

(No Model.)

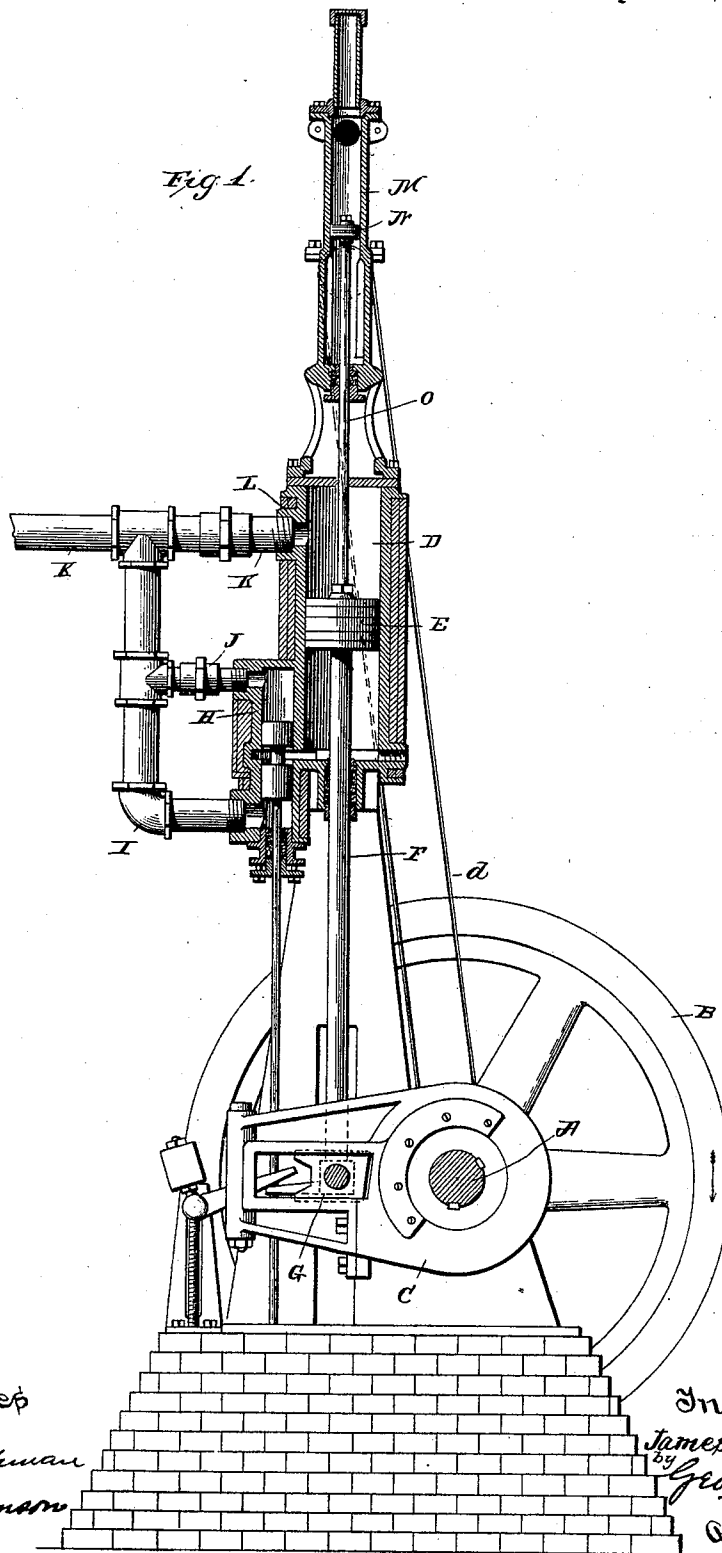
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J. D. GRAY.

GOVERNING MECHANISM FOR DIRECT ACTING ENGINES.

No. 581,346.

Patented Apr. 27, 1897.



(No Model.)

