

(No Model.)

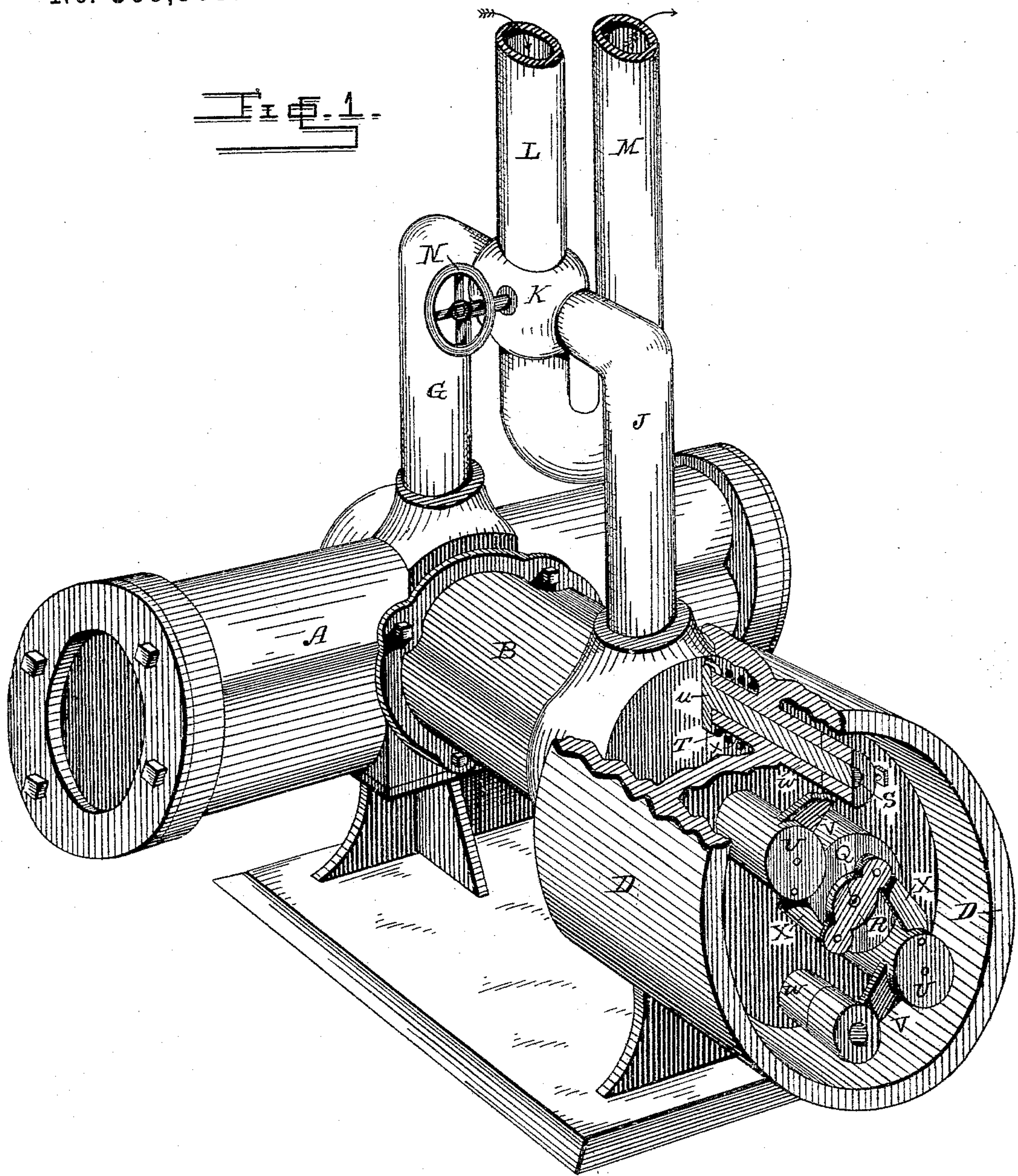
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H. A. TOBEY.

STEAM ENGINE.

No. 369,303.

