(No Model.) 4 Sheets—Sheet 1.

J. F. DURYEA.

ENGINE OR MOTOR.

No. 557,496. Patented Mar. 31, 1896.

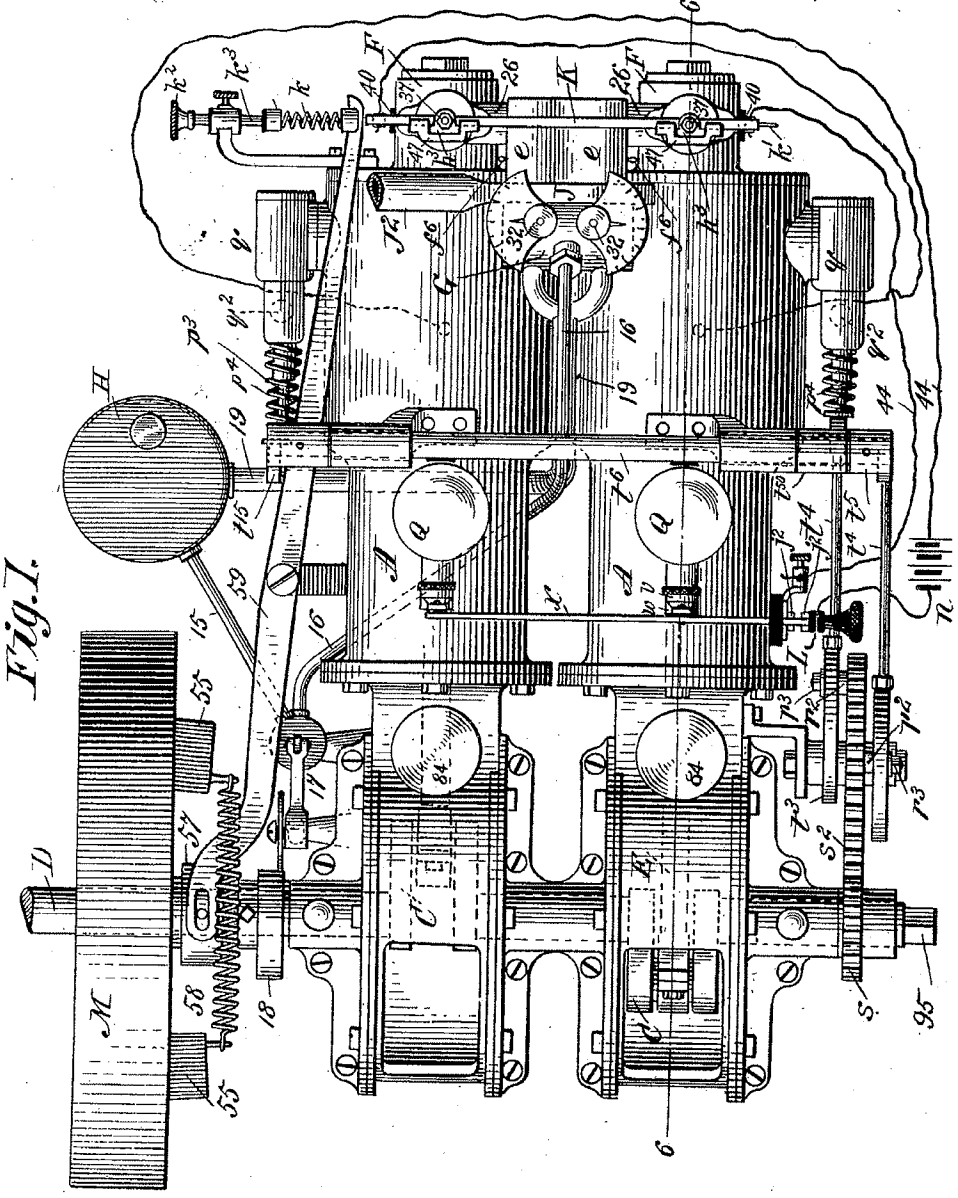

Fig. 1.

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Fig. 3.

