No. 690,511. Patented Jan. 7, 1902.

J. C. BLEVNEY.

ENGINE.

(Application filed Apr. 7, 1900.)

(No Model.) 2 Sheets—Sheet 1.

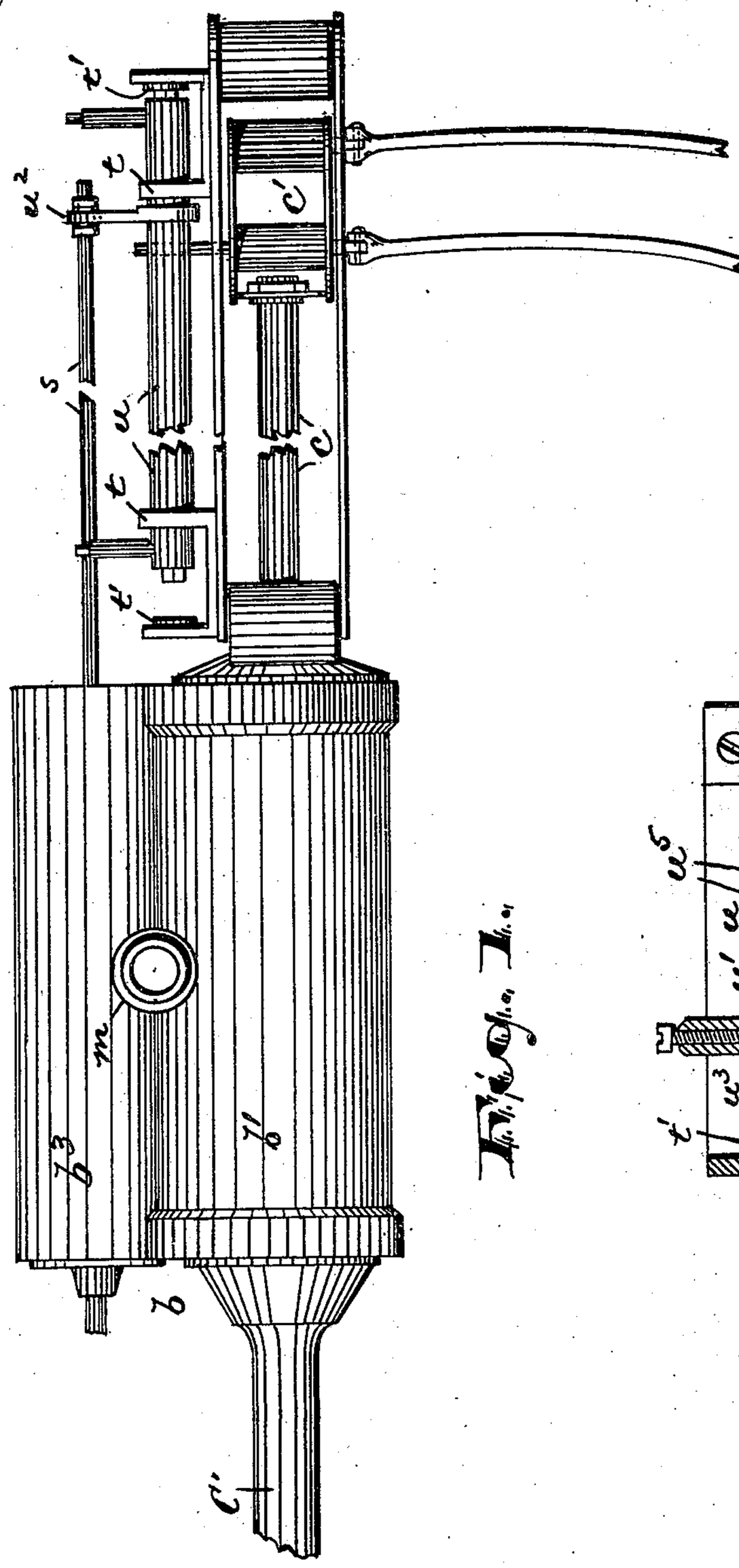

Fig. 1.