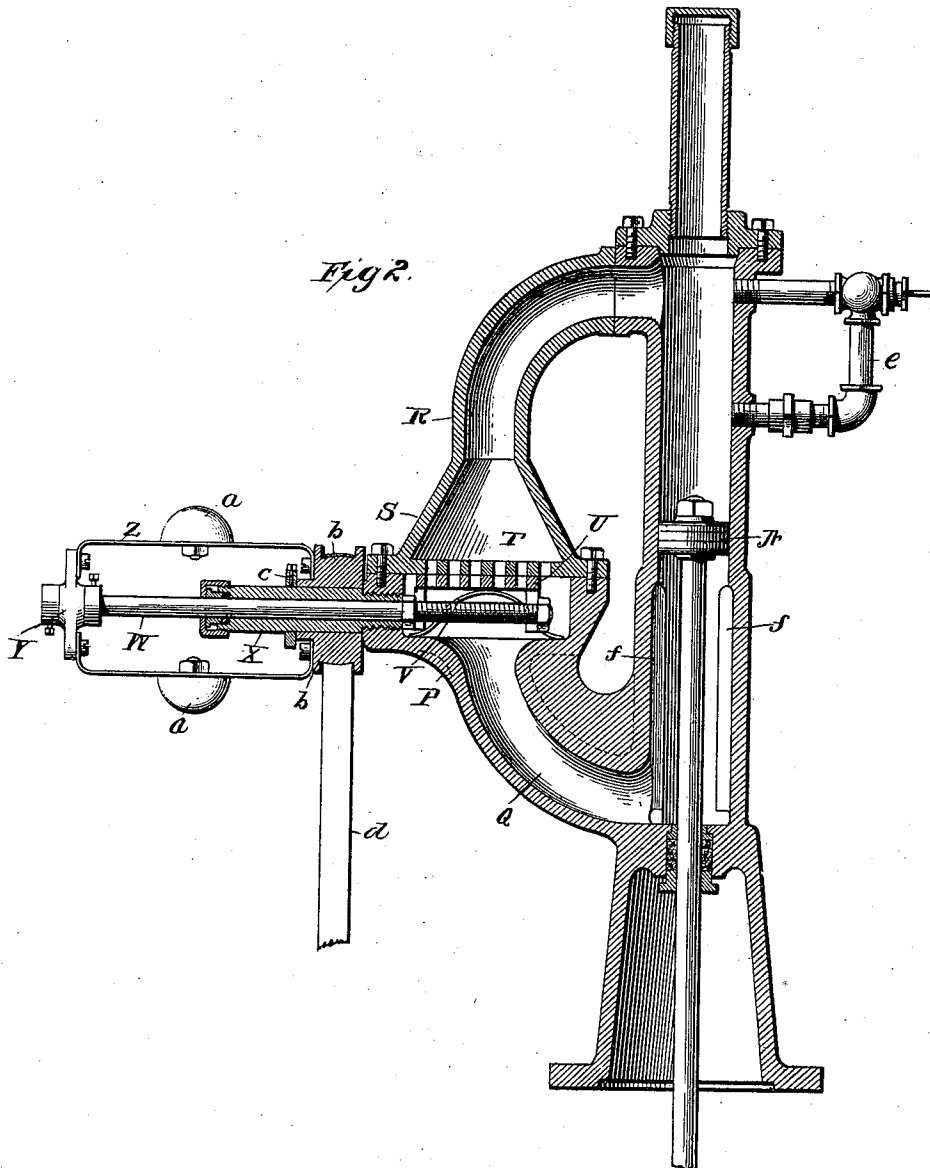
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GOVERNING MECHANISM FOR DIRECT ACTING ENGINES.

No. 581,346.

Patented Apr. 27, 1897.



Witnesses:

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Attorney

(No Model.)

