C. C. STEDMAN.

REGULATOR FOR EXPLOSION ENGINES.

APPLICATION FILED MAR. 29, 1911.

1,027,778.

Patented May 28, 1912.

3 SHEETS—SHEET 1.

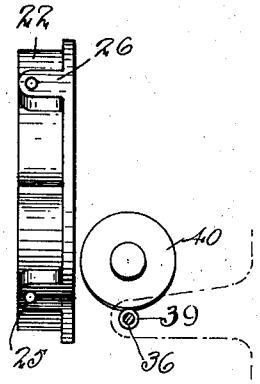

FIG. 5.

FIG. 6.

FIG. 1

Witnesses.

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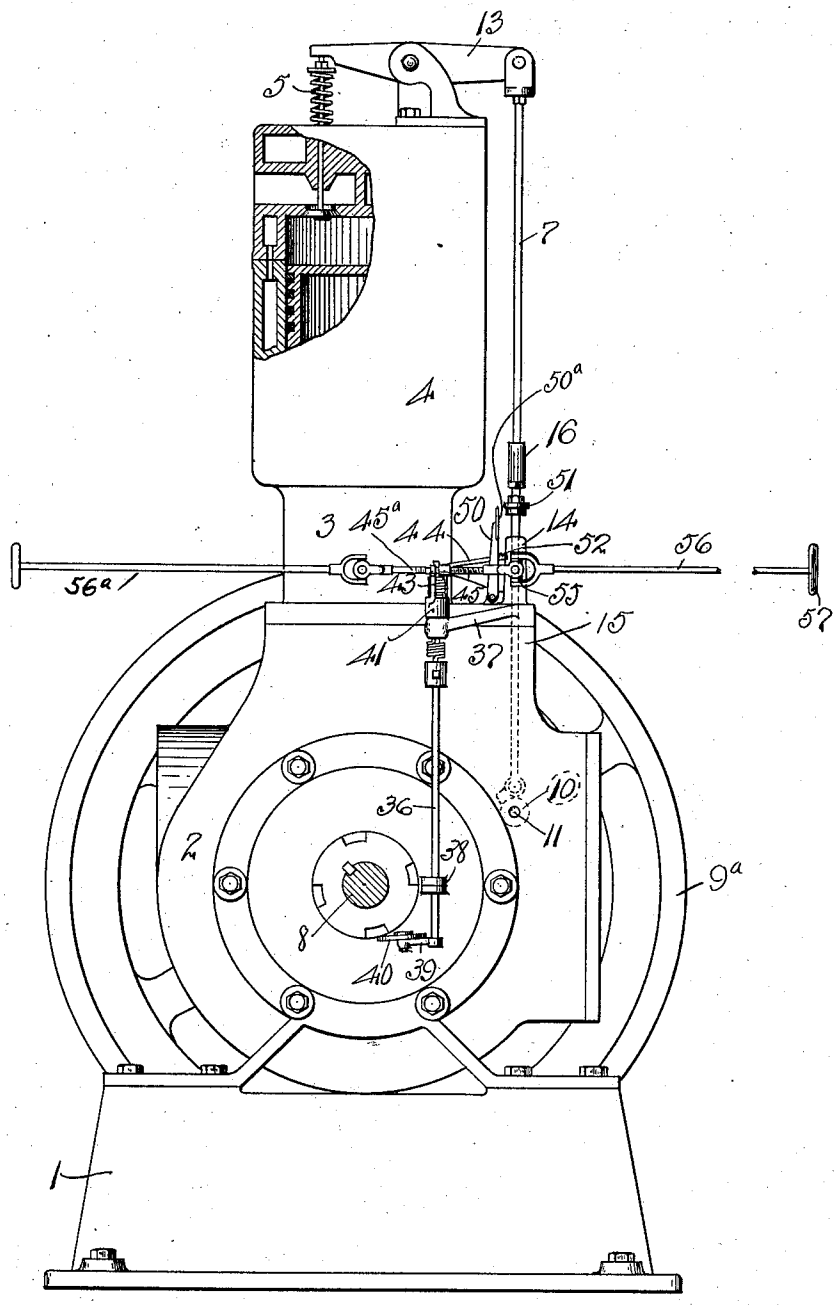

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FIG. 2

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3 SHEETS—SHEET 3.

