A. W. DANIEL.

EXPLOSIVE ENGINE.

APPLICATION FILED JAN. 20, 1906.

898,974.

Patented Sept. 15, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

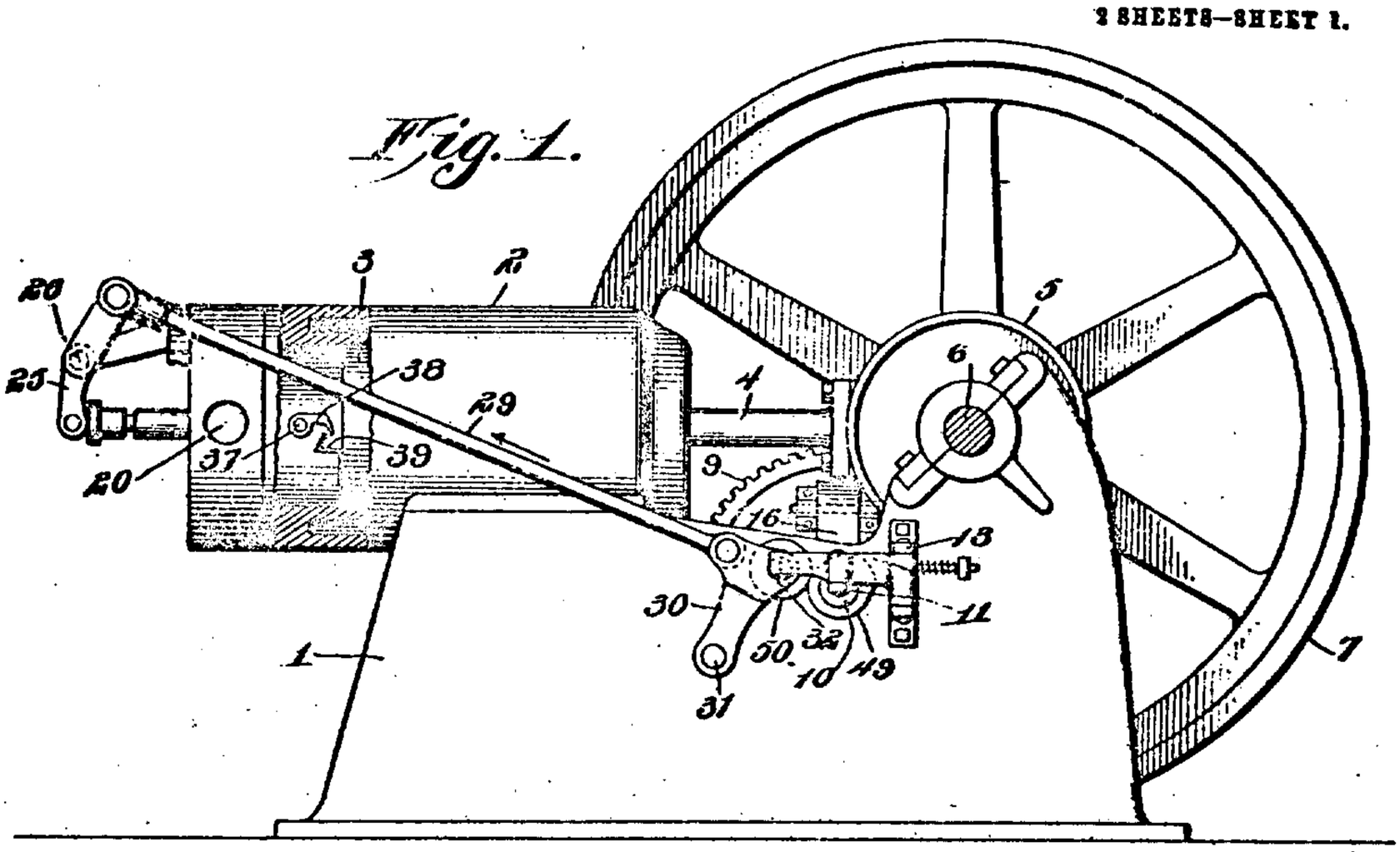
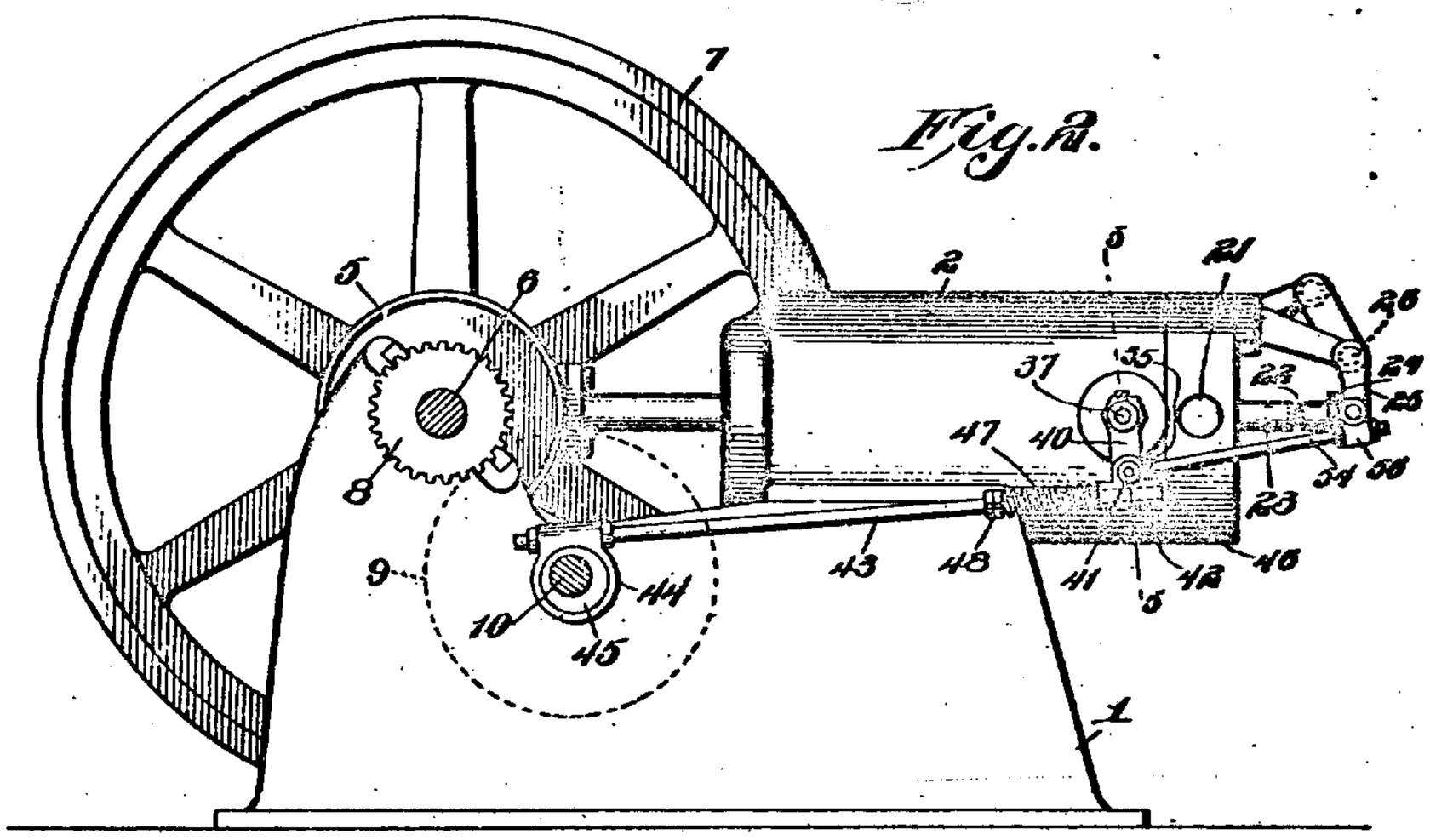


