(No Model.)

2 Sheets—Sheet 1.

J. D. GRAY.

DIRECT ACTING ENGINE.

No. 592,248. Patented Oct. 26, 1897.

Fig. 1.

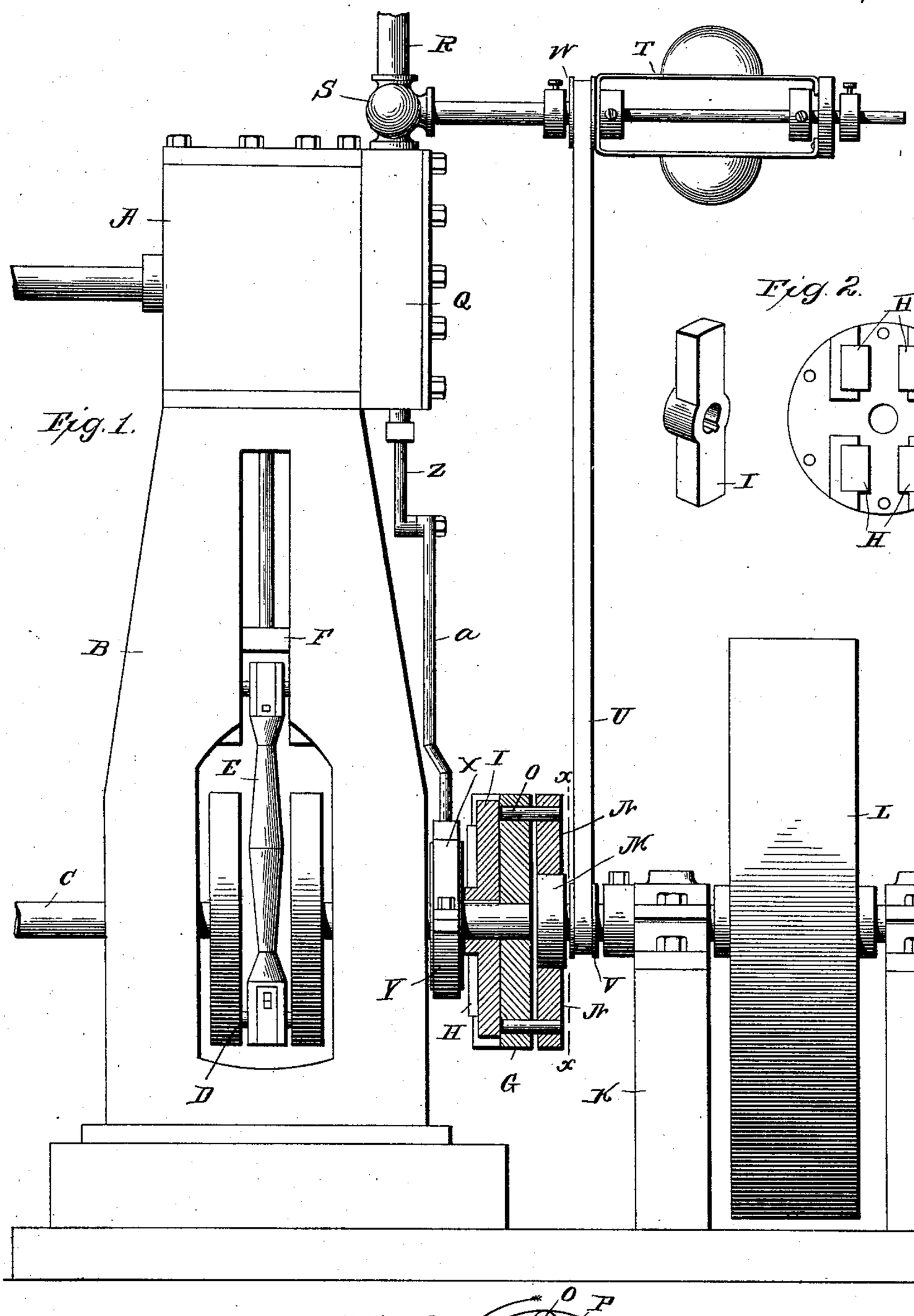
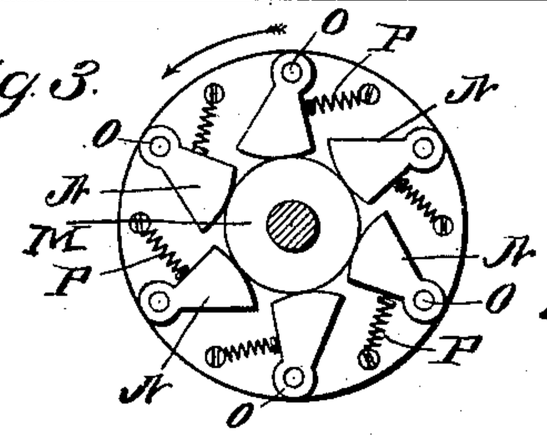


Fig. 2.

