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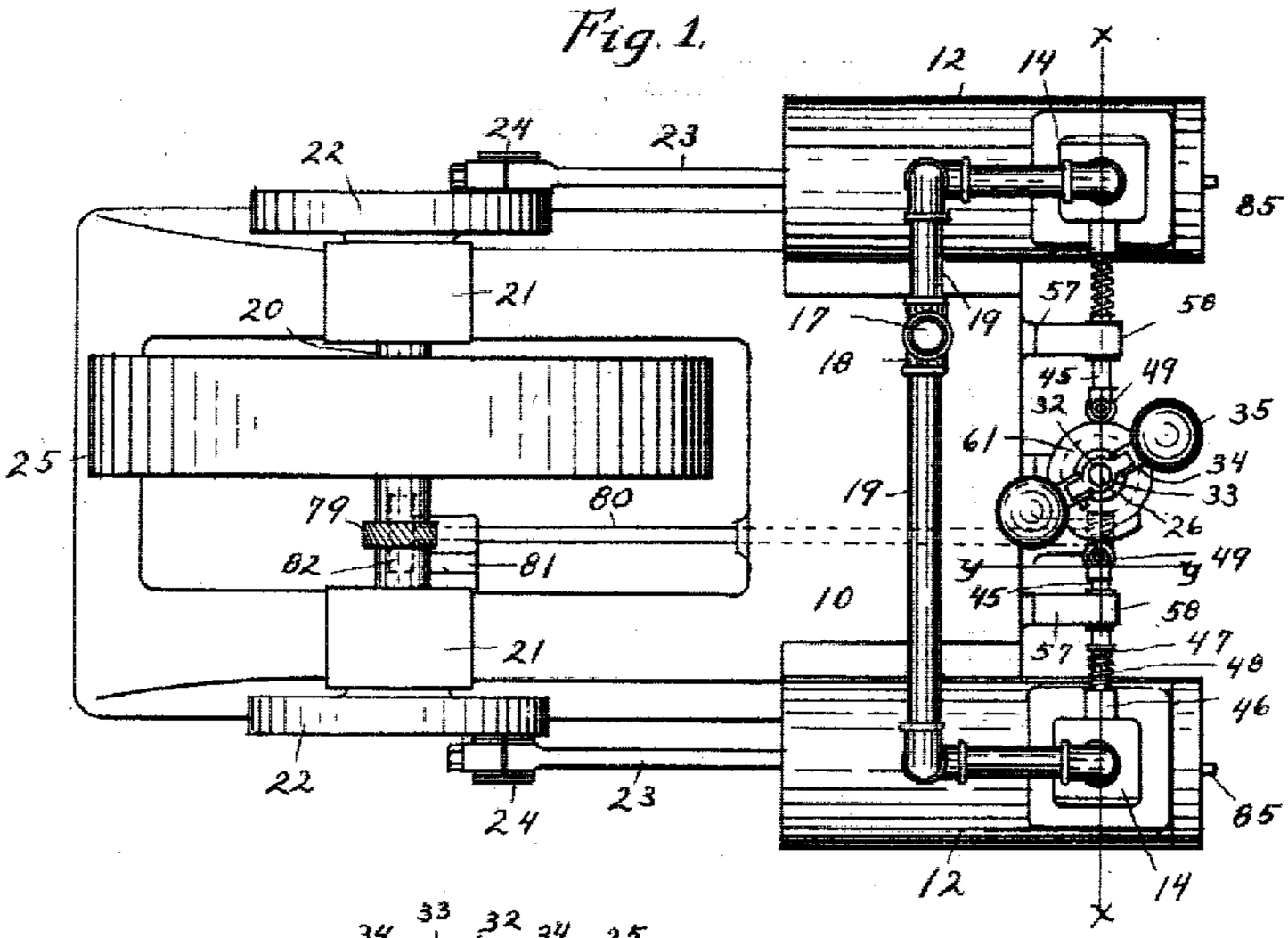
AUTOMATIC GOVERNING DEVICE FOR GASOLENE ENGINES.