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

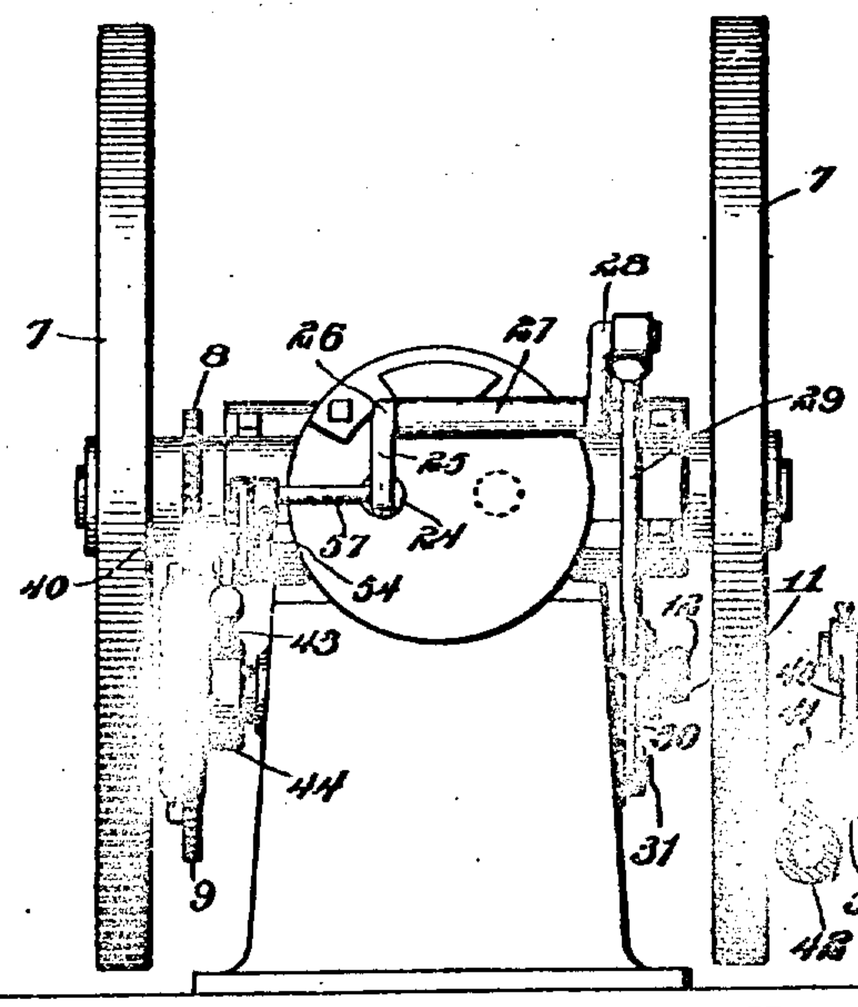
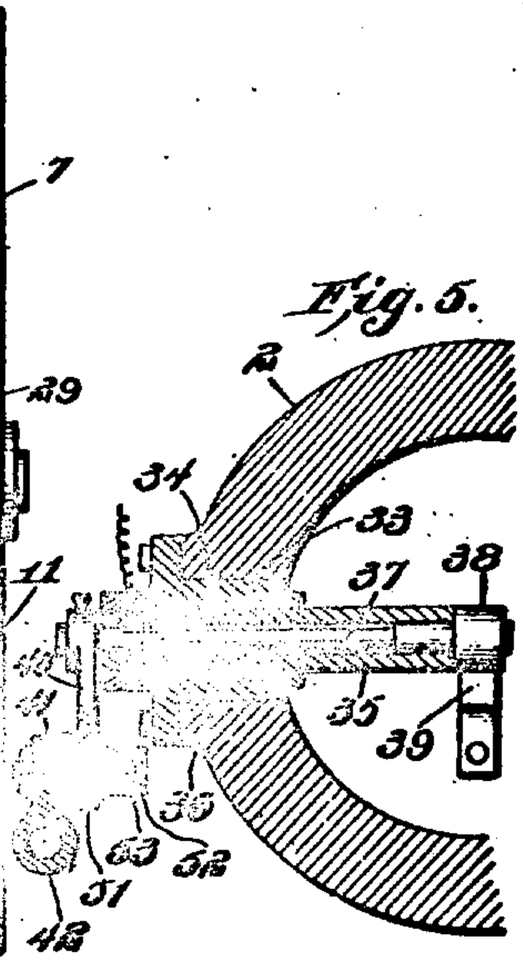


Fig. 5.



