No. 640,710. Patented Jan. 2, 1900.

J. A. SECOR.

MOTIVE POWER.

(Application filed May 16, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

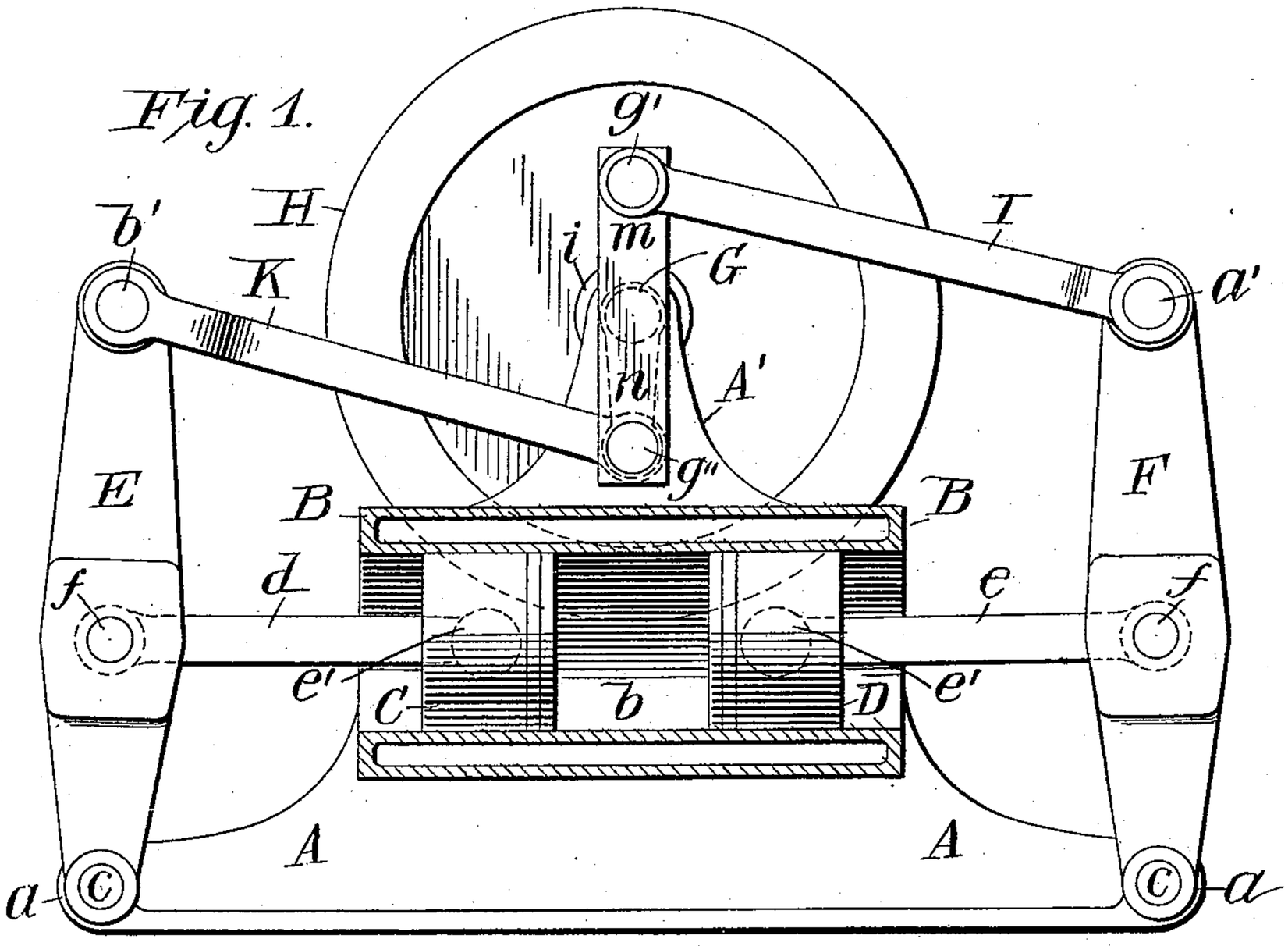

Fig. 2.

