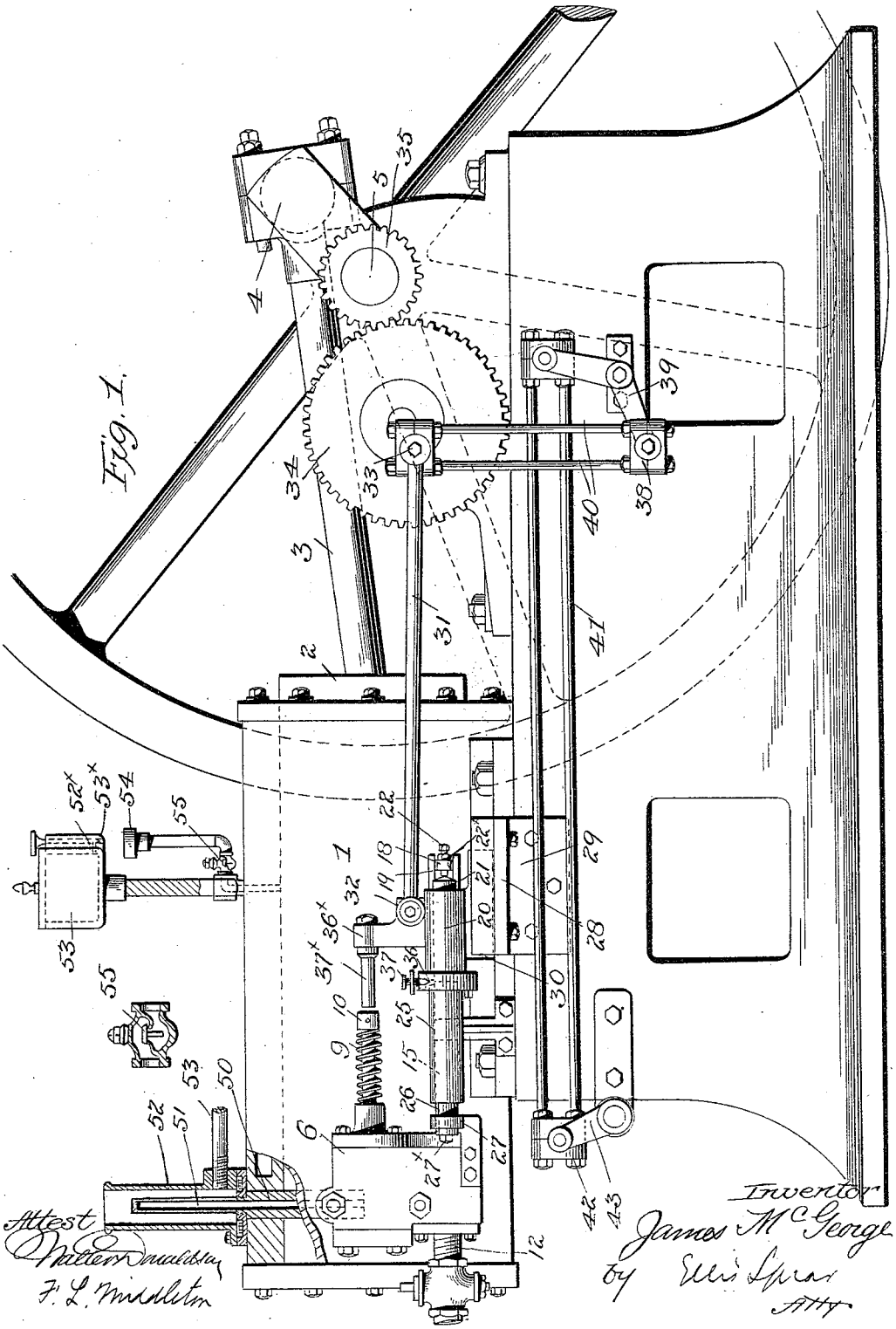
(No Model.) 4 Sheets—Sheet 1.

J. McGEORGE.

GAS ENGINE.

No. 525,857. Patented Sept. 11, 1894.

Fig. 1.



