

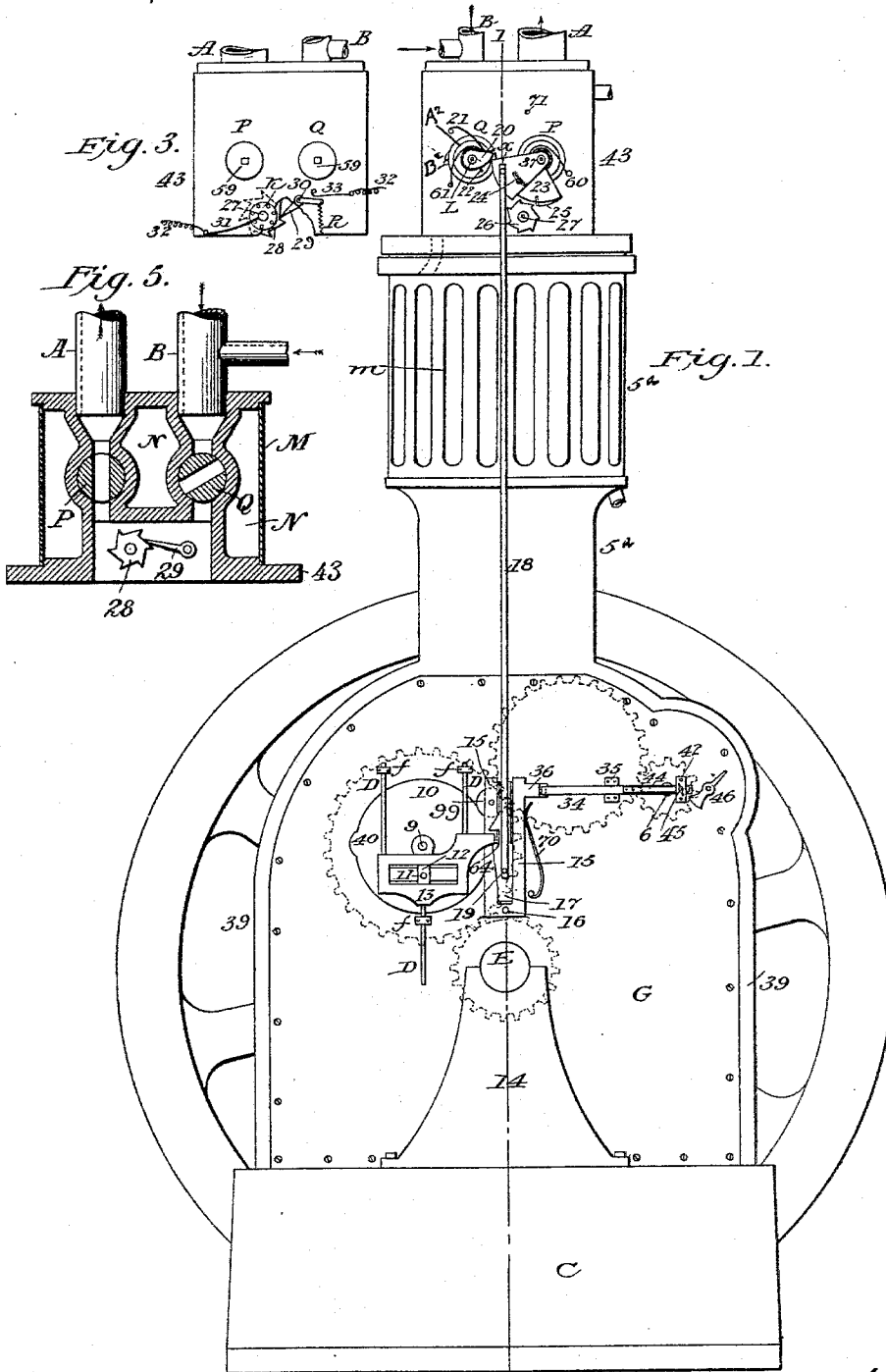
(No Model.)

2 Sheets—Sheet 1.

P. B. & S. D. McLELLAND.
GAS OR VAPOR ENGINE.

No. 584,188.