Patented Aug. 30, 1887.



Witnesses;

Josh. Blackwood.
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Inventor;

Henry A. Tobey

By his Attorney

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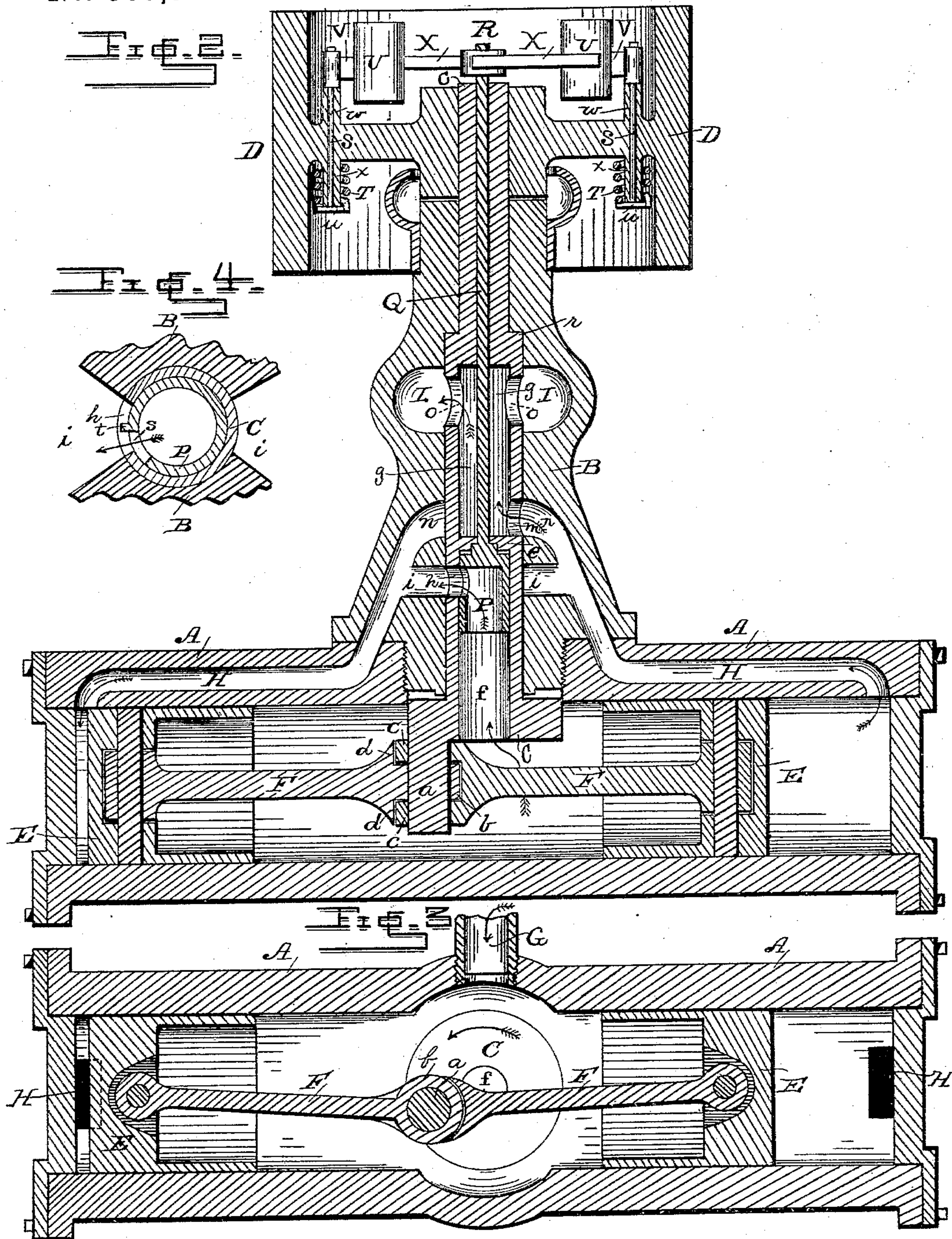
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UNITED STATES PATENT OFFICE.