3 Sheets—Sheet 3.

J. D. GRAY.

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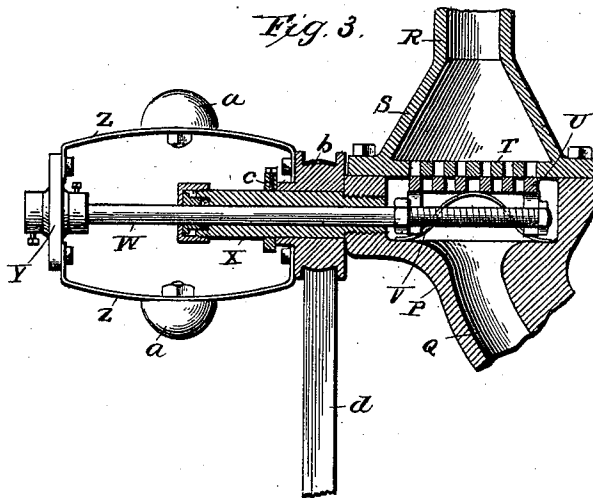


Fig. 4.

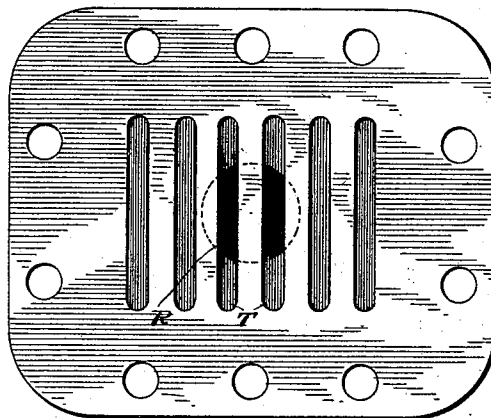
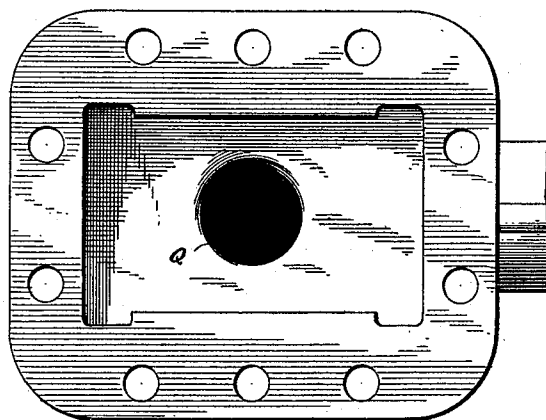


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

JAMES D. GRAY, OF BALTIMORE, MARYLAND, ASSIGNOR OF TWO-THIRDS
TO WILLIAM B. PRICE AND ABRAHAM SHARP, OF SAME PLACE.

GOVERNING MECHANISM FOR DIRECT-ACTING ENGINES.

SPECIFICATION forming part of Letters Patent No. 581,346, dated April 27, 1897.

Application filed June 30, 1896. Serial No. 597,523. (No model.)

To all whom it may concern:

Be it known that I, JAMES D. GRAY, a citizen of the United States, residing in the city of Baltimore and State of Maryland, have invented certain new and useful Improvements in Governing Mechanism for Direct-Acting Engines, of which the following is a specification.

My present invention relates to a new and useful improvement in direct-acting engines designed to utilize fluid under pressure for the development of mechanical power, and especially to that portion of such an engine which determines the travel and dwell of the piston relative to the speed of the main shaft, and has for its object to improve upon the construction shown and described in Letters Patent No. 533,290, granted to me upon the 29th day of January, 1895.

With these ends in view my invention consists in the details of construction and combination of elements hereinafter set forth, and then specifically designated by the claims.

In order that those skilled in the art to which this invention appertains may understand how to make and use the same, I will describe its construction and operation in detail, referring to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a vertical section of an engine built in accordance with my present improvement; Fig. 2, an enlarged section of the dash-pot and governor-valve, showing said valve open, which is the position assumed thereby when the piston is freed and permitted to move downward; Fig. 3, a detail section of the governor-valve, showing it closed; Fig. 4, a bottom plan view of the valve-seat; and Fig. 5, a plan view of the chest, the cap being removed.

In carrying out my present invention I provide a suitable framework for the mounting of the several operating parts of the engine, and within suitable bearings in this frame is journaled the main shaft A, upon which is mounted the fly-wheel B, of a size and weight to maintain the momentum imparted thereto by the operations of the engine. This shaft is caused to revolve in the direction of the arrow by a clutch C of any suitable design, but as the construction thereof forms no part of

this invention I will not describe it in detail, the only essential being that this clutch shall grip the shaft when moving in one direction, but be adapted to freely move in the opposite direction without affecting said shaft, or to permit the shaft to revolve therein without affecting the clutch, the reasons for which will be hereinafter clearly seen.

