A. L. HARBISON. GAS ENGINE.



2 Sheets-Sheet 1.

(No Model.)

2 Sheets-Sheet 2

No. 595,625.

GAS ENGINE.

A. L. HARBISON.



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Hig.12

Witnesses Hig.2 Samuel S. Mehard Edward a Laurice

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UNITED STATES PATENT OFFICE.

ALBERT L. HARBISON, OF NEW BRIGHTON, PENNSYLVANIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 595,625, dated December 14, 1897.

Application filed April 25, 1896. Serial No. 589,042. (No model.)

To all whom it may concern: Be it known that I, ALBERT L. HARBISON, a citizen of the United States, residing at New

- Brighton, in the county of Beaver and State 5 of Pennsylvania, have invented or discovered new and useful Improvements in Gas-Engines, of which the following is a specification.
- In the accompanying drawings, which make 10 part of this specification, Figure 1 is a vertical section through my engine with the exterior parts shown in elevation. Fig. 2 is an elevation of the same at the right-hand end of Fig. 1. Fig. 3 is an edge view of the sec-
- tional guides, connecting-block, and swinging link. Fig. 4 is a plan of the guide-plate for the sectional guides. Fig. 5 is a cross-section of the guide-plate. Fig. 6 is a plan
- view of the face-plate for the guide-plate. 20 Fig. 7 is a broken section through the center of the valve-chamber for the oscillating valve. Fig. 8 is a transverse section through rocking shaft, oscillating valve, and upper end of cylinder. Fig. 9 is a perspective of the os-
- 25 cillating valve. Fig. 10 is an elevation of the oscillating valve. Fig. 11 is an end view of same, and Fig. 12 is a section of same on line XII XII of Fig. 10.

My invention relates to gas-engines in which 30 the piston motion is obtained by a series of explosions of mingled gas and air admitted to

- the cylinder; and my invention consists, gen-erally stated, in means for regulating the admission of the gas and air and in the oscillating
- 35 valve at the head of the cylinder, all as hereinafter more specifically set forth, and pointed out in the claim.

In the several views, which make part of this specification, 2 is the driven shaft, hav-

40 ing twin fly-wheels 3 3 thereon inclosed in the upright base 4.

5 is the working cylinder; 6, the piston-head; 7, the piston-rod, and 8 the crank-pin. The cylinder has water-cooled passages 9 9.

- 10 is a gear-wheel on shaft 2, meshing with the gear 11, of double size, on stub-shaft 12, which shaft has a bearing in boss 13 on shell of upright base 4.
- 14 is a cam on the outer end of stub-shaft 12, 50 and 15 is a roller in contact with said cam. The roller 15 is on sleeve 16, turning on spindle 17, riveted to lower slide 18.

19 is a cotter-pin passing through collar 20 on sleeve 16 and end of spindle 17 to prevent longitudinal displacement of sleeve 16. The 55 lower slide 18 moves in guide-plate 21, (seen in detail in Figs. 4 and 5,) and which is pro-vided with an opening for the spring-bracket. Guide-plate 21 is secured to upright base 4.

Projecting rearwardly from slide 18 is 60 spring-bracket 22, which supports the lower end of slide-spring 23, the upper end of which spring bears against lug 24 on the rear face. of guide-plate 21.

25 is the guide-rod for spring 23.

26 is a catch-block secured to swinging link 27, which oscillates on bearing 28 on block 29, which in turn is fastened to upper slide 30. The catch-block 26 is normally held away from the slides 18 and 30 by springs 31.

21' is the closing-plate for guide-plate 21. 32 is a main-valve rod extending from the catch-block 29 to toe 33 on rocking shaft 34, which rocks in bearings 35 35. Shaft 34 between said bearings has toe 36 bearing on 75 the stem 37 of main valve 38, normally seated by spring 39.

The main-valve rod 32 is provided with adjustable collar 40, which engages collar 41 on bell-crank 42, pivoted to bracket 43 on cylin- 80 der 5. Bell-crank 42 rests against the stem 44 of gas-valve 45. 46 is a supply-pipe for said gas-valve.

47 is a second adjustable collar on the mainvalve rod 32, and 48 is a spring interposed 85 between said collar 47 and a second collar 49 on bracket 50, attached to valve-chamber.

51 is the air-inlet, and 52 is a threaded plug projecting into the air-inlet passage and which can be adjusted to pass the required 90 amount of air.

53 is the lowest exhaust-port. 54 is a valvecontrolling by-pass in working cylinder. 55 is the furnace or igniter-passage. 56 is the upper foul-air exhaust. The function of 95 these ports and passages is explained below in connection with the operation of the engine.