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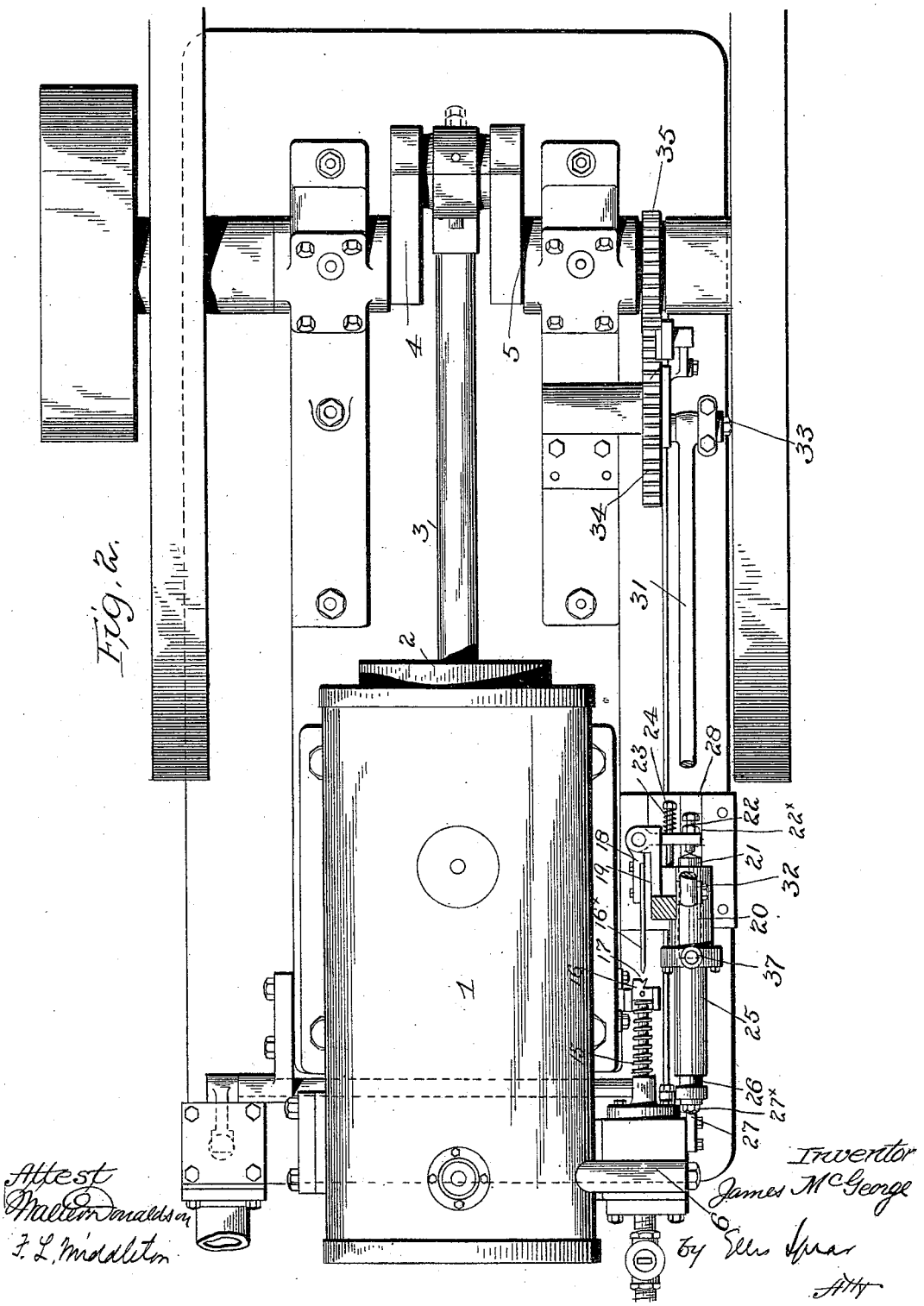
GAS ENGINE.

No. 525,857. Patented Sept. 11, 1894.



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GAS ENGINE.

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Fig. 3.