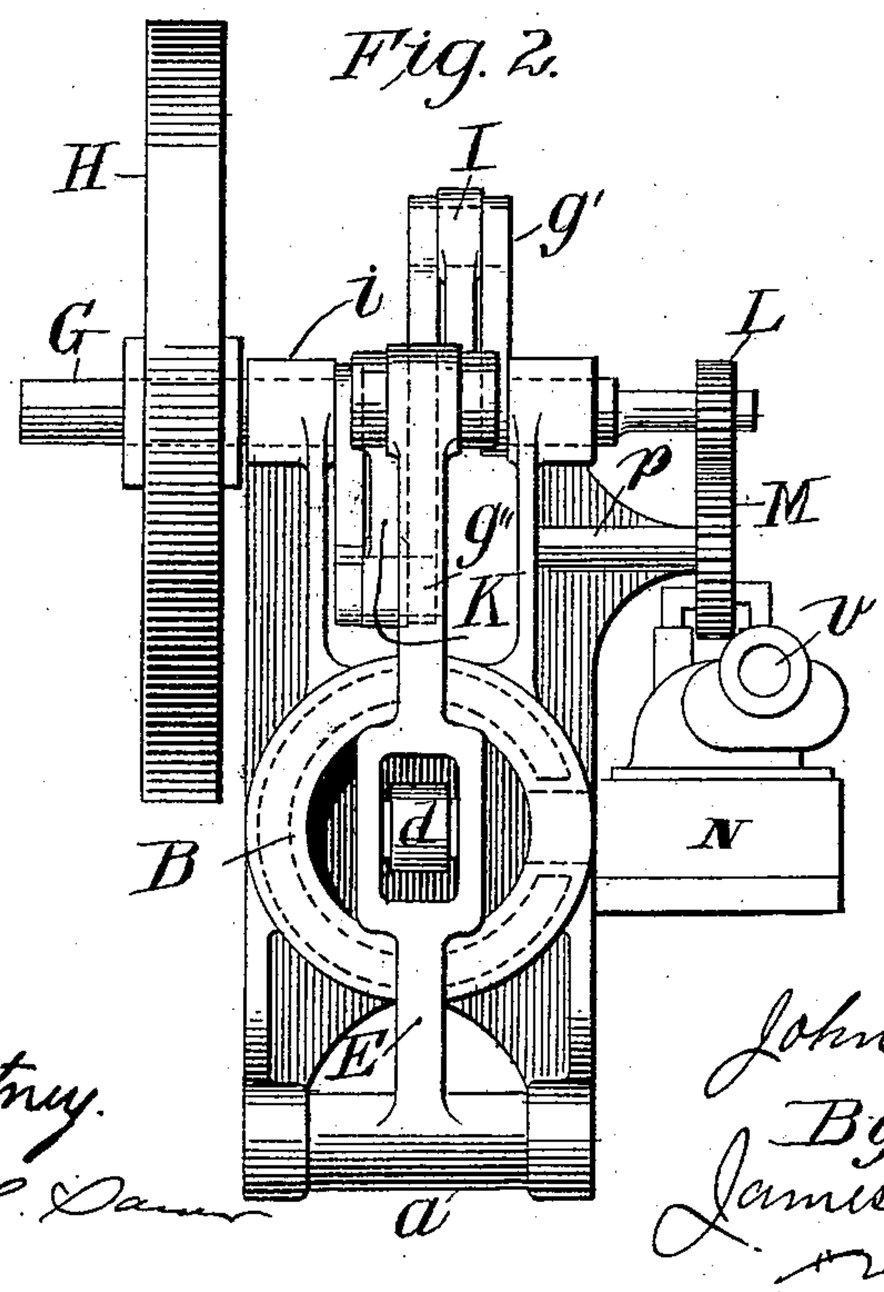

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Fig. 3.

