(No Model.)

3 Sheets—Sheet 1.

T. M. DOYLE.

GAS OR GASOLENE ENGINE.

No. 602,556. Patented Apr. 19, 1898.

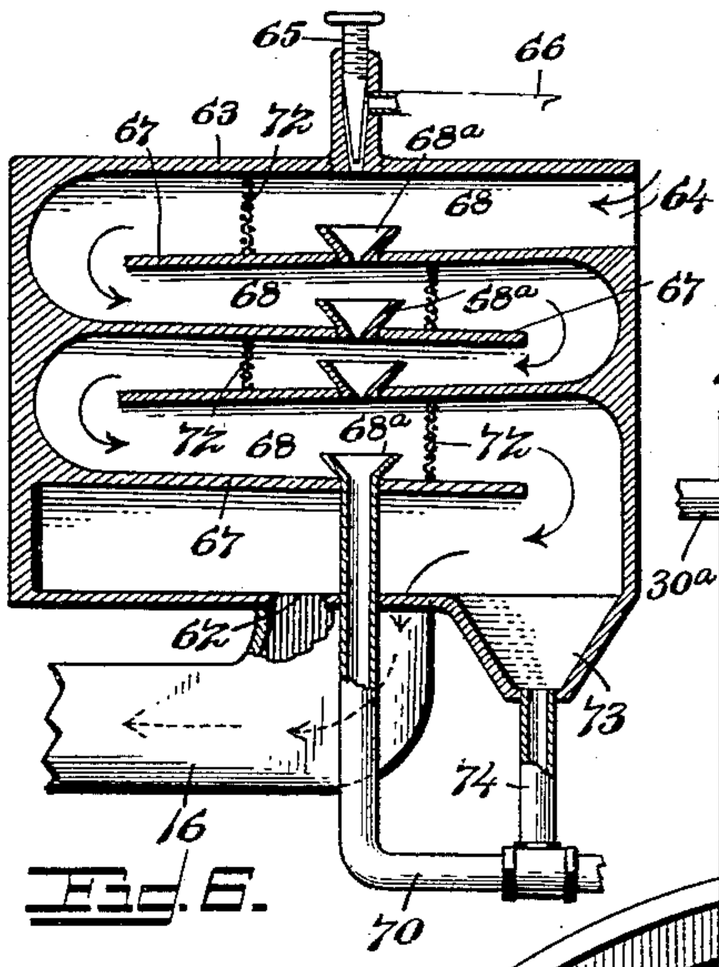
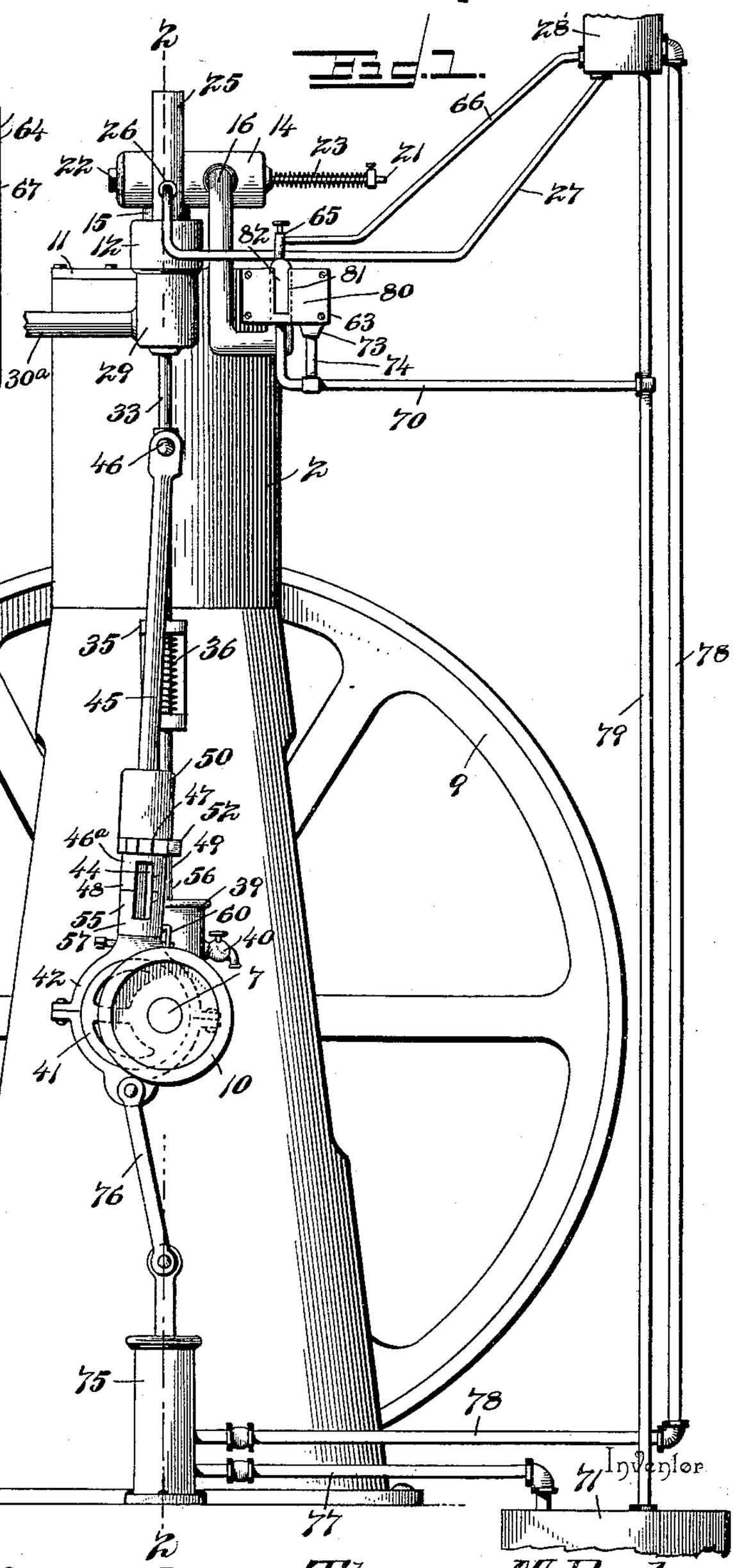


