No. 753,876. PATENTED MAR. 8, 1904.

DE CLOISE GLASBY.

GAS ENGINE.

APPLICATION FILED JUNE 11, 1901.

NO MODEL. 4 SHEETS—SHEET 1.

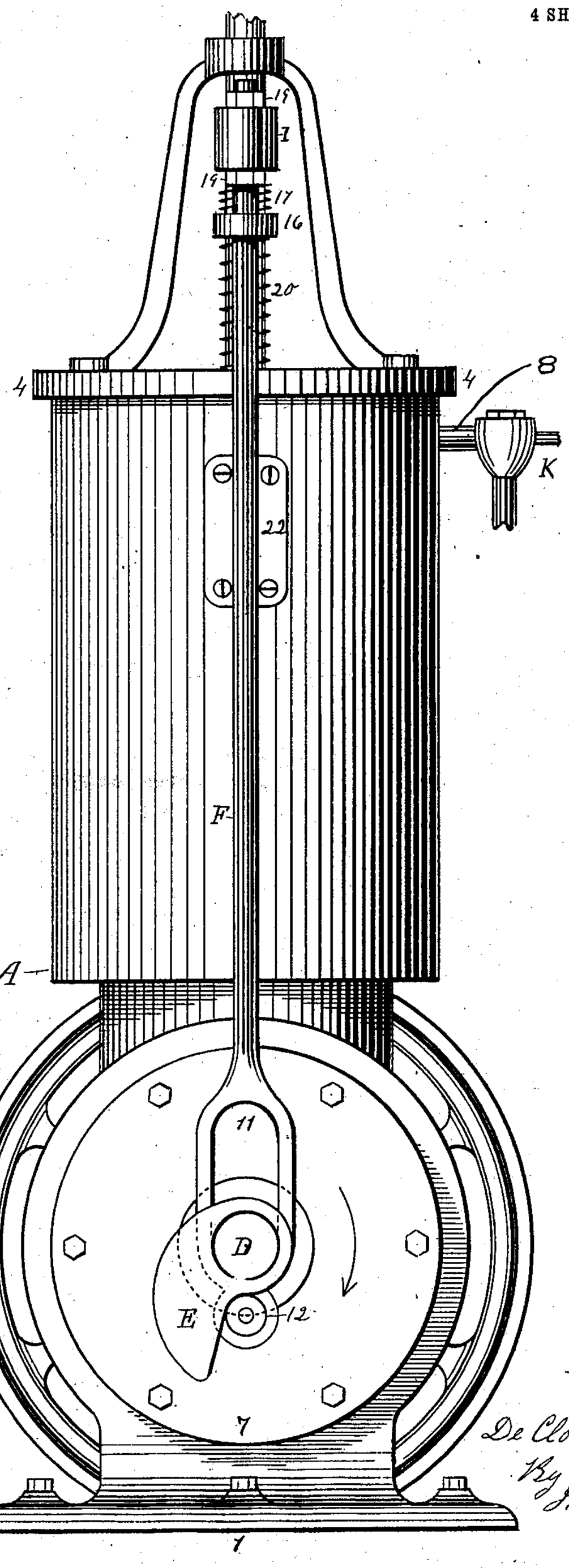

Fig. 1.

