C. G. SPRADO.

GAS ENGINE.

APPLICATION FILED JUNE 7, 1905.

923,591.

Patented June 1, 1909.

2 SHEETS—SHEET 1.

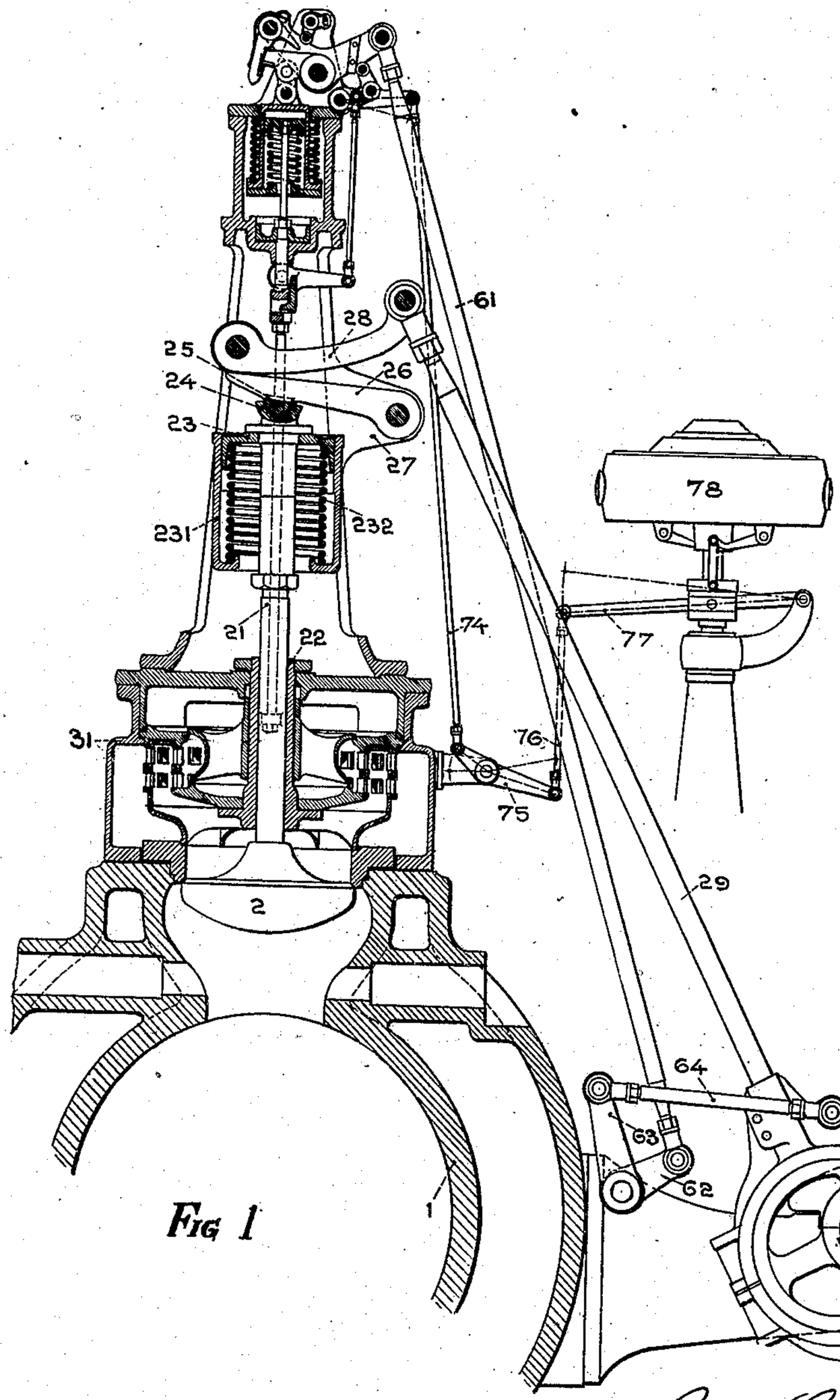