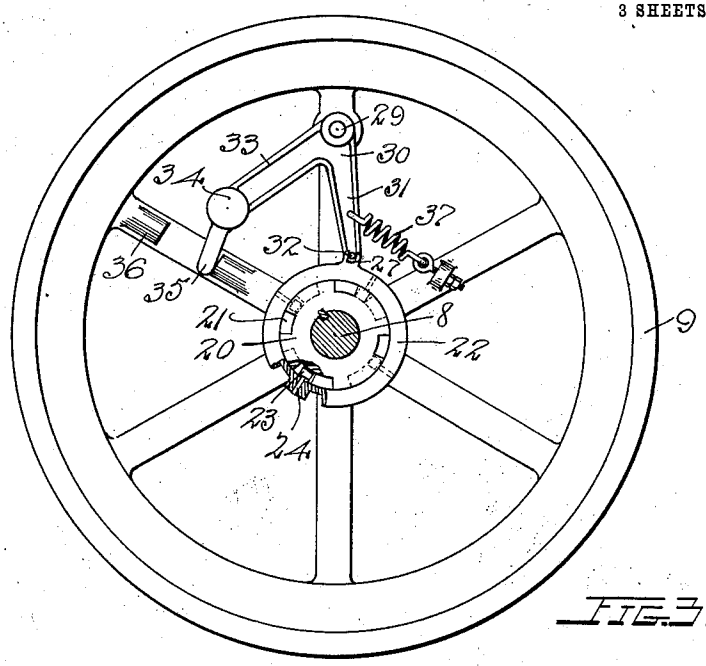

FIG. 3.

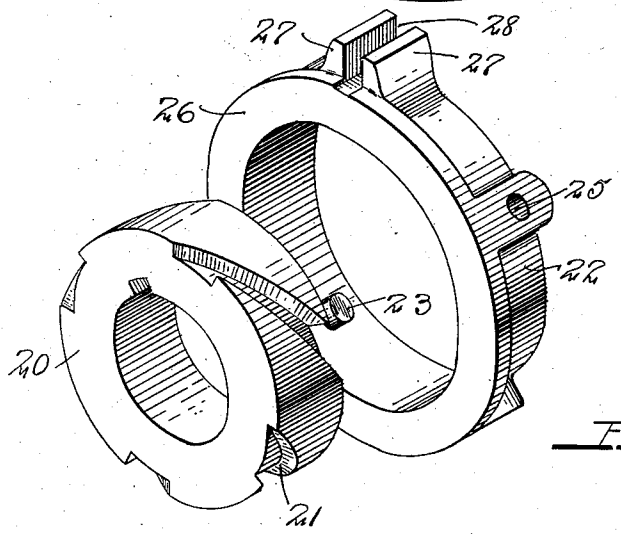

FIG. 4.

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UNITED STATES PATENT OFFICE.

CHARLES C. STEDMAN, OF DELAWARE, OHIO, ASSIGNOR TO THE COOK MOTOR COMPANY, OF DELAWARE, OHIO, A CORPORATION OF OHIO.

REGULATOR FOR EXPLOSION-ENGINES.

1,027,778. Specification of Letters Patent. Patented May 28, 1912.

Application filed March 29, 1911. Serial No. 617,757.

To all whom it may concern:

Be it known that I, CHARLES C. STEDMAN, a citizen of the United States, residing at Delaware, in the county of Delaware and State of Ohio, have invented a certain new and useful Improvement in Regulators for Explosion-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to gasolene or other internal combustion engines, and has for its object the provision of a governing device therefor, which shall regulate the speed thereof with great exactness, and at the same time shall be capable of adjustment so as to permit changing the maximum speed at the desire of the operator and without interfering with the operation of the engine.