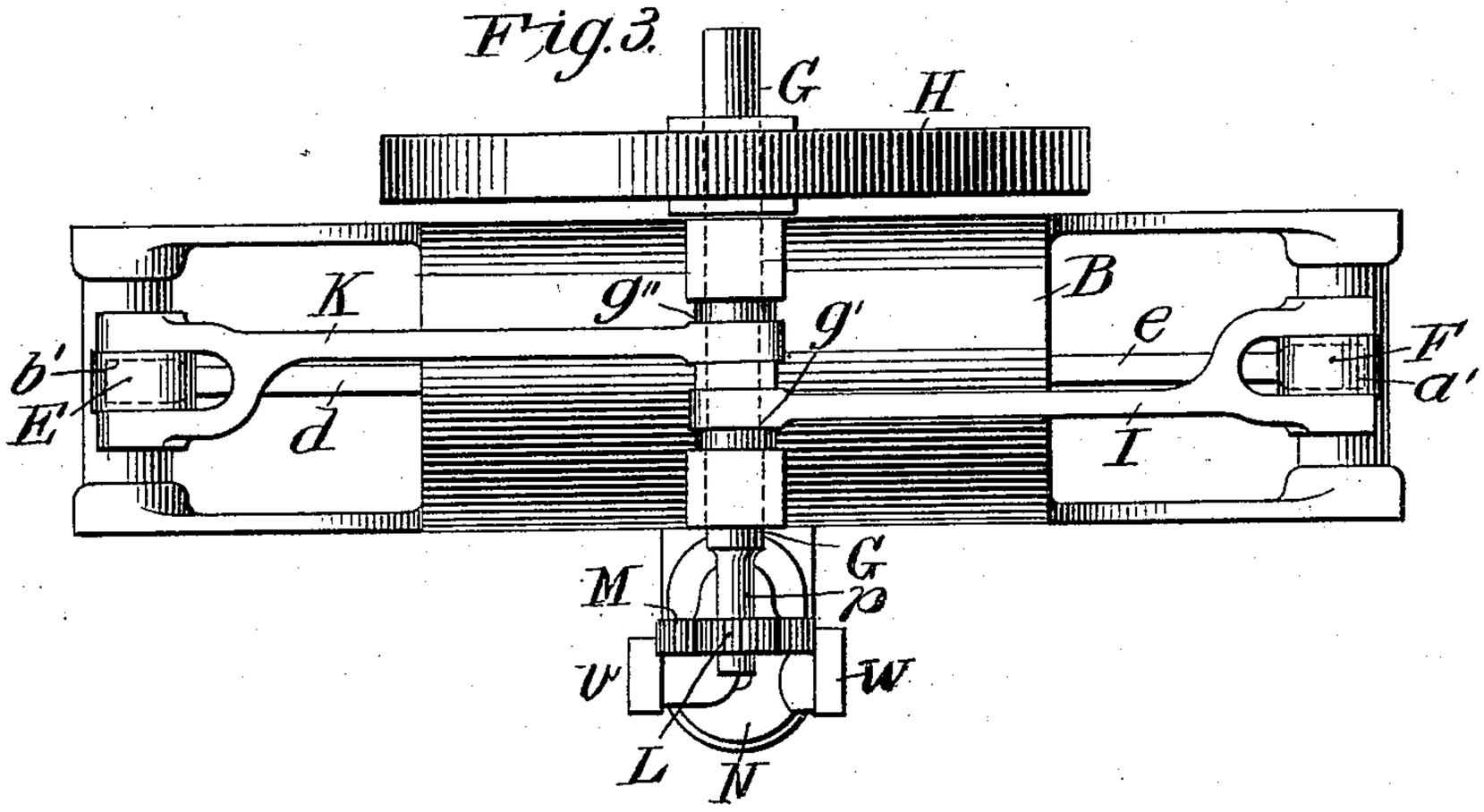


Fig. 4.

Fig. 5.

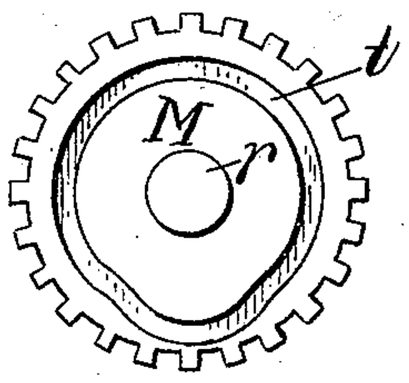
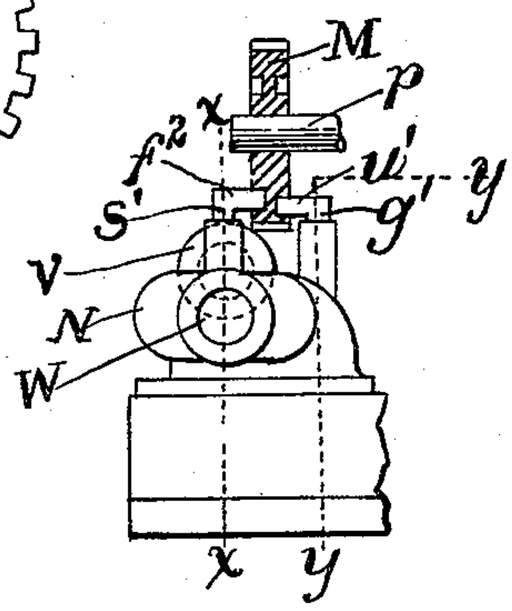