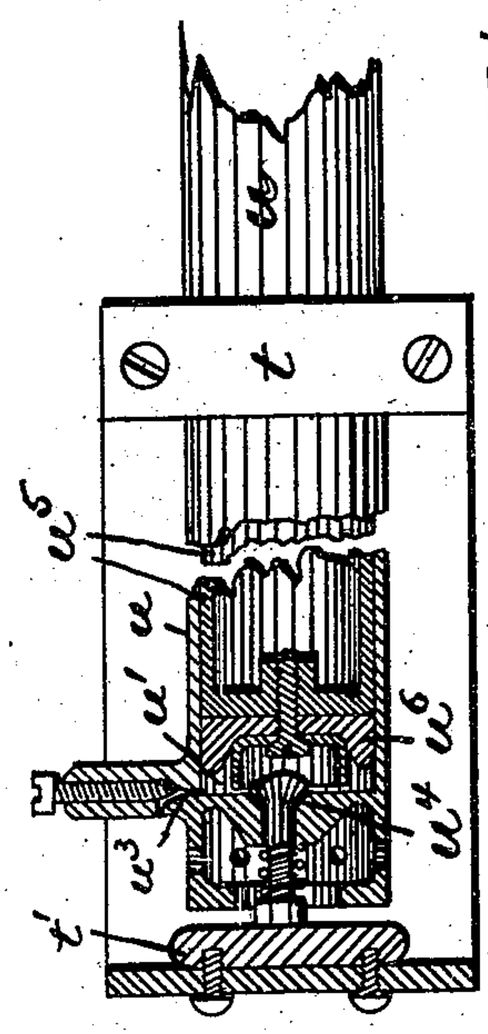

Fig. 2.

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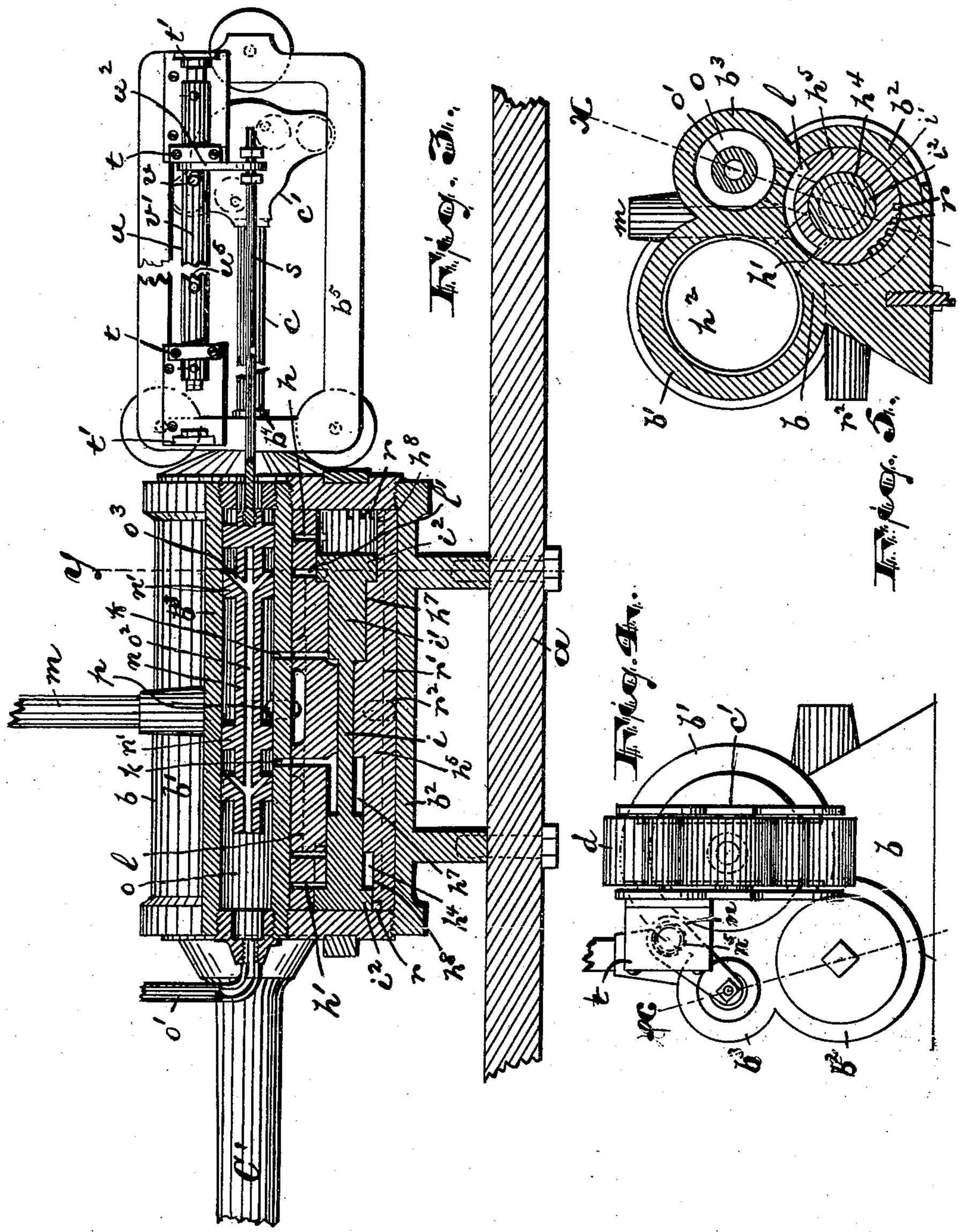