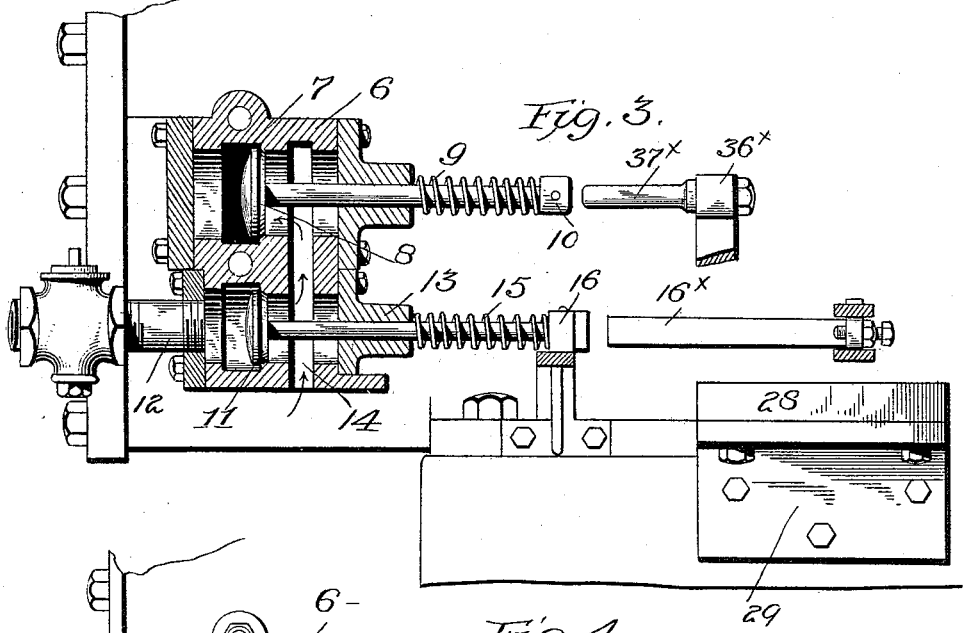


Fig. 4.

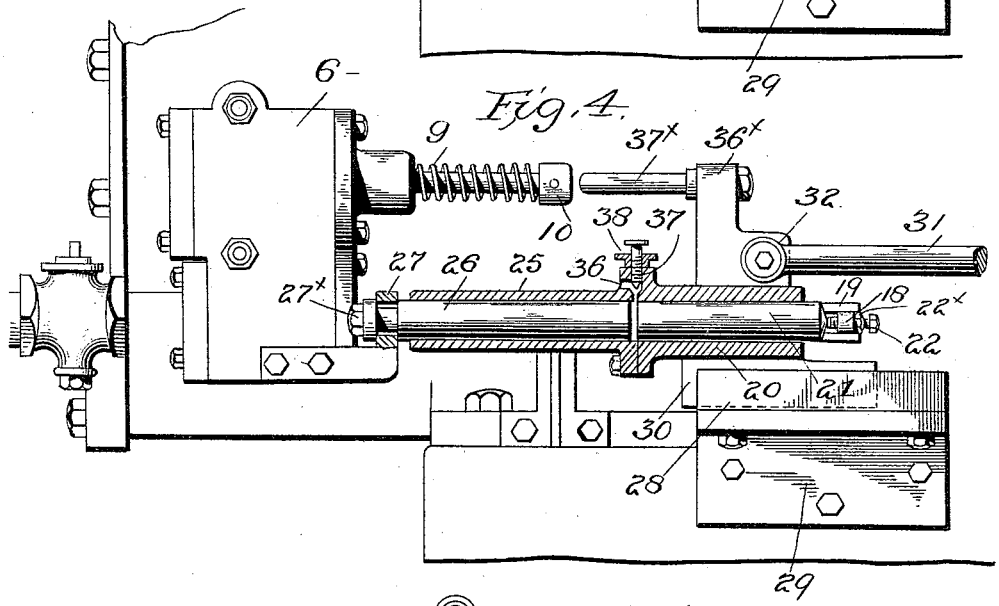
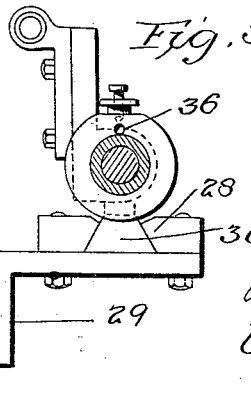


Fig. 5.



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(No Model.) 4 Sheets—Sheet 4.

J. McGEORGE.

GAS ENGINE.

No. 525,857. Patented Sept. 11, 1894.

Fig. 6.