Patented June 8, 1897.



Witnesses.
John C. Kessler
F. P. King

Inventors
Percy B. McLelland
Stephen B. McLelland

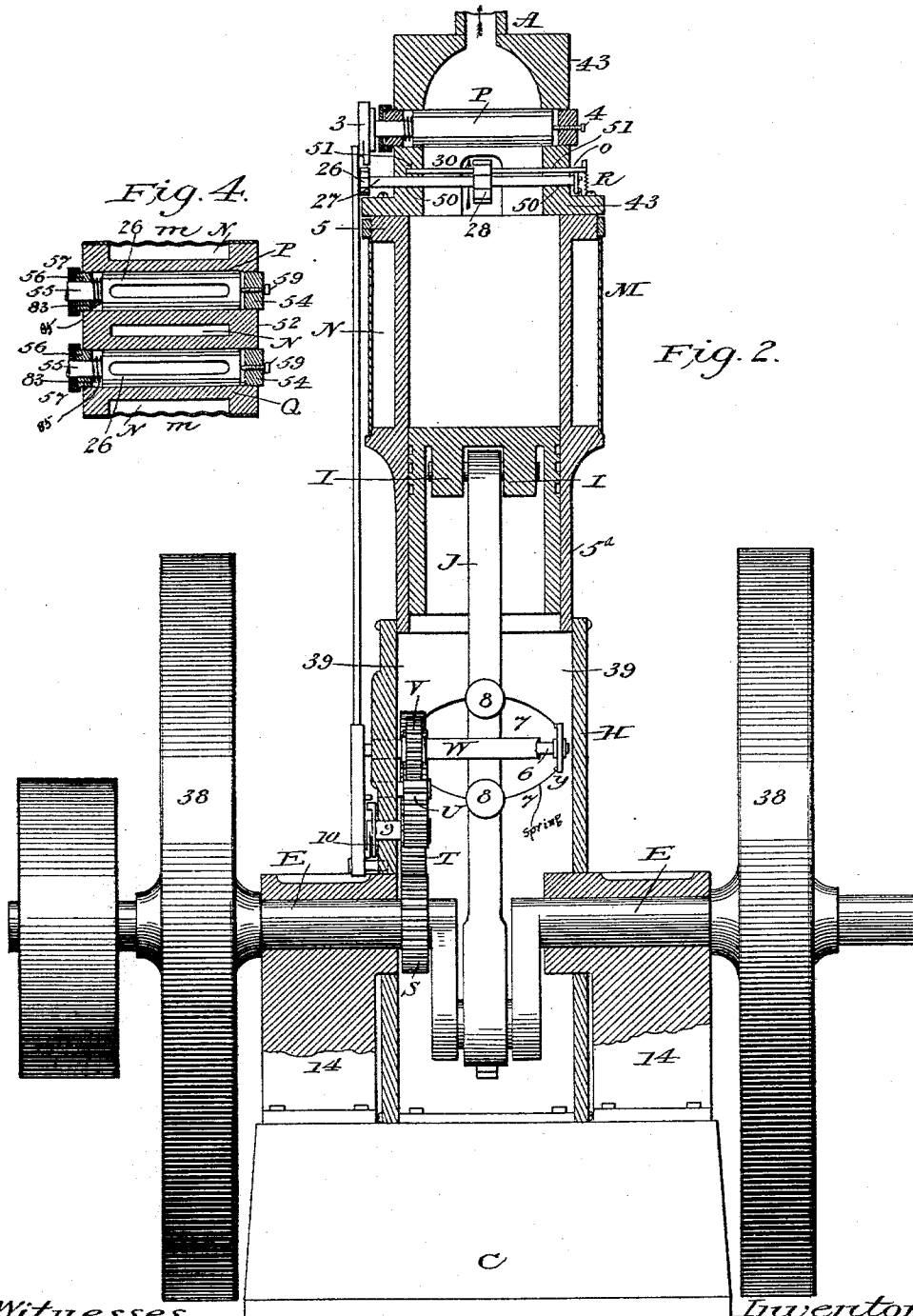
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UNITED STATES PATENT OFFICE.