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UNITED STATES PATENT OFFICE.

JOHN C. BLEVNEY, OF NEWARK, NEW JERSEY.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 690,511, dated January 7, 1902.

Original application filed January 29, 1900, Serial No. 3,138. Divided and this application filed April 7, 1900. Serial No. 11,915. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. BLEVNEY, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The objects of this invention are to provide an engine particularly adapted to be used in connection with the power-transmitting means shown in my application, Serial No. 3,138, filed January 29, 1900, and of which application the present one is a division; to obtain an improved construction of engine, and more especially an improved arrangement of valves for admitting steam or other expansive fluid to the power-cylinder, and to secure other advantages and results, some of which may be referred to hereinafter in connection with the description of the working parts.

The invention consists in the improved engine and in the arrangement and combinations of parts of the same, all substantially as will be hereinafter set forth, and finally embraced in the clauses of the claim.

Referring to the accompanying drawings, in which like letters of reference indicate corresponding parts in each of the several views, Figure 1 is a plan of my improved engine. Fig. 2 is a detail sectional view of a certain steam-cut-off device. Fig. 3 is a longitudinal section of the cylinder-valves, taken on lines x of Figs. 4 and 5. Fig. 4 is an end view of the engine, and Fig. 5 is a cross-section at line y of Fig. 3.

In said drawings, a indicates a bed-plate, and b is a casting in which is formed the power-piston cylinder b', the main-valve cylinder b^2, and the governing-valve cylinder b^3. This casting may be and preferably is formed in one integral piece of metal; but under some conditions it may be cast in two or more separate pieces joined in any suitable manner.

In the power-cylinder b' is arranged one end of a piston c, adapted to reciprocate longitudinally under the power imparted by the steam or fluid under pressure within the cylinder b' in any ordinary and suitable manner. The outer end of the piston c, which extends out from the cylinder, is provided at or near its extremity with gripping means c', adapted to transmit the power to an endless belt d, as is fully set forth and described in my application, Serial No. 3,138, above referred to.

The power-cylinder b' is provided with suitable ports h h', opening into the cylinder-chamber h^2 at opposite ends thereof and opening into the valve-chamber h^4, disposed longitudinally parallel with the main-cylinder chamber h^2 within the casting b.

For convenience of manufacture the valve-portion cylinder of the casting is first cored out and afterward partly filled with a bushing h^5, in which latter is formed the valve-chamber h^4. Said bushing prior to being inserted in the casting is provided with steam-passages and ports, hereinafter described. The ports h h' are extended from the casting b' through said bushing and communicate with the valve-chamber h^4. The bushing itself is centrally cored out, as indicated in Fig. 3, at the center, the chamber therein being made smaller in diameter to receive the small center part of the valve i, which nicely fits into said chamber, so that there is no communication between the enlarged portions h^7 of the valve-chamber at the opposite ends of the bushing. At the opposite ends of the small portion of the chamber the said chamber is first enlarged, as at h^7 h^7, to receive the enlargements i' i' of the valve, the said enlargements i' fitting into the first enlargements of the chamber, so that steam-chambers are formed in open communication through ports k k with a governing-valve, hereinafter described. Outside of the enlargements h^7 the valve-chamber is again enlarged, as at h^8, at opposite ends of the bushing to receive the heads i^2 i^2 of the valve. The enlargements h^8 are in open communication with the ports h h',

above referred to, and also in open communication with steam or fluid admission ports $l\,l'$, adapted to receive the live steam or other impelling fluid entering through the steam-supply pipe m.