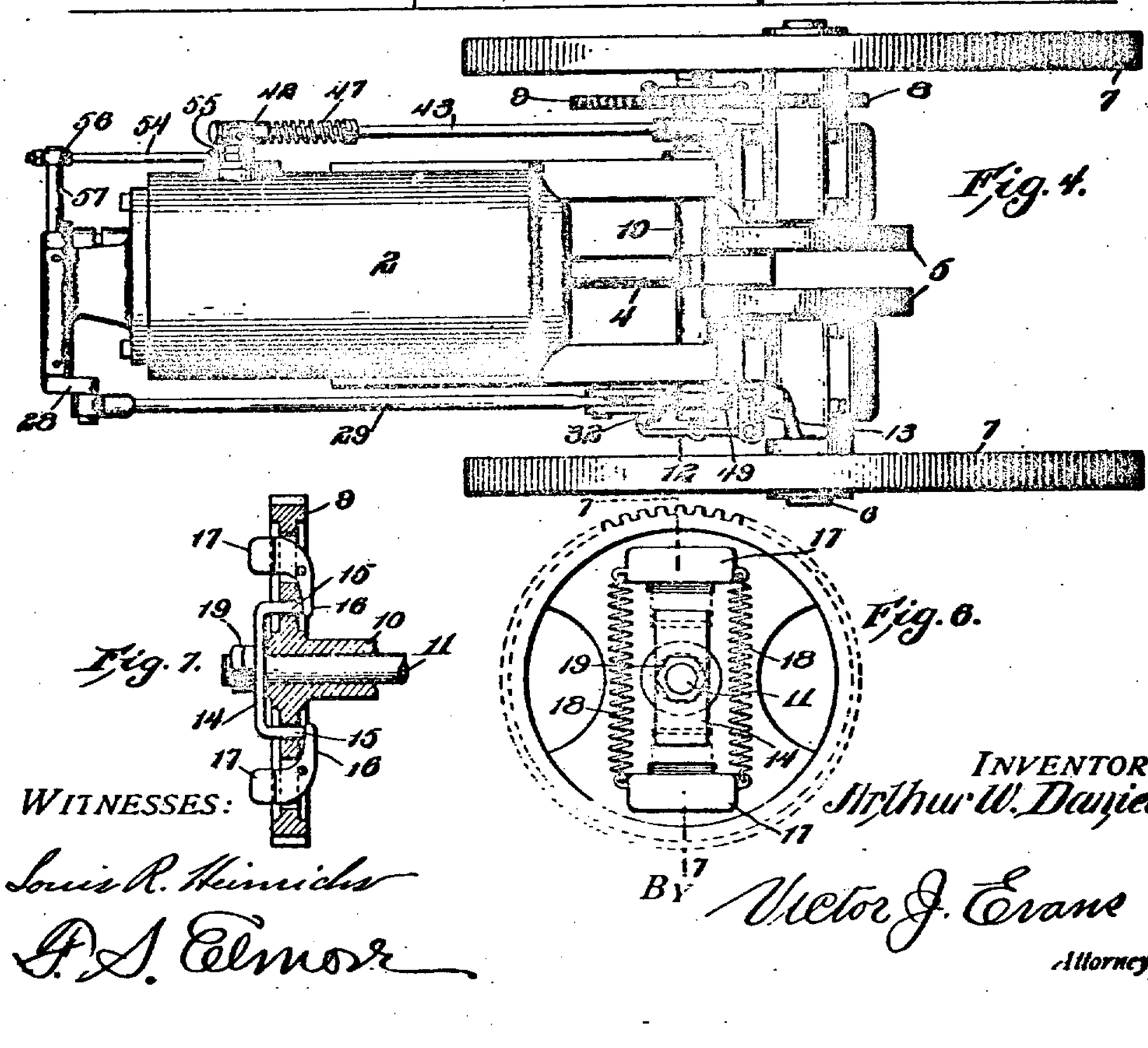


Fig. 4.

Fig. 7.

Fig. 6.

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UNITED STATES PATENT OFFICE.

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EXPLOSIVE-ENGINE.

No. 898,974. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed January 20, 1906. Serial No. 297,030.

