i* of the forked frame, and is prevented from moving vertically upward or downward by a collar therein. At about midway of the forked frame L, the screw rod *h* passes through a cross head *j* that is fastened to the sides of the frame, and by means of a collar above and below the cross head on said rod, it is also held from moving vertically upward or downward, while it is free to turn around; and passing on downward it goes through another cross head *k*, that unites the two lower ends of the forks of the frame L. This screw rod *h* may be operated by a hand wheel placed in any convenient position for the engineer, and worked by bevel gearing or otherwise, to bring the two planes nearer together or farther from each other, as may be required. The object of the inclined planes *g*, *g*, is twofold—first, they partially work the roller levers *l l*, and the rock shaft arm *y*, through its several connections *w*, *s*, *v*, *x*, *z*, (see Figs. 1, 5); and they also permit the engine to be started with a stroke equal to about three-fourths of the whole stroke, and then gradually let out (by working the screw

rod *h*) to full stroke, or until the clearance in the cylinder is reduced to a minimum.

Between the sides of the forked frame L, and in its vertical central line are placed the two perpendicular levers *l*, *l*, having their fulcra at *t*, which is midway of their length. The upper ends of these levers are furnished with friction rolls *u*, which run in contact with the planes *g*, *g*, when they vibrate past them. These levers *l*, *l*, must be so set in their bearings, as to permit their upper ends that carry the friction rollers *u*, *u*, to be precisely central or midway between the extreme points of the stroke of the frame L. The lower ends of the levers *l*, *l*, are connected to an arm *s* (see Fig. 5) on a rock shaft *v*, (placed in bearings underneath the engine bed M). by rods *w*, and forward of a vertical line through the steam cylinder A; another arm *x*, on this rock shaft *v*, is connected to the rock shaft arm *y*, on the rock shaft *a*, that operates the valves, by a connecting rod *z*, as seen in Fig. 1.

In addition to the inclined arms or planes *g*, *g* on the sides of the forked frame L, there are two other inclined pieces *a'*, *a'*, which are set in the same relation to each other, as the planes *g g*, that is, their inner faces are always parallel, but unlike their counterparts, in being fixed to the sides of the frame L, at or near its center by knuckle joints *b'*, *b'*, while their other ends are connected to said frame by tangent screws *c'*, or their equivalents, so that the inclination of these pieces *a' a'*, may be increased or reduced at pleasure to suit the effective working of the gearing.

On a small frame N, placed on the engine bed M, and between the uprights or standards O, O, that support the beam B, is placed an independent hydraulic cylinder P, having a piston Q, (Fig. 7,) and other connections similar to a steam cylinder. There are two induction valves *d'*, *e'*, connected with this independent hydraulic cylinder, viz: one (*d'*) a main valve, and the other (*e'*) an auxiliary valve. These valves *d'*, *e'*, maintain a certain relation to each other, in regard to the times of opening and closing; and their combined action secures a very important point in the working of the engine that will be hereafter described. The main valve *d'* is a balance slide valve, and the auxiliary *e'*, an ordinary slide valve. The opening *f'* through the latter communicates, by means of a pipe *g'* running over the top of the cylinder P, with the main valve chamber *h'*.

The stem *i'*, of the main valve *d'*, is connected to the lower arm of a double acting curved lever *j'*, the fulcrum of which lever is in the center between its arms; and this lever *j'*, is hung or pivoted at *k'*, to the frame N of the hydraulic cylinder P, so that it may freely vibrate on, or with, its support *k'* (or bearing, as a rock shaft may be used instead of the pivot, in which case it would move with the rock shaft). The point *k'* is in the same horizontal line or plane that the centers of the rollers *u u* are, when the levers *l*, *l*, that carry them are in a perpendicular position.

The main water-valve lever *j'* above referred to, receives its vibrating or rocking motion, from a roller *l'* fixed on one side of the forked frame L, at a point corresponding with a mean between the extreme points of movement of said frame—or in other words, half of the total movement of said forked frame, measuring from the center of the lever *j'*. The roller *l'* comes in contact, both in its upward and downward movement with the frame, first, with the upper arm of the lever *j'*, and secondly in its downward motion with the lower arm, and thus through the stem *i'*, giving the requisite motion to the main valve *d'*, of the hydraulic cylinder.