FIG 1

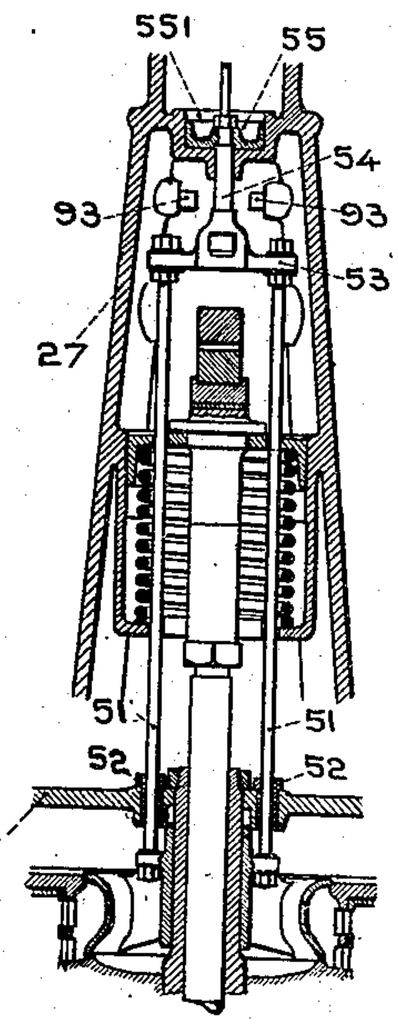

FIG. 2

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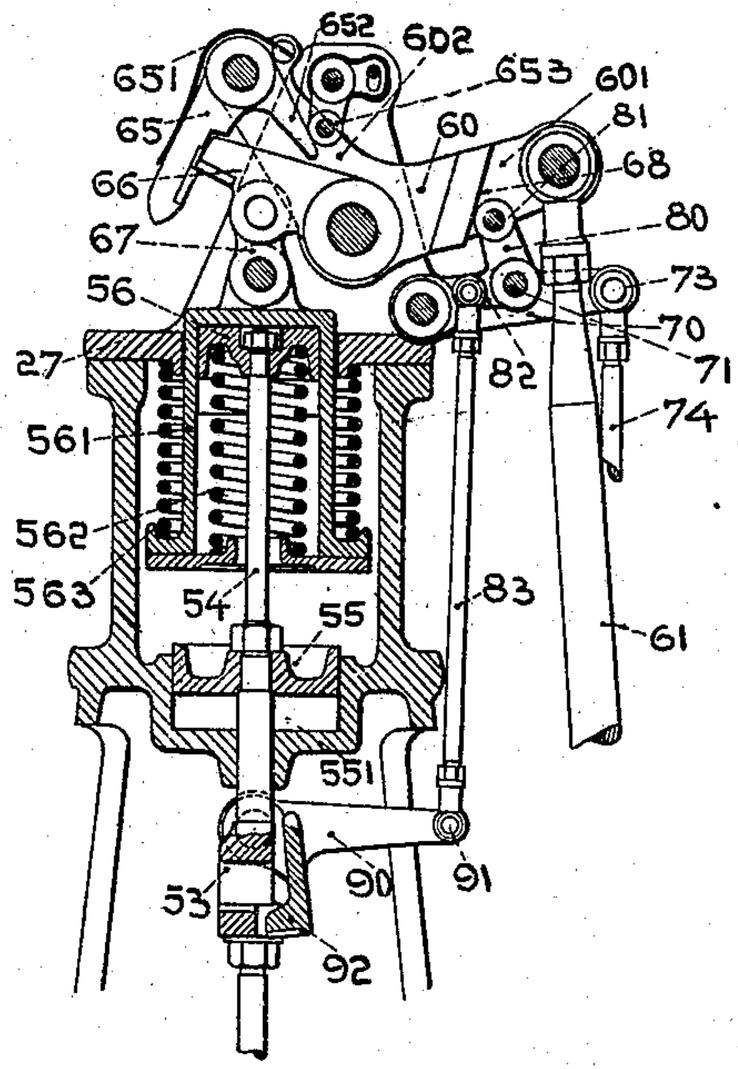