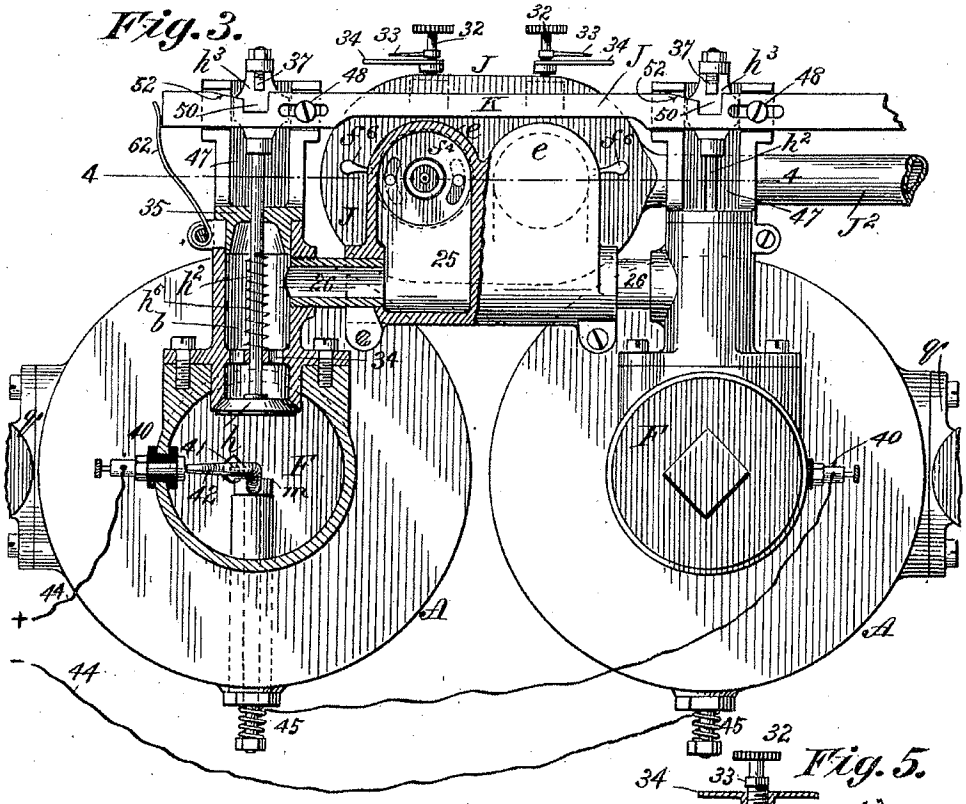

Fig. 4.

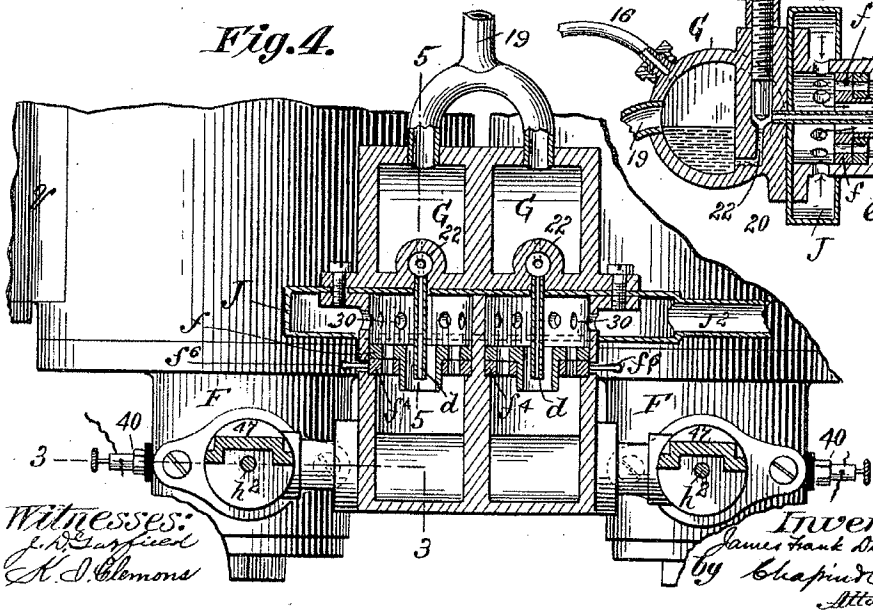

Fig. 5.

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UNITED STATES PATENT OFFICE.

JAMES FRANK DURYEA, OF SPRINGFIELD, MASSACHUSETTS.

ENGINE OR MOTOR.

SPECIFICATION forming part of Letters Patent No. 557,496, dated March 31, 1896.

Application filed June 7, 1895. Serial No. 552,029. (No model.)