Returning to the main shaft, 57 is an eccentric, 58 the eccentric-strap, and 59 the eccen- 100 tric-rod, connected to sleeve 60, turning on stud 61, secured to upright base 4. 62 is the oscillating valve-rod, connected with sleeve 60 and extended to rocking shaft 63, moving

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in head 64 of oscillating valve-chamber 65. The oscillating valve 65° is seen in detail in Figs. 9 to 12, inclusive. It is both an inlet-valve for the mixture of gas and air and an

- 5 outlet-value for the burned gases. The value is cored at each end and at quartering distances into the value-passages A A', to each of which there is a quartering inlet-port a a'. Each end of the value is provided with split
- 10 rings of such diameter as to receive the entire wear upon the bushing 66, slotted at 67. 67 is the inlet-port of the main valve from the slotted bushing.
- Returning again to the main shaft, 68 is a ²⁵ governor of any appropriate form secured upon the main shaft, here being for illustration an eccentric - governor of well-known type. 69 is an eccentric - strap conflected therewith. 70 is the eccentric - rod, having two
- 20 adjustable collars 71 and 71, between which plays the collar 72 of knocker 73, pivoted in bracket 74 on the under side of arm 75, secured to base 4. The inner end of knocker 73 is in rubbing contact with swinging link
- 73 is in rubbing contact with swinging link 25 27. Arm 75 is provided with an eye 76, through which passes eccentric-rod 70, and between which eye 76 and nut 77 is tensionspring 78, adjusted by nut 79.
- The operation of the various mechanisms 30 thus described is as follows: Air is admitted through the air-inlet passage 51 and the proper proportion of air determined by adjusting plug 52. The proper ratio of gas and air is secured by the means of pipe 46, which 35 may have a suitable valve. The valve 54, con-
- 35 may have a suitable valve. The valve 54, controlling by-pass out from the cylinder, is also open, provided a large type of engine is used, the purpose of the by-pass valve being to give the engine one-half of its ordinary compres-
- sion and also thus reducing the labor of turning the engine over by hand when it is starting. A corresponding light impulse is derived on the first explosion of gas, because the force of the explosion is relieved by the use
- 45 of this by-pass valve at midway point of the cylinder instead of being maintained until the main exhaust is reached. In other words, the contents of the cylinder are by-passed or discharged with only half of the traverse of
- 50 the piston. As the engine is turned over by hand by a suitable crank, (not seen,) when the piston is on its top center the gas-valve 45 is in position to open and the main valve 38 has already opened. The down motion of
- 55 the piston sucks in air and gas, the passage being open through the right-hand end of the valve - chamber 65, through the oscillating valve 65°, and the valve-passage 67 into the upper end of the working cylinder. The same
- 60 proportion of air and gas is introduced at each downstroke, because the piston is relieved at its lowest exhaust-port 53 and has a constant load and a constant valve area supplying air and gas. When the piston reaches
- 65 about its bottom center, cam 14, that operates the main valve and the gas-valve, is in posi-

tion to close both these valves very quickly. On the upstroke of the piston, both the gas and the main valves being closed, the compression of the air and gas takes place and 70 continues until the piston reaches its top center, at which point ignition takes place by means of the igniter at 55. The cylinder is now full of burned air and the fly-wheels have received a sufficient impulse to carry them 75 around for a given number of revolutions without any further explosions. There is now very little compression on the upstroke of the piston, as the burned gases are very rarefied and offer little resistance to the up- 80 ward motion of the piston. During the intermediate revolutions between two explosions the piston in passing over the lowest exhaustport 53 will release portions of the foul air, and, futhermore, passing over the exhaust- 85 port causes a suction of the piston upon the main valve 38, slightly opening the same and releasing a small portion of the burned gases through the main valve; but the greater portion of the burned gases is not expelled until 90 just before a fresh influx of gas and air is admitted for a second explosion. Then the piston, traveling over the bottom center, the cam 14 having been so set as to cause the main value 38 to open and to continue to keep open 95 during the upstroke of the piston until the top center is reached, the burned gas is forced out through the oscillating valve 65^a, which is in a proper position to pass the same through its left-hand port and out through the foul- 100 air exhaust 56. When the piston descends, the oscillating valve returns to its position, which permits it to receive fresh air and gas and pass the same through its right-hand end and the port 67 to the working cylinder. 105

The manner in which the gas is cutoff from the working cylinder in the period between two explosions is as follows: When an explosion has taken place and the main shaft is rotating rapidly, there is not sufficient throw 110 imparted to the eccentric-rod 70 to move the knocker 73 against the swinging lever 27 to force the catch-block 26 into engaging position between the slides 18 and 20. No motion is therefore imparted to the main-valve 115 rod 32 and the main valve 38 remains stationary, as well as the gas-valve 45. When, however, the speed of the engine falls to a predetermined point, a sufficient throw is imparted to the eccentric-rod 70, which is then 120 reciprocated, moving knocker 73 against swinging link 27, forcing catch-block 26 into engagement with slides 18 and 20, moving main-valve rod 32, opening main-valve, and opening gas-valve through bell-crank lever 125 42, actuated by collar 40 on the main-valve rod 32. The spring 78 and regulating-nut 79 at the upper end of the eccentric rod 70 permit me to adjust the tension of the governor without stopping the engine. 130

Having described my invention, I claim— In gas-engines, the combination of a lower

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slide reciprocated by a positive connection with the main shaft and an upper slide suit-ably connected with a gas-inlet valve; a catch-block on a pivoted link adapted to bring said 5 upper and lower slides in operative engage-ment when inserted between them; a pivoted knocker in contact with said swinging link; an eccentric-rod actuating said knocker and

the governor on the main shaft controlling the throw of said eccentric-rod. In testimony whereof I have hereunto set my hand this 21st day of April, A. D. 1896. ALBERT L. HARBISON. IO

Witnesses: WM. L. PIERCE, L. D. IAMS.