Another object of the invention is to produce a device of this character of the smallest possible complexity and cost and of the highest efficiency and sensitiveness, while further objects and advantages will be made apparent from the following description and claims.

One embodiment of my invention is illustrated in the drawings accompanying and forming a part of this description, in which;

Figure 1 is a front view of a complete engine provided with my improved governing device; Fig. 2 is a side elevation of the same, one of the fly wheels being removed and a part of the cylinder broken away; Fig. 3 is an inside elevation of the removed fly wheel and associated parts; Fig. 4 is a perspective view of the governor collar and ring; Fig. 5 is an edge view of these members illustrating their relation to the governor shaft; and Fig. 6 is a detail view illustrating the connection between the governor shaft and the valve operating rod.

Describing the parts by reference characters, 1 indicates the base of an internal combustion engine, 2 the crank case, 3 the cylinder, 4 the water jacket, 5 the exhaust valve stem, 6 the inlet valve stem, 7 the exhaust valve operating rod, 8 the engine shaft, and 9 and 9ª the fly wheels. The exhaust valve operating rod is operated by a cam 10 carried by a countershaft 11 as in the usual construction, and actuates the exhaust valve 12 by means of the walking beam 13 in a well known manner. This valve operating rod is guided in its reciprocation by a sleeve 14 mounted upon a projecting portion 15 of the crank case, and is preferably provided with a turn-buckle 16 for adjusting its length. All these parts are of the well known almost universal construction and need no further description.

Upon the shaft 8 of the engine inside the fly wheel 9, I key or otherwise rigidly secure a cylindrical collar 20, said collar having formed in its periphery a plurality of spiral grooves 21, and upon this collar I mount a ring 22, having a plurality of radial projections 23 carried by its inside surface and adapted to fit the grooves 21. These projections are preferably made in the form of rollers having reduced stems 24 journaled in radial perforations 25 formed in the ring 22. This ring is also provided with a flat outer face 26, and with a pair of external abutments 27 defining a transverse notch 28.

Upon one of the spokes of the fly wheel 9 I pivot, as at 29, the bent or bell crank lever 30, said lever having a substantially radial arm 31, provided at its inner end with a transverse pin or finger 32 fitting in the notch 28. The other arm 33 of said lever extends in substantially a circumferential direction and carries an enlargement or governor weight 34. The extremity of the lever is preferably extended in the form of a finger 35 overlying the adjacent spoke and having its range of motion therealong limited by means of stops 36. A spiral spring 37 is connected to the arm 31 of the lever and to the adjacent spoke on the opposite side, and tends to retain the governor weight 34 in inward position. With this construction it will be obvious that an increase in the speed of rotation of the fly wheel will throw the weight 34 outwardly and rotate the ring 22 about the collar 20, whereupon the interaction of the rollers 23 and the grooves 21 will shift said ring in a sidewise direction. The direction of said grooves is such that the outward movement of the weight 34 will shift the ring 22 toward the crank case and my experiments have shown that the best results are obtained when the slope of said grooves is in the neighborhood of thirty degrees. This cam action may, of course, be obtained in other ways.

Carried by the engine inside the fly wheel 9 and adjacent to the ring 22 is a verti-

cal shaft 36 which I term the governor shaft. This shaft may be journaled in any suitable brackets, but I have illustrated the upper bracket 37 as being formed as an extension of the plate which carries the sleeve 14, and the lower bracket 38 as secured to one of the shaft boxes. At its lower end this shaft is provided with an arm 39 having a roller or friction wheel 40 journaled thereto adjacent the flat surface 26 of the ring 22. Near its upper end the shaft 36 is provided with a yoke 41 rigidly secured thereto, as by the set screw 42, and having an upwardly extending projection 43. Pivoted to this shaft above the bracket 41 is in elongated arm 44, having opposite the end of the branch 43 an extension 44ª having a threaded perforation adapted to receive an adjusting screw 45. The yoke 41 and arm 44 are yieldingly connected together by means of the comparatively strong spiral spring 46, which is so wound as to tend to bring the arm 44 strongly into contact with the yoke projections. With this construction it will be obvious that the arm 44 will be moved with the shaft 36 in all cases, but that the angle between the arms 39 and 44 can be varied by adjusting the screw 45. Below the bracket 37 a collar 47 is secured to the shaft 36, and a comparatively weak spiral spring 48 is secured thereto and to the bracket 37. The effect of this spring is to hold the friction wheel 40 yieldingly in contact with the face of the ring 22.