Fig. 8



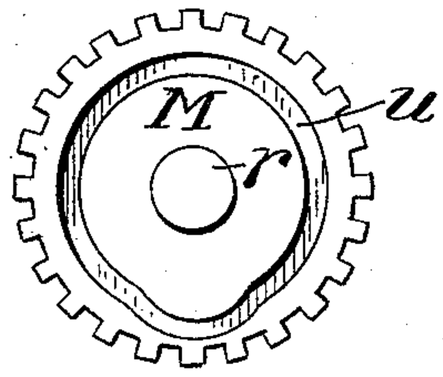


Fig. 6

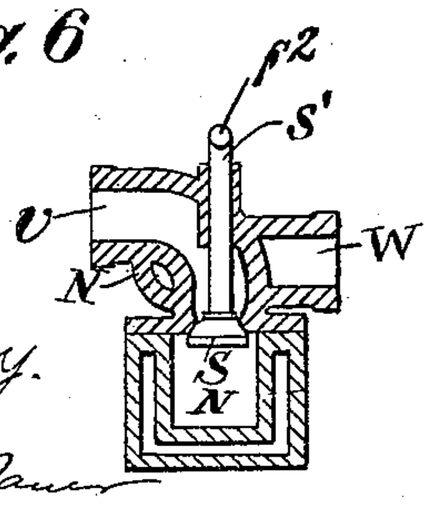
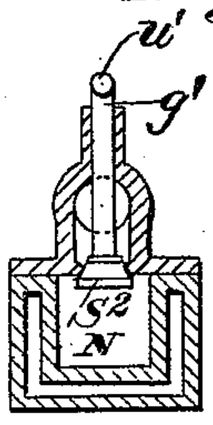


Fig. 7



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MOTIVE POWER.

SPECIFICATION forming part of Letters Patent No. 640,710, dated January 2, 1900.

Application filed May 16, 1899. Serial No. 717,003. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. SECOR, of New York, in the borough of Brooklyn, State of New York, have invented certain new and useful Improvements in Motive Power; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a vertical longitudinal sectional view of a motor made according to my invention. Fig. 2 is an end view of the same. Fig. 3 is a plan view of the same. Figs. 4 and 5 are detail face views of parts of the valve-operating mechanism of the motor. Figs. 6 and 7 are detail vertical sectional views showing the valves and valve-chests of said motor. Fig. 8 is a detail view showing the connections between the parts shown in Figs. 4 and 5 with those shown in Figs. 6 and 7.

This invention comprises certain novel and useful combinations of parts whereby I produce an engine or motive power capable of being operated or energized by gaseous products of explosion by slight mechanical changes, by compressed air, steam, or other elastic fluid under pressure, and in which stability, absence of injurious vibration, regularity and uniformity of motion, and consequently greatly-increased efficiency, durability, and steadiness of operation are secured.

A is the bed-plate of the motor. This bed-plate is so shaped and constructed that the engine-cylinder B rests firmly and solidly thereon, as more clearly shown in Fig. 1. At each of its ends the bed-plate is extended beyond the adjacent ends of the cylinder to afford bearings *a*, which preferably are integral with the body of the bed-plate and which are placed at a substantial distance below the axis of the engine-cylinder B. Firmly secured upon the cylinder B are standards A′. These should be so firmly bolted or otherwise secured in place that the bed-plate, the cylinder, and the standards together constitute a framework whereof the cylinder is a substantial portion, the cylinder not only being held in position by the bed-plate, but also serving to hold and sustain the standards and parts supported thereby in definite relation with the bed-plate and with the moving mechanism supported by the latter.