Fig. 3.



Witnesses

E. C. Wurdeman

S. J. Williamson

Inventor

James D. Gray

By Geo. H. Holgate

Attorney

(No Model.) 2 Sheets—Sheet 2.

J. D. GRAY.

DIRECT ACTING ENGINE.

No. 592,248. Patented Oct. 26, 1897.

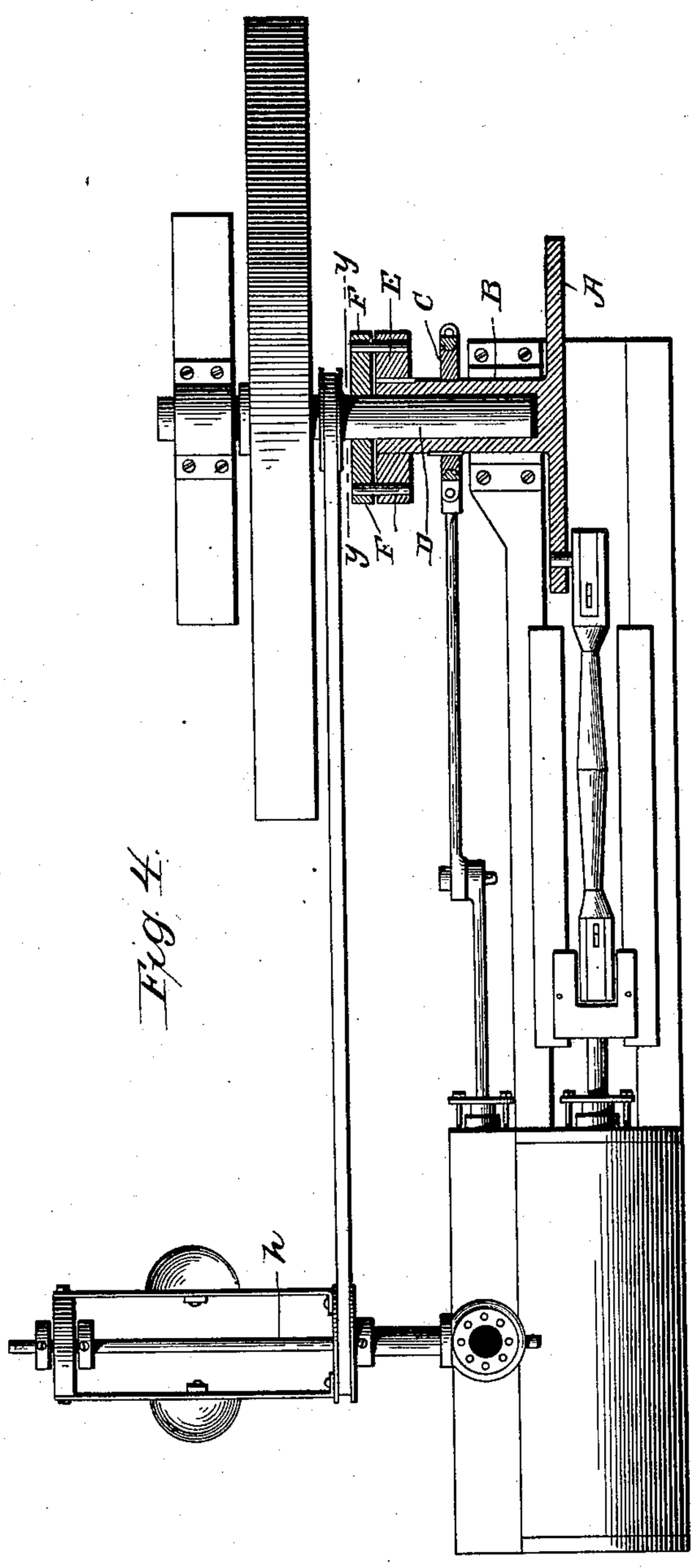


Fig. 4.