APPLICATION FILED NOV. 29, 1904.

Fig. 1.



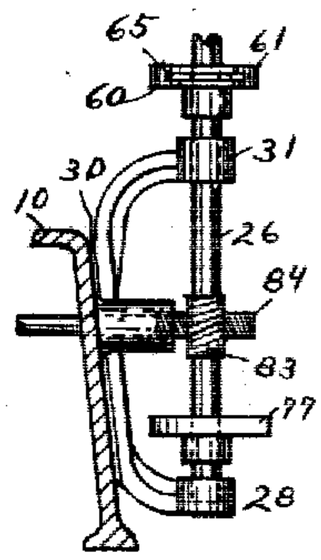


Fig. 5.

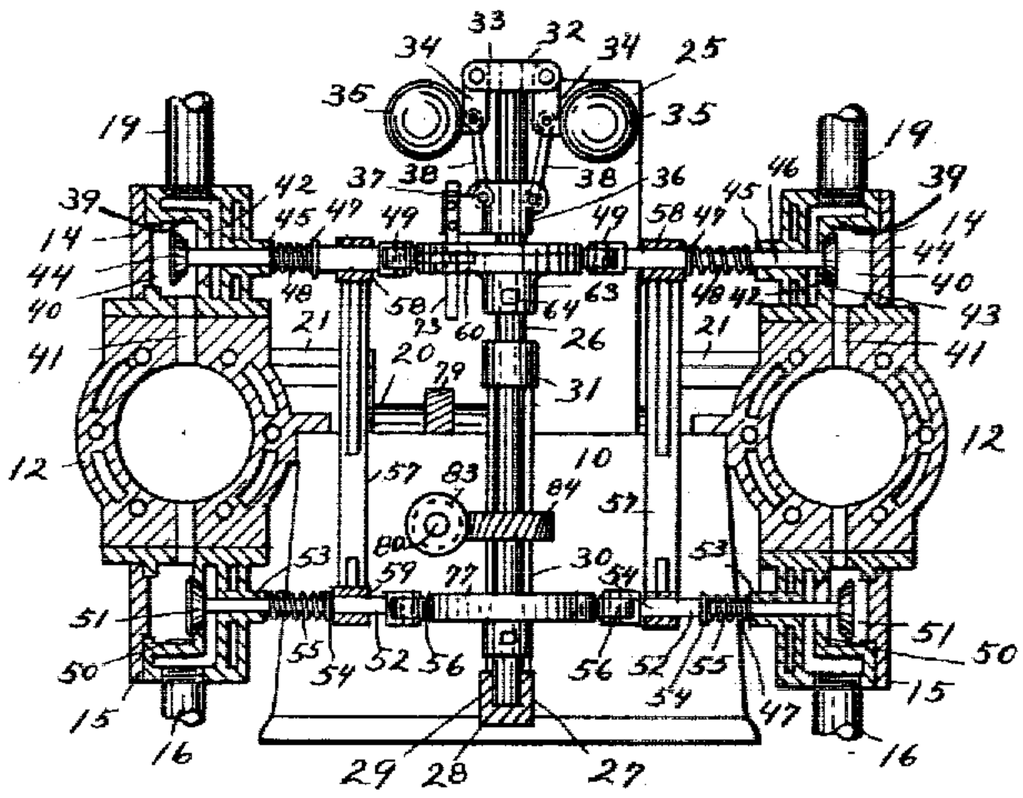


Fig. 2.