The cylinder D is supported by suitable uprights, and has fitted therein the piston E in the usual manner, and from this piston runs the piston-rod F, through a stuffing-gland, and this rod carries the cross-head G, said head being guided by the uprights, so as to move upon the axial line of the cylinder. The cross-head also carries suitable slippers fitted within slots formed in the clutch-arm, by means of which motion is imparted from the said head to the clutch-arm in bringing about the rotations of the main shaft.

Suitable admission and exhaust valves are arranged within the chest H, and these valves are operated by the motions of the cross-head, so as to bring about the admission of live steam below the piston and the exhaust of said steam after being utilized at the proper times. An exhaust-pipe I leads from the chest, as also a branch J thereof, this arrangement being utilized to balance the exhaust-valve, and said exhaust-pipe passes to the pipe K, which connects at L with the upper portion of the cylinder, so that when the piston has been moved upward and the steam which has brought about this movement is released from the lower portion of the cylinder it will gain access to the upper portion thereof through the pipe K, thereby counteracting the back pressure incident to the exhausting of all of the dead steam directly to the atmosphere.

The point at which the pipe K enters the cylinder is somewhat below the upper wall of said cylinder, so that when the piston is forced upward until its upper edge passes this pipe the amount of fluid then contained within the upper portion of the cylinder will be compressed by the piston and serve as a cushion for arresting the movement of said piston without shock to the engine. After the piston has moved upward, carrying with it the cross-head, and thereby causing the

clutch to act upon the main shaft to revolve the same, should the predetermined momentum of the fly-wheel be then established, it is essential that the piston remain in its elevated position and that it be not again operated until the speed of the fly-wheel has fallen below the predetermined number of revolutions per minute, and this is accomplished in the following manner: Mounted upon the top of the cylinder at a suitable height therefrom is a dash-pot M, and fitted therein is a plunger N, connected by the plunger-rod O to the piston E, so that said plunger will be caused to move in exact unison with said piston. A valve-chest P is located at one side of the dash-pot and has leading thereto from the lower end of said dash-pot the passage-way Q and from the upper portion of the dash-pot the passage-way R, and this last-named passage-way merges into the funnel-shaped cap S, which has formed thereon the valve-seat T, and is bolted to the chest so as to close the latter.

A valve U is fitted to the under side of the valve-seat T, and both this valve and the seat have formed therein elongated slots, which when registering permit the free passage of the liquid which is contained within the dash-pot, but when these slots do not register the flow of said liquid in the direction of the arrow in Fig. 2 is cut off. The valve U is held against the seat by the semielliptical spring V, and this arrangement permits of the liquid passing through the slots of the valve-seat in the opposite direction of the arrow when sufficient pressure is brought to bear upon said liquid to overcome the resistance offered by the spring, since the valve will then be forced downward from off its seat.

In order that the valve U may be opened or closed as occasion requires, a stem W is attached thereto, which passes without the valve-chest through the tube X and carries upon its outer end the yoke Y. This yoke has attached thereto the plate-springs Z, the latter carrying the weights *a*, and the opposite ends of these springs are secured to the pulley *b*, which latter is journaled upon the tube X and prevented from lateral movement by the collar *c*.

Rotation is imparted to the pulley *b* by the belt *d*, which also passes over a suitable pulley carried by the main shaft A. Thus when the speed of the fly-wheel is above the predetermined number of revolutions per minute the governor will be so revolved as to cause the weights *a* by centrifugal action to bow the springs Z, thereby forcing the stem W inward and closing the passages through the valve-seat by moving the slots within the valve out of alinement with the slots in said seat, from which it will be seen that when the piston is moved upward, imparting the desired speed to the fly-wheel, the liquid which is contained within the dash-pot, and which I prefer should be oil, will be forced from the

