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GOVERNING MECHANISM FOR EXPLOSIVE ENGINES.

APPLICATION FILED JULY 31, 1907.

960,173.

Patented May 31, 1910.

2 SHEETS—SHEET 1.

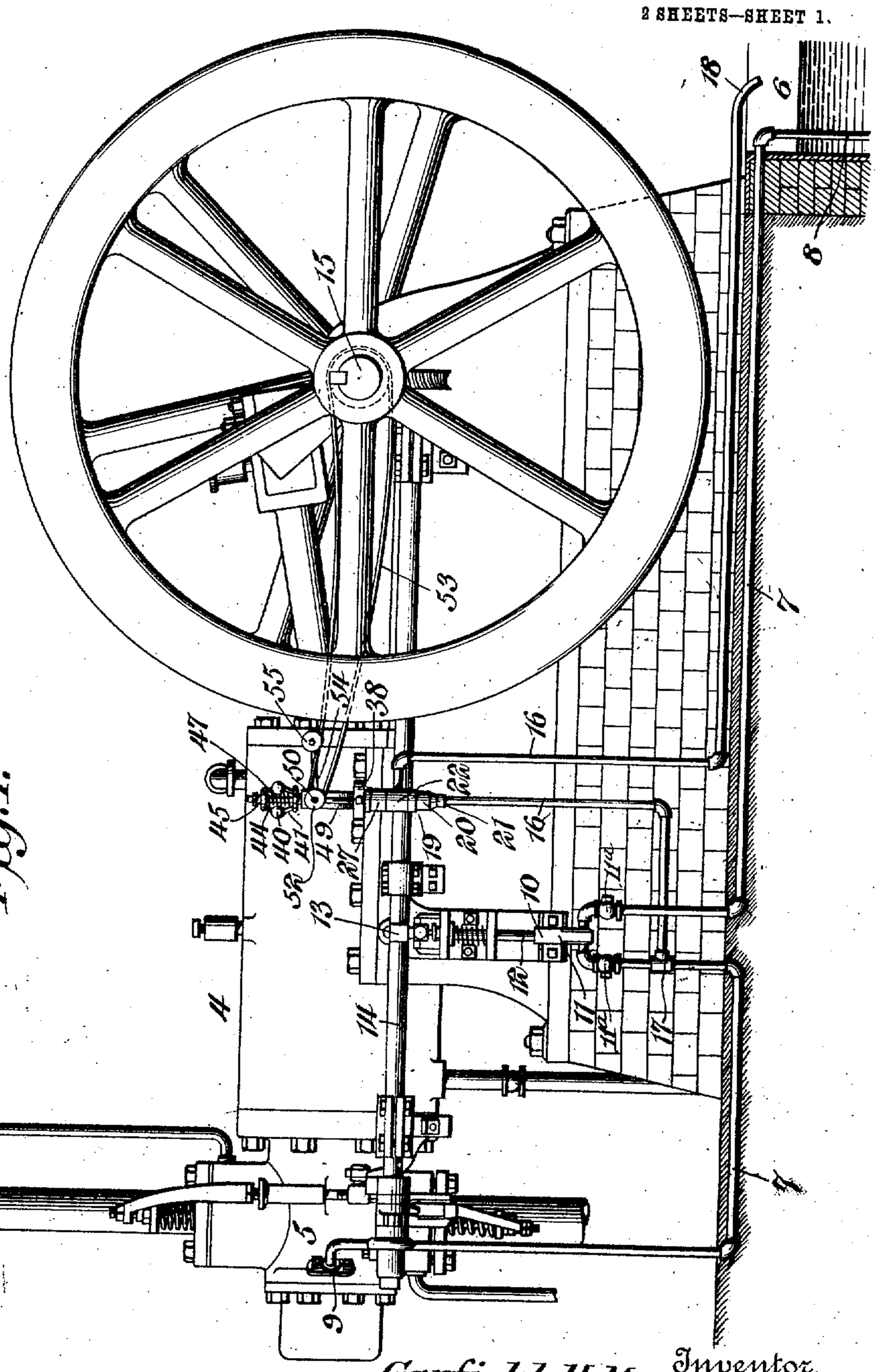

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

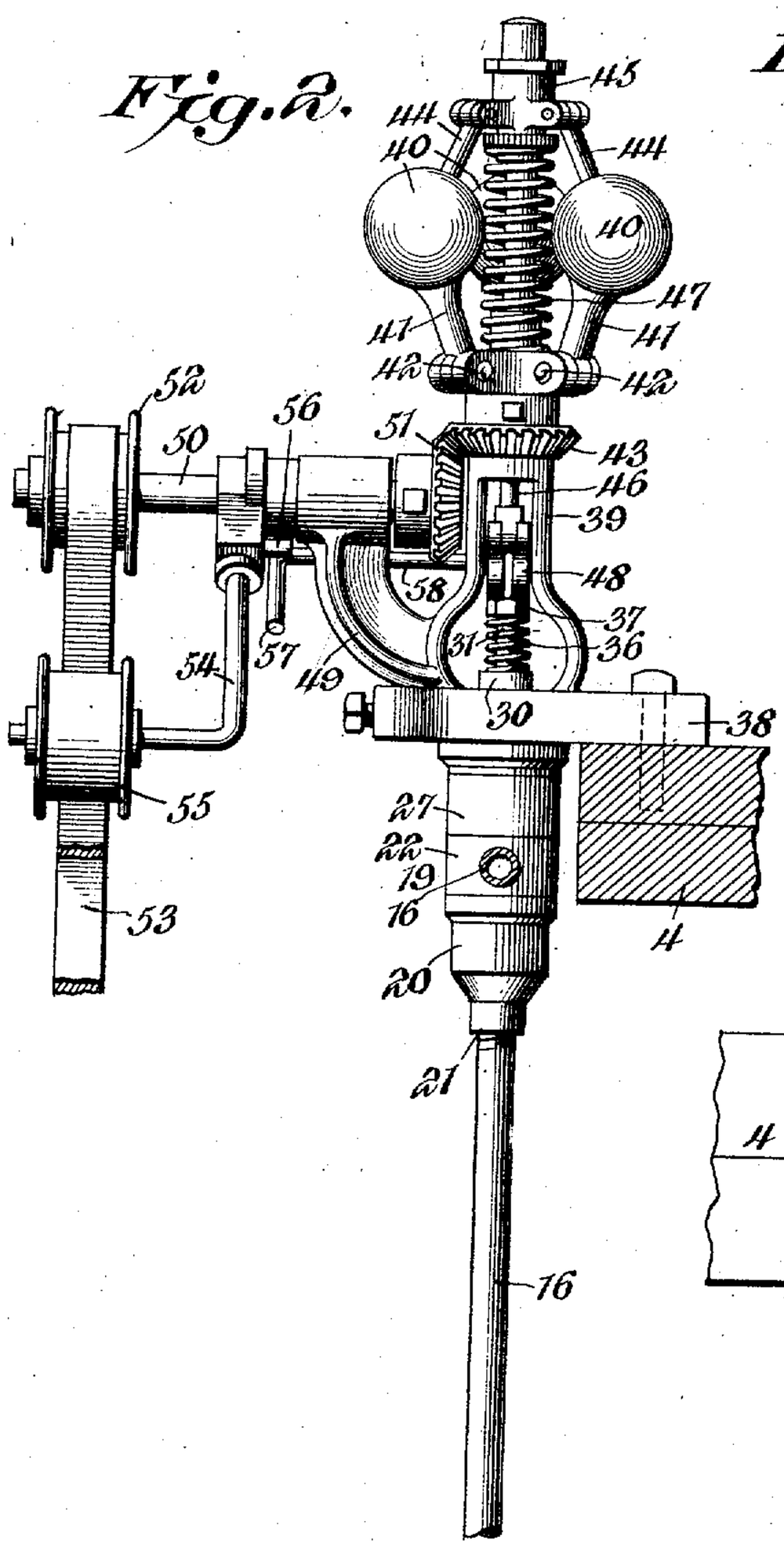
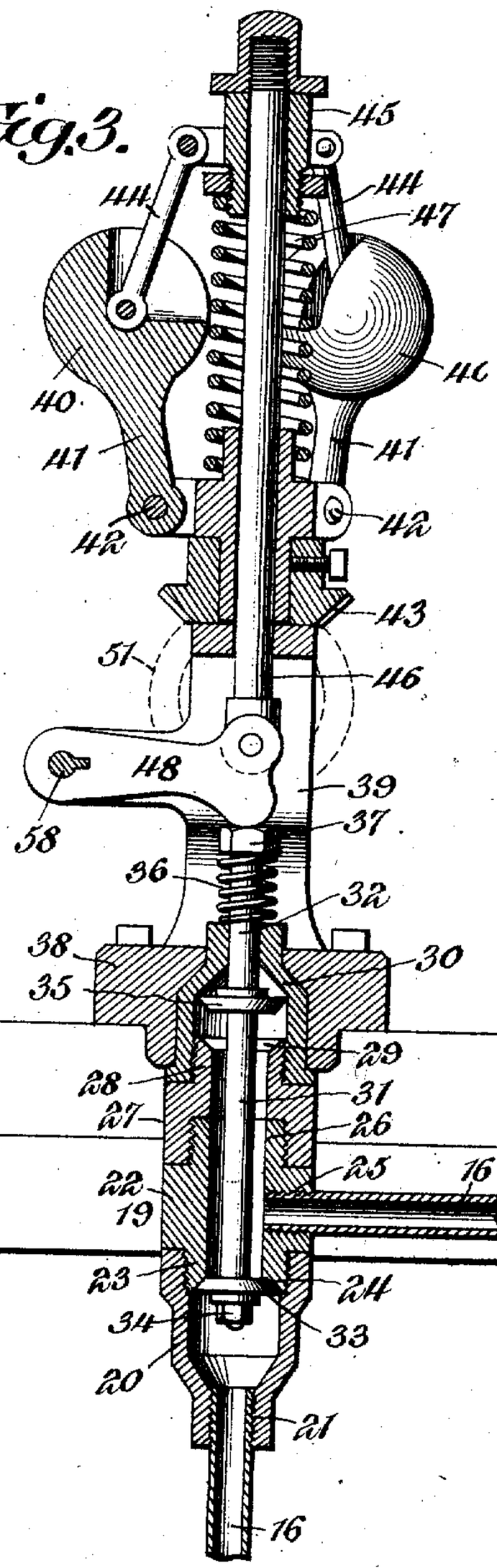