To all whom it may concern:

Be it known that I, JAMES FRANK DURYEA, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Engines or Motors, of which the following is a specification.

This invention relates to improvements in engines or motors which are driven by an explosive gas—such, for instance, as aerated and vaporized gasolene.

The improved motor is specially devised for the propulsion of road-vehicles, launches, and other conveyances, the special objects to be attained being compactness, lightness, certainty and efficiency in operation, ease of controlling, and the avoidance of cumbersome equipments or accessories.

The invention consists in constructions and combinations of parts, all substantially as will hereinafter fully appear, and be set forth in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which a double-acting motor is shown, and in the drawings—

Figure 1 is a plan view of the motor. Fig. 2 is a side elevation of the same. Fig. 2^a is a section horizontally through the fly-wheel, the same comprising the governor devices in part. Fig. 2^b is a sectional view through the valved exhaust-outlet for one of the cylinders. Fig. 3 is an end view of the principal parts of the motor, the same being on a larger scale than the preceding figures and showing certain parts, comprising the vapor or gas inlets into one of the cylinders, in vertical sectional view. Fig. 4 is a partial plan taken at one end of the motor and a partial horizontal section. The plane on which the parts are shown in section is indicated by the line 4 4, Fig. 3. The line 3 3 on this Fig. 4 indicates the plane on which the parts in section in Fig. 3 are taken. Fig. 5 is a partial vertical sectional view taken in a plane parallel with the length of one of the cylinders and as indicated by the line 5 5, Fig. 4. Fig. 6 is a longitudinal section taken vertically and centrally through one of the cylinders. Fig. 7 is a partial horizontal section taken on line 7 7, Fig. 6. Fig. 8 is a view in section similar to the right-hand end portion of Fig. 6, but showing a modification of the arrangement of the entrance-chamber for the gas or vapor and of the sparking device. Fig. 9 is a vertical sectional view, on a large scale, of the improved lubricator and showing in a manner connections therewith for automatically shutting it off concurrently with the switching out of the electric sparking-circuit.

This motor, as shown, comprises two cylinders A A, each having a piston B, to and between which and the crank C on the driving-shaft D is secured and interposed the connecting-rod E. The cranks are set at different radial lines to accord with the usual alternating operations of the two pistons, as usual. At the rear end of each cylinder, which is approached by the piston on its backward movement, is an induction-chamber F, which opens freely to communication with the cylinder-chamber back of the piston and which has connection through the valved passage *b* with the service tank or receptacle G for each cylinder, in which is contained the gasolene, there being passages and chambers intermediate between the said service-tank G and the said valved passage *b*, which will be hereinafter particularly described.

The adequate supply of the gasolene is carried in a properly-located storage or supply tank H of suitable capacity, the same being indicated in the plan view Fig. 1, and with this tank the conduits 15 16 have connection, leading thence to the aforesaid service-tank G. The pump indicated at 17, which is automatically operated by the cam 18 on the motor-shaft, serves to force the fluid in sufficient quantities into the service-tank. This pump, in connection with the conduits leading from the supply-tank to the service-tank for the cylinders, is not regarded as an important part of the present invention and is not illustrated in detail or claimed and is regarded as only one of many ways for maintaining a sufficient quantity of the motor fluid in the service-tank. Any of the well-known gravity systems with regulating devices might be substituted with good effect.

19 represents an overflow-pipe having branched connections with each of the service-tanks G and extending therefrom back into the supply-tank H.

ated in the cylinder back of the piston and also in the induction-chamber F for gas, the valve *h* is drawn downwardly open, the vacuum or suction thereby induced drawing inwardly such a quantity of air from within the air-jacket J through the thimble f^2, which is within the ejector-chamber *e*, that a quantity of the gasolene will be from the service-tank G injected through the tube *d*, whereupon it becomes commingled with the air in the injector-chamber and passes into the connected ingress-chamber F, and also into the cylinder-chamber within which the ingress-chamber is, as to all or a portion thereof, located and with which said ingress-chamber has free and open communication. The piston again rearwardly returning compresses the gas which is in the chambers behind it and which is now in readiness to be exploded, and just as the piston reaches its rearmost extent the projection 41, by contacting with the arm 43 of the circuit-breaking lever *m*, so swings such lever as to carry its extremity 42 away from the contact 40, the spark following the said extremity 42, as well known in electric spark-producing devices, whereupon the piston will again have its stroke as impelled by the exploding gas. Thus briefly summarizing the movements of the piston in each cylinder there is, first, the forward stroke on the explosion of the gas; secondly, return of the piston and exhaust of the dead gas; thirdly, another forward movement of the piston drawing in the vaporized gasolene and commingled air, and, fourthly, the return of the piston compressing the gas and air, and, finally, causing the spark and explosion for the next stroke.