WITNESSES

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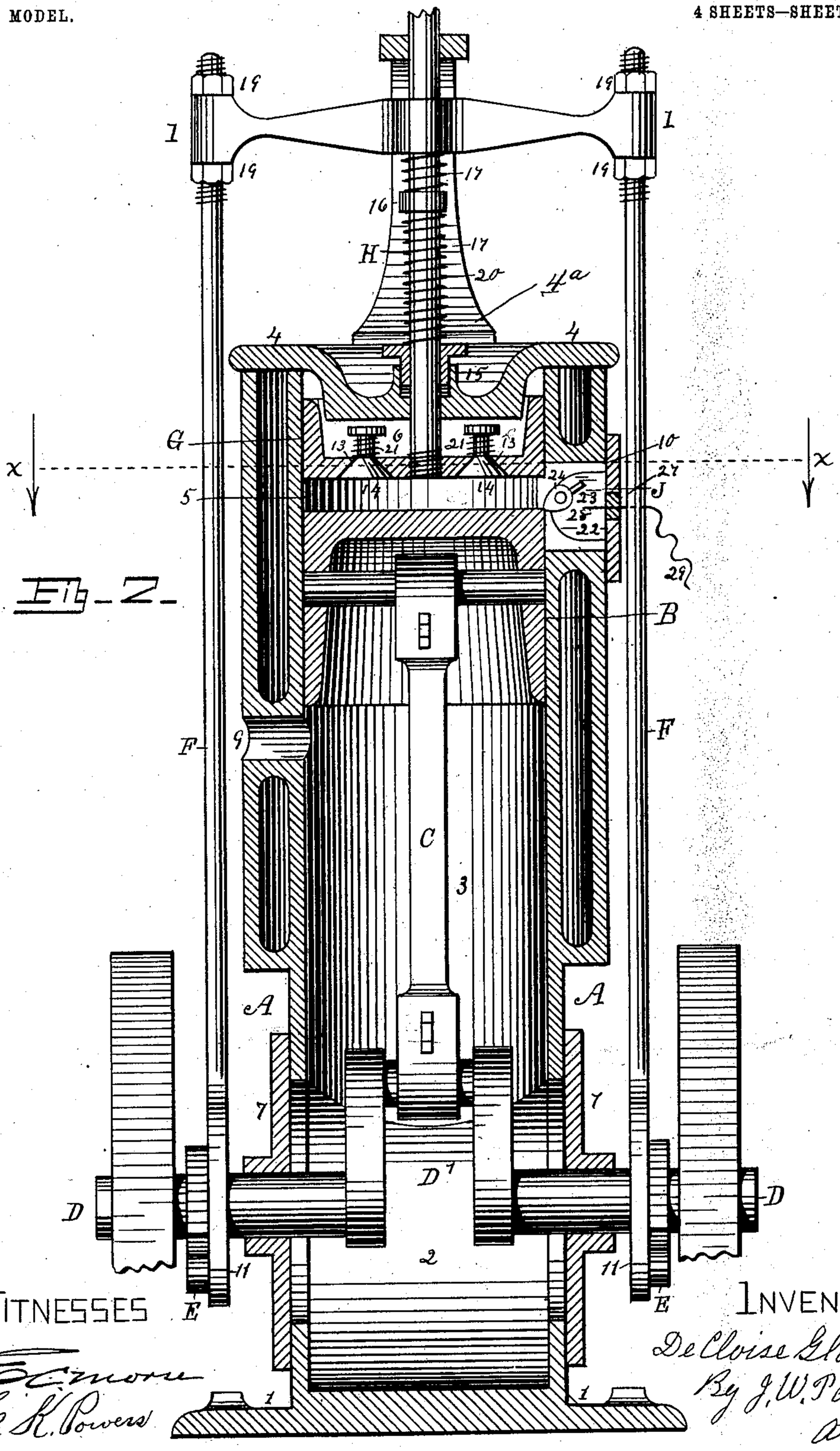

Fig. 2.

WITNESSES

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NO MODEL. 4 SHEETS—SHEET 3.