Pivoted to the engine casing adjacent the valve operating rod 7 is a stop finger or latch 50, having its upper end adapted to be brought underneath a stop collar 51 carried by said rod and having associated with it a spring 52 tending to throw said finger out of the path of movement of said collar. The arm 44 projects past said finger or latch so as to move it into the path of movement of said collar at the proper time. The stop finger 50 may be provided with a removable wear plate 50ª.

The operation of my governor will probably be clear from the foregoing description. When the ring 22 is moved inwardly as explained above it presses the roller 40 inwardly so as to swing the arm 44, and move the finger 50 into the path of the stop collar 51. The effect of this action is to prevent the closing of the exhaust valve so that upon the succeeding down stroke of the piston no explosive mixture is inspirated into the cylinder and no explosions are obtained until the exhaust valve is again released. By adjusting the screw 45 the angle between the arms 39 and 44 can be adjusted so as to vary the maximum speed of the engine within wide limits.

I have illustrated the adjusting screw 45 as provided with a universal joint 55, having a rotatable rod 56 connected thereto provided with a hand wheel 57 at its end. I have illustrated the yoke 41 as provided with a second projection 43ª, 180 degrees from the projection 43. The arm 44 is provided with a threaded perforation 44ᵇ opposite this second projection and facing in the opposite direction from the first perforation. The spring 46 tends to hold the arms or projections 43, 43ª in engagement with the corresponding portions of the arm 44. The threaded apertures or perforations in the arm 44 are for the reception of the adjusting screws 45, 45ª. This construction permits an adjusting screw to be inserted and manipulated from either side of the engine by the operating rod 56 or 56ª. In practice, both adjusting screws and their operating rods will frequently be employed, enabling the engine speed to be controlled from either end of the engine. By adjusting either of the rods 56, 56ª in an appropriate direction, the arms 43 and 43ª will be separated from the adjacent portions of the arm 44, against the action of the spring 46. When either of the rods is operated in the reverse direction, the spring will automatically bring these parts toward each other. It will be noted that the arms 43 and 43ª are offset so that the arm 43, extension 44ª, arm 43ª and the main body of the arm 44 follow each other consecutively in the arc of a circle described from the center of the shaft 36. With this arrangement, the screws 45 and 45ª can be extended in opposite directions from the bracket. When it is desired to use one of these adjusting devices, the other will be unscrewed a sufficient distance to bring its end out of engagement with the arm 43 or 43ª of the yoke. A further advantage of this construction resides in the fact that, should the end of the arm 44 fail to control the mixture, through its failure to operate the rod 7, and thus allow the engine to "run away", the extreme movement of the centrifugal governing element will not injure the parts of the bracket, as such movement of the governing element will be accommodated through the spring connection between the yoke and the shaft 36.

Reference has been made hereinbefore to the function of the spring 48. This spring performs an additional function in connection with the devices by which the relative position of the arms 39 and 44 may be varied. There is a tendency, through the vibration of the engine parts and through frictional resistance and inertia, for the operating rods to affect the relation between the arm 44 and the shaft 36. This spring effectively counteracts such effect.

The spiral grooves 21 in the collar 20 preferably form an angle of thirty degrees with the faces of the ring, making an angle

of about sixty degrees with a line parallel with the axis of the collar. The purpose of making these inclines at the angle described is to allow a free movement of the ring on the collar, there being no locking by the lateral thrust as would be the case if the angle were greater. A further object is that it allows a long movement of the ring 22 and of the governor arm with a comparatively short longitudinal movement of said ring. This results in flexibility, making the engine responsive to speed changes; it also keeps the friction between the rollers and the collars constant, reducing the friction so that the ring will not bind on the inner member or collar.