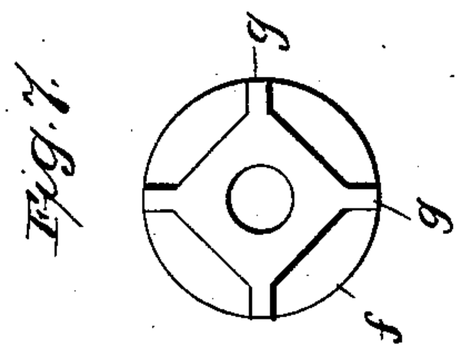


Fig. 7.

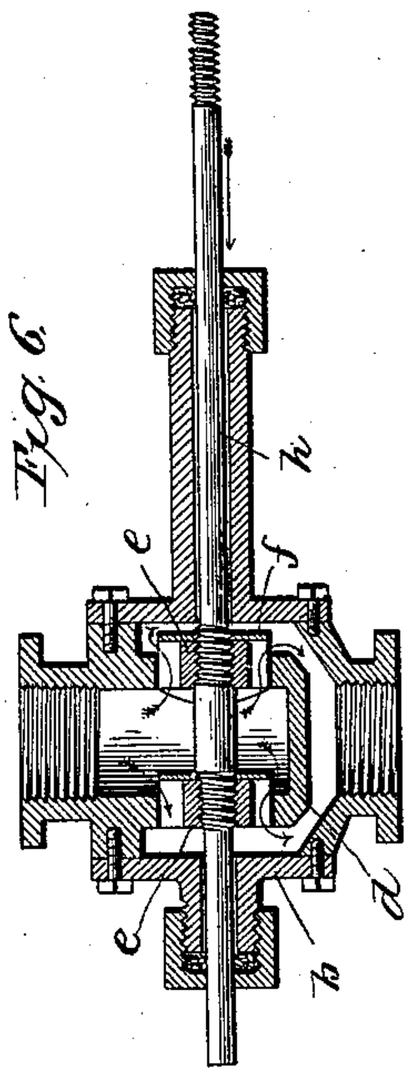


Fig. 6

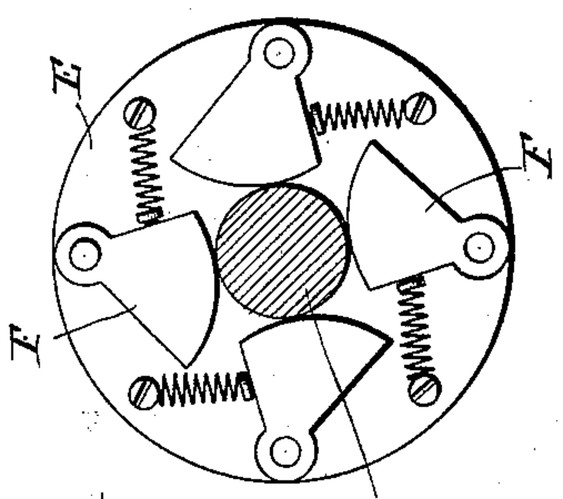


Fig. 5.

Witnesses
E. C. Wardman
S. J. Williamson

Inventor
James D. Gray
By Geo. H. Holgate
Attorney

UNITED STATES PATENT OFFICE.

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

DIRECT-ACTING ENGINE.

SPECIFICATION forming part of Letters Patent No. 592,248, dated October 26, 1897.

Application filed December 2, 1896. Serial No. 614,200. (No model.)

To all whom it may concern:

Be it known that I, JAMES D. GRAY, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented a certain new and useful Improvement in 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 has for its object to so modify and alter the constructions shown in United States Letters Patent No. 533,290, granted to me upon the 29th day of January, 1895, and in certain allowed applications for United States Letters Patent, bearing serial numbers, respectively, 597,521, 597,523, and 597,522, as to permit the application of the principle embodied in said patents and applications to be applied to engines of ordinary construction with but slight alteration thereof. In engines of ordinary construction the piston, its rod, and all parts carried thereby or attached thereto are caused to travel or revolve at the same rate of speed as the wheel or pulley utilized for the transmission of the power from the crank-shaft to the machinery driven, with the evident disadvantage of a constant generation of friction, as well as the absorption of a large percentage of the initial force exerted upon the piston and the admission of steam or other motive fluid to the cylinders upon either side of the piston at every complete stroke of the same, although in practice it is usual for the load carried by the engine to so vary as to require but little exertion of force for the maintenance of the minimum speed; and while it is the general practice to utilize a governor for varying the admission of steam to the cylinder the object of such governor is only to vary the point of cut-off of the steam, and while effecting a large saving of steam by permitting the expansion of the same to a certain extent, yet a certain amount of steam is constantly passing through the exhaust when the engine is in operation, even though the momentum of the moving machinery or balance-wheel is entirely sufficient to maintain the minimum speed. These disadvantages I contemplate overcoming by regulating the admission of steam or other motive fluid to the chest by the variance of the momentum-perpetuator independent of the ordinary valve mechanism, so that so long as the speed of said perpetuator is maintained above the minimum no steam will be admitted to the chest, and consequently cannot be admitted to the cylinder or flow through the exhaust.