The main valve *d'* is opened, when the forked frame L, arrives at half stroke on its upward movement, and admits the pressure on the rear side of the piston Q—said opening being effected by the roller *l'*, and lever *j'*, as above described. The levers *l*, *l*, at this position of the forked frame, are at one extreme of their movement, and commence on their return movement—the hydraulic cylinder assisting in conjunction with the lower inclined arm or plane *g*, in carrying them over to their point of half movement, or perpendicular position, at which point the auxiliary valve *e'* is opened. This auxiliary valve is worked by a straight lever *m* (Fig. 5,) hung perpendicularly at the center of its length on a pin *r* fixed to the frame N supporting the hydraulic cylinder P; the upper end of the lever *m*, is connected to the valve stem *m'*, and the lower end *q* has an attachment to a pin *o* in the levers *l*, *l*, through the rod *p*. The pin *o*, may be adjustable in the levers *l*; and the pin *q* that, connects the lower end of the lever *m*, to the rod *p*, instead of being rigid, passes through a slot in the end of said rod *p*, so that there will be lost motion between *p*, and *m*, until *p*, moves through the extent of its slot, and then the lost motion is taken up, and the auxiliary valve *c'* is opened. The upper end of the lever *m*, has a vertical slot through it, and the pin that connects the lever and valve stem *m'*, is adjusted in this slot, so as to give the auxiliary valve its required throw. This lost motion may be effected just as well, by allowing the pin *o* to move through a slot of just sufficient length to permit the levers *l*, to be moved from their first point of contact with the inclined arms *g*, until they reach a perpendicular position, or half movement, when the lost motion is taken up, and the auxiliary valve opened. And, when the levers *l*

have arrived at the other extreme of their movement, the auxiliary valve is closed, and left ready to be opened again when the levers reach their perpendicular position on their return movement.

The means of supplying water to the hydraulic cylinder P, is so adjustable that, the water piston Q, may perform a stroke slowly or quickly as may be desired; and should the inclined arms g, g, on the forked yoke L, move at a velocity upward or downward that, would carry the water piston Q, away from the water that is permitted to enter the cylinder through the main valve opening, a partial vacuum would be created behind the piston. To avoid this vacuum, a supply of water is permitted to enter the cylinder through a suction valve n' in a pipe o' which communicates with the water chest of the cylinder P, and a cistern or reservoir that may receive and contain the exhaust water, so as to have a constant supply for this purpose. By this precaution no time is lost, and the water cylinder is brought into play on the next stroke at the proper time.

It may be proper to state that the positions and movements of the various pins, levers, rods, valves &c. named in the foregoing description hold a geometrical relation to each other, and are based on the movement of the forked frame L, from which they receive their motion. The combined action of the various parts of this gearing is intended to perform and does perform all the peculiar offices of an eccentric the principle of my engine not permitting the use of this latter contrivance.

Having given a detailed description of the various parts of the valve gearing, and the manner in which these parts receive their motions, and the effect produced at the three points of the stroke of the forked frame L, I will now proceed to describe the action of the whole of the valve gearing and the part it performs in the effective working of the engine.