To all whom it may concern:

Be it known that I, ARTHUR W. DANIEL, a citizen of the United States, residing at Owensboro, in the county of Daviess and State of Kentucky, have invented new and useful Improvements in Explosive-Engines, of which the following is a specification.

This invention relates to explosive engines, being especially directed to the governing and sparking mechanism therefor, and has for its objects to produce a comparatively simple, inexpensive device of this character, wherein one of the sparking members will be moved out of the path of the other during each alternate instroke of the piston, or that is, during the exhausting intervals, and one wherein the movable sparker will, in the event of the engine speed increasing beyond a predetermined limit, be automatically moved out of the path of the other sparker and maintained in such position until the speed has decreased to normal.

A further object of the invention is to provide a device of this character with a simplified form of mechanism for operating the movable sparker, one in which said sparker will be automatically moved to inactive position simultaneously with the opening of the exhaust port, and one wherein the parts will upon an abnormal increase in the speed of the engine be locked for maintaining the exhaust open and the movable sparker in inactive position.

With these and other objects in view, the invention comprises the novel features of construction and combination of parts more fully hereinafter described.

In the accompanying drawings: Figure 1 is a side elevation of an engine equipped with a mechanism embodying the invention. Fig. 2 is a similar view looking from the other side of the engine. Fig. 3 is a rear elevation of the same. Fig. 4 is a top plan view of the same. Fig. 5 is a detail, sectional view taken on the line 5—5 of Fig. 2 and showing the parts on an enlarged scale. Fig. 6 is a front view of the governor weights and adjacent parts. Fig. 7 is a detail, sectional view taken on the line 7—7 of Fig. 6.

Referring to the drawings, 1 designates an engine base sustaining a cylinder 2 in which is arranged for reciprocation a piston 3, the rod 4 of which is connected at its rear end with eccentrics 5 carried by a drive shaft 6 journaled in suitable split bearings in the base 1 and equipped with fly wheels 7, these parts, except as may be hereinafter explained, being of the usual or any preferred construction and arrangement and adapted in practice to perform their ordinary functions.

Fixed upon the shaft 6 for rotation therewith is a gear 8 in mesh with a second gear 9 in turn fixed upon a tubular governor shaft 10 journaled in the base 1 and containing a longitudinally movable operating member or rod 11 pivotally engaged at one end with a locking member or dog 12 in turn pivoted to a suitable bearing 13 on the base 1, there being loosely mounted upon the rod 11 a cross head or piece 14 having inturned portions or fingers 15 projecting through suitable openings in the governing wheel 9 within the path of and for engagement by the adjacent, inwardly extending portions or arms 16 of a pair of weighted governor members or levers 17 pivoted in suitable bearing openings in the wheel 9 and held in normal position under the influence of springs 18, there being tapped onto the adjacent end of rod 11 a bearing nut 19 designed for fixing the cross piece 14 against movement longitudinally of the rod 11. It will be noted in this connection that when the speed of rotation of shaft 6 increases beyond a predetermined limit the weighted ends of governor levers 17 will swing outward by centrifugal action, as usual, thus causing the inner portion 16 of said levers to act upon the fingers 15 and through the medium of cross piece 14 move the rod 11 longitudinally in a direction for swinging the free end of the locking member 12, as indicated by the arrow in Fig. 4, and for a purpose which will hereinafter appear.

The cylinder 2 is provided with an inlet port 20 and with an exhaust port 21 adapted to be opened or closed under the action of a suitable valve carried by a longitudinally movable stem 22 slidably disposed in a bearing 23 at the rear end of the cylinder and having a head 24 disposed in the path of a crank arm or portion 25 provided on a rock shaft 26 journaled in a suitable bearing 27 and having a crank portion or arm 28 to which is pivoted one end of a governor rod or link 29 having its other end pivoted to a bell crank lever 30 in turn pivoted at 31 to the base 1, there being provided on the lever 30 a projecting portion or keeper 32 lying normally out of the path of the locking member 12 and adapted for engagement by the latter when swung inward, as heretofore explained.