HENRY A. TOBEY, OF LIMA, OHIO.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 369,303, dated August 30, 1887.

Application filed December 27, 1886. Serial No. 222,740. (No model.)

To all whom it may concern:

Be it known that I, HENRY A. TOBEY, of Lima, in the county of Allen and State of Ohio, have invented a new and Improved Steam-Engine, of which the following is a specification.

This invention relates to a form of engine wherein there is a single cylinder in which two pistons reciprocate, both of these pistons being connected to an intermediate crank on a shaft extending within and at right angles to the axis of this cylinder. This shaft carries directly on its outer end the fly-wheel, and it is hollow throughout a portion of its length, its bore being divided by a partition into two compartments, through which the steam is fed to and exhausted from the cylinder. By this arrangement all valve-gear is dispensed with, the rotation of the shaft cutting off and admitting the steam at the proper intervals. A governor mechanism specially adapted to this engine is carried by the fly-wheel, which controls a valve regulating the quantity of steam admitted to the cylinder. By this construction a reciprocating engine is formed having a minimum of working parts, the essential working parts being the fly-wheel shaft, the two pistons, and their connecting-rods. At the same time, there being no reciprocating piston-rods extending through the cylinder-heads, a minimum amount of packing is required to render the cylinder steam-tight.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of the engine, a portion of the fly-wheel being broken away to show the construction of the governor. Fig. 2 is a central horizontal section of the engine. Fig. 3 is a vertical axial section of the steam-cylinder; and Fig. 4 is a detail vertical section, on an enlarged scale, of the main shaft, showing the regulating-valve.

A is the steam-cylinder, and B a housing or casing bolted at right angles thereto, in which is journaled the shaft C. This shaft at one end extends beyond the housing B, to which end is rigidly secured the fly-wheel D. The other end of the shaft extends within the cylinder A, and this inner end is formed with a crank-pin, *a*. Within the cylinder, on either side of the crank-pin *a*, are the two pistons E

E, each of which is connected by a pivoted connecting-rod, F, to the crank-pin *a*. Both pistons thus move in the same direction, and their reciprocation rotates the shaft.

To distribute the strain upon the crank-pin, caused by the connecting-rods, the end of one connecting-rod has a collar, *b*, surrounding the crank-pin, which is straddled by forked collars *c c* at the end of the other connecting-rod, which also surround the crank-pin, so that the end of the collar *b* bears against the body of the connecting-rod between the collars *c c*. The first-named connecting-rod on either side of the collar *b* is formed with flanges or shoulders *d' d*, against which the forked collars *c c* of the other rod bear. The strain upon the crank-pin is thus distributed throughout its entire length, whichever of the connecting-rods is bearing upon it.

The housing B is of considerable length, so as to give a sufficient bearing for the shaft C and also to contain the steam induction and eduction passages. As to the steam-passages and the course of the steam, the preferred course of the steam will be described, although it may be premised at this point that the course of the steam may be reversed, so that in the latter case the exhaust-passages and ports become the induction passages and ports, and vice versa.

The live steam is preferably introduced by a pipe, G, into the central portion of a steam-cylinder between the pistons E E, so that the cylinder constitutes the steam-chest. The shaft C is hollow through a portion of its length, and its bore is divided by a partition, *e*, into two chambers, *f* and *g*, which may be termed "induction" and "exhaust" chambers, respectively. The induction-chamber *f* opens directly into the steam-cylinder, so that it is at all times filled with live steam.