Fig. 6.



Witnesses

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(No Model.)

3 Sheets—Sheet 2.

T. M. DOYLE.

GAS OR GASOLENE ENGINE.

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Fig. 2.

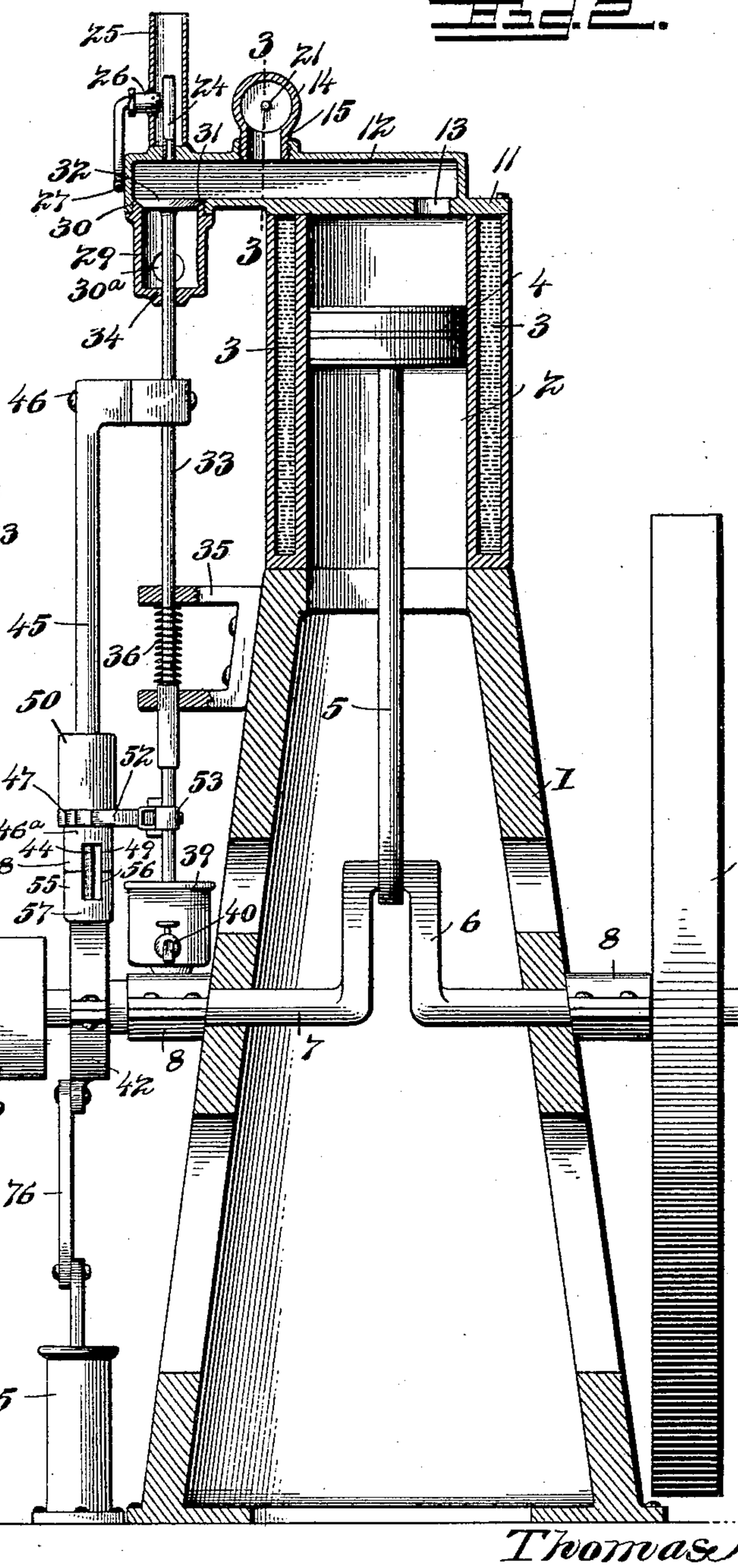
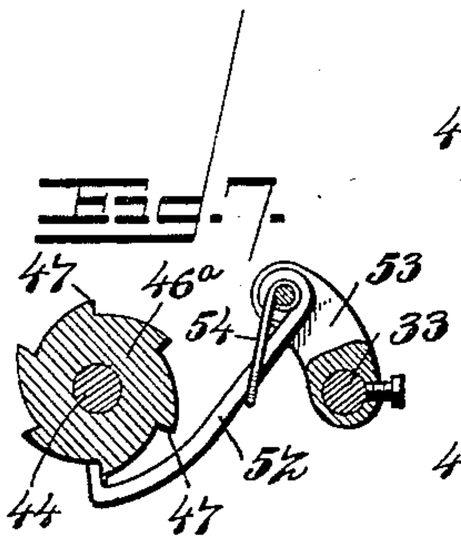


Fig. 7.



Witnesses

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(No Model.) 3 Sheets—Sheet 3.

T. M. DOYLE.

GAS OR GASOLENE ENGINE.