The valve *h* has a spring h^6 applied thereto for normally maintaining it closed at all times, except when the piston has its forward motion between the working strokes on explosions, which are the times when the valve should be allowed to open for the ingress of the motor fluid. The valve is opened against its spring by the vacuum or suction within the cylinder when the latter moves forward between each working stroke.

The governor hereinbefore referred to and comprising in part the bar K will be now more fully described. The said bar K is guided to move horizontally on the ways of the bracket-supports 47 therefor and has the pin-and-slot engagements with the said bracket, as seen at 48. This bar operates in common relative to both of the yokes h^3 of the valve-stems, which are provided at the back of each cylinder, and has beneath the screw 37, which is adjustable on each of the yokes, the recess 50, at the left of which the upper edge of the bar K is inclined, as seen at 52.

The fly-wheel M, which is cored out suitably, has pivoted to the ear-lugs 53 thereof the angular levers *o*, having the arms 54 and 55, the latter being weighted, while the arms 54 have pin-and-slot engagements with the sleeve 56, which rotates with the motor-shaft D and which slides along the same. Said sleeve 56 is suitably grooved and is surrounded by the collar 57, which partakes of the sliding movement of the sleeve, but not of its rotary movement. The opposite weighted arms 55 are connected by the spiral spring 58.

The long lever 59, which is intermediately pivoted, has a pin-and-slot connection with the aforesaid collar 57, and its rear end has an engagement with the aforesaid governor-bar K, whereby upon the sliding movement of the collar, as induced by variations in the speed of the motor and the consequent centrifugal operation of the governor, the said governor-bar K will have such an endwise movement as to bring its inclined portions 52 under the screw 37 of the valve-stem yoke, whereby upon excessive speed, which induces a more considerable endwise movement to the bar K, the inclined portion 52 will have a position to limit, in degree, the downward movement of the valve-stems and the extent of opening of the valves *h*.

The sensitiveness of the governor is regulated by applying the springs *k* and *k'* for pressing longitudinally upon the bar K, at opposite ends thereof, and providing means for varying the compression of one or both of the springs, and in Fig. 1 the spring *k* is shown as applied between the extremity of the lever 59 and a button k^2 at the end of the rod k^3, which rod is adjustable longitudinally coincident with the length of the said bar K and of the spring *k*. By this means a greater or less resistance may be imposed against the force generated by the governor-levers against their spring 58 at the fly-wheel, so that the motor may be adjusted to be governed for a high or comparatively low maximum speed.

The exhaust mechanism is constructed and arranged so as to open the exhaust-port on the return of the piston next after each working stroke thereof, and therefore as the cylinder is to be exhausted only once to every two reciprocations of the piston a special mechanism for this purpose is provided for operating the exhaust-valve *p*, which has its seat at p^2 within the casing inclosing the exhaust-chamber *q* at a rear lateral part of each cylinder. The exhaust-chamber is, when the valve *p* is open, in communication with the pipe or passage q^2, which leads and opens to or into any desired place or receptacle.

At one side of the motor, upon one end of the motor-shaft D, is a spur gear-wheel *s*, which meshes into a second spur gear-wheel s^2 of double the diameter, and which is mounted on a suitable stud or arbor supported upon a bracket at the side of the motor. Rotating in unison with this gear s^2 are two eccentrics *t t*, which are set at quarters, as seen in Fig. 2. Each eccentric is surrounded by an eccentric-strap t^3, which has as the radial continuation thereof the eccentric-rod t^4. One of