PRESLEY B. MCLELLAND AND STEPHEN D. MCLELLAND, OF CHICAGO,
ILLINOIS.

GAS OR VAPOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 584,188, dated June 8, 1897.

Application filed December 20, 1895. Serial No. 572,816. (No model.)

To all whom it may concern:

Be it known that we, PRESLEY B. MCLELLAND and STEPHEN D. MCLELLAND, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Gas or Vapor Engine, of which the following is a specification.

Our invention relates to improvements in gas or vapor engines in which the explosion of gas or vapor forms the motive power.

The objects of our improvements are, first, to provide straightway valves arranged so as to be quick-acting and give a free circulation of gas or vapor to and from the cylinder of the engine; second, to provide a device for operating the valves which is easily controlled by the governor of the engine; third, to provide an adjustable device by which to obtain a positive electrical spark by which the gas or vapor is ignited in the cylinder of the engine; fourth, to provide an elastic water-jacket that surrounds the cylinder and sides of valves of gas or vapor engines for the purpose of preventing damage to the engine by freezing; fifth, to provide a device to facilitate the starting of gas or vapor engines. We attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical elevation of the engine. Fig. 2 is a vertical section of part of the engine on the line 1 2, Fig. 1. Fig. 3 represents the opposite side of the upper part of Fig. 1, having a part of the outer wall removed to show the electrical igniting device within. Fig. 4 represents a top view of the upper part of the engine as it appears after removing the part above line 3 4, Fig. 2. Fig. 5 represents Fig. 3 with the front wall removed, showing the position of the valves and openings and the space that connects with the space in the cylinder in which the electrical igniter is placed.

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

We construct our engine either horizontal or perpendicular, but prefer the perpendicular position, as shown in the accompanying drawings, in which C, Figs. 1 and 2, represents the base of the engine, to which are attached the boxes 14 14, in which the driving-

shaft E E revolves, carrying the fly-wheels 38 38.

5^a 5^a is the cylinder of the engine, supported on the legs 39 39, which are securely fastened to the base C.

G and H are plates fastened to opposite sides of the legs and also to the base, forming a part of the support of the cylinder, as shown in Figs. 1 and 2.

43 is the valve-box, securely fastened on the top of the cylinder, forming the cylinder-head.

P and Q are straightway valves similar to each other in construction, having elongated holes through them, as shown in Fig. 4. Through the box of the valves forming the cylinder-head are openings which connect with the holes in the valve-plugs. The opening through valve Q, Figs. 2 and 5, is connected with pipe B, through which we obtain gas and atmospheric air which is exploded in the cylinder. The opening through valve P connects with the exhaust-pipe A, through which the gas or vapor is discharged after being exploded in the cylinder. We construct our straightway valves as shown in Fig. 4, and they can be used single or in pairs, as desired. P and Q represent the plugs forming the valves.

The box of the valves is bored at right angles to the cylinder to form tapering holes, having fitted in them the tapering plugs P and Q. The plugs do not reach entirely through the box, leaving space for the screw-plugs 54 54, which are threaded to correspond with threads in the box, into which they are screwed, as shown. Through the centers of the screw-plugs 54 54 we insert the set-screws 59 59, the inner ends resting against the ends of the valve-plugs. The opposite or larger ends of the valve-plugs we construct as shown. The valve-plugs are not of the same size all the way through the box, but one end is turned smaller, forming the stem 55 55. Into this end of the opening in the box we screw the plugs 56 56. Through the centers of these plugs are holes through which the stems of the valve-plugs pass. On the ends of the plugs 56 56 we screw the caps 57 57, which fit around the stem, leaving a space between the ends of screw-plugs 56 and caps 57, which forms a

stuffing-box that is packed, forming an air-tight bearing in which the stem of the valve-plugs turn.