upper portion of said pot through the passage R and downward through the openings in the valve-seat; but when the piston has reached the limit of its upward stroke it will be there held against a return movement by the plunger N, resting upon the liquid within the lower portion of the dash-pot, and this liquid will be prevented from escape by the seating of the valve U, as before described. Now so long as the fly-wheel continues to revolve at the proper rate of speed the governor will hold the valve U in its closed position, but should the speed of this wheel fall below the predetermined speed thereof the decrease in centrifugal action upon the weights *a* caused by this decrease of speed will permit the springs Z to move the stem W, and consequently the valve U, outward, which will bring the slots in said valve in alinement with the slots in the valve-seat T, thereby permitting the escape of the liquid from beneath the plunger N to the upper portion of the dash-pot, and this will permit the descent of the plunger, which will be then drawn downward by the weight of the piston and parts carried thereby. During the downward movement of the piston, and consequently the cross-head, said head will operate the admission and exhaust valves in such manner as to close the latter and open the former at the lower portion of its stroke, and the admitted steam will again force the piston upward, causing the clutch to again operate upon the main shaft, so as to increase the rotations of the fly-wheel, which will again increase the revolutions of the governor, thereby closing the passages through the valve-seat T, as before described, and for the purpose of again supporting the piston in its elevated position until the speed of the fly-wheel has decreased below the predetermined point, when the action just set forth will again take place.

It is necessary after the piston has been cushioned at the upper end of the cylinder, as before described, to permit said piston to move downward until its upper edge passes sufficiently below the pipe K for the escape of the cushioning fluid, and this is brought about by the runaround *e*, which enters the upper portion of the cylinder at two points, said points being at a distance apart equal to the distance through which the piston must travel to release the cushioning fluid, so that when the plunger has been forced upward by the piston to the extreme upper end of the dash-pot it is permitted to return downward until registering with the lower entrance of the runaround on account of the liquid which occupies the dash-pot below the piston escaping through the lower entrance of the runaround and flowing into the dash-pot above the plunger. I have also found in practice that it is desirable to permit the piston to fall rapidly after starting downward, and as the openings in the valve U do not of necessity fully register with the openings in the valve-seat T when the governor first imparts a lon-

itudinal movement to the valve I therefore provide the longitudinal grooves *f* in the walls of the lower portion of the dash-pot, so that when the plunger N passes below the upper ends of these grooves the liquid below the plunger may escape around said plunger to the upper side thereof, thus permitting the rapid downward movement of the plunger and piston, which facilitates the operations of the valves and prevents wiring of the admission-steam.

From this description it will be obvious that the piston will dwell in an elevated position so long as the fly-wheel is revolving at the proper rate of speed, and will only be caused to move downward and operate the valves to bring about a further action upon the main shaft when said fly-wheel has decreased in speed below a predetermined point, the advantages gained thereby being that the wear and tear of the moving parts of the engine are greatly reduced in that they remain at rest, except when their movements are needed, and that the unnecessary use of steam is not occasioned.

In practice it has been found that an engine thus constructed will utilize the fluid which is admitted thereto for the operations of the piston in the most effective manner, and when this fluid is steam or other expansible gas the expansion thereof may be so limited as to prevent its passing below an effective pressure.

It is to be noted that such an engine is especially adapted for using non-expansible fluids, such as water, in that the volume of fluid used will be in direct proportion to the amount of power generated, since the piston will dwell when its movements are not needed, thus obviating the necessity of filling and emptying the cylinder, which will greatly economize the volume of fluid used.

Having thus fully described my invention, what I claim as new and useful is—

1. In a device of the character described, a dash-pot, a plunger sliding therein, a rod connecting the plunger with the piston of the engine, a by-pass connecting one end of the dash-pot to the other, a valve located in said by-pass, said valve adapted to allow the contents of the dash-pot to pass in either direction when open, but in only one direction when closed and means controlled by the speed of the engine for operating the valve, substantially as described.

2. In an engine of the character described, a main shaft, clutch mechanism for operating said shaft in one direction only, said mechanism being so arranged as to permit the free revolving of the shaft independent of the movements of the clutch, an intermittently-operated piston fitted to slide within a cylinder, means for controlling the admission and exhaust of fluid to said cylinder, a plunger connected to the piston, said plunger being fitted within a dash-pot containing a non-compressible liquid, a valve for controlling the

movements of said liquid, and a governor for operating said valve, the operations of said governor being dependent upon the speed of the main shaft, substantially as and for the purpose set forth.

