(No Model.)

C. QUAST.

EXPLOSIVE ENGINE.

No. 584,960. Patented June 22, 1897.

Fig. I.

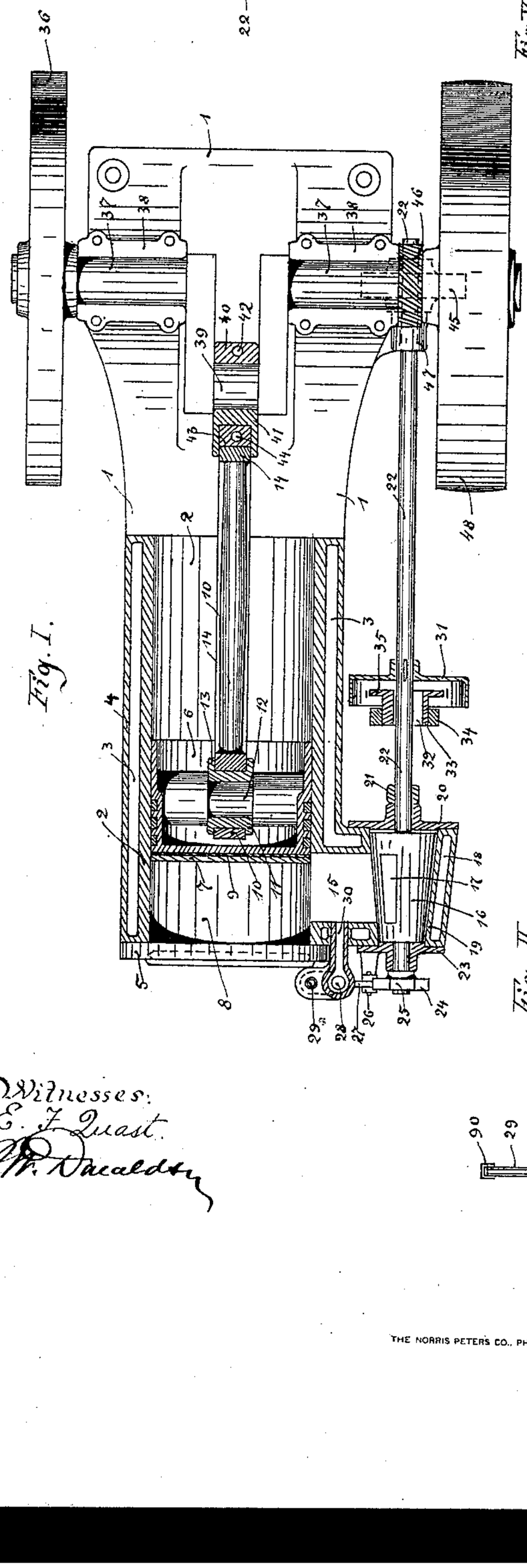


Fig. II.

Fig. III.

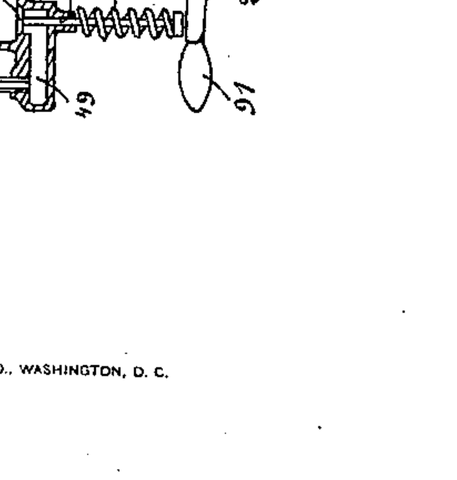


Fig. IV.