In the space between the screw-plugs 56 56 and the shoulder of the valve-plugs formed by reducing the size of the valve-plugs to form the stem we place the spiral springs 85 85 around the stem, the tension of which is to force the plugs of the valves against the set-screws 59 59. By the use of the set-screws the valve-plugs can be set to work tight or loose, as desired. By this form of construction the valves are made air-tight at both ends, and by constructing the valves with a long and narrow opening through them, as shown, we obtain a large opening that can be opened or closed by the least possible motion of the valve-plugs.

To the stem of the valves P and Q we attach the springs 60 and 61, which are coiled around the stem, the opposite ends fastened to the valve-box, as shown in Fig. 1, the tension being used to facilitate the opening and closing of the valves, as hereinafter described.

The object of constructing our valve P as shown in Figs. 2, 4, and 5 is to obtain a straightway passage direct from the cylinder of the engine, through the valve-box 43 and valve-plug at right angles to the axes of the valve-plug, into the exhaust-pipe A. When the valve-plug P is turned so as to close the passage through it and after the explosion and expansion of the gases in the cylinder by the tension of spring 60, the valve-plug is turned nearly instantaneously opening the full size of the passage through the valve for the discharge of the burned gases in the cylinder, causing nearly an instantaneous freeing of the pressure in the cylinder, allowing the piston to make its upward or return stroke free and unobstructed by any back pressure caused by the escaping gases having to pass through or around any curves or elbows.

By the tension of spring 85 the valve-plug P is held in its seat while the cylinder is taking a charge of gas and air through supply-pipe B and valve Q, preventing the suction of burned gases back into the cylinder. The tension of the spring 85 is sufficient to hold the valve-plug P to its seat during the compression of the gas and air compound in the cylinder, but by the tapering shape of the valve-plug of valve P when the gas and air compound is exploded in the cylinder the increased pressure against the side of the valve-plug caused by the explosion is sufficient to force the valve-plug longitudinally against the spring 85, compressing the spring and giving to the valve-plug a longitudinal motion, loosening the valve-plug in its seat, allowing it to be thoroughly lubricated, preventing undue wear, and allowing the spring 60 to easily turn the valve-plug when disengaged from action of the engine to allow the burned gases to escape from the cylinder. The spring 85 forces the valve-plug back to its seat after the explosion. It will be seen

that the valve-plug of valve P is double-acting, having a longitudinal as well as a rotary motion, the longitudinal motion being caused by the pressure of the explosion against the side of the tapering valve-plug, forcing it longitudinally against and compressing spring 85, and a reverse longitudinal motion being caused by the tension of spring 85, forcing the valve-plug back to its seat after the force of the explosion is spent, a rotary motion being caused by action of the engine and a reverse rotary motion caused by the tension of spring 60 after the valve-plug is disengaged from the control of the engine.

We construct valve Q similar to valve P, with a straightway passage from the gas and air pipe B through the valve-box 43 and valve-plug into the cylinder. The passage-way is kept open by the use of arms 20 and 37 in their operation, and as the piston makes its down or outward stroke it draws a full charge of gas and atmospheric air into the cylinder, filling the cylinder to its utmost capacity, giving the engine all the supply of working force possible, which is not the case in a high-speed gas or vapor engine where there are angles, elbows, or valves in the passage-way, forming an obstruction to the free passage of gas and air to the cylinder, and in the operation of the engine as the piston reaches near its full down or outward stroke arm 20 slips past arm 37, and by the tension of spring 61 the valve Q is closed nearly instantaneously, allowing the gas and air compound to be compressed in the cylinder.

M M is a thin metallic casing surrounding the cylinder 5^a and two sides of the valve-box 43, made elastic by being corrugated and rigidly attached to the cylinder and valve-box.

N N, Figs. 2 and 4, represent a space between the cylinder and casing surrounding the cylinder and sides of the valve-box to be supplied with circulating water for the purpose of keeping the cylinder and valves cool.

I I, Fig. 2, represent the piston-head; J, the piston-rod; E, the driving-shaft.