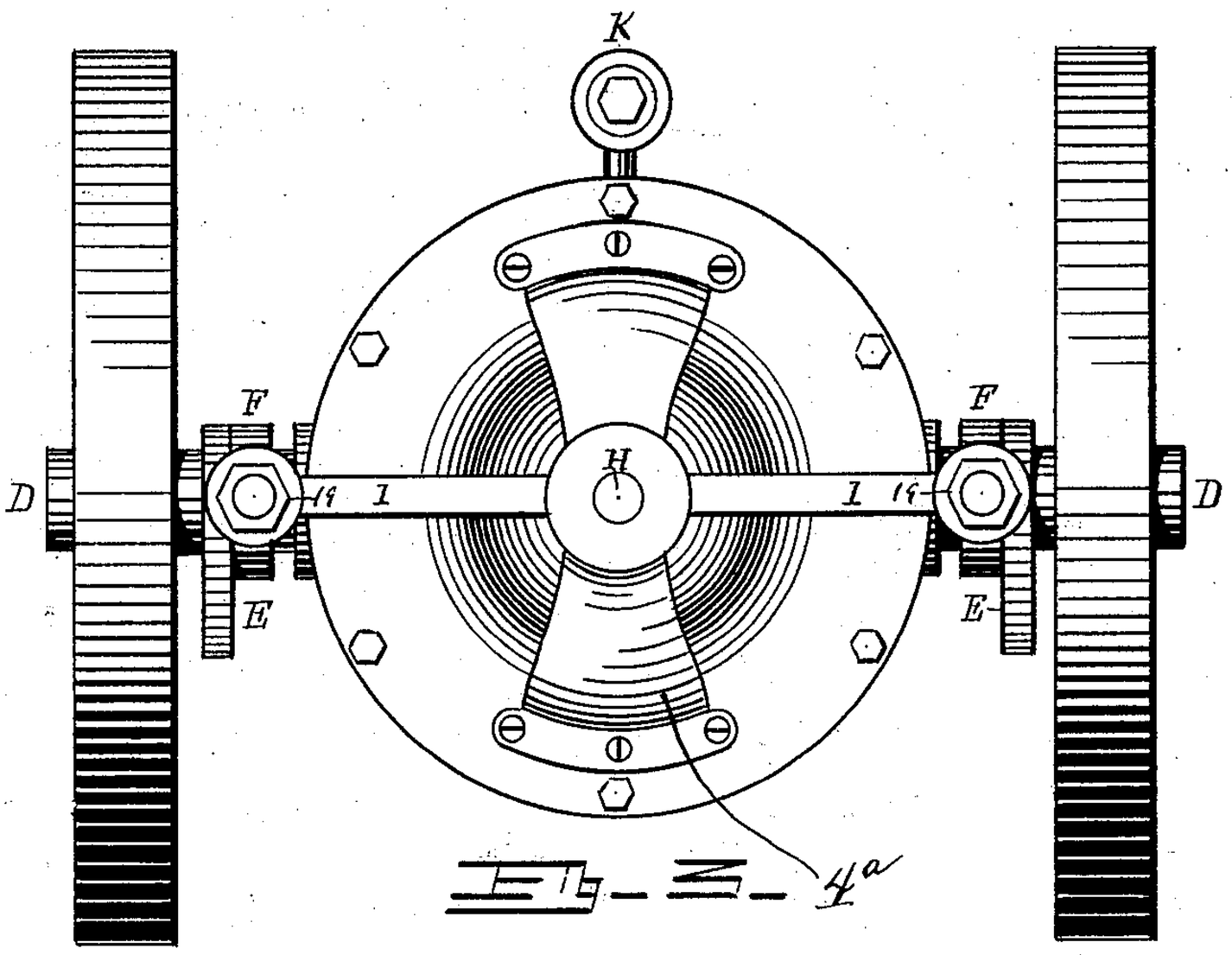

Fig. 3.

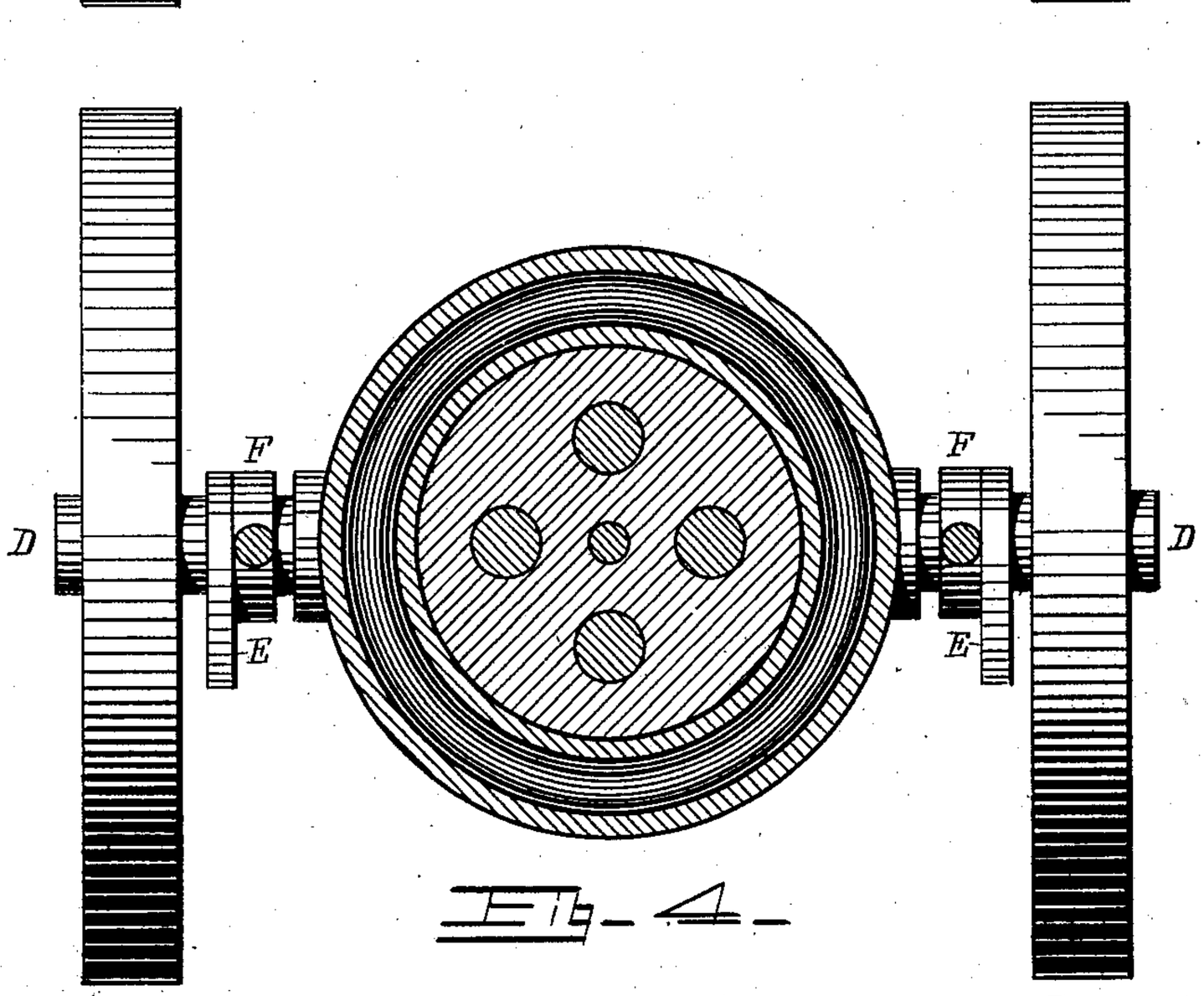

Fig. 4.