FIG 3

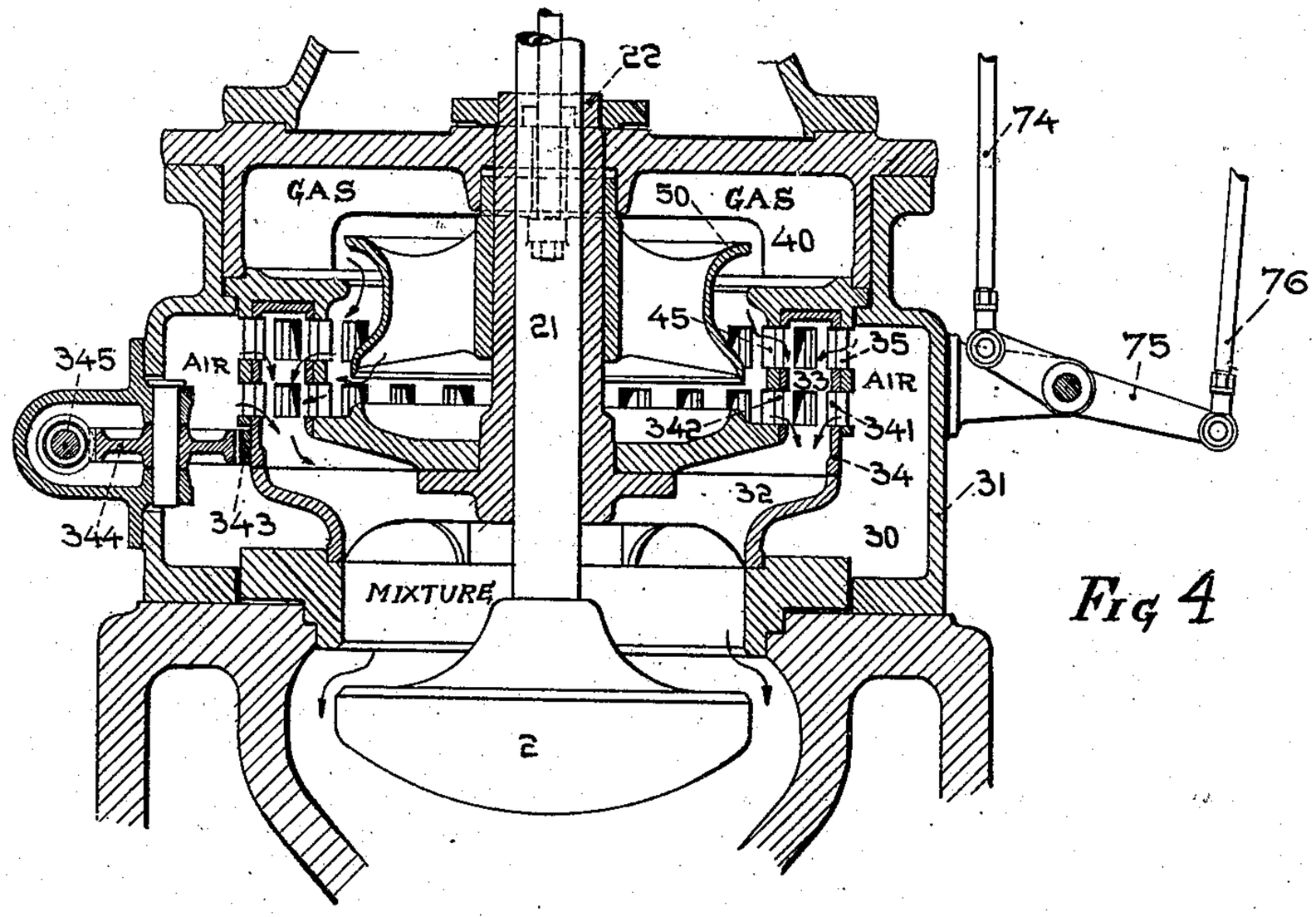

FIG 4

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UNITED STATES PATENT OFFICE.

CARL G. SPRADO, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF NEW JERSEY.

GAS-ENGINE.

No. 923,591. Specification of Letters Patent. Patented June 1, 1909.