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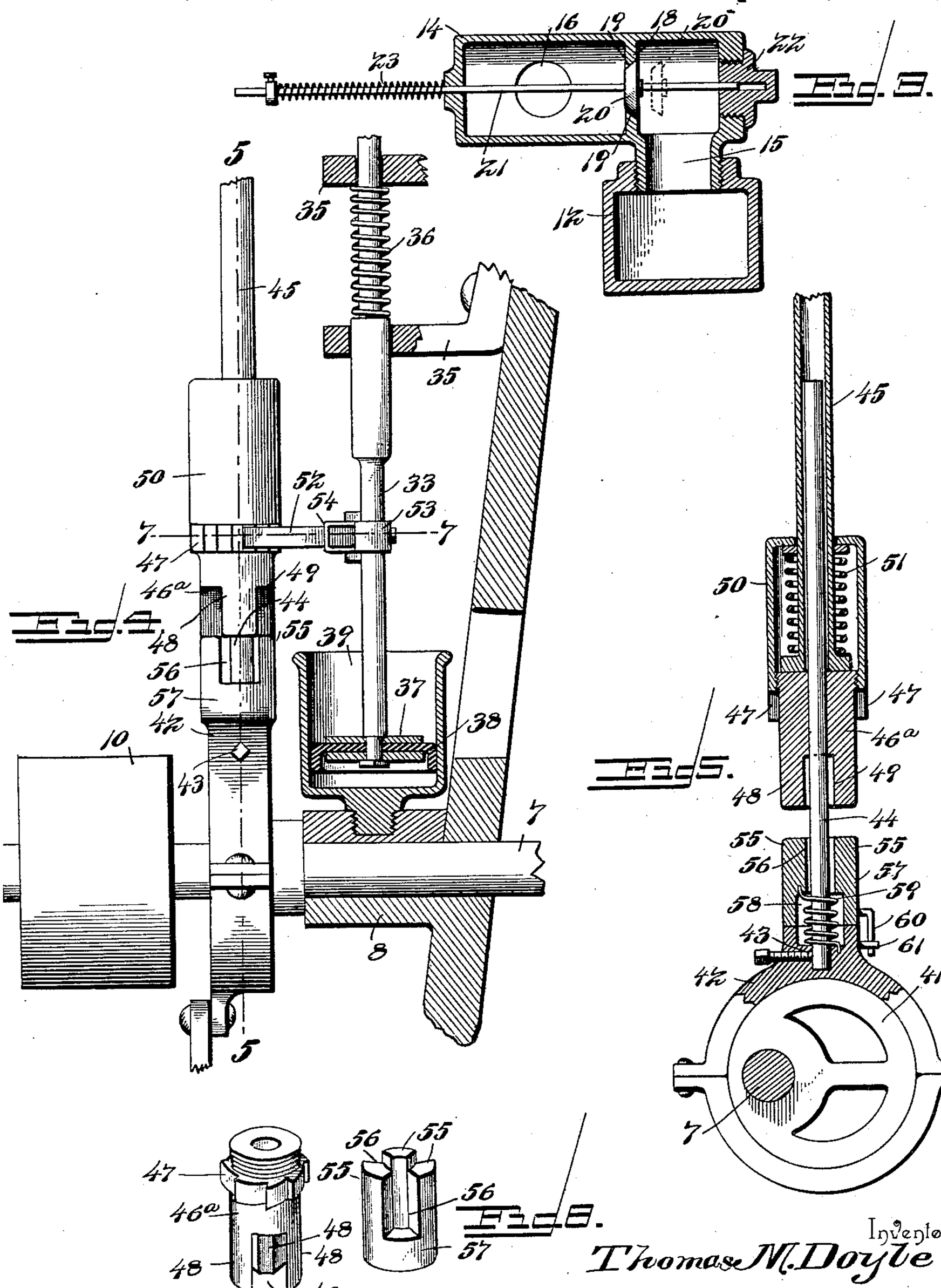

Fig. 3.

Fig. 5.

Fig. 8.

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UNITED STATES PATENT OFFICE.

THOMAS M. DOYLE, OF FORT MADISON, IOWA, ASSIGNOR OF ONE-HALF TO MAURICE WAHRER, OF SAME PLACE.

GAS OR GASOLENE ENGINE.

SPECIFICATION forming part of Letters Patent No. 602,556, dated April 19, 1898.

Application filed June 8, 1897. Serial No. 639,876. (No model.)

To all whom it may concern:

Be it known that I, THOMAS M. DOYLE, a citizen of the United States, residing at Fort Madison, in the county of Lee and State of Iowa, have invented a new and useful Gas or Gasolene Engine, of which the following is a specification.

This invention relates to gas or gasolene engines; and it has for its object to provide certain new and useful improvements in engines of that character which are operated by the impulse of carbureted air or explosive gases derived from the vapor of gasolene or other liquid hydrocarbon.

To this end the invention primarily contemplates the equipment of the engine with improved means for controlling the speed of the engine and also for operating the exhaust-valve at certain intervals without the use of gears, cams, rock-arms, or similar devices which are commonly employed in operating the exhaust-valves of gasolene-engines.

With these and other objects in view, which will readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the drawings, Figure 1 is a side elevation of a gas-engine embodying the improvements contemplated by this invention. Fig. 2 is a vertical longitudinal sectional view of the engine on the line 2 2 of Fig. 1. Fig. 3 is a detail sectional view on the line 3 3 of Fig. 2. Fig. 4 is an enlarged detail elevation, partly in section, of the exhaust-valve-operating mechanism and speed-controlling device. Fig. 5 is a detail sectional view on line 5 5 of Fig. 4. Fig. 6 is an enlarged detail sectional view of the carbureter. Fig. 7 is a detail sectional view on the line 7 7 of Fig. 4. Fig. 8 is a detail perspective view of the two tappet-collars of the exhaust-valve mechanism.