Near the inner side of plate G we fasten the cog-wheel S on the driving-shaft. Cog-wheel S is geared into cog-wheel T, which is attached to shaft 9, which turns in the plate G, which forms a box for the same. On the opposite end of shaft 9 and on the outer side of plate G we attach the disk 10. Cog-wheel T is geared into cog-wheel U, which revolves on a pin projecting from the inner side of plate G. Cog-wheel U is geared into cog-wheel V, which revolves on the shaft W, one end of which passes through plate G, to which it is rigidly attached. Shaft W is bored its entire length, forming a sleeve, in which the rod 6 is loosely fitted, and revolves at the same speed as the cog-wheel V, to which it is attached by means of the disk Y, which is attached to rod 6 and connected to cog-wheel V by means of the springs 77, having weights 8 8 attached to them near their centers, as shown, and as the speed of the engine is in-

creased or diminished the rod 6 is drawn back or forced forward, which forms the revolving part of the governor.

To the disk 10, Fig. 1, is attached the pin 11 in such a position as to form a crank on the shaft 9. The pin 11 passes through the block 12, in which it turns. The block 12 is secured in the cross-head 13 by means of ways, on which it is free to move forward or back. By the revolving of shaft 9 the cross-head is reciprocated, being guided by the rods D D D, attached to it and sliding through the boxes F F F, which are fastened to plate G.

15 is a bar hinged at its lower end to plate G by means of the pin 16, on which it oscillates. The face of the bar 15 is channeled nearly its entire length in such a manner as to form ways, which retain the block 17, which is free to slide upward and downward. In the side of block 17 is the notch 64, which is designed to connect with the projection of cross-head 13, as shown.

18 is a rod, the lower end being attached to block 17 by means of the pin 19, forming a hinge.

On the edge of disk 10 is the projection 40, and as it revolves the projection strikes against the friction-wheel 99, which is placed in the end of bar 15, which forces the bar over against the spring 70, sliding the projection 36 of the bar under the end of the lever 34, to which it connects by means of corresponding notches in the projection 36 and the end of the lever 34.

The lever 34 is hinged to plate G near its center, which forms the fulcrum 35. The opposite end of the lever passes over the end of rod 6 of the governor and under the bridge 42, which is fastened to plate G. On the face of the lever is fastened the spring 44, one end of which passes under the bridge, the tension being governed by the set-screw 45 in the bridge.

The opposite end of rod 18 is hinged to the arm 37 by means of the pin α , as shown in Fig. 1.

The pin 71 projects from the side of the valve-box, forming a stop for the arm 37 on its upward movement.

The arm 37 is fastened to the stem of valve-plug P, which forms a crank by which the plug is turned.

On the corresponding end of the stem of valve-plug Q we hinge the arm 20 by means of the pin L, which projects from the end of the stem of the valve-plug on which it oscillates, being held between the spring 21, which is attached to the side of the valve-box, and the pin 22, which projects from the side of disk A², which is rigidly fastened to the valve-stem. Disk A² has a projection on its edge which comes in contact with pin B², which projects from the side of the valve-box, forming a stop to the revolving of the valve-plug.

On the inner side of arm 37 is hinged the plate 23 and held in position by the set-screw 24, by which it can be adjusted. In the lower

edge of plate 23 is fastened the spring-latch 25, which comes in contact with ratchet-wheel 26, which is rigidly fastened on one end of shaft 27, which is held in position by the boxes 50 50 in the valve-box, in which it is free to revolve, (shown in Fig. 2,) and when in operation ratchet-wheel 26 is turned one tooth at a time.

On the shaft 27, near its center, is fastened the electrical igniting ratchet-wheel 28. The ratchet-wheel is formed of a disk with teeth cut in its outer edge, the front of the teeth being cut back under the points, as shown in Fig. 3, forming sharp-pointed terminals. 30 is a shaft running parallel to shaft 27, retained in place by boxes 51 51, attached to the valve-box, in which it is free to oscillate. On this shaft, opposite ratchet-wheel 28, is fastened terminal point 29, (shown in Fig. 3,) which is designed to slide from one tooth to another of the ratchet-wheel when the wheel is revolved, breaking the electrical current, causing an electrical spark, which ignites the gas or vapor in the cylinder through an opening connecting therewith. On the end of shaft 30 is attached the crank O, which by means of the spring R holds the point 29 against the ratchet-wheel 28. On the corresponding end of shaft 27 is fastened the disk K, having pins projecting from its side placed so as to correspond in position and number with the teeth of ratchet-wheel 28.