Application filed June 7, 1905. Serial No. 264,163.

To all whom it may concern:

Be it known that I, CARL G. SPRADO, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to the regulating means of a gas engine, more especially to the operating gear for the gas valve, there being separate operating gear for the main valve, both however being operated by a single eccentric, as shown; but separate eccentrics may be used.

The object of the invention is to provide a regulating means for gas engines which will insure a good regulation, a constant mixture during gas admission, namely, the constant proportion of the entering air to the entering gas, a minimum of back-fires, and a regulation of gas consumption more nearly proportional to the power the engine is furnishing.

In the drawings,—Figure 1 shows a transverse sectional view of the regulating means, parts being shown in elevation; Fig. 2 shows a longitudinal section through a portion of the regulating means; Fig. 3 is an enlarged transverse section through the extreme upper portion of the regulating means; and Fig. 4 is an enlarged transverse section through the valve portion of the regulating means, the adjusting means for the mixing valve being brought into the plane of section for convenience of illustration.

Referring to the drawings,—the regulating means for the valves is mounted upon the gas engine 1 shown fragmentarily in Figs. 1 and 4. A main valve 2 is mounted so as to open inwardly, its closed position being shown in Fig. 1, and its open position in Fig. 4. The stem 21 of the main valve 2 extends through a suitable guide sleeve 22, mounted in the valve casing 31. Near the upper end of the stem 21 is mounted a piston guide 23, while its extreme upper end is provided with a bearing seat 24 for a bearing piece 25 the upper side of which is grooved to slidably coact with a lever 26. Lever 26 is pivoted to the frame 27 at one end to swing vertically. The frame 27 supports the valve tripping means. Upon the opposite side of the frame 27 is pivoted a rolling lever 28 having its lower edge suitably shaped to coact with the upper surface of lever 26, and having its opposite end pivotally connected to the eccentric rod 29 of the eccentric strap 201 on the eccentric 202 mounted upon the lay shaft 3 geared in any convenient way to the main shaft, not shown, so as to rotate at half the speed of the main shaft. The piston guide 23 is mounted to slide vertically in a cylindrical guide 231 supported in any convenient way from the frame 27. A spring 232 is supported from the lower end of the cylinder guide 231 and within the same and bears upwardly against the piston guide 23 so as to maintain the main valve 2 in closed position when otherwise allowed to do so.

Thus far described the structure is old and well known and is a common means for positively opening the main valve at a given part of the cycle and closing it by a spring at another given part of the cycle. The eccentric 202 communicates a vibratory motion to the rolling lever 28, which by a cam action communicates a proper vibratory motion to lever 26, which in turn operates to positively and quickly open the main valve 2 which at other times is closed by action of spring 232.

An annular air chamber 30 is formed in the valve casing 31. Another chamber 32, annular in its upper portion 33, is formed in the valve casing 31, and is surrounded by the air chamber 30. This chamber 32, together with its annular upper portion 33, forms the mixing chamber. The entire inner walls of the annular upper extension 33 are lined by an annular mixing valve 34. This mixing valve will be hereinafter more fully described. Also in the valve casing 31 is formed a gas chamber 40. This gas chamber 40 extends downwardly so as to be surrounded by the upper portion 33 of the mixing chamber 32. A plurality of ports 45, 35, extends through the walls of the valve casing 31 so as to form communication leading from the gas chamber 40 and from the air chamber 30 to the upper portion 33 of the mixing chamber 32.

A balanced gas valve 50 controls the admission from the gas chamber 40 to the ports 45 leading to the mixing chamber. This gas valve 50 is operated by two stems 51, 51, (see Fig. 2), extending through stuffing boxes 52, 52, in the valve casing 31. This double arrangement of stem for the gas valve is necessitated by the concentric arrangement of the gas valve 50 to slide upon the guide sleeve 22 for the valve stem 21 of the main valve 2. After the stems 51, 51, are extended up be-