WITNESSES

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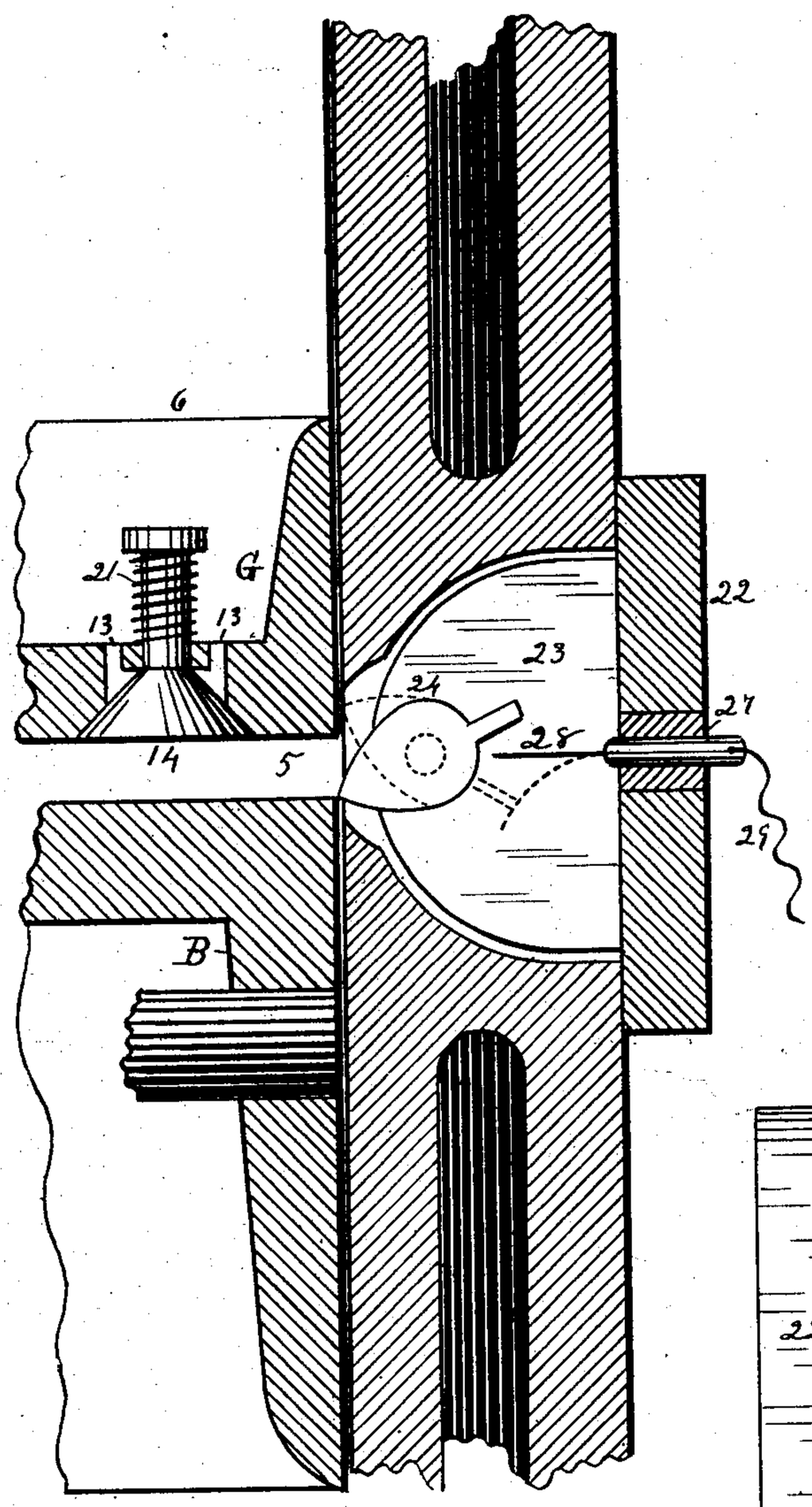

Fig. 5.