Referring to the accompanying drawings, the numeral 1 designates the engine base or stand supporting the cylinder 2, which is of the usual form employed in gas-engines, and is provided with the ordinary water-jacket 3, through which water is circulated to prevent overheating the cylinder, and said cylinder is open at one end and accommodates for movement therein the piston 4, connected with the inner end of the piston-rod 5, the outer end of which piston-rod connects with the intermediate crank 6 of the crank drive-shaft 7. The crank drive-shaft 7 is journaled in suitable bearings 8 on the base or stand 1 and carries at one end the usual fly-wheel 9 and at its other end the belt wheel or pulley 10, which receives the belt for transmitting motion to any machinery designed to be operated by the engine.

While in the drawings the engine cylinder and stand is illustrated as being arranged in a vertical position, it is to be understood that the improvements hereinafter described are equally as well adapted for use in connection with an engine of the horizontal type.

The engine-cylinder 2 is closed at one end by the usual cylinder cap or head 11, having an offset gas-chamber 12 and a gas-port 13, providing communication between the said gas-chamber and the closed end of the cylinder. The said offset gas-chamber 12 at the closed end of the cylinder is designed to receive the explosive charge of gas from the gas-supply-valve chamber 14, provided at one end with a delivery-neck 15, fitted into an opening formed in one side of the gas-chamber, and said valve-chamber 14 has connected therewith near one end one end of a suction supply-pipe 16, which conducts the carbureted air or explosive gas from the carbureter, to be hereinafter described, into the supply-valve chamber. The supply-valve chamber 14 is provided at a point intermediate its ends between the inlet and outlet for gas with a valve-seat partition 18, having therein a valve-seat 19, within which works a supply-valve 20, fitted on a valve-stem 21, arranged longitudinally in the chamber 14 and supported at one end in the guide plug or cap 22, fitted in one end of said chamber. At the end opposite the guide plug or cap 22 the valve-stem 21 is extended through the valve-chamber 14 and has fitted on the exterior projecting portion thereof a controlling-spring 23, the tension of which spring serves to normally close the valve 20 on its seat.

To provide for exploding the explosive gas mixture delivered from the chamber 14 into

the gas-chamber 12 of the cylinder, the said gas-chamber has fitted thereto at a convenient point, preferably near one end, the open end of an igniting-tube 24, incased within a casing-tube 25, supported on the offset chamber 12 over the tube 24. The casing-tube 25 receives in an opening in one side thereof a hydrocarbon-burner 26, the flame from which is directed against the tube 24, so as to maintain the same sufficiently hot to provide for the explosion of the gas when compressed therein by the movement of the piston toward the closed end of the cylinder, and the said burner-tube 26 receives its supply of hydrocarbon through a supply-pipe 27, extending to a gasolene-supply tank 28, conveniently supported in a plane above the engine to provide for the gravity feed of the liquid fuel to the point of use.

The products of the explosion are discharged from the gas-chamber 12 through the exhaust-valve casing 29, preferably threaded at its inner end, as at 30, in one side of the gas-chamber 12. The exhaust-valve casing 29 has an exhaust-pipe connection 30ª therewith to conduct the products of explosion to any desired point of exhaust, and at its inner end the said casing 29 is formed with a valve-seat 31, beveled to register with the corresponding edge of an exhaust-valve 32, working within the gas-chamber 12 over said seat. The said exhaust-valve 32 is fitted to the inner or upper end of a sliding exhaust-valve stem 33, working through a guide-opening 34 in the outer closed end of the valve-casing 29 and also through a guide-bracket 35, secured at one side of the engine base or stand and having arranged therein a valve-controlling spring 36, coiled on the stem 33 and engaging therewith in such a manner as to provide for tending to normally close the exhaust-valve on its seat 31. At the end opposite the exhaust-valve 32 the stem 33 has fitted thereto a controlling-plunger 37, having a flexible packing-disk 38, snugly working within a dash-pot or air-cup 39, open at one side and conveniently screwed or supported on one of the bearings 8 of the drive-shaft. The said dash-pot or air-cup 39 has fitted to one side thereof at its closed end an air-cock 40, which may be regulated to regulate the resistance offered to the movement of the plunger 37, thereby providing simple and efficient means for controlling the speed of the engine. In this connection it will be observed that when the valve in the air-cup 40 is wide open the engine will run at its fastest speed, as the plunger is then permitted to freely reciprocate within the dash-pot or cup, thereby permitting the exhaust-valve to seat itself very quickly; but as the valve in the air-cock is closed more and more the speed of the engine proportionately decreases, as the greater the resistance to the free movement of the plunger in the dash-pot the more slowly the exhaust-valve seats itself and the engine cannot take a new charge of explosive mixture and compress the same until the exhaust-valve is seated. The dash-pot and the plunger therein therefore act in the capacity of a manually operated or adjusted governor for the speed of the engine.