By means of the spring 31, one end being attached to the valve-box and the opposite end resting on one of the pins of disk K, the ratchet-wheel 28 is held in its proper place when not in use. When in motion, the end of spring 31 does not slide from one pin to the next of disk K until after the terminal, point 29 has passed from one tooth to the next of ratchet-wheel 28. Thereby the electrical current is not broken by the action of spring 31. 32 32 are electric wires. One is attached to the spring 31 and the other to spring 33, and when the crank O is raised against the spring 33 by the revolving motion of ratchet-wheel 28 the electrical circuit is closed, and when the terminal point 29 slides from one tooth to the next of ratchet-wheel 28 the electrical current is broken.

By the use of the ratchet-wheel 28 we obtain sharp-pointed terminals, and as the sharp-pointed terminal 29 slides from one tooth to the next of the ratchet-wheel the electrical current is broken nearly instantaneously, and with a given amount of electrical current we obtain a much longer and hotter igniting-spark than when round terminals are used, and we obtain nearly the same result whether the engine is running at a high or low speed. The shaft 30 and springs 33 and R are insulated. The electrical current is not closed when the ratchet-wheel is at rest, but as the ratchet-wheel is revolved in an opposite direction from the pitch of the ratchet-teeth and the terminal point 29 slides toward the point of a ratchet-tooth the crank O is raised against

spring 33, closing the electrical current through spring 33, crank O, shaft 30, terminal point 29, ratchet-wheel 28, shaft 27, disk K, and spring 31, and as the terminal point 5 leaves the point of the tooth of the ratchet-wheel the electrical current is broken between the terminal points, causing the igniting-spark. As the terminal point 29 drops between the teeth of the ratchet-wheel, crank O 10 leaves spring 33, thereby disconnecting the electrical current, by which arrangement the electrical supply is not wasted. As the contacts between the spring 33 and crank O, between terminal point 29 and the teeth of 15 ratchet-wheel 28, and between spring 31 and the pins of disk K are all sliding contacts, they always wear bright, forming a good conductor of electricity.

Our engine is so geared that the piston 20 makes two strokes while the rod 18 is making one.

To better describe the working of our engine, (see Figs. 1 and 3,) the rod 18 and bar 15 are in line with each other and held in position between disk 10 and spring 70, the valve P being closed and held in that position by rod 18. As the disk 10 is revolved the projection 40 of disk 10 comes in contact with friction-wheel 99, which forces bar 15 over, 30 throwing bar 15 out of line with rod 18, thereby disconnecting block 17 and cross-head 13, allowing valve P to be thrown open by spring 60, carrying rod 18 and block 17 to their upper limit. Then as the cross-head 13 reaches 35 its upper limit it connects with block 17, which has regained its position in line with rod 18 and bar 15, and as cross-head 13 recedes it draws rod 18 down, and as the lower corner of arm 37 catches over the end of arm 20 both 40 arms are drawn down, closing valve P and opening valve Q. The disk 10 is attached to shaft 9 in such a position that as the valve P closes the piston starts down, and as valve Q is then open the cylinder takes its charge of 45 gas and atmospheric air, and as the piston-head reaches near the end of its down or outward stroke the arm 20 slips past the end of arm 37 and valve Q is closed nearly instantaneously by spring 61. Then as the piston 50 makes its return stroke the compound of gas and air is compressed by the piston-head in the upper end of the cylinder, and as the piston passes the limit of its upward stroke the latch 25 comes in contact with ratchet-wheel 55 26, which revolves shaft 27 and ratchet-wheel 28, causing the terminal point 29 to slide from one of the terminal teeth of ratchet-wheel 28, causing an electrical spark which ignites and explodes the gas and air compound in the cylinder, driving the piston down, and as it 60 reaches near its lowest limit the projection 40 of disk 10 comes in contact with friction-wheel 99, which forces bar 15 over, releasing block 17 from cross-head 13, which allows 65 spring 60 to open valve P nearly instantaneously, drawing rod 18 and arm 37 to their upper limit and arm 37 past arm 20.