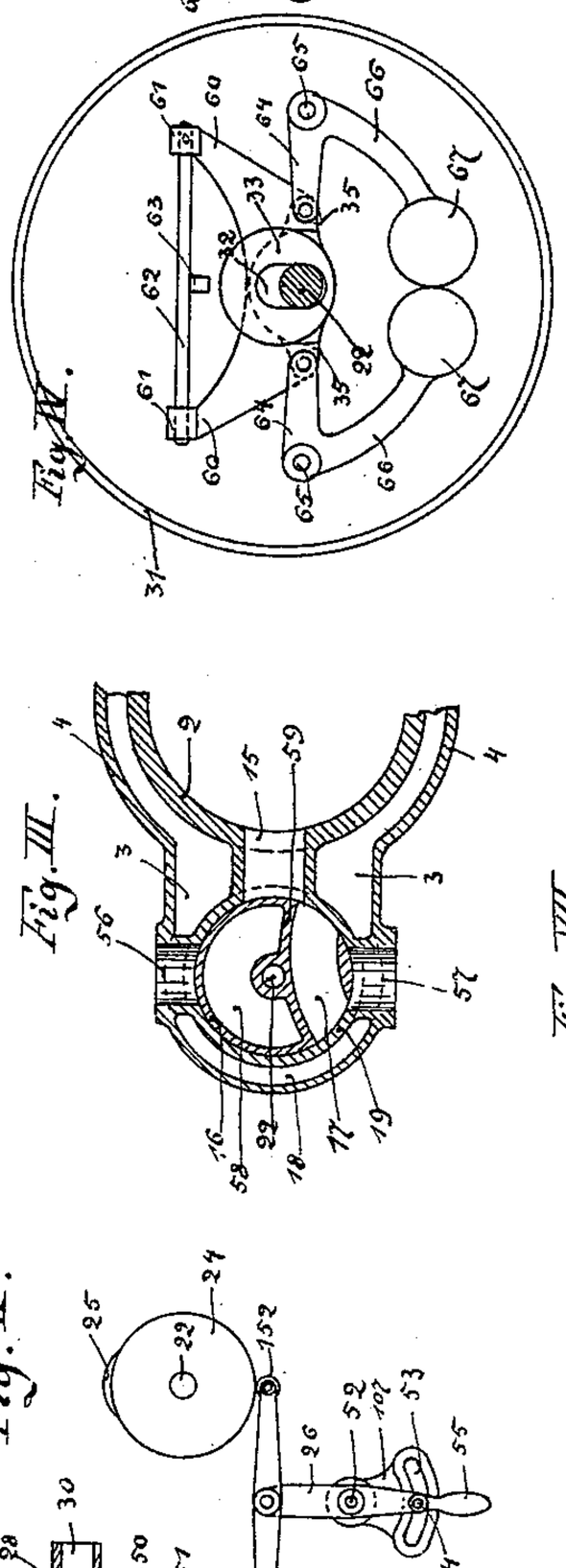


Fig. V.

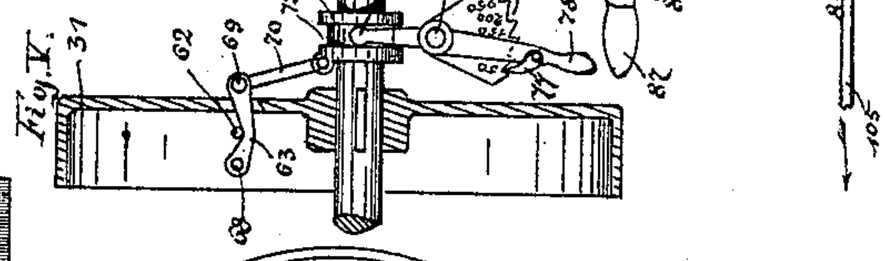
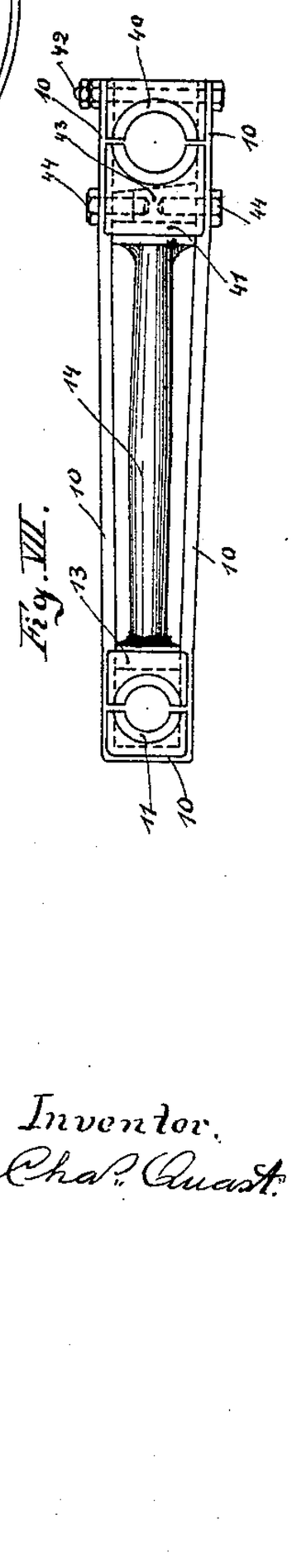


Fig. VI.