yond the operating levers 26, 28, for the main valve, they are united by a yoke 53. A central rod 54 extends coaxially of the rod 21 above the yoke 53 and is connected thereto at the middle point of the yoke 53. The rod 54 extends up through the frame 27 and is guided thereby. A dash piston 55 (see Fig. 3) is mounted upon the rod 54 and coacts with a dash pot 551 in the frame 27. The dash piston 55 serves to break the force of the down stroke of the gas valve 50 and connected parts. On the up stroke of the gas valve 50 and connected parts, a check valve, not shown, breaks the vacuum of dash pot 551. Upon the extreme upper end of the rod 54 is mounted a dash piston 56. The dash piston 56 coacts with a dash pot 561 guided thereby, and serves to check the force of the up stroke of the gas valve 50 and integrally connected parts. The dash pot 561 may also be vertically guided in the frame 27. A spring 562 is mounted within the dash pot 561, resting at its lower end upon an inwardly projecting flange attached to the bottom of the pot, and coacting at its upper end beneath dash piston 56 to maintain the piston when possible at its innermost position within the pot 561. A spring 563 has a bearing at its upper end underneath a portion of the frame 27, and at its lower end rests upon an outwardly extending flange formed on the lower end of the pot 561. The spring 563 tends to force the pot 561 and connected parts in their lowermost position with reference to the frame 27. Both springs 562 and 563 are spiral compression springs.

The operating trip gear for the gas valve is mounted upon the upper end of the frame 27. A bell crank lever 60 is pivotally mounted at its angle upon the frame 27. One end 601 of this bell crank lever 60 is pivotally connected by means of the rod 61 to one end 62 (see Fig. 1) of a lower bell crank lever mounted upon the cylinder near the eccentric 202, the other end 63 of the lower lever is pivotally connected to rod 64, pivotally connected to eccentric strap 201. Upon the other end 602 of the bell crank lever 60 is pivotally mounted a hook 65. A drop arm 66 is pivotally mounted upon the frame coaxially with the pivotal mounting of bell crank lever 60. A connecting link 67 pivotally connects the drop arm 66 with the upper end of the dash pot 561. A spring 651 mounted upon the bell crank lever 60 tends to hold the hook 65 in coaction with the drop arm 66. A projection 652 extends radially from the hub of hook 65. A manually adjustable trip 653 is mounted upon the frame 27 in such a position as to coact with the radial projection 652 of the hook 65 at a desired point of the cycle.

Thus far described, the operating means serves to trip the gas valve to its closed position. This is done as follows: The rod 61 on its downward course, during a portion of the travel of which both springs 562, 563, are placed under compression, actuates the bell crank lever 60 in such a way that the hook 65 engaging with the drop arm 66 elevates the drop arm 66 to a certain height at which, by means subsequently to be described, the gas valve is tripped open by spring 562. Upon a continued operation of the rod 61 in its downward course spring 563 is further compressed and the drop arm 66 is further elevated and continues to the point where the projection 652 comes into contact with the stationary trip 653 so that the hook 65 will be disengaged from the drop arm 66. The spring 563 having been placed in compression up to this point, exerts a stress to force the dash pot 561, together with its spring-connected parts, including the gas valve 50, downwardly, thus suddenly spring closing the gas valve 50, the motion being checked by dash pot 551, as hereinbefore described.

The means for tripping the gas valve 50 open are as follows: Upon the frame 27 is pivotally mounted at one end a lever 70. This lever furnishes an automatically adjustable fulcrum 71 for a bell crank lever 80. The fulcrum 71 is mounted on the lever 70. The other end of the lever 70 is pivotally connected by means of rods and levers 74, 75, 76, 77, to a governor 78 of any suitable type. One arm 81 of the bell crank lever 80 is formed to coact with a cam surface 68 formed upon the arm 601 of the bell crank lever 60. The other end 82 of bell crank lever 80 is pivotally connected by means of rod 83 to an arm 91 of a bell crank lever 90 mounted within frame 27 upon pins 93, 93, Fig. 2. Bell crank lever 90 is double in form at its place of pivotal support so as to avoid interference with the stem 54 about which it is mounted. The other end 92 of bell crank lever 90 is formed to trip the yoke 53 connecting stems 51, 51, of the gas valve 50 with stem 54.