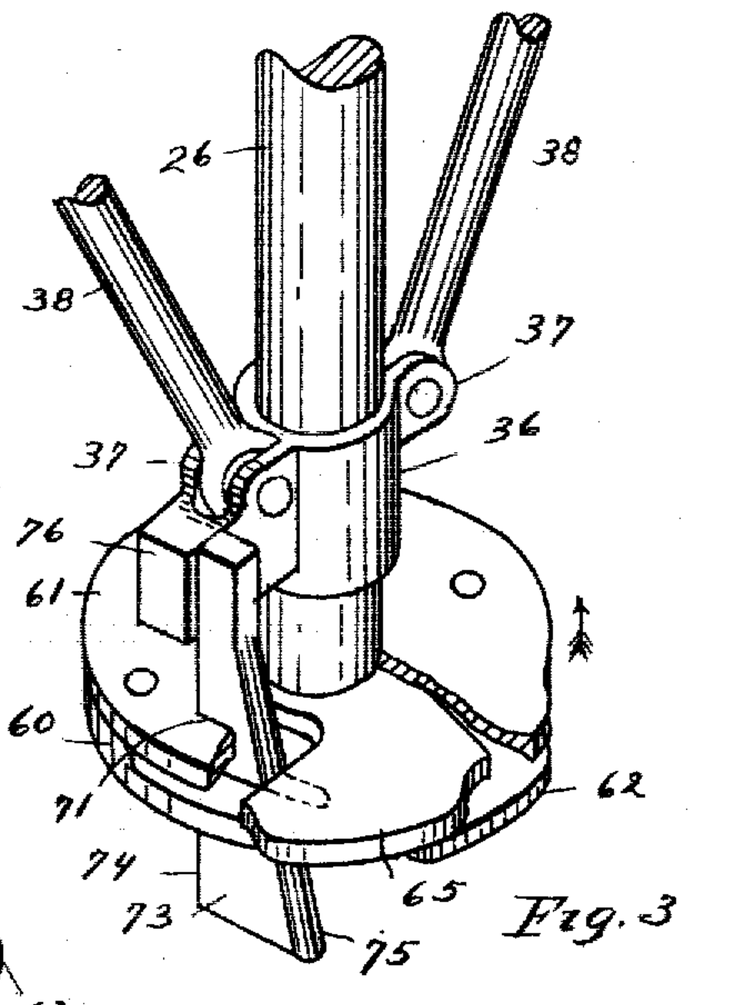


Fig. 3.

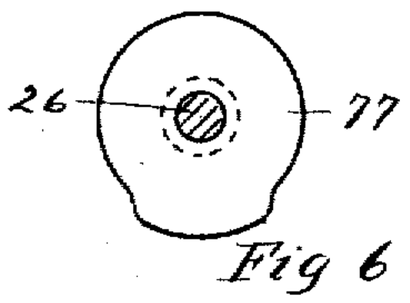


Fig 6

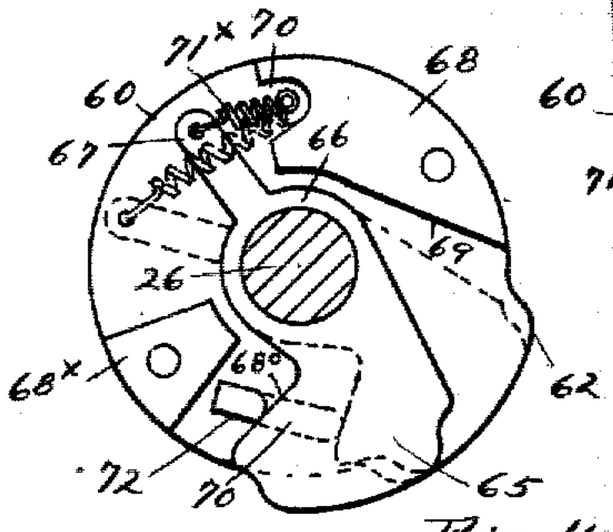


Fig. 4.

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AUTOMATIC GOVERNING DEVICE FOR GASOLENE-ENGINES.

No. 811,734. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed November 29, 1904. Serial No. 234,702.

To all whom it may concern:

Be it known that I, DAVID C. McCARROLL, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Automatic Governing Devices for Gasolene-Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

My invention has for its object the regulation of the speed of the engine by varying the volume or supply of air and gas to the cylinder or cylinders in proportion to the degree of resistance occasioned by the load carried by the engine in the transmission of power from the driving-shaft of the engine.