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UNITED STATES PATENT OFFICE.

CHARLES QUAST, OF MARION, OHIO.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 584,960, dated June 22, 1897.

Application filed September 5, 1894. Serial No. 522,179. (No model.)

To all whom it may concern:

Be it known that I, CHARLES QUAST, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

The object of my invention is to produce a gas-engine in which a perfect governing action may be secured not only by shutting off the supply of explosive mixture entirely when the engine attains a certain speed, so as to miss an explosion, but also to regulate to a nicety the amount of explosive mixture supplied, so that as the engine begins to attain a higher speed than that determined upon the supply of explosive mixture will gradually be reduced, so that while an explosion may still take place it will be of less force and thus act to keep the engine at a uniform speed.

The invention includes special features in the valve arrangement, governor arrangement, lighting arrangement, regulating arrangement, and in the pumping device; in means for setting the governor for a certain speed, in an improved piston-rod, and in various details of construction and arrangement hereinafter described.

Figure 1 is a sectional plan view through cylinder, valve-chest, igniter, and governor. Fig. 2 is a vertical section through igniter and shows the operating mechanism therefor. Fig. 3 is a section through the valve and chest, showing inlets and outlets. Fig. 4 is a front view of the governor. Fig. 5 is a section through the governor, showing speeding-dial. Fig. 6 shows pump mechanism. Fig. 7 shows connecting-rod. Fig. 8 shows valve and valve-chest in combination with the carbureter and pressure-valve.

Bed-plate 1 carries cylinder 2, in which moves back and forth piston 6, the latter being connected through trunnion 12 and connecting-rod 14 with crank 39 of crank-shaft 37. Crank-shaft 37 rotates in bearings 38 and carries fly-wheel 36, pulley 48, and worm-gear 46. Worm-gear 46 meshes in worm-gear 45, which is fixed on valve-shaft 22. Shaft 22 carries governor-hull 31, cylindrical valve 16, and igniting-cam 24. Igniting-cam 24 has projection 25, which operates lever 27, and the latter igniting-valve 28. Lever 27 is pivoted on lever 26, which is pivoted at 52 of quadrant 107. The governor-hull carries by pins 65 knee-levers 66, which have on their extreme ends balls 67. Knee-levers 66 are pivotally connected at their ends 64 with lugs 35 of governor-disk 33. Governor-disk 33 carries by arms 60 bearings 61, in which is carried spring 62. Spring 62 rests with its center on link 63, which is pivoted at 68 to shell 31 and has a movable end 69, which is carried by link 70. Link 70 connects with collar 71. A lever 73 rests in grooves 72 of collar 71 and is pivoted at 74 of disk 75, which has notches 76. Lever 73 has handle 78 and latch-dog 77, which fits in the corresponding notches 76. Disk 75 has engraved figures at each notch giving the speed at which the engine will run if the latch is placed in the respective notch. Disk 33 has an oblong hole 32, which surrounds shaft 22. This hole changes the disk to an eccentric when the governor is not wide open. Disk 33 carries strap 34, which has tail end 79, which connects with pump-lever 80. Pump-lever 80 has handpiece 87, fulcrumed on pin 88, and carries in the slot 81 pump-plunger 83. Fulcrum 89 of lever 80 is open at its bottom, enabling the raising of the lever away from pin 88 and fulcruming it on tail end 79. Plunger 83 is movable with its end 82 in slot 81 of lever 80. Pump-barrel 84 carries suction check-valve 85 and suction-pipe 106 and discharge check-valve 86 and discharge-pipe 105, which connects through elbow 104 and pipe 102 with pressure-valve 97. Pressure-valve 97 is seated in flange 100 of pipe 102 and is guided with its stem 95 in flange 99, the latter being supported by posts 98 of flange 100. Spring 96 is compressed between valve 97 and flange 99. Valve-chest 19 is surrounded by water-jacket 18, which connects with cylinder-jacket 3. Chamber 58 of valve 16 may be filled with water and brought in connection with cylinder-jacket 3. Duct 17 of valve 16 forms the communication between inlet 57 and combustion-chamber 15 and also between chamber 15 and outlet 56. Chamber 30 of the igniter, which is screwed into valve-chest and communicates with chamber 15, is separated by valve 28 from chamber 49. Tube 29 is screwed