The governor illustrated herein is of the type which controls the speed of the engine by interfering with the operation of one of the valves, and is here shown as governing the operation of the exhaust valve, though it is obvious that it could be modified so as to interfere with the motion of the inlet valve without departing from the scope of my invention. It would also be possible to cause the lateral shifting of the ring 22 to operate a throttle valve, and certain of my claims have been drawn with this possibility in view. In all these cases it will be seen that the ultimate effect is to control the admission of mixture to the cylinder, either directly by operating upon the throttle or upon the inlet valve, or indirectly by leaving the exhaust valve open and so interfering with the suction.

While I have described my invention in detail, I do not propose to be limited to such details except as the same may be positively included in the claims hereto annexed or may be rendered necessary by the prior state of the art.

Having thus described my invention, what I claim is:

1. The combination, with the cylinder of an internal combustion engine, of a speed-operated governing member, a shaft, a pair of arms projecting from said shaft, one of said arms being arranged in operative relation to said governing member, means in operative relation to the other arm for controlling the supply of explosive mixture to the engine, and connections, extending in opposite directions, whereby the angular relation of said arms may be varied.

2. The combination, with a cylinder of an internal combustion engine, of a speed-operated governing member, a shaft, a pair of arms projecting from said shaft, one of said arms being arranged in operative relation to said governing member so as to rock said shaft upon changes in the position of said member, means operative upon a forward movement of the other arm for controlling the supply of explosive mixture to the engine cylinder, means for adjustably fixing the angle between said arms, and a spring yieldingly opposing the forward movement of the latter arm.

3. The combination, with the cylinder of an internal combustion engine, of a speed-operated governing member, a pair of arms movable about a common axis, one of said arms being arranged in operative relation to said governing member, means in operative relation to the other arm for controlling the supply of explosive mixture to the engine, and means, comprising two rotatable parts connected by a universal joint for varying the angle between said arms.

4. The combination, with the cylinder of an internal combustion engine, of a speed-operated governing member, a shaft, a pair of arms projecting from said shaft, one of said arms being arranged in operative relation to said governing member, means in operative relation to the other arm for controlling the supply of explosive mixture to the engine, a pair of projections mounted on said shaft, a spring tending to hold one of said projections and the last mentioned arm in engagement, and threaded means operatively engaging one of said projections for varying the angular relation between said arms.

5. The combination, with the cylinder of an internal combustion engine, of a speed-operated governing member, a shaft, a pair of arms projecting from said shaft, one of said arms being arranged in operative relation to said governing member, means in operative relation to the other arm for controlling the supply of explosive mixture to the engine, a yoke upon said shaft, a spring tending to hold said yoke and the last-mentioned arm in engagement, and a rod having a threaded connection with said arm and bearing against one branch of said yoke.

6. The combination, with the cylinder of an internal combustion engine, of a speed-operated governing member, a shaft, a pair of arms projecting from said shaft, one of said arms being arranged in operative relation to said governing member and the other arm being mounted upon said shaft and having a yielding connection therewith, means for adjusting the position of the latter arm with reference to the shaft, and a spring surrounding said shaft and having one end operatively connected thereto and its opposite end connected to a relatively fixed member.

7. The combination, with an engine cylinder, of a speed-operated governing member, a shaft, an arm projecting from said shaft in operative relation to said member, a second arm rotatably mounted on said shaft and having a yielding connection therewith, said arm being arranged and adapted to control the supply of explosive mixture to the engine and said arm being

provided with a threaded aperture on each side of said shaft, an adjusting screw adapted to be mounted in either of said apertures, and a pair of projections rigid with said shaft and extending opposite to the apertures in said arm, whereby said adjusting screw may engage one or the other of said projections to permit the adjustment of the angle between said arm from either side of the engine.