By means of the valve and steam passages and chambers constructed as described the live steam entering through the passage or duct m first enters the valve-chamber through the duct m and passage l, where it is brought into contact with the piston-head i^2, at the inner side thereof, where it is brought into communication, when communication is opened, with the ports h', and thence it passes into the power-cylinder.

The movements of the valve i are such as that when the communication between the ports or passages l and h' are opened at one end such communication is closed at the opposite end of the valve i, as will be understood.

To operate the valve and secure the desired longitudinal reciprocations thereof, I have provided a governing-valve n. This is arranged in a valve-chamber o, formed in the casting b, parallel with the chambers for the power-piston and valve, before referred to. Said governing-valve n is operated by means of a valve-rod s, arranged in operative relation to the piston-head c, being moved thereby, as will be hereinafter more fully described.

The reciprocating governing-valve n, moving back and forth in the chamber o with the piston c, alternately opens and closes communication of the live-steam port p with the valve-ports $k\,k$. When the said ports k are opened, the live steam enters the valve-chamber h^7 and serves to drive the valve i. Said ports k being opened alternately, the valve is caused to reciprocate, as will be understood. Thus when the governing-valve n is in the position shown in Fig. 3 the live steam, entering from the duct m through the port p into the chamber o, enters between the flanges $n'\,n'$ of the governing-valve and passes into the one passage k in open communication with the port or passage p and then passes behind the valve enlargement i' and forces the said head past the contiguous port h, so that said port is in open communication with the port l', thus permitting the steam from the duct m to pass into the power-cylinder to draw the piston therein. The movement of the valve, just described, to permit the inflow of steam through the valve-port h opens an exhaust-port r through the bushing, so that the exhaust-steam from the cylinder may flow out through the opposite valve-port h' and into the valve-chamber h^4, into the common exhaust-passage r', and thence through the passage r^2 to the open air, condenser, or the like. The exhaust-steam from the valve-chamber o passes out through the exhaust-pipe o', the valve n being provided with passages $o^2\,o^3$, by means of which the exhaust may pass from the passage k, near the opposite end of the valve-chamber from the point of connection of the exhaust-pipe o' with the chamber o.

To operate the governing-valve rod s, I have provided at one side of the frame b^5 bracketed bearings $t\,t$ for a sliding and slotted cut-off governor u, having at its opposite ends tubular air-chambers u'. (Shown in Fig. 2.) An arm or extension v of the gripping-head c' of the power-piston is arranged in the slot v' of said cut-off and works therein as the piston reciprocates, the slot permitting an independent movement of the piston and the said cut-off receiving a limited movement at the end of each reciprocation of the said piston, the slot v' in the cut-off governor being somewhat shorter than the length of stroke of the said piston. The said cut-off governor is also provided with a laterally-extending arm u^2, to which the valve-rod s is connected, so that as the power-piston imparts movement to the cut-off governor the said movement will be communicated to the governing valve-rod to effect the results hereinbefore described. At the outer opposite extremities of the tubular portions of the cut-off governor are arranged valves $u^3\,u^4$, and within the said tubular portions is arranged a piston u^5, the opposite ends of which are provided with suitable packing u^6, which fits within the inner walls of the said tubular ends of the cut-off. As the said power-piston reciprocates, as hereinbefore described, the cut-off piston u^5 is reciprocated also. In the present case the piston u^5 consists of a hollow tube closed at opposite ends, through which said extension v of the power-piston rod passes. Any other form of piston-rod may be employed. At the outer ends of the cylindrical or tubular parts of the cut-off, governing the same, is provided the valve u^3, which normally permits an outflow of air as the piston reduces the air-space between the cylinder or tube. Thus when the power-piston c is at a normal speed the governing-piston u^5 merely moves back and forth ineffectively, the air escaping through the valve u^3 as the said piston moves, excepting as hereinbefore described; but should the speed of the power-piston increase beyond a desired normal then it is evident that the air will be entrapped in the tubular chambers, and as a result the governing-valves will be moved forward before the power-piston extension v engages the end of the slot v', thus sooner reversing the governing-valve n, and with it the valve i, so that the steam is brought more quickly upon the opposite sides of the power-piston at the ends of the stroke, tending to cushion the stroke of said power-piston.