3. In an engine of the character described, a main shaft journaled in a suitable frame, a clutch mechanism for operating said shaft in one direction, a cross-head adapted to impart an oscillatory movement to said clutch, a piston connected by a piston-rod to said cross-head, a cylinder in which said piston is fitted to slide, valves for admitting and exhausting steam from the cylinder mechanism under the control of the cross-head for the operation of said valves at predetermined times, a plunger connected by a plunger-rod to the piston so as to move in unison therewith, a dash-pot in which said plunger is fitted to slide, said dash-pot containing a liquid—such as oil—passages leading from the upper end of the dash-pot to the lower end thereof, a valve interposed between said passages for controlling the flow of the liquid from one side of the plunger to the other, and a governor for opening and closing said valve, the operations of said governor being so controlled by the relative speeds of the main shaft as to cause the piston to dwell except when its movements are needed to maintain the predetermined speed of said shaft, as specified.

4. In an engine of the character described, a main shaft mounted in a suitable frame, a momentum-perpetuator carried by said shaft, a clutch for operating said shaft in one direction, a cross-head for operating said clutch, a piston connected by a piston-rod to said cross-head, a cylinder in which said piston is fitted to slide, valves for controlling the admission and exhaust of steam to and from the cylinder, mechanism adapted to be operated by the movements of the cross-head for bringing about the proper movements of the valves, a pipe leading from the exhaust to the reverse side of the piston and at a point below the upper limit of the stroke of said piston, a plunger N, a rod connecting said plunger with the piston, a dash-pot in which said plunger is fitted to slide, said dash-pot containing the proper quantity of liquid, a runaround so located relative to the movements of the plunger as to permit a sufficient downward movement of said piston to release the cushioning fluid, a valve-chest P, passage-ways leading from each end of the dash-pot to said chest, a valve-seat formed upon the cap of the chest and having elongated slots formed therein, a valve also having elongated slots fitted upon said seat, means for normally holding said valve in contact with the seat but adapted to permit said valve to be forced thereof, and a governor connected with said valve, said governor being so connected with the main shaft as to open or close its valve by the variance in the speed of said shaft, substantially as and for the purpose set forth.

5. In an engine of the character described, a dash-pot, a plunger sliding therein, a rod connecting the plunger to the piston of the engine, a by-pass connecting one end of the dash-pot to the other, a slotted valve-seat within the by-pass, a spring-pressed slotted valve slidable therein, a valve-stem journaled in the by-pass and slidable in slots of the valve and a governor operated by the engine and controlling the valve, substantially as described.

6. In an engine of the character described, a dash-pot, a plunger slidable therein, a rod connecting the plunger to the piston of the engine, a by-pass connecting one end of the dash-pot to the other, a valve-chest formed in the by-pass, a slotted valve-seat in the top thereof, a slotted valve slidable thereon, a spring pressing the valve against the seat, a tube leading to the valve-chest, a valve-stem slidable therein, slotted ears depending from the valve slidable on the valve-stem and engaging nuts thereon, a pulley journaled on the tube, a belt connecting the pulley to the drive-

shaft of the engine, a yoke journaled on the valve-stem, spring-straps connecting the yoke and pulley and weights on the spring-straps, as and for the purpose described.

7. In an engine, a valve-chest, a slotted valve-seat therein, a slotted valve slidable thereon, a spring pressing the valve against the valve-seat, a tube leading to the valve-chest, a valve-stem slidable therein, depending ears slidable on the valve-stem and engaging nuts thereon, a pulley journaled on the tube, a belt connecting the pulley with the drive-shaft of the engine, a yoke journaled on the valve-stem, spring-straps connecting the yoke to the pulley and weights on the spring-straps, as and for the purpose described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

JAMES D. GRAY.

Witnesses:

S. S. WILLIAMSON,
R. BRENT WALLING.