being had to Fig. 6. The piston-rod E is tubular, the passage or chamber therein being of reduced size at its ends, and in these reduced end passages, which lead to the internal wall of the strap or eye which surrounds the crank or piston pin, is a quantity of absorbent fibrous compressible material, which is indicated at 80. The tubular piston-rod is intermediately, at its upper side, provided with the hole 82, which is closed by the screw cap or plug 83. This is accessible through the opening at 84 in the apron of the motor for the entrance of oil into the hollow piston-rod. The oil will slowly ooze through the compressible absorbent material 80 and be conveyed upon the crank-pin and the cylinder-pin. At the left-hand end of the piston-rod, as shown in Fig. 6, a screw-plug 85 is shown as laterally entering the chamber in which is contained the absorbent material, which may be turned inwardly, so as to cause the oil-saturated compressible material therein to be crowded by displacement against the crank-pin. As shown, this piston-rod is made sectional, the same comprising parts as follows: At the right-hand end the eye-section 90 has the longitudinally-bored and externally-screw-threaded stem 92. The strap at the other end is similarly constructed, with the exception that it is made in the form of a two-part strap 93, united by bolts to embrace the crank-pin. The intermediate part 94 of the connecting-rod is in the form of a tube, with the opening therethrough of considerable size, and having its ends internally screw-tapped to engage the externally-threaded stems 92 of the sections 90 and 93. The orifice of each of the stems 92 is also internally screw-tapped to receive the externally-threaded axially-bored nipples 95, which produce the contraction of the passage or chamber adjacent the ends of the piston-rod and which may be turned at the time of setting up or overhauling the motor to the proper crowding action against the oil-absorbing material in the hollow end sections.

In Fig. 8 a slightly different specific construction of the gas-induction chamber F is shown, the same in this case entering the end portion of the cylinder transversely of the length of the latter, its lower open end not extending so far down as the bottom of the cylinder-chamber. The sparking device in this case is located at a point which at the time of producing the spark will be fully surrounded or flushed by fresh gasolene vapor. The provision, in all cases, of the induction-chamber, within or adjacent which is the sparking device, always insures a good and fresh supply of the explosive vapor or gas at and surrounding the point at which the spark is produced, and obviates any possibility or failure to explode or to completely utilize in the explosion all of the effective explosive gas or vapor by reason of any dead carbonic-acid gas which might remain in the cylinder after the preceding stroke.

In starting up the motor the switch L is moved to close the electric circuit, and the motor-shaft is rotated by hand-power, turning the fly-wheel M or applying a crank at the squared end 95 of the motor-shaft D, whereupon the movements to the pistons will be in this way imparted, causing the injection of the gas into the cylinders and the sparking and explosion thereof. After a few turns have been thus given to the motor-shaft the motor will continue to be run by the successive explosions of the motor fluid so long as the gasolene supply is maintained and the current continues through the sparking-circuit.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motor, in combination, a piston-cylinder, an injector-chamber and a valved passage communicating therefrom with the cylinder, a service-tank and an injector-tube communicating therewith and extending rearwardly into the injector-chamber, a partition which transversely divides the injector-chamber and which has the longitudinally-passaged thimble extension widely surrounding the injector-tube, an air-chamber having communication with the rear compartment of the injector-chamber, and means for periodically igniting the motor fluid which is entered at the rear of the piston, substantially as described.

2. In a motor, in combination, a piston-cylinder, an injector-chamber having a valved passage communicating with the cylinder, a service-tank, and an injector-tube communicating therewith and extending rearwardly into the injector-chamber, a partition which transversely divides the injector-chamber which has the longitudinally-passaged thimble of greater diameter than the injector-tube which it surrounds, and which partition has the perforations, f^3, f^3, the apertured register-plate, f^4, overlying the perforated partition, and means for moving it, an air-chamber having communication with the rear compartment of the injector-chamber, and means for periodically igniting the motor fluid at the rear of the piston, substantially as described.

3. In a gasolene or analogous motor, in combination, the service-tank, G, having the passage, 22, leading from a lower portion of its interior upwardly and rearwardly therefrom, the injector-tube connecting with said passage, the injector-chamber, *e*, inclosing the injector-tube and having the thimble inclosed therein which widely surrounds the tube, and which has its rear end in communication with atmospheric air, the cylinder, and piston therein, and connecting ways leading from the injector-chamber to the rear part of the cylinder-chamber, substantially as described.

4. In a gasolene or analogous motor, in combination, the service-tank, G, having the passage, 22, leading from a lower portion of its interior upwardly and rearwardly therefrom,

and each with a shaft, Q′, provided with a spring for forcing it closed and each shaft having a lever-arm, *w*, to which said bar, *x*, is connected, and a cam, *v*, which so coöperates with the hubs of the arms, *w*, as the latter are swung, as to cause, in conjunction with their swinging movements, also outward movements thereof in the direction of the axis of the shaft, substantially as and for the purpose set forth.

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