Provided in the cylinder B are two pistons C and D. These are preferably of the trunk variety, as illustrated in Fig. 1, and are arranged to move simultaneously in opposite directions with reference to each other and to and from the middle portion *b* of the cylinder. This latter may be open at both ends, inasmuch as the presence of cylinder-heads would add nothing to the working mechanism of the motor and would not beneficially affect its operation in any way.

At opposite ends of the bed-plates—in other words, at the opposite ends of the cylinder B—are levers E and F, the lower extremities of which are pivoted or fulcrumed on the bearings *a*, provided to the extended ends of the bed-plate A, as shown at *c* in Fig. 1. The connecting-rods *d* and *e* of the pistons C and D, respectively, are pivoted at their outer ends, as at *f*, to the adjacent levers E F at points between the fulcra of the levers and the points of connection of the latter at their free ends with the crank-rods of the driving-shaft, hereinafter described, the pivotal connections of the two levers, through the respective connecting-rods, with the two pistons being shown in dotted outline at *e′* in Fig. 1.

G is the hereinbefore-mentioned crank-shaft of the motor, through and from which power is transmitted from the latter. This crank-shaft G is supported in suitable journal boxes or bearings *i* in the upper parts of the standards A′ and has two cranks *m* and *n*, which extend in opposite directions from the axis of the shaft and the wrists of which are shown at *g′ g″*. This crank-shaft has a balance-wheel H and may be provided with driving-pulleys or other suitable means for transmitting power from the motor. The crank-rod I of the crank *m* has at its outer end pivotal connections, as at *a′*, with the upper or free end of the lever F, and in like manner the connecting-rod K of the crank *n* has pivotal connection, as at *b′*, with the upper or free end of the lever E. The location of the points of connection of the connecting-rods *d e* of the pistons may be varied within wide limits, so long as these points of connection

are between the fulcra of the levers and their points of connection with the crank-rods. I prefer, however, that the lower or short arm of each lever be about one-half the length of the upper or longer arm, as illustrated in Fig. 1.

One end of the crank-shaft G is extended over the valve-chest, as shown more fully in Figs. 2 and 3, sufficiently to carry a spur-pinion L, which is fast thereon and which gears with a spur-wheel M. This latter is revoluble on a gudgeon *p*, which is provided to one of the standards A′ and which is parallel, or substantially so, with the axis of the crank-shaft. This spur-wheel M, as shown in the drawings, has twice the diameter of the pinion L, from which it is driven, and in its preferred construction its sides are flat, or substantially so, as indicated in Figs. 2 and 3. In each of the said two opposite sides of this spur-wheel is formed a cam-track. These cam-tracks are illustrated at *t* and *u* in the detail views, Figs. 4 and 5, and also in Fig. 8.

N is the valve-chamber, hereinbefore referred to, of the cylinder. In this valve-chamber are located the inlet-valve *s*, which controls the inlet of the elastic or expansive fluid from which the propelling energy of the apparatus when in use is provided, and also the outlet-valve s^2, which regulates the exhaust or outlet of the spent fluid from the motor when its energy has been expended in the operation of the latter. The inlet and outlet ports controlled by these valves may be arranged in any manner usual or suitable in that class of engines in which two pistons working in opposite directions in one cylinder are employed. A like remark applies to the valves *s* and s^2; but in practice simple puppet-valves, as shown in Figs. 6 and 7, are preferred. The stem *s*′ of the inlet or supply valve *s* is extended upward and has at its upper end a lateral stud f^2, which projects into the cam-track *t* in the one side of the spur-wheel M, while the valve-stem *g*′ of the outlet or exhaust valve s^2, being similarly extended, has a similar lateral stud *u*′, which extends into the cam-track *u* on the other side of said spur-wheel, as indicated in Fig. 8. The cam-tracks being calculated to lift and drop the valves at the proper time as the spur-wheel M is rotated by the driving-shaft, it follows that the inlet of the energizing fluid, whether products of explosive materials, steam, compressed air, or other, and its exhaust from the engine are regulated and controlled. The entrance of the inlet-port is shown at *v* and the outlet of the exhaust-port at *w* in Fig. 2. When the energizing power, instead of being that employed in an expansion-engine, is provided by steam, compressed air, or the like, the arrangement of the valve is reversed to suit the different requirements of the energizing fluid.