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

Figure 1 is an elevation of an upright engine having my improvement embodied therein, the clutch-coupling being in section, so as to clearly show the operating parts thereof; Fig. 2, a detailed view of the buffer-disk and the driving-bar therefor; Fig. 3, a section at the line X X of Fig. 1, showing the friction-pawls of the clutch in operative position upon the friction-disk; Fig. 4, a plan view of a horizontal engine, illustrating the method of embodying my improvements therein without the addition of pillow-blocks other than those already used in such an engine; Fig. 5, a section at the line *y y*, showing the operative parts of the clutch; Fig. 6, a section of one form of governor-valve which I have found to be very effective in bringing about the desired results, and Fig. 7 a front view of one of the valve-blocks.

In carrying out my invention as embodied in Figs. 1, 2, and 3, A represents the cylinder of an upright engine of usual construction, which is supported upon the standards or frame B, in which is journaled the crank-shaft C, the latter carrying the crank-pin D, to which is connected the lower end of the pitman E, the upper end thereof being connected to the cross-head F in any well-known manner.

Upon the inner end of the shaft C is loosely mounted the clutch-disk G, having formed upon one face thereof suitable recesses for the reception of the buffer-blocks H, which latter may be of rubber or other suitable material, and a drive-bar I is keyed or otherwise rigidly secured to the shaft C back of this

disk and lies between the buffer-blocks, so as to cause the clutch-disk to revolve in unison with the shaft upon which it is fitted, and the effect of the buffer-blocks is to bring about a certain amount of cushioning action between the drive-arm and the clutch-disk, so as to relieve the parts of the engine from sudden shock or jar in picking up its load, as will be readily understood.

The fly-wheel shaft J is journaled within the pillow-blocks K and carries thereon the fly-wheel L for the usual purpose, and upon the inner end of this shaft is rigidly secured the friction-disk M, and against the periphery of this disk the clutch-pawls N are adapted to bear, said pawls being pivoted at O to the clutch-disk and drawn into active position by the springs P, from which it will be seen that when the shaft C is revolved at a given speed in the direction of the arrow the shaft J will also be revolved at a like speed through the medium of the clutch; but after the fly-wheel has gained a given speed the shaft C may be caused to revolve at a less speed or brought to a complete stop without affecting the shaft J, since the friction-disk M will revolve between the pawls without affecting the same.

Q represents the steam-chest, to which is led the steam by the induction-pipe R, and a valve S is interposed between said pipe and chest for the regulation of the passage of steam to said chest through the operations of the governor T. This governor is connected by the belt U with the shaft J by passing over a suitable pulley V upon said shaft and a similar pulley W upon the governor-spindle, and this governor is here shown as one type of the ball-governor.

An eccentric X is secured upon the shaft C and has a strap Y fitted thereto for the actuation of the valve-rod Z through the connecting-rod *a*, and this valve-rod is attached to a suitable valve for bringing about the admission and exhaust of steam to and from the cylinder in any of the well-known ways.