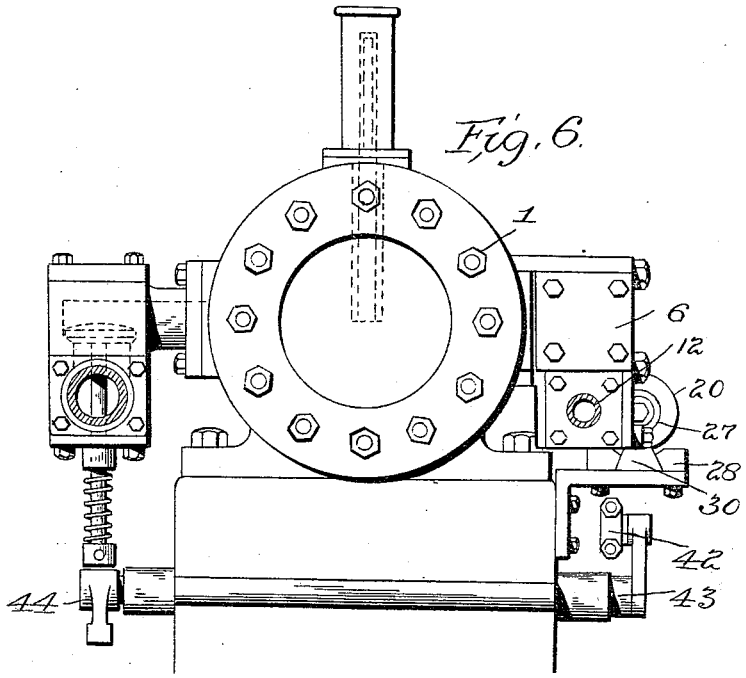
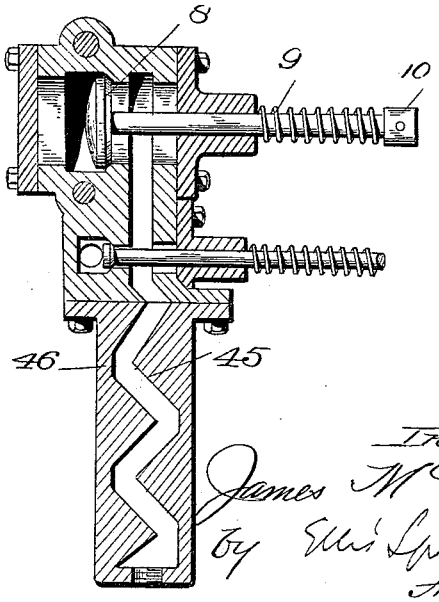


Fig. 7.



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by Ellis Spear
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UNITED STATES PATENT OFFICE.

JAMES McGEORGE, OF CLEVELAND, OHIO.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 525,857, dated September 11, 1894.

Application filed October 23, 1893. Serial No. 488,900. (No model.)

To all whom it may concern:

Be it known that I, JAMES McGEORGE, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

It is the object of my invention to provide a gas engine free from complication of parts and especially in respect to the valve mechanism and the governor and in providing a governor it is my object to render the action of the same positive and certain and of such a sensitive nature as to secure easy and even running of the engine.

My improved governor is pneumatic in character and includes a movable index finger adapted to operate the gas valve regularly when the engine is running evenly and the finger is in normal position, an index piston to operate the index finger and throw it out of line with the stem of the gas valve when the engine exceeds its required speed in order thus to miss an explosion and a governor cylinder and piston operating at each reciprocation to press upon the air between the index piston and governor piston in order to operate the index piston when said pressure exceeds a predetermined degree due to increased speed of the engine and consequently of the governor cylinder. It includes also an adjustable valve controlling an open air port leading from the space between the two pistons by which the escape of air may be regulated to control the speed of the engine.

I aim especially to provide a sensitive arrangement of the index piston so that it will move under the slightest increased pressure in the governor cylinder and with this object in view I arrange the index piston in the same axial line with the governor cylinder and with the direction of reciprocation of said cylinder and the parts moving it so that the inertia of the index piston will render it more sensitive to increased pressure in the governor cylinder, said piston of course tending constantly to lag behind in the reciprocation of the parts. This axial arrangement of the index piston and cylinder also simplifies the arrangement and permits me to employ an index finger or arm in the form of a bell crank lever and thus multiply the movement of the index piston to effect a larger movement at the point of contact with the valve stem. I have also improved the mechanism for operating the exhaust valve and for lubricating the engine.