The invention consists in the novel construction and combination of parts, such as will be first fully described and then specifically pointed out in the claims.

In the drawings, Figure 1 is a plan view of a compound gasolene-engine shown upon its bed and with the invention applied thereto. Fig. 2 is a vertical sectional view taken upon the line *x x* of Fig. 1. Fig. 3 is an enlarged detail broken view in perspective of the rotary shaft carrying the governor, showing in detail the sleeve and lower portions of the links connecting the sleeve with the arms of the governor, the upper and lower slotted cam-plates and the spring-controlled expanding and contracting cam between the said plates and the automatically-operating cam-closing device connected with the sleeve. Fig. 4 is a datail view in plan of the lower slotted cam-plate, showing the expanding and contracting cam on the shaft and the arm and spring. Fig. 5 is a longitudinal sectional view of the rear end of the bed-frame, showing the bracket and journal-bearing for the governor-shaft. Fig. 6 is a plan view in detail of the cam operating the exhaust-valve.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

Referring to the drawings, 10 indicates the cast frame or bed, upon which are mounted the jacketed cylinders 12 12 of a compound gasolene or gas engine, the rear ends of the cylinders projecting a considerable distance beyond the line of the rear end of frame 10.

14 indicates the inlet-valve casings for the mixed air and gas on the top and rear end portions of the cylinders.

15 indicates the exhaust-valve casings on the under side of the cylinders, and 16 indicates the exhaust-pipes leading from the casing.

17 indicates the main supply-pipe for the mixed air and gas, which is shown connected with a three-way pipe-joint 18, and 19 19 are branch pipes, the inner ends of which are connected with the three-way pipe-joint 18 and the outer ends extended in opposite directions and connected with the top of the inlet-valve casings 14.

20 indicates the driving-shaft of the engine, which is journaled in the journal-boxes 21 on the forward end of the bed-frame.

22 represents the crank-wheels on the ends of the driving-shaft 10.

23 represents the piston-rods, the outer ends of which rods are connected with the wrist-pins 24 on the crank-wheels.

25 indicates the fly or balance wheel on the driving-shaft 20.

Adjacent to the rear end of the bed-frame 10, supporting the cylinder 12 of the engine, is a rotary governor-shaft 26, which is arranged in a vertical position and at a point midway between the cylinders 12 12 and in a line transversely with the axis of the inlet-valve casings 14 and the exhaust-valve casings 15. The lower end of the rotary shaft 26 is stepped in an outwardly-projecting boxing or lug 28, secured to the rear end of the bed-frame 10, a short distance upwardly from the lower edge of the said frame, in which boxing is a vertical opening or bearing 29.

Upon the rear end of the frame 10 is a vertical bracket 30, which extends from the upper surface of the lug 28 a short distance above the line of the upper edge of the frame 10, and upon the outer surface and upper end of said bracket is a journal-box 31, which is in a vertical line with the pivot-bearing 29 in the lug 28 and in which journal-box is supported the vertical governor-shaft 26. The upper end of the governor-shaft is reduced in size circumferentially, and upon said end is fitted a sleeve 32, from the sides of which extend radially the flanges 33. With the said flanges are pivotally connected the forked ends of the governor-arms 34. Upon the lower end and outer edge portions of the arms 34 are the weighted balls 35. Upon the shaft 26, below the positions of the balls 35, is a slidable sleeve 36, upon the outer surface

of which are the forked lugs 37 37. With the lugs 37 are pivotally connected the lower ends of the links 38, the upper ends of which links are pivotally connected with the outer ends of the arms 38.

Within the inlet-valve casings 14 are longitudinal partitions 39, which are located adjacent to the inner side of the casing and extend to within a short distance of the top of said casing and are bent at right angles and extended to the inner surface of the outer side of the casing, thus forming a narrow chamber communicating with the inner ends of the air and gas supply pipes 19 and upon one side of the partition and a large chamber 40 on the other side of the partition. Leading from the bottom of the chamber 40 in the valve-casings 14 through the side of the cylinders 12 are the openings 41.