At the end of the induction-chamber nearest the partition *e* the shaft has a port, *h*, communicating with the induction-chamber. This port is brought by the rotation of the shaft alternately into coincidence with steam-passages *i i* on opposite sides of the shaft in the housing B. These passages *i i* are branches of the main passages H H, leading through the housing B and the wall of the cylinder A to the two ends of the cylinder, where they

communicate with the interior of the cylinder behind the two pistons. The rotation of the shaft thus admits live steam first to one piston and then to the other. The two pistons are
 5 balanced on the sides next the crank-pin, since the live steam between the two presses equally on both. The exhaust-chamber *g* of the shaft has also a port, *m*, communicating with it, extending through the shaft close to the parti-
 10 tion *e*. This port is situated opposite to the port *h*, and it is brought by the rotation of the shaft alternately into coincidence with ex-
 15 haust-passages *n n* within the housing *B* on opposite sides of the shaft. These exhaust-passages are also branches of the main steam-passages *H H*, and, owing to the relative posi-
 20 tion of the ports *h* and *m*, when one passage *H* is in communication with the live-steam port the other passage is open to the exhaust-chamber. The exhaust-chamber at its outer
 25 end has one or more apertures, *o o*, which are always open to an annular cavity, *I*, in the housing *B*, which communicates with the ex-
 30 haust-pipe *J*. While this is the preferred course of the steam, it might be reversed, the live steam being admitted through the pipe *J*, and the exhaust-steam being discharged through the pipe *G*. This adaptability offers
 35 a convenient means for reversing the engine. Both pipes *G J* may be led to the same fitting *K*, with which communicate the permanent supply and exhaust pipes *L M*. A four-way cock (indicated at *N*) will then enable the
 40 live steam to be conducted to either pipe *G* or *J* by simply turning the cock.

The only opportunity for the escape of the steam would be along the shaft *C*; but this is prevented, first, by the length of the bearing of the shaft, and, second, by shoulders *r r* on
 45 the shaft, which abut against corresponding seats formed in the housing. These seats also receive any thrust due to the pressure of the steam on the inner end of the shaft.

If after wear packing is necessary, it can
 45 be introduced between the shoulders on the shaft and the seats in the housing. Although but two pistons are shown in a double-length cylinder connected to the crank-pin of the shaft, the invention is not restricted thereto.
 50 Three cylinders, all opening into each other, set at an angle of one hundred and twenty degrees to each other, and each containing a piston connected to the inclosed shaft, could be employed, or any desirable number, without
 55 departing from the invention.

The remainder of the invention relates to the governor mechanism for regulating the admission of the steam to the cylinders in inverse proportion to the speed of the main shaft.
 60 The control of the steam is had by a valve co-operating with the induction-port *h* to regulate the extent of the opening thereof. When the speed is normal, the port is open to its full width, and when above the normal it is
 65 closed to an extent proportional to the excess of speed. This valve consists of a rotary cylinder, *P*, located and fitted within the induc-

tion-chamber *f* of the shaft. This cylinder is open at its end next the steam-cylinder, and is closed at its opposite end. It has a port, *s*,
 70 in its wall, which at all times coincides more or less with the port *h*. A projecting lip, *t*, on the cylinder at the edge of the port *s* extends into the port *h* and limits the independent movement of the cylinder *P*, so that it
 75 cannot be turned to entirely separate the ports *h s*. With this limitation the cylinder *P* can rotate within the induction-chamber. This regulating-valve is secured to the inner end of the longitudinal shaft *Q*, which extends
 80 through an axial bore in the main shaft *C*, the outer end of the valve-shaft projecting beyond the main shaft and carrying thereon a cross-head, *R*.

Bosses *w x* on opposite side of the web of
 85 the fly-wheel *D* constitute bearings for the governor-shafts *S S*. These shafts have on their inner ends heads *u u*, outside the inner bosses, *x*, to each of which is secured one end of a coiled spring, *T*, surrounding the boss *x*
 90 and connected at its other end either to the boss or to the fly-wheel. *U U* are the governor balls or weights, to each of which is rigidly secured an arm, *V*, which is attached to one of the governor-shafts *S*. Each gov-
 95 ernor-weight is also connected by an arm, *X*, to one end of the cross-head *R*, the arm being pivotally connected at both ends. The tension of the springs *T T* holds the governor-weights at their nearest point to the center of the fly-
 100 wheel, and when in this position the port *h* is open to its full width. When, however, the speed of the fly-wheel exceeds the normal, the centrifugal force, acting on the governor-weights, overcomes the resistance of the
 105 springs, thus throwing the weights out, rotating the valve-shaft *Q* and closing the port *h* more or less, as the case may be.