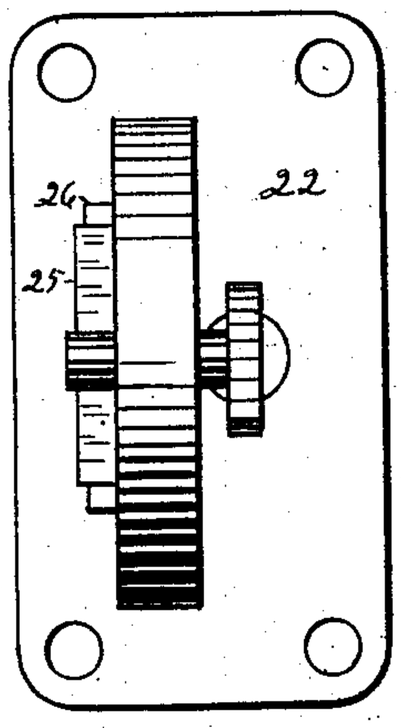

Fig. 6.

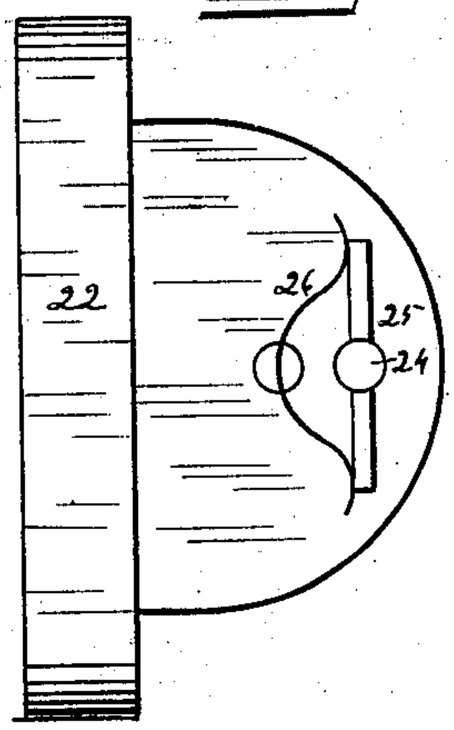

Fig. 7.

WITNESSES

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No. 753,876. Patented March 8, 1904.

UNITED STATES PATENT OFFICE.

DE CLOISE GLASBY, OF MINNEAPOLIS, MINNESOTA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 753,876, dated March 8, 1904.

Application filed June 11, 1901. Serial No. 64,095. (No model.)

To all whom it may concern:

Be it known that I, DE CLOISE GLASBY, a citizen of the United States, residing at 2124 Fremont avenue, in the city of Minneapolis, county of Hennepin, and State of Minnesota, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which my invention appertains to properly construct the same, reference being had to the accompanying drawings.

My invention relates to engines, and especially to that class of engines wherein gas is employed as a motive fluid and wherein the gas is injected or is drawn into a chamber wherein it is ignited and where by its sudden expansion it impels a piston forward, which piston in turn imparts motion to other necessary parts. Engines of this class are usually (if not always) "single-acting" (receiving the impact of the exploding gas upon one side of their pistons only) and are "four-cycle," (getting an explosion at each alternate revolution of the shaft only,) and it is therefore necessary to build them very strong to withstand the recoil of the heavy charges of explosives and to equip them with very heavy balance-wheels the momentum of which will carry the load during the alternate revolution in which their pistons receive no impulses from the motive fluid.

The purpose of this invention is, first, the production of an engine adapted to receive a charge and to explode the same at each and every revolution of the shaft and therefore one of uniform speed and power; second, the production of an engine wherein the exploded gas is expelled from the explosion-chamber before the unexploded gas is admitted thereto. Hence the motive fluid used is not deteriorated by the residuum of the previously-exploded charge, and, third, the production of an engine wherein its recoil is cushioned, and therefore one in which the disintegrating tendency of the explosions is minimized.

To these ends my invention consists of the device shown in the accompanying drawings, wherein—

Figure 1 is a side elevation; Fig. 2, a longitudinal section; Fig. 3, a top view; Fig. 4, a horizontal section of Fig. 2, taken on the line *x x;* Fig. 5, a side elevation of the igniter attached; Fig. 6, a rear elevation of the same detached, and Fig. 7 another side elevation detached.

Similar letters and numerals refer to similar parts throughout the several views.

A represents the frame; B, the power-piston; C, the power-piston rod; D, the crank-shaft; E, the cams; F, the cam-rods; G, the movable valve-seat; H, the valve-rod; I, the cross-head; J, the igniting mechanism, and K the gas and air valve.

The frame A embodies the base portion 1, by means of which the engine is secured to its foundation, the crank-chamber 2, within which the crank-shaft D revolves, and the cylinder portion 3, within which the power-piston B and the movable valve-seat G reciprocate. That portion of the cylinder 3 lying between the power-piston D and the movable valve-seat G (regardless of their respective positions) I designate as the "explosion-chamber," and that portion lying between the movable valve-seat G and the cylinder-head 4 (regardless of the position of the former) I designate as the "gas-chamber," and number them, respectively, 5 and 6.