In the vertical portion of the partitions 39 are the valve-openings 42, and upon the side of the partition in the chamber 40 are the valve-seats 43. With the valves 44 in the seat 43 are connected the inner ends of the valve-stems 45, the outer ends of which stems extend through the inner sides of the valve-casings and through the stuffing-boxes 46 the proper distance in the direction of each other to be operated upon, as hereinafter described. Upon the valve-stems 45, a short distance from the stuffing-box 46, is a fixed annular plate or washer 47. Extending around the stem is a spiral spring 48, one end of which bears on the washer and the other against the stuffing-box 46. The extreme outer ends of the stems 45 are forked, and in the said forked ends are journaled the antifriction-rollers 49.

In the exhaust-valve casings 15 on the under side of the cylinder 12 (which are the same as the valve-casings 14 inverted in position) are the longitudinal partitions 50, which are the same as the partitions 39 in the valve-casing 14. In the vertical portion of the partitions 50 is seated the exhaust-valves 51, connected with which are the valve-stems 52, which extend through the inner side of the valve-casing and the stuffing-boxes 53. Upon these valve-stems 52, which are the same in length as the valve-stems 45, are the fixed washers 54 and the springs 55, bearing against the washer and stuffing-box 53. Upon the outer ends of the valve-stems 52 are the antifriction-rollers 56. The outer ends of the valve-stems are supported by brackets 57, secured to the rear end of the bed-frame 10. Upon the upper end of the brackets are journal-boxes 58 58 in line with the valve-stems and which receive the end portions of said stems between the fixed washer 47 and the antifriction-rollers 49. Upon the lower ends of the brackets are the journal-boxes 59 59, which are in line with the valve-stems 52 and support said stems between the washers 54 and the rollers 56.

Upon the shaft 26 for the governor in a horizontal line with the valve-stems 45 is arranged the valve-operating compound cam, which is composed of the upper and lower annular cam-plates 60 and 61, which rotate with the shaft 26, and upon a portion of the outer edge of said plates are coequal projecting concentric portions which form the cam 62, the edge portion of which cam-surfaces are less than one-fourth of the circumference of the plates and which act upon the rollers 49 49 on the respective valve-stems alternately when they come into contact in the rotation of the governor-shaft 26. The lower cam-plate 60 is secured to the shaft 26 by a boss 63, cast on the under side of the plate, extending around the shaft and secured by the screw-bolt 64. Upon the upper surface of the cam plate or blade 60 is an automatic supplemental cam-expanding plate 65, which extends radially from the shaft 26, the outer edge portion of which plate is curved in the arc of a circle and is in a vertical plane with the outer edge of the cam 62, the length of the said curved edge being slightly less than the cam 62. Upon the inner end of the plate 65 is a ring or collar 66, extending loosely around the shaft 26. Connected rigidly with the collar 66 and extending in the opposite direction to that of the cam-expanding plate 64 is an arm 67. Between the plate 60 and the plate 61 is a separating-plate 68, slightly of increased thickness to that of the plate 65, which extends from a position in line with the end of the cam-surfaces 62 a portion of the distance circumferentially to the plate, the inner edge 69 extending in a line tangential to the shaft 26 and the end of the plate opposite the arm 67 being cut away upon a line radial to the shaft, and upon said end is a lug 70. With the lug 70 is connected one end of a spiral spring $71^{\times}$, the other end of which spring is connected with the outer end of the arm 67 on the collar 66. The longitudinal edge portion of the cam-expanding or extension plate or blade 65 opposite the inner edge 69 of the separating-plate 68 extends from the outer edge of the collar 65 to the outer end of the plate in a line tangential to the shaft 26, and when in position between the upper and lower cam-plates 60 and 61 said inclined edge contacts with the edge portion 69 of the separating-plate 68. In the opposite edge of the plate 65 is an opening extending from the outer edge of the collar 66 at a tangent to the shaft 26 and for a short portion of the length of the plate in the direction of the central portion and from said point to the outer end of the plate at an acute angle, as at 70, and transversely to the line of the edges of the slots 72 $68^{\times}$ is a small separating-plate on the upper surface of the plate 60, on the other side of shaft 20. Adjacent to the edge portion 70 of the cam-expanding plate 65 and in the respective upper and lower plates 60 and 61 are cam-slots 71 72, regis-