The engine works on the expansion principle. At the commencement of the stroke the steam valves of the engine are opened fully, and held open until the steam cylinder piston has reached the required point of cutting off, when they are closed perfectly and instantaneously, without any noise or blow by a method which I will hereafter describe. Now, assuming the piston in the steam cylinder to be at half stroke—and the steam working expansively in the cylinder on the lower side of the piston, of course the beam would be at half stroke, as would also the forked frame L, which moves with it, and carries the inclined arms g, g:—the levers l, are at their backward extreme movement or nearest to the hydraulic cylinder P, and the main water valve in the hydraulic cylinder is just opened; the steam piston is still moving upward, also the forked frame; and the levers l, are retracing their track on their forward movement toward their half movement or perpendicular position by the means heretofore described. When the steam piston had moved upward sufficient to have carried the forked frame far enough so that the lower inclined arm has moved the levers l, to their forward half movement as seen in Fig. 1, and further assuming that, the auxiliary water valve e' is just opened, as above described, admitting a column of water from a reservoir, or any high head of water, or water under pressure, and a sudden increase of pressure on the back of the water piston Q, and consequently carrying the levers l beyond the perpendicular and toward their extreme forward movement quickly, and the lower ends of the levers in a contrary direction, and thereby moving the steam valve rock shaft a, and its attachments—opening the valves and permitting the steam to enter the cylinder above the piston, forming a cushion for it, and terminating the upward stroke:—the valves still being kept open the piston commences to move on its downward stroke till it reaches the point of cutting off, when the valves are instantly closed, and the piston proceeds on by the force of the expanding steam, and when it has reached half stroke the same operation is gone through (as above stated) by the valve gearing, controlled by the forked frame and hydraulic cylinder, and the perfect working of the engine thus effected. It is thus manifest that the steam valves rock shafts are controlled by the forked frame in combination with the independent hydraulic engine or cylinder, the latter being so perfectly adjustable to any given time that, the valves are brought into play at proper and fixed intervals, and keeping them in one sense independent of the beam—as for example should the steam piston fail from any cause to complete a full stroke and the engine stop, the hydraulic cylinder will open the valves by its own independent action, and move the engine on its next stroke, and thus avoiding the necessity of compelling the engineer to use the starting bar for that purpose.

Before proceeding with the description of the cut-off and the operation of the valves, it may be necessary to mention in connection with the independent hydraulic engine that, the valve stems i', and m', though passing through the cross head p', are not connected to said cross head, but move independent of it; that the piston rod q', of the hydraulic cylinder is connected to the cross head p', and the cross-head in turn connected to the roller levers l, l, by the rods r' r'. s', is the water pipe or way for the main valve chamber h', and t', the water pipe or way for the auxiliary valve chamber, and u', the exit

pipe—and, in connection with the main engine, R, is a counterpoise on the piston rod I, and S, an air pump, worked from the beam B, and to be used in connection with a condensing apparatus if required. The point of cutting off is effected, and the instantaneous closing of the valves regulated by a mechanism which will be now described.

On a stationary shaft *b*, at a proper height, and secured in front of the valve work, are placed four levers 1, 2, 3, 4,—two of them (1, 3,) are for producing the cut-off and hold opposite positions on the fixed shaft *b*, one being in operation on the up stroke, and the other on the down stroke:—the other two levers (2, 4,) are for insuring the closing of the valves, the instant the cut-off takes place. Each of the cut-off levers (1, 3,) have two arms (5, 6,) of equal length—one (5) above and one (6) below the shaft, center, or fulcrum, and nearly in the same right line with each other—the deviation from a right line being only so much as is required to give them their proper and requisite shape. Each cut-off lever 1, 3, is connected to its corresponding supplemental toe *v'* of the cut-off mechanism, by a link *w'*, or hinged arm, hung to the steam or cut-off yoke *x'*; this arm *w'* is attached to both the lever 1, and the supplemental toe *v'*, and the movement of the lever gives the movement to the toe *v'* that releases the valve, and leaves it at liberty to drop. Instead of moving the supplemental toes, in the line of their length they may be moved laterally, and effect the same unlatching or detaching of the valve, and thus allow it to drop.

The valve closing levers 2, 4, are of a different form from those 1, 3—one of them being straight, and the other curved. The straight arm 2^2, has a slot 7, (see Fig. 3,) in which a fixed pin in the steam yoke *x'* works; this lever is hung on the fixed shaft *b* as shown, and (as in the case of the cut-off levers) holds on said shaft a reverse position to its fellow 3—one only being engaged at each stroke of the engine; the other or curved lever 3 is operated substantially like its fellow 1, as will be hereinafter explained.