From the foregoing description the operation of my invention as therein embodied is as follows: Assuming that the engine is at rest, the governor will be in such a condition as to hold the valve S open to its widest capacity, so that when steam is admitted to the induction-pipe it will flow directly to the chest and from thence through the admission-port, which is left open by the valve carried by the rod Z, and cause the proper movement of the piston to bring about a rotation of the shaft C, and this in turn, through the clutch, will revolve the shaft J. Now when the revolving of the last-named shaft and the fly-wheel thereon has been brought to the desired speed the governor will be so acted upon through the belt U as to cause it to close the valve S, thereby shutting off the flow of steam to the chest, which will preclude the admission of steam to the cylinder, thus permitting the travel of the piston therein to "die out," or nearly so, during the time that the fly-wheel and the machinery actuated thereby are maintained by momentum above the desired minimum of speed; but when this momentum has been overcome sufficiently to reduce the speed of the shaft J below the minimum the governor will be so affected as to open the valve S to a degree which will supply sufficient steam to the chest to again actuate the piston and parts carried thereby, thus again revolving the shaft C, in order that energy may be again applied to the shaft J to reëstablish the desired speed thereof, and this again in turn will affect the governor so as to reduce or cut off the flow of steam to the chest. From this it will be seen that when sufficient energy has been stored in the momentum-perpetuator to continue the operations of the driven machinery to the desired speed the piston and parts carried thereby may be materially reduced in speed or entirely stopped until new energy is required for maintaining the speed of the fly-wheel above the minimum, and this will relieve the reciprocating parts of the engine, as well as the crank-shaft, from undue wear and tear, as well as greatly reduce the amount of steam or other motive fluid for performing a given amount of work, the latter resulting from the fact that the steam is always utilized at its most effective pressure within the cylinder and is not permitted to extend beyond an undue limit, as has heretofore been the case in engines of the Corliss type.

In Figs. 4 and 5 I have illustrated one method of applying my improvement to a horizontal engine which obviates the necessity of providing an extra pillow-block, and in this arrangement A represents the crank-disk, having formed therewith or attached thereto a sleeve B, said sleeve being fitted in suitable bearings, so as to freely revolve, and carrying the eccentric C for actuating the valve mechanism. Within the sleeve is journaled one end of the fly-wheel shaft D, the opposite end thereof being journaled in a suitable pillow-block, and the sleeve has secured thereon a clutch-disk E, to which are pivoted the pawls F, adapted to grip the shaft D and cause it to revolve with the clutch in one dition, but permit it to revolve independent of said clutch should the latter fall below the speed of the former, as described in connection with Fig. 1. The operations of this embodiment of my invention are in all respects similar to those just described.

In Figs. 6 and 7 I have shown one form of governor-valve which is well adapted for use in connection with my improvement, and consists of the casing *b*, having formed therein the valve-housing *d*, through which suitable openings are provided, and the plugs *e*, fitted thereto. Each of these plugs consists of a disk *f* and ribs *g*, which latter serve as guides when placed within the openings in the valve-housing. *h* is the valve-stem, having the plugs *e* secured thereon in such manner that when the stem is moved in the di-

rection of the arrow marked adjacent thereto the disks *f* will approach toward the openings in which the plugs are fitted and reduce the flow of steam therethrough, but when the stem is moved in the opposite direction this flow will be increased, and as the flow of the steam takes place through both openings it will be seen that the action upon the plugs will be equalized by said flow, leaving the valve balanced and at the same time making it very sensitive to the changes in the governor, which is desirable.

Other details of construction may be arranged for the carrying out of my improvement, and I therefore do not wish to be limited to those here shown and described, since the gist of my invention rests in the broad idea of providing means for controlling the flow of steam or other motive fluid to the chest independent of the crank-shaft.

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

1. In combination, an engine of the character described, a clutch-disk loosely mounted on the crank-shaft, buffer-blocks placed in one face of the disk, a drive-bar keyed on the shaft and lying between said blocks, and a secondary shaft driven by said clutch-disk, substantially as described.

2. In combination with an engine of the character described, a clutch-disk loosely mounted on the crank-shaft, a drive-bar keyed to said shaft, buffer-blocks placed on either side of said drive-bar in the face of the disk, a secondary shaft run by said clutch, a governor operated by the secondary shaft and a valve operating under the control of the governor for regulating the flow of steam into the chest of the engine, substantially as described.

3. In combination, an engine of the character described, a driving-bar secured upon the crank-shaft thereof, a clutch-disk loosely mounted upon said shaft, buffers carried by said disk embracing the driving-bar, pawls carried by the clutch-disk, a secondary shaft journaled in axial alinement with the crank-shaft, a friction-disk carried by said secondary shaft with which the pawls are adapted to engage, a governor so arranged as to revolve in unison with the secondary shaft, and a valve actuated by the governor, said valve being interposed between the induction-pipe and the chest of the engine for regulating the flow of motive fluid to said chest, substantially as and for the purpose set forth.

4. In an engine of the character described, a clutch-disk loosely mounted on the crank-shaft, a secondary shaft engaged by the clutch, a drive-bar secured on the first-named shaft for causing the disk to revolve in unison with said shaft, and means on the disk for relieving the parts from jar when the engine picks up its load, 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,
JOHN L. HEBB.