tering with each other and the opening in the cam-blade 65, said slots being upon a line tangential to the shaft 26 and a short distance inwardly from the circumference of the plates 60 and 61.

Through the slot 72 in the plate 60 and the slot 71 in plate 60 is extended the upper end of a plate-operating angle-bar 73, which is movable in a vertical direction in said slots, the rear edge 74 being in a parallel line with shaft 26 and the forward edge 75 extending from a point a short distance below the upper end of the bar in a downwardly and forwardly extended inclined plane, the edge portion 75 coming into contact with the edge portion 70 of the cam-expanding plate 65 and moving said plate in the direction of the edge portion 69 of the separating-plate 68. The rear edge and upper end portion of the angle-bar 73 is secured rigidly to the outer end of a fixed lug 76 on the outer surface of the sleeve 36 on the governor-shaft 26, which lug is located directly below the lugs 37, with which the links 30 are connected. On the governor-shaft 26, in a horizontal line with the exhaust-valve stems 52, is a cam-plate 77, as seen in detail in Fig. 6, which operates alternately the exhaust-valves.

Upon the driving-shaft 20 of the engine is a worm-gear 79.

80 indicates the transmission-shaft, the outer end of which shaft is supported by the shaft-hanger 81 on the side of the bed-frame 10. Upon the said end of shaft 80 is a worm 82, which engages with the worm-wheel 79. The other end of shaft 80 extends through the rear end of the bed-frame 10 to a position near the governor-shaft 26, and upon said end is a bevel-gear 83. Upon the governor-shaft is a bevel-gear 84, with which the gear 83 engages.

85 indicates the spark-igniting device in the end of the cylinders 12, which is of the ordinary description.

In operation the mixed air and gas in the proper porportions is conducted through the pipes 17 and 19 to the chambers 40 40 in the inlet in exhaust-valve casings 14 14. During the initial supply of gas to the engine for producing the energy necessary to accomplish under repeated explosions the cycle movements, which require two or more complete revolutions of the balance or fly wheel, in the stages of compression, explosion, and consequent expansion and exhaust, the position of the arms 34 on the governor are close to and nearly parallel with the shaft and rotated in the direction of the arrows in Fig. 2. Consequently the angle-bar 73 is at the limit of its downward movement in the slots 71 and 72 in the respective cam-plates 60 and 61, and the expanding cam-plate 65, under the power of contraction of the spring 71, retains said plate outwardly in its normal position and with the inwardly-inclined edge portion of said plate in contact with the forwardly and downwardly inclined surface 75 of the angle-bar 74. During the initial movements of the shaft 26, as stated, the cam-surface 62 of the plates 60 and 61 and also the cam-surface of the supplemental cam 65 comes in contact with the antifriction-rollers 49 49 on the valve-stems 45, operating the inlet-valves 44, and the full volume of mixed air and gas is admitted to the cylinders 12 12 of the engine alternately and ignited by the igniter during the time required for the rotation of the cam-plates 60 and 61 past the valve-stems one-fourth of their circumference, in which movement the driving-shaft 20 of the engine has completed one full rotation, and in the meantime the cam 77 comes into contact with the valve-stems 52 52 of the exhaust-valves 51 51, which are opened to permit the exit of the burned gases from the cylinders 12. Following these explosions of the gas and under the impulses conveyed to the fly-wheel the speed of the engine is accelerated and the increased motion of the driving-shaft 20 communicated to the power-transmission shaft 80 and thence to the governor-shaft 26 through the gear 83 and 84 and an increased rotary speed is communicated to the shaft, and the balls 35 move outwardly from the shaft, the arms 34 taking a position at an angle to the shaft and drawing upwardly through the links 38, the sleeve 36, and the angle-bar 73 in the slots 71 and 72 in the plates 60 and 61, and causing the inclined edge 75 of the bar to force the cam-expanding plate in the direction of the separating-plate 68 and between the cam-surfaces of the plates 60 and 61, thus presenting for contact with the rollers 49 on the valve-stems a decreased length or contraction of the circumferential area of cam-surface of the cam, which action allows the inlet-valves 44 to close sooner, thus admitting a lesser volume of the mixed air and gas to the cylinders of the engine, which lessens the degree of compression, thereby governing the speed of the engine according to the load it is carrying.