The engine repeats its operation until the limit of speed required is reached, when as the bar 15 is forced over by projection 40 and its projection 36 passes under the end of lever 70 34 the end of rod 6 of the governor presses on the underside of the lever, suppressing spring 44, causing the opposite end of lever 34 to connect with bar 15 by means of corresponding 75 notches in the end of projection 36 and the end of lever 34, and is held in that position, allowing the cross-head 13 to reciprocate without affecting the valves. As the speed of the engine decreases the rod 6 of the governor is withdrawn, and as the projection 40 80 of disk 10 comes in contact with friction-wheel 99 bar 15 is forced over sufficiently to allow the notches in the end of lever 34 and projection 36 to be disconnected by spring 44, 85 allowing bar 15 to resume its former position in line with rod 18. It will be seen that the bar 15 and block 17 oscillate between cross-head 13 and lever 34, automatically connecting first to one and then the other, as is required, to keep the engine to a uniform speed. 90

We are aware that prior to our invention gas or vapor engines have been constructed with cylinders, pistons, driving-shafts, fly-wheels, and valves driven by the explosion 95 of gas and atmospheric air and ignited by electricity. We therefore do not claim such a construction broadly; but

What we do claim as our invention, and desire to secure by Letters Patent, is— 100

1. The combination in a gas or vapor engine of the disk 10, rigidly attached to shaft 9, which is driven by action of the engine, disk 10, having pin 11, projecting from its side in such a position as to form a crank on shaft 9, cross-head 13 being attached to pin 11, by means 105 of block 12, by which the cross-head is reciprocated, being held in position and sliding on rods or ways, bar 15 hinged to plate G, block 17 held in bar 15 by means of ways on which it is free to slide. block 17 having a notch 64 in its side by which it may connect with cross-head 13, rod 18 hinged to block 17 at its lower end the opposite end being hinged to arm 37 110 of the valve of the engine by which said valve is operated, as described for the purpose specified. 115

2. The combination in a gas or vapor engine of the bar 15 hinged to plate G on pin 16, operated by projection 40 of disk 10 and spring 120 70, disk 10 being attached to shaft 9 which is rotated by action of the engine, block 17 retained in bar 15 by means of ways in which it is free to slide being reciprocated by cross-head 13 attached to disk 10 which is revolved 125 by action of the engine, rod 18, hinged at one end to block 17, and at the opposite end to plate 37 which forms the crank of valve P, substantially as described for the purpose specified. 130

3. The combination in a gas or vapor engine of the disk 10 rigidly attached to shaft 9, which is driven by action of the engine, disk 10 having projection 40 on its edge which comes in 135

contact with friction-wheel 99, which is connected to bar 15 and urged against disk 10 by means of a spring-bar 15 being hinged to plate G by pin 16, block 17 retained in bar 15 by means of ways on which it is free to slide, rod 18 being hinged to block 17, at its lower end, the opposite end hinged to arm 37 which is attached to the valve of the engine by which said valve is operated, lever 34 hinged to plate G, forming its fulcrum, one end of lever 34 having notches which correspond to notches in projection 36 by which it may connect to bar 15 the opposite end of lever 34 resting on the end of rod 6 of the governor by which it is controlled, substantially as described, all for the purpose specified.

4. The combination in a gas or vapor engine of the bar 15 hinged to the frame of the engine, block 17 which slides in bar 15, rod 18 hinged to block 17 and connected with a valve of the engine which it operates, a body driven by the engine that automatically connects and disconnects with block 17 by action of the engine causing block 17 and rod 18 to reciprocate when connected with said body, a piece that automatically connects and disconnects with bar 15 by action of the governor and a spring, bar 15 and block 17 being oscillated by action of the engine causing said body to connect or disconnect with block 17, or said piece to connect or disconnect with bar 15, connecting and disconnecting first with said body and then with said piece, and controlled by the action of a governor to keep the engine to a uniform speed substantially as described.