into the igniter and has communication with chamber 49. Valve 28 has valve-stem 50 and is kept seated by spring 51. Piston 6 carries a plate 7, between which and the piston is a non-conductive material 9 to prevent the heat from affecting the piston-pin. The connecting-rod is composed of rod 14, two half-boxes 11 and 13, two half-boxes 40 and 41, and wedge 43, strap 10, bolt 42, and set-up bolts 44. The feature of this rod is that by tightening one end both ends will equalize themselves. Rod 14, half-box 41, and half-box 13 are movable between half-boxes 11 and 40. In drawing up wedge 43 one or both of the two half-boxes 13 or 41 will be shoved outward. If box 41 is too tight, it can move backward and tighten up box 13, and vice versa. If one box is set up too tight, both are too tight, but both boxes are always of the same tightness.

The operation is as follows: As piston 6 moves back and forth in cylinder 2 connecting-rod 14 transmits the motion through crank-pin 39 upon crank-shaft 37, fly-wheel 36, pulley 48, and screw-gears 46 and 45, the latter driving valve-shaft 22, and this governor-hull 31, valve 16, and igniting-cam 24. Valve 16 is continually rotating and forms through duct 17 communication between inlet 57 and chamber 15 of the cylinder and communication between chamber 15 and outlet 56. As Fig. 3 shows, valve 16 is closing communication between 57 and 15, which was completed and shut off during one-quarter of a turn of the valve. This first quarter takes place during the forward moving of the piston or the suction-stroke. During the second quarter-turn of the valve the valve has no communication with anything and is called the "compression-stroke." The third quarter-turn of the valve, during which there is no communication with the cylinder and duct 17, is the exploding quarter, during which the piston is forced forward. The fourth quarter-turn of the valve produces communication between chamber 15 and outlet 56 and is called the "exhaust-stroke." Each stroke of the piston corresponds with the respective quarter-stroke of valve 16, and valve 16 makes one quarter-turn to each full stroke of the piston 6. As the engine runs slotted disk 33 causes pump 84 to discharge fuel through check-valve 86 into pipe 105. The outlet of pipe 102 is closed by pressure-valve 97, through which the oil will escape as soon as the pressure in pipe 102 is more than the pressure produced upon valve 97 by spring 96. As the pump makes a stroke after the pipe has been filled with the necessary pressure the oil will lift valve 97 and squirt and spread over screens 101 at the same moment valve 16 has brought communication through duct 17 between inlet 57 and combustion-chamber 15. This communication is started as soon as the piston starts to move outward, this forming a suction which draws the air over pan 103 through screens 101, thus gasifying the oil and carrying same along through chamber 94, screens 93, opening 57, and duct 17 into combustion-chamber 15 and 8 and cylinder 2. As soon as the piston has reached the limit of its out-stroke valve 16 has finished its quarter-turn and has closed all communications. During the return stroke the gases are compressed, and at the moment when the piston reaches the limit of its inward stroke projection 25 of cam 24 will touch roller 125 and raise the opposite end of lever 27, which causes valve-stem 50 and valve 28 to rise, which permits the entering of gas from chamber 15 through chamber 30 and 49 into tube 29. Tube 29 is kept in incandescent heat by a burner. (Not shown here.) The gases will light as soon as they enter tube 29 and then explode the charge in exploding-chamber 8. As soon as the ignition has taken place projection 25 will relieve roller 152, and thus allowing valve 28 to seat through the pressure of spring 51. At the return stroke of the piston the burned mixture will be expelled through duct 17 of valve 16, which has formed communication between outlet 56 and chamber 15. After this stroke is completed the full cycle is finished, and a new cycle begins again by the stroke of the pump. As the engine reaches its speed for which the governor is set balls 67 will spread outward, thus moving slotted disk 33 over shaft 22 and bringing the center of disk 33 closer to the center of shaft 22, thus diminishing the eccentricity and lessening the stroke of the pump. The diminishing the stroke of the pump will continue as long as the balls spread and until the center of the disk 33 is in line with the center of shaft 22. At this point the pump will be at a total standstill, and the least change in the speed of the engine will cause the balls to move toward each other and will also cause the moving of the pump in a corresponding measure. As balls 67 of the governor converge or diverge disk 33 moves from or toward the center of shaft 22, thus increasing or decreasing the stroke of the pump and consequently the amount of oil discharged through valve 97 into chamber 94, thus increasing or decreasing the strength of explosion in the cylinder. Spring 62, which bears on link 63, produces pressure on balls 67 and has a tendency to bring them together. By moving lever 78 the pressure of spring 62 upon ball 67 can be increased or diminished, and the engine will attain the speed indicated in the figures near the respective notch in which latch 77 will stand, thus facilitating a positive known change of speed without stopping or slacking the engine. The gross regulating of the pump is done by moving pivot 82 in slot 81 of lever 80. The moment of explosion is regulated by swinging lever 26 and fastening pivot 54 in slot 53 of quadrant 107, thus securing earlier or later striking of projection 25 and roller 152, which raises the lighting-valve 28 in corresponding time. In starting the engine the pump is operated by handle 87 and a few strokes of oil are pumped over screens 101.