It is obvious that the repeated contact of the rollers 49 on the spring-actuated valve-stems to the inlet-valves upon the cam-surfaces of both the loose and fixed cam-plates will have a tendency to retain the supplementary cam-plate in contact with the edge of the angle-bar and in an open position whether the spring is employed or not, and when employed assists to effect the same result.

It is also obvious that the invention may be applied to either single or multiple cylinder engines, the position of the governor-shaft being located according to convenience at the requisite point between the cylinders.

Such modifications may be employed as are within the scope of the invention.

Having fully described my invention, what

I now claim as new, and desire to secure by Letters Patent, is—

1. In valve-operating mechanism a rotary shaft, a main cam-plate fixed on said shaft, and a supplemental cam-plate loosely connected with said shaft and having its cam in a normally open or extended position from the fixed cam said plates having registering openings extending tangentially to the said shaft, an angle-bar having an inclined edge within said registering openings adapted to move said loose cam-plate toward a coincident position with the cam on the fixed cam-plate and self-adjusting means for holding the supplemental cam-plate in contact with the said inclined edge of said angle-bar.

2. In valve-operating mechanism a rotary shaft, a main cam-plate fixed on said shaft and having a slot extending tangentially to the circumference of said shaft, an angle-bar having an inclined edge within said slot and a cam-blade loosely connected with said shaft and normally in an open position from the cam on the main cam-plate and having a notch in the direction of said angle-bar and a radial arm on said blade and resilient means for retaining the notched portion of the cam-blade in contact with the inclined edge of said angle-bar.

3. The combination in an engine with the governor-shaft and governor and with a valve-operating spring-controlled valve-stem on the engine of a compound cam on the governor-shaft consisting of a main cam-plate and cam fixed on said shaft and a supplemental member of said compound cam loosely connected with said shaft, said main and supplemental cam-plates having suitable registering openings extending tangentially to the circumference of said shaft said loose member of the compound cam having its cam-surface in a normally open or extended position from the cam on the fixed cam-plate and in the opposite direction to the rotation of said shaft both cam-surfaces of the compound cam being adapted to come into contact with the spring-actuated valve-stem and control the time of the opening and closing of said valve by the reciprocal movement of the loose member, and a movable angle-bar actuated by the governor having an inclined edge within said registering openings in said fixed and loose members of said compound cam with which inclined edge the side of the opening in the loose member contacts said angle-bar acting to vary the movements of the loose member of the compound cam from the reciprocal action of the valve-stem.

4. The combination in a gas-engine with the cylinder and piston and piston-rod, of a driving-shaft actuated thereby, gas supply and exhaust casings on said cylinders and valves within said casings, spring-retracted valve-stems connected with said valves, a governor-shaft and governor, a movable sleeve on said shaft, operated by the governor, means for transmitting power to the governor-shaft from the driving-shaft, a main cam-plate on the governor-shaft, having a slot therein, a supplemental cam plate or blade, a collar connected therewith extending around the shaft of the governor, an arm on said collar, a spring connected with the main cam-plate and said arm, and an angle-bar in the slot of the main cam-plate connected with the movable sleeve on the shaft of the governor and bearing against the supplemental cam-blade.

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