Mounted in a bearing 33 provided in the wall of the cylinder 2 at a point adjacent its forward end is a bushing 34 adapted to receive a tubular bearing member 35 of a length to project into the cylinder, as seen in Fig. 5, there being journaled in said bearing member, which is insulated from the bushing 34 by suitable insulating material 36, a rotary stub shaft 37 having fixed upon its inner end and for movement therewith a primary movable sparking member or contact 38 adapted for coöperation with and for movement into and out of the path of a secondary sparking member or contact 39 fixed upon the piston head 3.

Fixed upon the outer end of shaft 37 is a crank arm 40 to the outer end of which there is pivoted by means of a tubular coupling member 41, a bearing member or sleeve 42 having slidably arranged therein the upward end of a rigid connecting element or rod 43, the rear end of which is connected by means of an eccentric strap 44 with an eccentric 45 fixed upon the shaft 10, there being arranged upon the rod 43, which is provided at its upward end with a head or enlargement 46 a normally expanded spring 47 arranged to bear at one end against the sleeve 42 and at its other end against a bearing shoulder 48 on the rod, while fixed upon the shaft 10 at the end thereof remote from the eccentric 45 is a cam member or head 49 arranged in contact with an antifriction roller 50 journaled to the lever 30 and adapted for locking the latter to move the rod 29 forwardly as indicated by the arrow in Fig. 1 to operate the rock shaft 26 for actuating the exhaust valve to open the port 21.

Journaled in the tubular coupling member 41 is a second coupling member or pin 51 having a head 52 provided with a bearing opening 53 in which is slidably arranged one end of a connecting rod or link 54 provided at a point suitably remote from said end with a bearing shoulder 55 and having its other or forward end pivotally connected by means of a coupling link 56 with a fixed bearing portion or arm 57 projecting from the outer end of crank arm 25, as seen more clearly in Fig. 3.

In practice, as the shaft 6 rotates the shaft 10 will be driven therefrom through the medium of gears 8 and 9 and the cam head 49 will, during each rotation of the shaft 10, act upon the roller 50 for rocking lever 30 and moving the governor rod 29 forwardly, whereby the rock shaft 26 will be operated to move the arm 25 into contact with and for opening the exhaust valve as hereinafter explained, it being understood that the shape of the cam 49 is such that the exhaust valve will be open during each alternate instroke of the piston 3, or that is, during appropriate intervals for exhausting the exploded gases from the cylinder 2. During the rotation of shaft 10 the rod 43 will be actuated through the medium of the eccentric 45 for rocking the shaft 37 to move the sparking member or contact 38 into and out of the path of the coöperating sparking member 39, it being inderstood that during the normal operation of the parts the movement of the contact 38 to inactive position, or that is, out of the path of the sparker 39, will be simultaneous with the exhausting stroke of the piston 3 and the movement of the exhaust valve to open position, and further that under normal conditions the rod 54 will have sufficient longitudinal play in the bearing opening 53 to permit the proper movement of crank arm 40 without coming in contact with the stop shoulder 55. When the speed of the engine increases beyond the normal the governor members 17 will, in swinging outward, move the rod 11 longitudinally and throw the locking member 12 into the path of keeper 32, as heretofore explained, thus locking the governor rod 29 against movement with the exhaust valve open, under which conditions the link 54 will be moved longitudinally rearward through the medium of crank arm 25 a sufficient distance to bring the abutment 55 into contact with the head 52 and act upon the arm 40 for fixing the shaft 37 against movement with the sparking member 38 held out of the path of sparking member 39, in which position the parts will be maintained until speed of the engine decreases sufficiently for the governor members 17 to return to normal condition under the action of springs 18, whereupon the locking member 12 will be actuated for releasing the parts and permitting a continuance of their normal operation, as just explained. It will be seen that when the locking rod 54 is moved to position for holding the arm 40 and shaft 37 against movement the spring 47 will permit the rod 43 to play idly back and forth through the bearing 42.

Having thus described my invention, what I claim is:

1. In an internal combustion engine, the combination of a piston and cylinder, a shaft connected with and driven by the piston, an ignition device having a movable electrode in the cylinder, an arm connected with said electrode and disposed outside the cylinder, a secondary shaft, a member actuated by the shaft and slidably connected with the arm, a spring arranged on the member to cause the arm to move therewith, a valve mechanism, a speed responsive device controlling the valve mechanism, and a connection between the mechanism and said arm for rendering the latter inoperative during abnormal speed conditions.