In the accompanying drawings: Figure 1, is a side elevation of the engine with minor parts in section. Fig. 2, is a plan view. Fig. 3, is a detail sectional view of the valve box and parts of the governor mechanism. Fig. 4, is a detail side view of the governor box and parts of the governor in section. Fig. 5, shows the slide way for the governor with a part of the governor in place. Fig. 6, is an end view of the cylinder showing the connection to the exhaust valve. Fig. 7, shows a valve box adapted for use with gasoline instead of gas and this figure also shows a serpentine air passage leading up to the gasoline inlet in order to more thoroughly vaporize the liquid fuel.

The cylinder 1 may be jacketed as usual and be of any approved construction. The piston 2, its rod 3, and crank 4, of the shaft 5 may be of any ordinary construction. The valve box 6, is secured to the side of the cylinder over the inlet port 7, for the explosive mixture. The inlet valve 8, controlling the supply from the valve box to this inlet port is held normally closed by a spring 9, on its stem pressing on a collar 10 thereon. The gas valve 11, with its stem is arranged in the same vertical plane with the inlet valve, below the same and parallel thereto to move in the same direction in opening and closing. The gas supply pipe 12, enters the box in front of the valve, on the opposite side from the bearing or collar 13, through which the valve stem passes and this arrangement prevents leakage of the gas along the valve stem and the gas pressure aids in keeping the valve on its seat. The air passage is shown at 14, and the direction of flow of the air and gas is indicated by the arrows in Fig. 3.

The gas valve is held normally closed by a spring 15, about its stem pressing on a collar or block 16 on the end of the stem. When the engine is running evenly at the required speed this gas valve is operated at the be-

ginning of each cycle by an index finger 16× engaging a notch 17 in the block of the gas valve stem, and then the inlet valve is also opened, as hereinafter described and air and gas being drawn into the cylinder the explosion takes place.

When the speed increases above that for which the engine is set the index finger is thrown aside out of line with the block on the valve stem and thus the gas valve is not opened and an explosion will be missed.

The index finger forms the long arm of a bell crank lever 18 pivoted to a bracket 19, extending from a reciprocating cylinder 20 which I have termed the index cylinder. This cylinder carries the index piston 21 adapted to act on an adjustable pin 22 in the short arm of the bell crank lever and when this piston is forced from the index cylinder the bell crank will be turned on its pivot and the index finger thrown out of line with block of the valve stem. The piston is kept normally within the cylinder and reciprocates with it by a spring 23 surrounding an adjustable screw rod 24 and engaging the bell crank lever by which the amount of tension upon the index finger and piston may be varied. The index cylinder is combined with a governor cylinder 25 forming an axial extension thereof and communicating therewith. A governor piston 26 works in this cylinder 25, said piston being fixed to a bracket 27 extending from the valve box.

The governor cylinder and index cylinder may be formed in one piece or separately as shown and bolted together. They reciprocate lengthwise of the main cylinder of the engine, guide ways 28 being provided in a bracket 29 bolted to the engine frame to receive the slide 30 carrying the index cylinder. The two cylinders are reciprocated by a pitman 31, connected to the bracket of the index cylinder at 32 and to the crank pin 33 of the large gear 34, which receives its movement from the crank shaft through the small gear 35. The escape of air from the space within the governor cylinder and between the governor and index pistons takes place through the port 36 Fig. 4, and this is controlled by a conical valve 37 which may be fixed in any position by the lock nut 38, to get any desired speed of the engine.

The governor cylinder works back and forth on the fixed governor piston and when the engine is running at the predetermined speed the air in the governor cylinder is pressed out by the governor piston through the air port mentioned without affecting the relative position of the index piston as the latter is held to withstand a certain air pressure by the spring 23, acting on the bell crank lever of the index finger. When however the speed of the engine increases and the cylinders reciprocate more rapidly and the governor piston increases the air pressure between it and the end of the index piston the latter will be forced out in relation to its cylinder and the bell crank lever will be turned to throw the long index arm or finger thereof out of line with the notched block on the gas valve stem and said gas valve for this cycle will not be opened and an explosion will thus be missed. The governor piston has a reduced neck passing through the bracket 27 of the valve box and held by a nut 27×.

The opening in the bracket is slightly larger than the reduced neck so that the piston may adjust itself laterally to align accurately with its cylinder while being held rigidly against endwise movement.

The reciprocating slide 30 not only carries the index and governor cylinders and the bell crank and index finger to give them constant reciprocating movement but through its reciprocation the inlet valve may be positively operated and for this purpose the bracket of the index cylinder has an upward extension 36× having a pin 37×, Fig. 4, to strike the stem of the inlet valve and this pin is so set to hold the inlet valve open after the gas valve has closed in order that the entire charge of gas will be drawn into the cylinder and none wasted.