The exhaust-valve stem 33 is reciprocated at intervals through the medium of an eccentric 41, mounted on the drive-shaft 7 at one side of the engine base or stand and having the usual eccentric-strap 42. The eccentric-strap 42 has fitted thereto, preferably by means of a detachable connection, as at 43, one end of an eccentric-rod 44, arranged within a pitman-tube 45, having a pivotal connection at one end, as at 46, to the valve-stem 33 to provide for transmitting motion from the eccentric to said valve-stem. The pitman-tube or tubular pitman 45 bears at its end opposite the connection with the valve-stem against one side of a rotatable tappet-collar 46ª, loosely mounted on the eccentric-rod 44 and provided with an annular series of ratchet-teeth 47 and an annular series of alternate fingers and notches 48 and 49, respectively. At the end opposite the series of alternating fingers and notches 48 and 49 the rotatable tappet-collar 46ª has detachably threaded thereon one end of a cage 50, housing therein a pressure-spring 51, coiled on the pitman 45 and bearing against one end of the cage 50 to provide for holding the collar 46ª with sufficient friction to prevent too great a freedom of movement thereof, and especially to prevent the same from moving when the pawl 52 is taking a new grip on the ratchet-teeth 47. The pawl 52 is pivotally mounted on a supporting-arm 53, attached to the valve-stem 33 below the bracket 35, and is normally held into engagement with the annular series of ratchet-teeth 47 by means of a spring 54.

The alternate fingers and notches 48 of the collar 46ª are arranged in opposition to the duplicate alternating fingers and notches 55 and 56, respectively, of the fixed tappet-collar 57, carried by the eccentric-strap. The tappet-collar 57 is fixed relatively to the rotatable collar 46ª, but is loosely mounted on the rod 44 and has an interior spring recess or socket 58, in which is arranged a spring 59, connected with the collar 57 and serving to normally hold the stop-arm 60, projected from one side thereof, against the stop-pin 61, fitted to an adjacent portion of the eccentric-strap.

In the operation of the engine the alternating fingers and notches of the adjacent tappet-collars are so arranged that the fingers 55 of the tappet-collar 57, carried by the eccentric, will move against the contiguous ends of the fingers 48 of the tappet-collar 46ª at every second revolution of the drive-shaft, thereby causing an opening and closing of the exhaust-valve, while during the time or period the drive-shaft or fly-wheel is making two revolutions the collar 46ª is being constantly turned by the action of the pawl 52, whereby the fingers 55 of the tappet 57 will pass into the notches 49 of the rotatable tappet, and vice versa. During this action the full move-

ment of the tappet-collar 57 is accommodated without causing a longitudinal movement of the tappet 46ª and a consequent movement of the valve-stem. Whenever the rotatable tappet-collar is moved in a longitudinal direction, the valve-stem is moved, so that the pawl maintains its proper working position at all times, and it will be observed at this point that as the pitman connection carrying the rotatable tappet-collar vibrates backward and forward this movement is the equivalent of a reciprocatory movement of the pawl, thereby causing a constant rotation of the rotatable tappet-collar and a proper shifting of the positions of the tappet-fingers and notches 48 and 49 with relation to the opposing fingers and notches 55 and 56.

In connection with the operation of the opposing tappets 46ª and 57 it is to be observed that in the event of the drive-shaft being turned in the wrong direction the two tappets would interlock and the tappet-collar 57 tend to turn with the collar 46ª, which action would break the pawl if it were not for the particular way in which the tappet-collar 57 is mounted, it being observed that under the conditions stated the collar 57 will turn against the tension of the spring 59, but will immediately resume its normal fixed position when the collar 56 is released therefrom and the drive-shaft turned in the proper direction.