In case the port *m* in the chamber *g* is made by preference the permanent induction-port,
 110 the valve *P* would be located to co-operate therewith instead of with the port *h*.

I have found that my improvements are also adapted to be used as a water-motor and also as a pump by suitable connection with the
 115 shaft.

I claim as my invention—

1. A steam-cylinder, a piston or pistons moving therein, and steam induction and education passages communicating with said cylinder, in combination with a rotary shaft entering said cylinder and connected to said piston, said shaft alternately opening and closing said steam-passages, substantially as set forth.

2. A steam-cylinder and two pistons located
 125 therein, with a steam chamber or space between them, through which steam is supplied or exhausted, in combination with a rotary shaft entering said cylinder between said pistons and connected thereto, a steam-chamber
 130 formed within said shaft, communicating with the steam-chamber between the pistons, steam-passages leading from opposite sides of said shaft to opposite ends of the steam-cylinder,

and a port in said shaft communicating with said steam-chamber, which by the rotation of said shaft alternately coincides with said steam-passages.

5 3. A steam-cylinder and two pistons moving therein, with a steam chamber or space between them, through which steam is supplied or exhausted, in combination with a rotary shaft entering said cylinder between said pistons, said shaft being formed with two independent chambers within it, one of said chambers communicating with the space between the pistons and the other communicating at all times with a steam-chamber exterior to the shaft, which latter chamber is open to the exhaust or the supply, steam-passages leading from each of the opposite ends of said steam-cylinder to said independent steam-chambers within the shaft, and ports in said shaft communicating with said independent steam-chambers, and which by the rotation of said shaft alternately coincide with the steam-passages on the opposite sides of said shaft, substantially as set forth.

25 4. A steam-cylinder, two pistons moving therein, a steam-inlet pipe entering the cylinder between said pistons, and a rotary shaft entering said cylinder between said pistons and connected thereto, said shaft having within it a steam-induction chamber communicating at all times with said steam-cylinder, and having also an independent steam-eduction chamber open at all times to the exhaust, in combination with main steam-passages leading from opposite ends of said steam-cylinder, each passage having two branches, which terminate at the rotary shaft adjacent to the induction and eduction chambers, respectively, and ports located, respectively, on opposite sides of said shaft and communicating, respectively, with said induction and eduction chambers, substantially as set forth, whereby when the induction-port admits steam to one end of the cylinder the eduction-port exhausts steam from the other end of the cylinder.

5. A steam-cylinder, two pistons moving therein, a rotary shaft entering said cylinder between said pistons, and a crank-pin in said shaft, in combination with connecting-rods connecting each piston to said crank-pin, one connecting-rod having a single collar, *b*, on its end, which surrounds said crank-pin, and having also projecting flanges *d d* on each side of said collar, and the other connecting-rod having a forked collar, *c c*, surrounding said crank-pin and embracing said collar *b*, substantially as set forth.

6. A hollow rotary shaft having a port therein, in combination with a hollow cylindrical valve rotatively mounted within said shaft, and having a port which co-operates with the port in said shaft, and a projection on said valve adjacent to its port, which extends into the shaft-port and limits the movement of the valve, substantially as set forth.

7. A hollow rotary shaft having a port therein, in combination with a valve having a limited rotary movement within said shaft, a valve-shaft connected to said valve and extending axially through said rotary shaft, and a governor mechanism connected to said valve-shaft, substantially as set forth.

8. A rotary shaft carrying a fly-wheel, a valve-shaft axially and rotatively mounted therein, and a cross-head mounted within the fly-wheel on the outer end of said valve-shaft and perpendicular thereto, in combination with governor-weights pivotally connected to said fly-wheels, and arms connecting said governor-weights to the outer ends of said cross-head, substantially as set forth, whereby the swinging of said governor-weights will give to said valve-shaft an independent rotary movement within the fly-wheel shaft.

HENRY A. TOBEY.

Attest:

W. H. PORTER,
HERBERT L. BRICE.