By providing the fulcra of the motion-transmitting levers E F at their inner extremities and at the extended ends of the bed-plate with the piston connections between the fulcra and the connections of the levers with the crank-rods there is obtainable a freedom from vibration in the engine heretofore found impossible in practice with motors having duplicate pistons in one and the same cylinder, and consequently a stability and firmness in the apparatus which not only promotes its durability, but permits, for any given power, of a considerable diminution in the weight of the engine.

It is of course to be understood that any suitable or usual method of igniting an explosive charge is to be employed when the motor is to be operated or energized after the manner of an "explosive-engine," so called, and that in such case also the cylinder and valve-chamber are to be cooled by means of water-jackets in the usual or in any appropriate way. As my invention is adapted to the use of a wide range of expansive energizing fluids, it is of course expected that any special devices involving simply the workshop skill of artisans familiar with the use for power purposes of any given expansive or elastic fluid—as, for example, the changing of the portion of the valves heretofore referred to—may be employed in connection with my invention without in any way affecting the scope or character thereof.

What I claim as my invention is—

1. The combination with a bed-plate, a cylinder bedded thereon with the ends of the bed-plate extended beyond the ends of the cylinder, duplicate pistons arranged for movement in opposite directions within the cylinder, and a crank-shaft the cranks of which extend in opposite directions, of levers fulcrumed at their lower extremities to the extended ends of the bed-plate, crank-rods which connect the free ends of the levers with the cranks of the crank-shaft, and connecting-rods which connect the pistons with the levers at points between their fulcra and their pivotal connections with the crank-rods, substantially as herein set forth.

2. The combination with a bed-plate, a cylinder bedded thereon with the ends of the bed-plate extended beyond the ends of the cylinder, a valve-chest and inlet and outlet valves therein, standards fixed upon the cylinder, a crank-shaft having cranks extended in opposite directions and with one of its ends projected over the valve-chest and duplicate pistons arranged for movement in opposite directions within the cylinder, of levers fulcrumed at their lower ends to the extended ends of the bed-plate, crank-rods which connect the free ends of the levers with the cranks of the crank-shaft, connecting-rods which connect the pistons with the levers at points between their fulcra and their connections with the crank-rods, and mechanism for actuating the valves in the valve-chest from the projected end of the crank-shaft, substantially as herein set forth.

3. The combination with a bed-plate, a cyl-

inder bedded thereon with the ends of the bed-plate extended beyond the ends of the cylinder, a valve-chest and inlet and outlet valves therein, a crank-shaft arranged above the cylinder with cranks extended in opposite directions and having one of its ends projected over the valve-chest, duplicate pistons arranged for movement in opposite directions within the cylinder, levers fulcrumed at their lower ends to the extended ends of the bed-plate, crank-rods which connect the free ends of the levers with the cranks of the crank-shaft, and connecting-rods which connect the pistons with the levers at points between the fulcra of the latter and their connections with the crank-rods, of a pinion fast on the projected end of the crank-shaft, a spur-wheel which gears with said pinion, cam devices provided to said spur-wheel, and means for transmitting motion from the cam devices to the valves in the valve-chest, substantially as herein set forth.

4. The combination with a bed-plate, a cylinder bedded thereon with the ends of the bed-plate extended beyond the ends of the cylinder, a valve-chest with inlet and outlet valves therein, standards fixed upon the cylinder and having a gudgeon extended therefrom, a crank-shaft carried by the standards with cranks extended in opposite directions and having one end projected over the valve-chest, duplicate pistons arranged for movement in opposite directions within the cylinder, levers fulcrumed at their lower ends to the extended ends of the bed-plate, crank-rods which connect the free ends of the levers with the cranks of the crank-shaft, and connecting-rods which connect the pistons with the levers between their fulcra and their connections with the crank-rods, of a pinion fast on the projected end of the crank-shaft, a spur-wheel revoluble on the lateral gudgeon of the standards and having cam-tracks on its opposite sides, and valve-stems provided with lateral studs which work in the cam-tracks of the spur-wheel, substantially as herein set forth.

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