The spring pressure on the bell crank and index piston may be varied by adjusting the screw 24, and the bell crank may be accurately adjusted to cause its finger to align with the valve stem block by the screw 22, mentioned above which may be locked in any position by a lock nut 22×.

It will be noticed that all the reciprocating parts with the gas and inlet valve stems are arranged lengthwise of the engine and operate in lines parallel with the reciprocating engine piston. It will also be noticed that the index piston and cylinder are arranged tandem with their axis in line with the axis of the governor cylinder and piston. This not only provides a simple and compact arrangement of parts, but it provides for action of the air pressure directly on the end of the index piston and avoids the use of any intermediate air passage. More important than these results however is the increased sensitiveness of the governor afforded by this tandem arrangement and axial alignment of the governor and index pistons and cylinders and their arrangement to reciprocate lengthwise of the engine as the inertia of the index piston renders it more sensitive to the air pressure as by this inertia the index piston tends to lag behind in the movement of the parts toward the valve box. By the use of the bell crank lever the movement of the index piston may be multiplied at the point of contact between the index finger and the gas valve stem, and it is only necessary that the index piston be moved slightly in its cylinder in order to throw the index arm out of line with the valve stem.

I have provided mechanism for operating the exhaust valve from the same large gear which reciprocates the governor pitman and as shown in Fig. 1, this mechanism consists

of a journal block on the wrist pin connected with a similar block 38 on one end of the bell crank 39, by the rods 40, said bell crank being pivoted to the frame of the engine and having at its end another block connected by rods 41, extending lengthwise of the engine to a block 42, on the lever 43, carried by a rock shaft extending transversely of the end of the engine and having an arm 44, arranged to strike and lift the stem of the exhaust valve at the proper times. This connection avoids the use of separate gearing for the exhaust valve and is simple, effective and inexpensive.

In order that the engine may be used with gasoline only slight change is necessary, the valve box shown in Fig. 7, being substituted for that above described. This valve box is similar to the former one excepting it has a smaller valve seat and valve for the liquid fuel and its air passage instead of opening direct to the outside air connects with a serpentine or zig zag air passage 45 formed in a box 46 bolted to the valve box.

The liquid fuel enters in front of the gasoline valve on the side opposite from the valve stem and box and leakage is thus prevented here as in the former case. The gasoline admitted through the valve meets the air current passing up through the zig zag passage. The liquid falls upon the first slope and the greater part of it is there taken up and vaporized. The remainder falls upon the next slope and further vaporization takes place here and so on the liquid falling from slope to slope and being exposed to the air current until it is all vaporized, the zig zag air passage being long enough for this purpose.

The ignition tube may be of any approved construction. In Fig. 1, it comprises a section 50 depending to about the middle of the cylinder, and a section 51 extending up into the chimney 52. A burner tube 53 is provided to heat the tube to incandescence. I have also provided an improved form of oil cup especially adapted to a gas engine for oiling the interior of the cylinder and the piston, and in providing this oil cup I aim to prevent the blowing out of the oil and the burning of the same by the explosions.

The oil cup 53 as represented in Fig. 1, is supported upon a standard in the upper side of the cylinder. It has, however, no direct communication with the cylinder, but by way of a lateral inlet hole $52^{\times}$, near the bottom, through a valve seat to a discharge orifice. A valve $53^{\times}$ on a rod in the side regulates or closes the discharge of oil. The oil discharged falls into the upper funnel shaped end of a pipe 54 which, by an elbow is connected with an oil passage opening into the cylinder from the lower end of the standard. The standard is attached midway in the length of the piston, when in the middle of its stroke. The piston is a little longer than the stroke, so that no oil is dropped uselessly outside of the piston ends. The valve $53^{\times}$, operated by hand, regulates the flow of oil into the pipe 54, but its further flow is at once prevented by a check valve 55, in the passage to the interior of the cylinder. When however, oil to the depth of two or three inches has accumulated in the passage, the check valve is moved thereby and the oil is permitted to flow to the cylinder until the weight of the column so reduced, is insufficient to hold up the said valve; when it falls and further flow or blowing out of the oil is prevented. This blowing out of the oil has heretofore been prevented by locating the lubricating passage near the free end of the cylinder, but in this arrangement much of the oil is wasted, and the rear end of the piston where the packing rings are located is not oiled at all.