5. The combination in a gas or vapor engine of the valve-box 43 rigidly attached to the cylinder the valve-box being bored at right angles to the cylinder and having fitted in it the valve-plug of valve Q having a straight-way opening from the cylinder through the valve-plug and valve-box at right angles to the axes of the valve-plug, disk A² rigidly attached to the valve-stem, arm 20 loosely fitted on the valve-stem on which it can turn and in connection with pin 22 which projects from the side of disk A² forming the crank by which the valve-plug is turned by action of the engine opening the passage through the valve-box and valve-plug into the cylinder allowing gas and atmospheric air to be drawn into the cylinder, the valve-plug being supplied with a spring which causes the valve to close when disengaged from the action of the engine substantially as described.

6. The combination in a gas or vapor engine of the valve-box 43 rigidly attached to the cylinder the valve-box being bored at right angles to the cylinder and having fitted in it the valve-plug of valve P having a straight-way opening from the cylinder through the valve-plug and valve-box at right angles to the axes of the valve-plug the arm 37 rigidly attached to the valve-stem forming a crank, the rod 18 hinged to the outer end of arm 37

by which the valve-plug is turned by action of the engine closing the passage from the cylinder, the valve-plug being supplied with a spring which turns the valve-plug opening the passage from the cylinder when released from the action of the engine substantially as described for the purpose specified.

7. The combination in a gas or vapor engine of the valve P the arm 37 rod 18 hinged to arm 37 which is reciprocated by action of the engine, plate 23 hinged to arm 37 and held in position by set-screw 24, spring-latch 25 connected to plate 23, ratchet-wheel 26, rigidly attached to shaft 27, ratchet-wheel 26 being revolved in one direction one tooth at a time by action of the engine driving-shaft 27 which reaches into a space in the valve-box or cylinder by which the electric igniting mechanism is operated substantially as described.

8. The combination in a gas or vapor engine of an electrical igniter consisting of rod 18 reciprocated by action of the engine the upper end hinged to arm 37 plate 23 attached to arm 37 designed to move with said arm spring-latch 25 attached to plate 23 in position to form contact with ratchet-wheel 26 which is rigidly attached to shaft 27 which reaches into a space in the valve-box 43 said space connecting with the space in the cylinder having a ratchet-wheel 28 consisting of a disk with ratchet-teeth cut in its outer edge the front of the teeth cut back under the points and rigidly attached to the shaft in said space, a second shaft reaching into the same space being designed to oscillate and provided with an igniting-point projecting from said shaft adapted to make contact with said ratchet-wheel, a spring urging the point against the ratchet-wheel, one shaft being insulated, means driven by the engine causing the ratchet-wheel to revolve in an opposite direction from the pitch of the ratchet-teeth, the point sliding from one tooth of the ratchet-wheel to the next, the point separating from the ratchet-wheel as it passes from one tooth to the next of the ratchet-wheel, a source of electricity having one terminal connected to one shaft and the other to the opposite shaft, substantially as described.

9. The combination in a gas or vapor engine of the disk K rigidly attached to the igniter-shaft 27, disk K having pins projecting from its side, spring 31, one end resting on a pin of the disk so that its tension is exerted to hold shaft 27 in position when released from control of the engine ratchet-wheel 28 formed of a disk with the ratchet-teeth cut in its outer edge, the front of the teeth being cut back under the points forming an electrode rigidly attached to the igniter-shaft 27, which reaches through the valve-box 43, ratchet-wheel 28 attached to shaft 27, in a space inside the valve-box, said space connecting with the space in the cylinder, ratchet-wheel 26 rigidly attached to shaft 27 intermittently

rotated in an opposite direction from the pitch
of the ratchet-teeth by action of the engine,
point 29, forming a second electrode rigidly
attached to shaft 30 in position to form con-
5 tact with ratchet-wheel 28 and operated by
the teeth of ratchet-wheel 28 and spring R,
spring R spring 33 and shaft 30 being insu-
lated, having a source of electricity, one ter-

minal connected to the insulated shaft and
the other to shaft 27 substantially as set forth. 10

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