The crank-chamber 2 of the frame A is provided with covers or heads 7, which covers constitute boxes or bearings in which the crank-shaft D revolves. The cylinder portion of the frame A is provided with a head 4, through which the movable valve-seat rod H passes; with the ingress or supply port 8, through which the gas and air (the motive fluid) is injected or is drawn; with the exit or exhaust port 9, from which the residuum or exploded gas escapes or is driven out, and with the opening 10, adapted to receive and to be covered by the igniter J. The ingress-port 8 communicates with the gas-chamber 6 only, and the exit-port 9 communicates with the combustion-chamber 5 only. The piston B, piston-rod C, and crank-shaft D are not unlike those of other engines, (either gas or steam,) hence need no detailed description herein. The cams E are adjustably affixed upon the crank-shaft D, outside the crank-chamber 2,

to the end that the movement of the movable valve-seat G, which they actuate, may be regulated. The cam-rods F, connecting the cams E with the movable valve-seat G, are fashioned with longitudinal loops 11, through which the crank-shaft D passes, which loops serve as guides therefor, and with the idlers or friction-rollers 12, against which the cams E work in depressing them.

The movable valve-seat G consists of a head portion provided with spring-packing to render it gas-tight, after the manner of constructing pistons in general, and is vertically pierced, thus providing ports 13, through which the gas may pass from the gas-chamber 6 to the combustion-chamber 5, which ports are provided with spring-controlled upward-closing valves 14, which are an important feature of my invention.

The movable valve-seat rod H is centrally affixed in the movable valve-seat G and extends upward therefrom through the stuffing-box 15 of the cylinder-head 4. The movable valve-seat cross-head I is affixed to the upper end of the movable valve-seat rod H, the manner of affixing the same thereto and to the cam-rods F being another important feature of my invention, and is as follows: The cross-head I is vertically pierced at its center to receive the piston-rod H and at its ends to receive the cam-rods F. A collar 16 is affixed to the movable valve-seat rod H a short distance from its upper end, and upon this collar 16 is placed a coiled spring 17, which spring is somewhat depressed when the cross-head I is in place. The upper end of the valve-rod H passes through the cross-head I and the bracket 4^a of the cylinder-head 4, the latter serving as a guide therefor. In like manner the upper ends of the cam-rods F are threaded and adjusting-nuts 19 screwed thereon, (two upon each rod,) one of each pair being below and one of each pair being above the said cross-head I. By uniting the cross-head and cam-rods in this manner I secure rigidity and stability thereto, while at the same time I provide for the adjustment of the parts, thereby regulating the stroke of the said movable valve-seat G. A coiled spring 20 incases a portion of the movable valve-seat rod H, its lower end resting upon the gland of the stuffing-box 15 and its upper end pressing against the collar 16. It operates (by its reflex action) to return the movable valve-seat G to its upward position after the cam-rods F, which depress it, have been released by the cams E. This spring 20 should be an "open coil," as it is depressed when the said movable valve-seat G is drawn downward.

The valves 14 are of the conical form, close upwardly into conical seats, and are held normally therein by the springs 21. Their operation will hereinafter be described.

The igniting device J consists of a plate 22, adapted to be affixed to the outer wall of the cylinder portion 3 of the frame A and to cover the opening 10 therein, an intervening packing serving to render the joint gas-tight. This plate 22 is fashioned with a laterally-extending vertical flange 23, in which the trigger 24 is journaled and upon the front or face of which it is oscillatory. A vertical bar 25 is affixed to the pin or shaft portion of the trigger 24, protruding from the back of the flange 23. A spring 26 is affixed to the back of the flange 23, which spring operates to hold the vertical bar 25 normally in place and to return it to position when it has been deflected through the operation of the trigger 24, to which it is affixed. A plug or bushing 27 of insulating material extends laterally through the plate 22 of the igniting device J, through which the outer electric terminal 28 extends. An electric conductor 29 connects the outer electric terminal 28 with the battery or dynamo furnishing the electrical energy.

The two electric terminals 24 and 28 are not normally in contact, but are so fashioned and so disposed that they are adapted to contact when the trigger 24 is deflected through the operation of the power-piston B, but do not contact when the said trigger 24 is deflected through the operation of the movable valve-seat G.

The gas and air valve K is not unlike those of other engines, hence needs no description herein.