The operation of the means for tripping the gas valve 50 open is as follows: Upon the descent of the rod 61 in its course, the cam surface 68 of the bell crank lever 60 will come into contact with the arm 81 of the bell crank lever 80 so as to vibrate the latter about its automatically adjustable fulcrum 71. This vibration of the bell crank lever 80 will cause a corresponding upward vibration of the arm 91 of the bell crank lever 90 through their connecting rod 83. The upward vibration of the arm 91 corresponds to an outward vibration of the arm 92, causing the latter to trip the yoke 53 so as to allow the yoke 53, together with its integral connections, the stems 54, 51, 51 and the gas valve 50, to be moved upwardly, being actuated by the spring 562 acting upon the dash piston 56 mounted upon the upper end of rod 54. The spring 562 up to the time of tripping had

been placed in compression by the downward movement of rod 61 acting through bell crank lever 60, hook 65, drop arm 66, link 67, and dash pot 561, to press upwardly on spring 562, the upper end being held by the piston 56, rod 54, yoke 53, and arm 92.

The automatically adjustable fulcrum 71 assumes a position determined by the operation of the governor 78, thus regulating automatically the point in the cycle at which the cam surface 68 contacts with the arm 81 so as to cause a tripping off between the arm 92 and the yoke 53, and allow the gas valve to be quickly spring-opened. There is thus provided a regulating means which operates automatically to suddenly open the gas valve at various points of the cycle according to the speed, and which actuates to suddenly close the gas valve at a constant point of the cycle predetermined by manual adjustment of the trip 653.

The mixing valve 34, as above described, lines the walls of the annular upper extension 33 of the mixing chamber 32. Its cylindrical walls have perforations 341, 342, arranged to be registrable with ports 35 and 45 in the walls of the valve casing 31. The mixing valve 34 is manually adjusted by having externally formed thereon, or attached thereto, at its lower end a segmental gear strip 343. A worm gear 344, (see Fig. 4) is mounted in the valve casing 31 so as to gear with the segmental strip 343 and also with a manually operable worm 345 mounted in the casing and having an end, not shown, projecting through the casing for manual manipulation.

In accordance with the provisions of the patent statutes, the principle of operation of the invention has been described, together with the apparatus which is now considered to represent the best embodiment thereof; but it is desired to be understood that the apparatus shown is merely illustrative and that the invention can be carried out by other means.

What I claim is:—

1. In a gas engine the combination of a gas valve, automatically controlled means for tripping the valve open at any point of the inlet stroke, and means for tripping the valve shut at a constant point of the same stroke.

2. In a gas engine, a gas valve, means for spring tripping the valve open and means for spring tripping the valve shut later than, but during the same stroke in which the valve is tripped open.

3. In a gas engine, a gas valve, an automatically regulated trip for opening the valve and a manually regulated trip for closing the valve.

4. In a gas engine, the combination of a main valve, means for operating the valve, a gas valve, and separate operating means for the valve comprising governor controlled means for tripping the valve open at any point of the inlet stroke and means for tripping the valve shut at a constant point of the same stroke.

5. In a gas engine, a main valve, means for operating the valve, a gas valve, and separate operating means for the gas valve comprising automatically regulated means for tripping the valve open and a manually regulated means for tripping the valve shut.

6. In a gas engine, a main valve, means for operating the valve, a mixing valve, a gas valve, and operating means for the gas valve comprising means for tripping the valve open and means for tripping the valve shut.

7. In a gas engine, a main valve, operating means therefor, a mixing valve, manual adjusting means therefor, a gas valve, and separate operating means therefor comprising automatically regulated means for tripping the valve open and a manually regulated means for tripping the valve shut.

8. In a gas engine, a gas valve, means for tripping the valve open, means for tripping the valve shut, and means for preventing concussion of parts at the end of opening and closing.

9. The combination in an engine, of a valve, means for tripping said valve open, means for tripping said valve shut, and means for simultaneously energizing the said tripping means.

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

CARL G. SPRADO.

Witnesses:
JOHN DAY, Jr.
R. M. STONE.