The suction supply-pipe 16 of the engine leads from its point of connection with the supply-valve chamber 14 to the delivery-port 62, formed centrally in the lower side of the carbureter-box 63, supported in a convenient position at one side of the engine-cylinder. The carbureter-box 63 is provided in one side at the upper end thereof with an air-inlet opening 64, which admits air directly from the atmosphere into the box, and at its central upper side the said box has fitted thereto the casing of a needle-valve 65, with which is connected a gasolene or hydrocarbon supply pipe 66, leading to the tank 28 and providing means for delivering a regulated supply or stream of gasolene into the carbureter-box. The said carbureter-box is provided with a series of downwardly-inclined partition-plates 67, arranged one above the other and extending alternately from opposite sides of the box to provide therein a circuitous or zig-zag passage 68 for the air. Each of the said partition-plates 67 has fitted centrally therein a drip-funnel 68ª, arranged in vertical alinement with each other, and the needle-valve 65 to provide for receiving the stream of gasolene which drips across the passages between the plates, so that the air is compelled to pass therethrough in its passage to the pipe 16, and the lowermost of said funnels is fitted to the upper end of a main drain-pipe 70, extended through the bottom of the carbureter and leading to a main gasolene or hydrocarbon reservoir 71, arranged in any convenient positon. Mixing-screens 72 are arranged in the passages between the plates 67 at one side of the vertical plane of the funnels 69, and said screens serve to insure a thorough mixing of the hydrocarbon vapor with the air, so that the air will be highly charged with the explosive gas when it reaches the pipe 16 and passes into the supply-valve chamber of the engine. Below the lower end of the lowermost partition-plate 67 the carbureter-box 63 is formed with a drain-trap 73, serving to connect the drain of oil from the partition-plates and discharging the same through a branch drain-pipe 74 into the main drain-pipe 70. It will be understood that in the operation of the engine the piston on its downstroke draws the air through the carbureter and the explosive mixture into the gas-chamber 12, while the upstroke of the piston serves to compress the explosive charge and cause an ignition thereof, so that an exhausting of the products of explosion is only necessary on the second upstroke of the piston.

The carbureter box or casing 63 is provided with a removable side plate 80, having a vertically-disposed slide-opening 81 therein, within which opening is fitted a slide 82, which may be raised up or pulled out of the opening 81 should it be desired to inspect or repair the interior of the carbureter.

The carbureter has been described and illustrated in connection with the means for supplying fuel to the engine; but it is understood that the said carbureter forms no part of the present application and is not claimed herein.

To provide for maintaining the supply of oil in the elevated tank 28, a pump 75 is employed, which pump has an operating connection 76 with the eccentric-strap 42 and has pipe connections 77 and 78, respectively, with the reservoir 71 and the tank 28, while the latter is also provided with an overflow-pipe connection 79 with the said reservoir 71.

Changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a gas-engine, the combination with the engine-cylinder, the exhaust-valve seat and the drive-shaft carrying an eccentric, of a longitudinally-movable valve-stem carrying the exhaust-valve working on said seat, a telescopic pitman connection between the valve-stem and the eccentric, a pair of tappet-collars mounted on one of the pitman-sections, one of which collars is rotatable and bears against the other section of the pitman connection, and both of said collars having registering parts adapted to alternately engage, and a pawl-and-ratchet device rendered active by the swing or vibration of the said pitman connection and connected with the rotatable tappet-collar, substantially as set forth.

2. In a gas-engine, the combination with

the cylinder, the exhaust-valve seat, and a drive-shaft carrying an eccentric, of the reciprocatory valve-stem carrying the exhaust-valve, a telescopic pitman connection between the valve-stem and the eccentric, a pair of tappet-collars mounted on one of the sections of the pitman connection and provided at their adjacent sides with a plurality of alternating fingers or notches, one of said tappet-collars having a loose rotary movement and the other of said collars having a limited circular movement, and means for automatically rotating the rotatable collar, substantially as set forth.

3. In a gas-engine, the combination with the cylinder, the exhaust-valve seat, and the drive-shaft carrying an eccentric, of a longitudinally-movable valve-stem carrying an exhaust-valve working on said seat, a tubular pitman pivotally connected at one end with a valve-stem, an eccentric-rod sliding in said pitman and connected at one end with the eccentric-strap, a pair of tappet-collars mounted on said eccentric-rod and provided at their adjacent sides with an annular series of alternate fingers and notches, one of said collars being capable of a limited circular movement and having a spring connection with the eccentric-strap, and the other of said collars being rotatable and bearing against one end of the tubular pitman and provided with an annular series of ratchet-teeth, a suitably-arranged spring for holding the rotatable collar tightly against the tubular pitman, and a spring-actuated pawl pivotally mounted on the valve-stem and engaging with the ratchet-teeth of the rotatable collar, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

THOMAS M. DOYLE.

Witnesses:
BARNEY J. WILKEN,
JOSEPH M. NAUER.