Then engine is given one half-turn for suction and another half-turn for compression. As soon as the compression is finished lighting-valve 28 is opened by hand-lever 91 and kept open till the gas lights and the engine goes off. Then the lever is let go and everything is automatic. The carbureter 92 has an open bottom, below which is catch-pan 103 to catch any surplus oil which may be pumped into same. This surplus oil will be vaporized and consumed during the next stroke.

It will be seen that the inlet-valve is substantially cylindrical, having all the advantages of a valve of this construction, and in addition thereto its construction, specifically considered, is conical, so that it will better seat itself in the valve-casing, and in this connection it may be pointed out that the means for rotating the valve will keep it seated, tending constantly to thrust the rotary shaft longitudinally and the valve upon its seat.

I claim—

1. In combination in a gas-engine, the cylinder and piston the valve mechanism, the igniter-valve, the cam, the lever between the cam and igniter-valve and the second lever 26 carrying the igniter-lever and adapted to adjust the same to vary the point of contact between the cam and igniter-lever and means for fixing the lever 26 in its adjusted position whereby the adjusting may be effected without stopping the engine, substantially as described.

2. In combination in a gas-engine, the cylinder and piston, the valve mechanism, the igniter-valve the cam for operating the same and the hand-lever between the cam and the valve-stem arranged to operate the same by hand, to open the valve at will, substantially as described.

3. In combination in a gas-engine the cylinder and piston the inlet-valve the carbureter-pipe extending therefrom and opening to the outside air, the fuel-supply pipe leading thereto and the catch-pan below the end of the carbureter-pipe with an intermediate air-space substantially as described.

4. In combination in a gas-engine, the cylinder the piston, the rotary inlet-valve the rotary stem the governor both the said valve and governor being carried directly on the rotary stem, the pump and the connections between the governor and the pump, substantially as described.

5. In combination in a gas-engine, the cylinder and piston the inlet-valve, the pump for supplying fuel thereto the rotary governor-shell, the slotted cam on the shaft thereof, the strap and arm extending therefrom to the pump and the weighted levers pivoted to the governor-shell and connected to the cam whereby the stroke of the pump will be regulated, substantially as described.

6. In combination, the cylinder, the piston, the pump for supplying fuel thereto the cam on the rotary stem of the inlet-valve, the arm 79, the piston-rod 83 and the slotted lever 80 between the arm and rod said lever being fulcrumed at 88 whereby the stroke of the pump can be adjusted manually, substantially as described.

7. In combination a gas-engine, the cylinder and piston the inlet-valve, the fuel-pump the cam and connections for operating the pump comprising the piston-rod, the reciprocating bar 79 and the hand-lever 80 pivoted to the bar 79 and to the piston-rod, said lever being detachably connected with its fulcrum 88 whereby the lever may be operated by hand independently of the reciprocating bar 79.

8. In combination in a gas-engine, the cylinder, the piston, the valve mechanism, the pump for supplying fuel to the valve mechanism, the governor with means for placing the governor-spring under tension and means for setting the governor for different speeds positively and indicating the speed comprising the notched quadrant, the lever having the pawl engaging the same and held in place by the spring and the connections between the lever and spring, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES QUAST.

Witnesses:

FRED. E. GUTHERY,

H. J. JURY.