The frame b^2 near its opposite ends is provided with cushioned projections t', which are disposed in the line of the sliding cut-off governor and limit the strokes of said cut-off governor, and the said cut-off governor is provided with valves u^4, which are opened by said projections $t'\,t'$ when the said cut-off governor is at the end of the stroke, so that when the said governor strikes the said bear-

ings the valves will be opened automatically, and any air within the tube-chambers of the governors will be immediately released, so that further movement of the power-piston *c* will not be impeded by the air. The projections *t'* are preferably provided with rubber cushions to prevent any noise being occasioned by the impact of the cut-off valve against the said projections. This construction allows me when the pipe *m* is fully opened to use a full expansion of the steam admitted. The speed given to the piston by the full steam-pressure will cause the piston to advance more rapidly than if I throttled the admission of the steam. The corresponding increase of the speed of the piston u^5 will produce a more rapid compression in the tubular ends of the governing cut-off *u* and cause an earlier movement of said cut-off and with it an earlier movement of the governing-valve.

If the admission of steam is throttled by partly closing the admission-valve (not shown) connected to the pipe *m*, the power-piston will not advance as rapidly, and the governing cut-off piston u^5 will only force the air equal to its ability to escape through the by-pass or escape-valve u^3, and as a result the governing cut-off will be moved by the piston u^5 therein, said piston u^5 striking the end of the chamber *u'*, when the governing cut-off, and with it the governing-valve, will be held from further movement by contact with the projection *t'*.

The power-piston may be in connection with a pump-piston C, working in connection with the pump-cylinder C' and connections to force water from a suitable reservoir (not shown) to a boiler (not shown) in any suitable and efficient manner.

In operation of the engine, the live steam, being admitted through the duct *m*, Fig. 3, to bring the piston to the position shown in said figure, has passed through port *l*, chamber h^4, and port *h'* into the working power-cylinder and has driven the power-piston to near the end of its outward stroke to the right and with it the governing-valve *n*. The steam has also entered from duct *m* through duct *p* to the space between the heads *n'* of the valve *n* into position to act on the right-hand head *i'* of the valve *i* to drive said valve to the right, when said valve *i* will in succession close the steam-port *h'*, close port *h*, open port *l'*, close port *l*, and again open port *h*, the valve *i* having effected these results and the full pressure of the steam admitted through the port *m* having been directed against the piston *c* to drive the same to its shown position. During and after the closing of the valve-port *h'*, and while the port *h* is still uncovered, the steam acts expansively to continue the driving of the piston *c*, the steam at the right of the power-piston meanwhile passing through port *h*, openings *r*, ducts *r'*, and passage r^2 to the atmosphere or a condenser. Port *h* being closed, the expansive force of the steam to the left of the piston *c*, assisted by the inertia of the piston, will still drive said piston, compressing the steam to right of said piston, when valve *i*, continuing its motion, will uncover port *h* and admit steam to the right of the piston *c*. Until port *h'* is opened the so-compressed steam and newly-admitted steam through port *h* will cushion the piston *c*, and upon the opening of port *h'* it becomes an exhaust-port, and the power-piston *c* will be driven in an opposite direction from what has been heretofore described. The exhaust from the valve-chambers h^7, flowing out alternately through ports *k k*, passes either directly out through port *o* or through valve *n* to said port. These movements are repeated alternately to effect the desired reciprocations of the piston *c*, as will be understood.

Should the speed of the piston *c* increase above a desired normal, the cut-off governor operates to reduce the speed in the manner already described.

Various changes of construction and operation may be made from what I have positively described in the foregoing specification without departing from the spirit and scope of the invention, and I therefore do not wish to be limited by such description except as the state of the art may require.

Having thus described the invention, what I claim as new is—

1. In an engine, the combination with the casting having a main cylinder-chamber for a power-piston, and a valve-chamber parallel with the said main chamber and suitable ports and steam-passages, of a power-piston, and an operating-valve having a valve-rod *s*, working in connection with and operated by a sliding cut-off governor *u*, having a piston therein in connection with the power-piston, substantially as set forth.

2. In an engine, the combination with the casting having therein chambers for a power-piston and an operating-valve and having steam ports and passages, of said power-piston and operating-valve, the latter having a valve-rod adapted to be moved by a sliding governor having pneumatic chambers at its opposite ends, valves or openings connecting said chambers with the outer atmosphere, and a piston reciprocated between said valved chambers by the power-piston, substantially as set forth.