2. In an internal combustion engine, the combination of a cylinder, a piston therein, an ignition device, a shaft driven by the piston, a movable member associated with the ignition device, a reciprocating rod actuated

by the shaft, a lost motion connection between the rod and member, a yielding device normally preventing lost motion in said connection, a valve mechanism, means for controlling the valve mechanism to regulate the speed of the engine, and a connection between the mechanism and said member for rendering the latter inoperative and causing the second device to yield.

3. In an internal combustion engine, the combination of a cylinder, an ignition device having a movable electrode disposed within the cylinder, a member connected with the electrode and disposed outside the cylinder, a rod operating continuously with the moving parts of the engine and yieldingly connected with the member, an abutment on the rod engaging the member to move the same in one direction, a spring on the rod bearing against the said member and yieldable when the said member is held stationary, a rock shaft, a valve operated thereby, means for actuating the rock shaft, and a connection between the rock shaft and member for holding the latter stationary during abnormal speed conditions and while the said rod continues to operate.

4. In an internal combustion engine, the combination of a cylinder, an ignition device including a movable electrode disposed within the cylinder, an oscillating arm connected with the electrode and disposed outside the cylinder, a rod positively engaging the arm for moving the latter in one direction, a spring on the rod through which the latter operates to move the arm in the opposite direction, an eccentric for actuating the rod, a valve mechanism, and a member connected with the mechanism and arm for preventing movement of the latter for controlling the speed of the engine.

5. In an internal combustion engine, the combination of a cylinder, a piston therein, a main shaft driven by the piston, a secondary shaft, an ignition device having a movable electrode and disposed at one side of the cylinder, an actuating rod yieldingly connected with the electrode for actuating the latter, means on the secondary shaft for operating the said rod, an exhaust valve at the head of the cylinder, a rock shaft extending transversely to the axis of the cylinder and disposed at the head of the latter, means for actuating the valve from the shaft, a mechanism between the secondary shaft and rock shaft for moving the latter, a speed responsive device controlling the said mechanism, and means between the rock shaft and ignition device for preventing movement of the electrode when speed becomes excessive.

6. In an internal combustion engine, the combination of relatively movable electrodes, an arm connected with one of the electrodes for rocking the same, a continuously operated rod slidably connected with and supported at one end by the arm for rocking it under normal conditions, a valve, mechanism for actuating the valve, a speed responsive device controlling the said mechanism, and means between the mechanism and said arm for holding the latter inoperative when the speed exceeds normal.

7. In an internal combustion chamber, the combination of a cylinder, an exhaust valve, an ignition device comprising relatively movable electrodes, a rocking member for actuating the exhaust valve, a speed responsive device controlling the rocking member, means for operating one of the electrodes, and a device between the rocking member and said means for rendering the latter inoperative when the speed exceeds a predetermined limit.

8. In an internal combustion chamber, the combination of a cylinder, an exhaust valve in the head thereof, a rock shaft mounted on the head a piston in the cylinder, a shaft driven thereby, a connection between the shaft and rock shaft to actuate the latter, an ignition device including relatively movable electrodes, means actuated by the piston driven shaft for operating one of the electrodes, and a device between the rock shaft and said means for holding the said electrode inoperative under abnormal speed conditions.

9. In an internal combustion engine, the combination of a piston cylinder, a main shaft driven thereby, a hollow secondary shaft driven thereby, a cam on the hollow shaft, a longitudinally movable member in the hollow shaft, a speed responsive device for actuating the member, a valve gear actuated by the cam, and a device connected with the said member for holding the valve gear out of operation during abnormal speed.

10. In an internal combustion engine, the combination of a piston and cylinder, a hollow shaft driven by the piston, a longitudinally movable member in the shaft, a valve gear actuated by the shaft, a wheel on the shaft, centrifugally acting weights on the wheel, means between the weights and member for moving the latter, a device attached to one end of the member for rendering the valve gear inoperative.

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

ARTHUR W. DANIEL.

Witnesses:

JOHN L. FLETCHER,

FABIUS S. ELMORE.