8. The combination, with an engine cylinder, of a speed-operated governing member, a shaft, an arm projecting from said shaft in operative relation to said member, a second arm rotatably mounted on said shaft and having a yielding connection therewith, said second arm being arranged and adapted to control the supply of explosive mixture to the engine and having a threaded aperture on each side of said shaft, a yoke rigidly secured to said shaft and having projections opposite said apertures, and a pair of adjusting screws threaded through said apertures and adapted to bear against said projections, whereby the angle between said yoke and second arm may be adjusted.

9. The combination, with an engine cylinder, of a speed-operated governing member, a shaft, an arm projecting from said shaft in operative relation to said member, a second arm mounted on said shaft and having a yielding connection therewith and extending in opposite directions therefrom, said second arm being provided with a threaded aperture on each side of said shaft, a yoke rigidly connected with said shaft and having a pair of projections, each projection being arranged opposite to one of said threaded apertures and the threaded portions of said arm and the projections of the yoke being arranged in consecutive order around said shaft, a threaded operating device in each aperture adapted to bear against a projection, and means operable by the movement of said second arm for controlling the supply of explosive mixture to the engine cylinder.

10. The combination, with an engine cylinder, of a speed-operated governing member, a shaft, an arm projecting from said shaft in operative relation to said member, a second arm mounted on said shaft and having a yielding connection therewith and extending in opposite directions therefrom and adapted to control the supply of explosive mixture to the engine, said second arm being provided with a threaded aperture on each side of said shaft, an adjusting screw adapted to be inserted into either of said apertures, and a pair of projections rigidly connected with said shaft, each projection being arranged opposite to a threaded aperture so as to be engaged by the end of the adjusting screw and the threaded portions of said second arm and the projections being arranged in consecutive order around said shaft.

11. The combination, with an engine cylinder, of a speed-operated governing member, a shaft, an arm projecting from said shaft in operative relation to said member, a second arm rotatably mounted on said shaft and having a yielding connection therewith, said second arm being provided with a threaded aperture on each side of said shaft and being arranged and adapted to control the supply of explosive mixture to the engine, a pair of projections rigidly secured to said shaft and extending opposite to said apertures, a threaded device mounted within one of said apertures and adapted to bear against the corresponding projection, and an operating member for said device having a universal-joint connection therewith.

12. The combination, with an internal combustion engine having a main shaft and a valve operating rod, said valve operating rod having a stop projection thereon, of a stop finger or latch carried by the engine casing and adapted to engage said projection and arrest the movement of said rod, a governor shaft carried by said engine casing and having a bracket thereon provided with a pair of oppositely disposed forwardly projecting branches, an arm carried by said shaft between said branches and projecting laterally therefrom and engaging said stop finger or latch, a ring surrounding the engine shaft and adapted to be shifted therealong upon changes in the speed of revolution thereof, a rigid arm carried by said governor shaft and engaging said ring, and an adjusting screw engaging said first arm and one of said branches and operable to vary the angle between said arms without interfering with the operation of the engine.

13. The combination, with the cylinder of an internal combustion engine, of a speed operated governing member, an arm in operative relation to said governing member, a shaft to which said arm is connected, a second arm on said shaft, means in operative relation to the second arm for controlling the supply of explosive mixture to the cylinder, a yielding connection between said second arm and the shaft and a yielding connection between said shaft and the engine frame.

14. The combination, with the cylinder of an internal combustion engine, of a speed-operated governing member, a pair of arms movable about a common axis, one of said arms being arranged in operative relation to said governing member, and the other arm being arranged and adapted for regulating the explosions in said cylinder, a pair of projections mounted in rigid relation as regards one of said arms, one of said pro-

jections being disposed on each side of the other of said arms, yielding means connecting said arms and tending to change their angular relation, and threaded means engaging one of said projections and the arm adjacent thereto and opposing the action of said yielding means.

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

CHARLES C. STEDMAN.

Witnesses.
J. B. HULL,
BRENNAN B. WEST.