I claim as my invention—

1. In combination, in a gas engine, the cylinder and piston, the gas valve and the governor for said gas valve comprising a governor cylinder and piston, an index cylinder and piston, the air escape port, said index piston being connected with an index finger arranged when in normal position to operate the gas valve, said governor being arranged to reciprocate parallel to the line of reciprocation of the engine piston and the connections for reciprocating the said governor, substantially as described.

2. In combination in a gas engine, the cylinder and piston, the gas valve and the governor therefor comprising a governor cylinder and an index cylinder, with the pistons therein arranged tandem with their axial lines coincident, the index finger to be thrown into and out of line with the gas valve stem by the operation of the index piston, the open air port, from the governor cylinder and the means for reciprocating the governor, substantially as described.

3. In combination, the main cylinder and piston, the gas valve and the governor for controlling the same comprising a governor piston fixed against reciprocation, the governor cylinder and index cylinder connected together and mounted upon a slide to reciprocate the governor cylinder over the governor piston, the index finger in connection with the index piston arranged to operate the gas valve when in normal position and the means for reciprocating the governor and index cylinders, substantially as described.

4. In combination, the main cylinder and piston, the gas valve and the governor comprising the governor cylinder and index cylinder arranged tandem with their axes coincident and parallel with the axial line of the main cylinder, the governor and index pistons and the index finger in connection with the index piston and the means for reciprocating the governor alongside the main cylinder, substantially as described.

5. In combination, the main cylinder and piston, the gas valve, the governor therefor comprising the tandem cylinders with their pistons arranged end to end, the index finger

arranged in connection with one of the pistons to be operated thereby, the air port extending from the space between the two pistons, and the means for reciprocating the governor, substantially as described.

6. In combination the main cylinder and piston, the gas valve and the governor comprising the governor cylinder and index cylinder, the pistons therein, and the index finger arranged to be operated by one of the pistons, said finger comprising a bell crank lever, one end of which is adapted to be thrown into and out of line with the gas valve stem, substantially as described.

7. In combination, the main cylinder and piston, the gas valve with its stem and the governor comprising the tandem cylinders with their pistons the slide carrying the said cylinders, the means for reciprocating the slide parallel with the movement of the gas valve and the index finger comprising a bell crank lever carried by the slide and adapted to be thrown into and out of line with the gas valve, substantially as described.

8. In combination, the main cylinder, and piston, the gas valve, the governor therefor comprising the reciprocating slide carrying the two cylinders, the pistons working in said cylinders, the index comprising the bell crank, the adjustable screw carried thereby bearing on the index piston, and the spring for applying tension to the bell crank with means for adjusting the same, substantially as described.

9. In combination, the main cylinder and piston, the gas valve, the inlet valve, the governor comprising the governor cylinder, the index cylinder, the pistons therefor, the slide carrying the cylinders, the index finger carried by the slide and the pin for operating the inlet valve also carried by the slide, substantially as described.

10. In combination in a gas engine, the cylinder, the piston, the reciprocating governor operating parallel with the movement of the piston, the exhaust valve, the gas inlet valve controlled by the governor, the crank shaft extending transversely of the cylinder and connected with the exhaust valve, the large gear 34, the gear 35 on the crank shaft for driving it, the bell crank 39, the eccentrically arranged pin 33 on the gear 34, the pitman connecting said pin with the reciprocating governor, the connection from said pin to the bell crank lever and the connection from the bell crank lever to the transverse shaft, substantially as described.

11. In combination, in a gas engine the cylinder and piston, the gas inlet valve, the reciprocating governor, the gearing 34 and 35, said gear 35 having an eccentric crank pin 33, the exhaust valve, the pitman connecting said crank pin with the governor and the indirect connection from said crank pin to the exhaust valve, substantially as described.

12. In combination in a gas engine, the cylinder and piston, the gas inlet valve with the fuel supply conduit leading thereto, and the zigzag air passage depending from the said valve and fuel conduit and connecting with the air at its lower end whereby the liquid fuel will fall from incline to incline down the zigzag passage and be vaporized by the ascending current of air.

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

JAMES McGEORGE.

Witnesses:
E. D. STARK,
A. W. SHIRRING.