A frame *y' y'*, composed of two screw rods 8, 8, and two standards 9, 9, moves vertically upward and downward in front of the valve work; the vertical center of this frame intersects the central line of the fixed shaft *b*, so that one screw rod, and one standard of the frame are on each side of the fixed shaft, and equally distant from its center. On each screw rod 8, is a nut 10, carrying a friction roller 11, whose face is wide or long enough to touch in its movement the face or edge of both the cut-off, and closing levers of its respective valve. The upper end of each screw rod 8, revolves in a step made in the upper cap piece *y'*, of the frame, and their lower ends are held in place by a shoulder on the rod, which rests on the upper side of the lower cap piece *y'*, said ends passing through the cap, and each furnished with a pinion 12. The spindle or rod *z'* which transmits motion to the frame passes through the lower cap piece *y'*, and thence through a hub 13, on the fixed shaft *b*, thence through the upper cap piece *y'*, and through a guiding bracket 14, secured to the upper steam chest. Under the lower cap piece is a hand wheel 15, through the hub 16 of which the moving spindle *z'*, passes; and on the end of this hub 16, is a pinion 17, which works into the screw pinions 12. The moving spindle passes down through a guide, in the floor plate M of the engine and is connected by the levers 18, 19, 20, 21, and rock shaft 22, to the pump rod E', from which it receives its motions—there are however, many other ways by which the frame may receive its motions from the movement of the engine, and I only deem it necessary to illustrate one mode, leaving it optional with builders to use this one, or any others that would obviously suggest themselves to a mechanician.

The operation of the frame and its several parts is as follows: When the frame on its upward movement has arrived at the exact point of cutting-off, the roller 11, on the screw of the frame, comes in contact with the face or edge of the upper arm 5, of the cut-off lever 2, and moves it inward, which draws back the supplemental toe *v'*, and allows the valve to drop:—but, should the valve from any cause not seat itself when free to do so, the roller 11, performs the operation for it, by coming in contact with the curved arm 23 of the closing levers 2, 4—the other or straight arm receiving a downward movement carrying the steam yoke *x'*, with it and closing the valve. On the down stroke, the roller 11, on the other screw rod 8, performs the same operation with the other pair of levers, and its corresponding valve, and at the same time the up stroke roller on its downward passage brings the supplemental toe into action, leaving it prepared for the next up stroke; and in like manner the down stroke roller leaves its corresponding supplemental toe ready for the next down stroke.

The points of cutting off, are regulated to a nicety by merely turning the hand wheel 15, which of course turns the pinions 12, 12, on the ends of the screw rods 8, 8, bringing the nuts 10, 10, that carry the rolls 11, 11, into such position that they will operate on their respective pair of levers sooner or later in the stroke, just as the efficient working of the engine demands.

The pumping cylinders C, D, are connected by a horizontal pipe T, but as this pump and its connections with the engine

will be the subject matter of another application for a patent, I will not describe it in detail here.

Having thus fully described the nature and object of my invention, what I claim therein as new and desire to secure by Letters Patent is,

1. The application of the forked yoke, inclined arms and levers, in conjunction with an independent hydraulic cylinder or engine, for working the valves of a steam engine properly—opening and closing them, and effecting the cut-off at the proper points, and performing all the offices, and obtaining all the useful results of a well regulated and effective valve gearing.

2. I also claim the combination of the forked frame and inclined arms, for controlling and regulating the length of stroke between certain points or the faces of said planes and graduating it between these points, at the will and pleasure of the engineer, so as to reduce the clearance in the steam cylinder to a minimum.

3. I also claim the manner in which the main valve of the hydraulic cylinder is brought into action at proper and fixed intervals, and working the steam valves of the engine independently of the forked frame and its inclined arms, should the latter part of the gearing fail from any cause to assist in performing that duty.

4. I also claim, the application of the auxiliary valve in combination with the main valve of the hydraulic cylinder, for effecting at the proper point the opening of the steam valves instantaneously and ahead of the steam piston—or, in other words for giving the lead to the valve as effectually as an eccentric will on a crank engine—and forming a cushion for the piston at the end of the stroke—reversing the movement, and holding the valves wide open until the cut-off is accomplished, substantially in the manner described.

5. I also claim, the mechanism for accomplishing positively the cut-off, and insuring the closing of the valves; and in connection therewith the method of regulating and adjusting the same to any required point of the cut-off that the beneficial working of the engine may demand, as explained.

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