The operation of my engine is as follows: I start my engine in the usual manner—that is to say, I rotate the crank-shaft D by means of the balance-wheels, throwing the cams F, affixed thereto, to their lowest point and drawing the cam-rods E, actuated thereby, downward, thus depressing the movable valve-seat G and creating a vacuum in the gas-chamber 6, which vacuum is filled by gas and air, which when combined form the motive fluid. I continue the rotation of the shaft in the same direction (the direction indicated by the arrow) until the cams F pass their "centers" and release the cam-rods E, when the spring 20 (which incases the valve-rod H and actuates in part the auxiliary piston G) will be released and by its reflex action will throw the movable valve-seat G to the upper end of the cylinder 3, transferring the motive fluid therein from the gas-chamber 6 to the combustion-chamber 5, the valves 14 being forced downward (opened) through the determination of the gas in the chamber 6 to equalize itself in density. When the pneumatic pressure becomes equal or nearly equal in the two chambers 5 and 6, the springs 21 by their recoil or reflex action will close the valves 14, thereby imprisoning the motive fluid in the combustion-chamber 5, where it is sparked and exploded, its sudden expansion giving an impetus to the power-piston B, the momentum of which (through the operation of its rod C) will be transmitted to the crank-shaft D, the

cams E thereon will be rotated, the cam-rods F (and with them the movable valve-seat G) will be depressed and in due time released, and the operation above described will be repeated *ad infinitum*. It is important that the cams E shall be so fashioned and so adjusted in relation to the crank D′ of the crank-shaft D that the cam-rods F will start the auxiliary piston G on its downward stroke at the instant that the power-piston B has opened or uncovered the exhaust-port 9, and that the said cams E shall release the cam-rods F and the spring 20 shall throw the said movable valve-seat G to the upper end of the cylinder 3 at the instant that the power-piston B has closed the said exhaust-port 9. By such configuration and adjustment of the cams E the movable valve-seat G will by its downward stroke free the explosion-chamber 5 by forcing therefrom the residuum or exploded gas and will by its upward stroke transfer thereto from the gas-chamber 6 the charge of motive fluid drawn into the gas-chamber 6 by its upward stroke, which charge will not be deteriorated by contact or admixture with the waste or exploded gas of the previous charge. The point at which I ignite and explode the motive fluid is at the instant the crank D′ of the crank-shaft D has reached the limit of its upward throw, (the upper dead-point of the power-piston B,) where it most nearly approaches the movable valve-seat G, then near the limit of its upward stroke, this being the point at which the motive fluid is properly compressed.

The operation of the igniting device J is as follows: When the power-piston B has nearly reached the limit of its upward stroke, it contacts with and raises the inner end of the trigger 24 (the end extending into the combustion-chamber 5) and depresses its outer end, (the end wholly within the opening 10,) thereby bringing it into contact with the outer (insulated) electric terminal 28, thus forming an electrical circuit, which circuit remains unbroken while the said power-piston is completing its upward stroke and has started upon its downward stroke. Through this operation of the power-piston the vertical bar 25, affixed to the stem of the trigger 24, is deflected, thereby depressing one end of the spring 26, which is in constant contact therewith. Then when the power-piston (having reached the limit of its upward stroke) starts upon its downward stroke and has reached the point shown in Fig. 5—the point where it releases the trigger 24—the spring 26 by its reflex action restores the bar 25 to its normal (vertical) position, thereby swinging the trigger 24 thereunto affixed to its normal (horizontal) position, thereby throwing its outer end upward and away from the outer electric terminal 28, thereby breaking the electrical circuit, when (as the terminals part) an electric spark will be produced, which spark ignites the charge of motive fluid then within the combustion-chamber with the effect and operation hereinbefore set forth.

It is apparent that in an engine constructed as hereinbefore described, wherein the motive fluid is exploded between the power-piston and a movable valve-seat both pistons will be affected thereby. This, too, is an important feature of my invention, for it is through the retraction of the movable valve-seat G (made possible by connecting its rod and cross-head in the manner described) that I secure the advantages hereinbefore set forth, for when the explosion occurs the said movable valve-seat G will be driven upward a short distance, (its rod H sliding through its cross-head I,) the unused motive fluid remaining in the gas-chamber 6 will be compressed, will operate as a cushion therefor, and will by its reëxpansion impart a retroactive movement to the said movable valve-seat G, which movement (being downward) will supplement the downward movement of the power-piston B by reducing the capacity of the explosion-chamber 5. The power-piston B, having farther to travel than the movable valve-seat G and both completing their strokes in the same time, it is apparent that the former travels with greater velocity than the latter and it is through this unequal speed that the power-piston B is enabled to uncover (open) the exhaust-port 9, complete its downward stroke, and return to the exhaust-port, while the movable valve-seat G has been completing its downward stroke and is forcing out the burned gas, the piston and valve-seat meeting at a point directly above the exhaust-port, when through the operation of the cams E the cam-rods F will be released, and the spring 20 will force the movable valve-seat G upward to the limit of its stroke.