3. In an engine, the combination with the cylinder having a power-piston chamber and power-piston, a valve-chamber and valve therein, ports and steam-passages, of a valve-rod extending from said valve to a cut-off governor and said governor comprising a pneumatic piston and cylinder, the latter having at opposite sides of the piston valves or vents leading into the open air, substantially as set forth.

4. In an engine, the combination with the cylinder, having a power-piston chamber and power-piston, a valve-chamber and valve therein, ports and steam-passages, of a valve-

rod extending to and operated by a sliding governor, said sliding governor having air-escape openings at opposite ends, and a longitudinal slot between said ends and having a piston therein in connection with the said power-piston and adapted to operate the same, substantially as set forth.

5. In an engine, the combination with the cylinder having a power-piston chamber and power-piston, a valve-chamber and valve therein, ports and steam-passages, of a valve-rod operated by a sliding governor, said sliding governor having a limited movement between stops t', t', and having air-escape openings at opposite ends and a longitudinal slot, and having therein a piston connected to and working with the main power-piston, substantially as set forth.

6. In an engine, the combination with the cylinder having a power-piston chamber and its power-piston, a valve-chamber parallel with said piston-chamber and communicating therewith, and steam supply and exhaust passages, of a governor for operating said valve by compression of air, said governor being provided with opposite air-chambers in which air may be compressed to effect a movement of said governor and valve-rod, substantially as set forth.

7. In an engine, the combination with the cylinder having a power-piston chamber and its power-piston, a valve-chamber parallel with said piston-chamber, a reciprocating slide-valve in said valve-chamber, ports and steam-passages, of a pneumatic governor having air-chambers adapted to permit the piston when under abnormally high speed to effect an air-compression and a transmission of power due to such compression to said governor, whereby said governor effects an advanced reverse action of the valve, open vents connecting said air-chambers with the atmosphere, and means for regulating said vents, substantially as set forth.

8. In an engine, the combination with the cylinder and power-piston and means for supplying the same with steam, of a valve controlling the supply of steam to said piston, whereby it is operated, and pneumatic chambers having therein a piston u^5, in connection with the power-piston and operated by the latter, said chambers having open communication with the atmosphere at their opposite ends, on opposite sides of the piston, and said piston u^5, being adapted to either expel the air from a chamber through the said open communication with the atmosphere or effect a compression of air in said chamber to cause an operation of the valve, according to its speed, substantially as set forth.

9. In an engine, the combination with the cylinder and power-piston and means for supplying the same with steam or motive fluid, of a valve controlling the supply of steam to said piston, and a governor movable to effect a movement of the valve and having therein air-chambers at opposite ends in open communication with the atmosphere and also having relief-valves u^4, and a piston arranged in said air-chambers and adapted at abnormal speed to temporarily compress entrapped air in said chambers and thus transmit power to the governor-valve, the last said piston being in communication with the power-piston, substantially as set forth.

10. In an engine, the combination with the power cylinder and piston and means operated thereby, of an operating-valve and its governor, and the valve i, arranged in chambers parallel with said power-cylinder, said valve i, having piston enlargements near its opposite ends adapted to be driven reciprocally by steam introduced thereto at the inner sides, substantially as set forth.

11. In an engine, the combination with the power-cylinder and its piston, of an operating-valve n, and its governor, and the valve i, interposed between the said operating-valve and the cylinder, said valve i, having piston heads or enlargements i', and further enlargements or heads i^2, to cut off the flow of steam, substantially as set forth.

12. In an engine, the combination with the casting having the power-cylinder chamber with ports h, h', a valve-cylinder chamber in communication with said power-cylinder chamber through said ports, steam-passages opening into said valve-cylinder chamber near the opposite ends in from the said ports h, h', exhaust-ports r, at the opposite ends of said valve-cylinder chamber and ports k, k, near the inner end of the first enlargement of said valve-cylinder chamber, the said valve-cylinder being small at the center, enlarged at h^7, to form a steam-chamber and further enlarged at the outer ends to receive the heads i^2, i^2, and a governing-valve chamber having a live-steam port p, and said ports or passages k, k, opening therein from the valve-cylinder chamber, of a power-piston, a valve i, having near and at its opposite ends corresponding enlargements, and a governing or operating valve controlled in its movements by a governor, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 19th day of March, 1900.

JOHN C. BLEVNEY.

Witnesses:
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C. B. PITNEY.