The advantages which I claim for this construction are, first, by the introduction of a movable valve-seat, and by thus dividing the cylinder into a combustion-chamber and a gas-chamber, I am enabled to draw a charge of motive fluid into the said gas-chamber while the power-piston is on its downward stroke and through the operation of the valves to open the ports in the movable valve-seat G, and to transfer the same to the said explosion-chamber while the power-piston is on its upward stroke I am enabled to get an explosion at each and every revolution of the shaft, and my engines therefore may be built much lighter than others and (through their frequent explosions) are more uniform in speed; second, by providing a slightly-movable abutment the movable valve-seat against which the motive fluid reacts in driving the power-piston forward and by providing a chamber therefor (the gas-chamber) I relieve the engines of the severe strain incident to explosives and give them an elasticity and ease of action not attainable in other types of en-

gines; third, through the use of the movable valve-seat operating in the manner described I am enabled to thoroughly incorporate the air and gas before their intromission to the combustion-chamber, therefore providing a motive fluid of greater potentiality than is ordinarily used, and, fourth, through the operation of the auxiliary piston I am enabled to force the exploded or spent gas from the explosion-chamber before admitting an unexploded and vital charge thereto. Hence I supply my engines with charges of motive fluid unmixed with and undeteriorated by the residuum from the previous charge.

Having thus described my invention and set forth its advantages, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-engine, the combination with the cylinder, power-piston and crank-shaft thereof, of a valve-seat chambered and longitudinally movable within the said cylinder; ports or passages for the gas extending through the said valve-seat; upward-closing valves adapted to open and close the said ports; a piston-rod affixed to the said valve-seat and extending upward therefrom through the head of the said cylinder; an annulus or collar affixed upon the said rod; a spring mounted upon the said cylinder-head, and acting against the said annulus or collar; said spring operating through its reflex action to raise the said valve-seat within the said cylinder; a cross-head affixed upon the said rod; cam-rods affixed to and extending downward from the said cross-head; cams mounted upon the said shaft and actuating the said cam-rods; and means for exploding the charges of motive fluid, substantially as shown and for the purposes specified.

2. In a gas-engine, the combination with the cylinder, piston, and crank-shaft thereof, of a valve-seat chambered and longitudinally movable within the said cylinder, ports and passages in the said valve-seat; valves adapted to close the said ports and passages; a rod connecting said valve-seat with a cross-head; a spring mounted upon the said cylinder and incasing the said rod; cams mounted upon and rotatable with the said shaft; cam-rods connecting the said cams with the said cross-head; said cams, cam-rods, and cross-head, operating to deflect the said spring, and to depress the said valve-seat; said spring operating through its reflex action to return the said valve-seat to its upward position, and means for igniting the said motive fluid within the said cylinder, substantially as shown and for the purposes specified.

3. A gas-engine embodying a frame, a cylinder therein, a crank-shaft journaled in the said frame, a piston within the said cylinder, a rod connecting the said crank-shaft and the said piston, an ingress-port leading into, and an exhaust-port leading out from the said cylinder, a valve-seat intermediate the said ingress and exit ports, spring-controlled valves therein, a cylinder-head, a valve-rod extending from the said valve-seat and through the said cylinder-head, an annulus on the said valve-rod, a spring intermediate the said cylinder-head and the said annulus, a cross-head loosely mounted upon the said valve-rod, a spring intermediate the said annulus and the said cross-head, and means for operating the said cross-head from the said crank-shaft, substantially as shown and described, and for the purposes specified.

4. In a gas-engine, the combination with the frame, the cylinder, the piston, the crank-shaft and the piston-rod, of the movable valve-seat lying between the ingress and exit ports of the said cylinder, and being provided with valves, a stem for the said valve-seat, an annulus upon the said stem, a spring intermediate the said cylinder and the said annulus, a cross-head loosely mounted and longitudinally movable upon the said valve-stem, a spring intermediate the said annulus and the said cross-head, cams upon the said crank-shaft, and cam-rods connecting the said cams with the said cross-head, substantially as shown and described, and for the purposes specified.

5. The combination in a gas-engine having a cylinder, a piston operating therein, a crank-shaft, a rod connecting the said piston and the said crank-shaft, a valve-seat intermediate the ports leading to and from the said cylinder, valves arranged in said valve-seat, a stem therefor, cams affixed to the said crank-shaft, a cross-head loosely mounted upon the said valve-stem, and cam-rods connecting the said cams and the said cross-head, of the annulus upon the said valve-stem, a spring intermediate the said cylinder and the said annulus, said spring operating to cushion the said valve, substantially as shown and described, and for the purposes specified.

6. The combination with the cylinder the piston operating therein, and the drive-shaft, of a valve-seat, spring-valves mounted in said valve-seat, a cross-head, a stem connected to said valve-seat and projecting through said cross-head, means operated by said shaft for operating said cross-head, and springs interposed between said cross-head and cylinder, substantially as and for the purpose specified.

DE CLOISE GLASBY.

Witnesses:
E. C. MORSE,
E. K. POWERS.