Fig. 3.



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GOVERNING MECHANISM FOR EXPLOSIVE-ENGINES.

960,173. Specification of Letters Patent. **Patented May 31, 1910.**

Application filed July 31, 1907. Serial No. 386,423.

To all whom it may concern:

Be it known that I, GARFIELD H. HAYES, a citizen of the United States, residing at Franklin, in the county of Venango and State of Pennsylvania, have invented a new and useful Governing Mechanism for Explosive-Engines, of which the following is a specification.

The primary object of the present invention is to provide novel, simple and highly effective means for governing the speed of an explosive engine by varying the amount of motive fluid charges supplied thereto without the necessity of changing the speed of the mechanism that forces such charges to the engine.

An embodiment of the invention that is at present considered the preferable one is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of the engine. Fig. 2 is an elevation on an enlarged scale of the governing mechanism. Fig. 3 is a vertical sectional view through said governing mechanism.

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

The invention is shown applied to an oil engine, designated generally by the reference numeral 4, and having an explosion chamber 5. A suitable reservoir or tank 6 for the motive fluid is connected to the explosion chamber by a conduit 7, said conduit having its inlet end 8 communicating with the reservoir or tank 6 and having its discharge end terminating in a suitable sprayer cap 9, which may be of any character well known to the art. A pump 10 of any well known character is located in the supply conduit 7, and preferably includes a cylinder 11 and a reciprocating plunger 12 that operates in the cylinder. The plunger 12 is actuated by a cam 13 carried by a cam shaft 14 that is driven from the engine shaft 15. It will thus be evident that when the engine is in operation, motive fluid charges will be drawn from the reservoir 6 by the pump 10 and delivered through the supply conduit 7 into the explosion chamber in a manner well understood. The intake of the motive fluid to and its eduction from the pump is controlled by a suitable valve shown at 11^a in Fig. 1. To govern the delivery of these charges, the following mechanism is preferably employed. A return conduit normally closed by-pass 16 has its inlet end 17 coupled to the supply conduit 7 between the pump 10 and the engine, and has its delivery end 18 communicating with the reservoir or tank 6. Located in the return conduit 16 is a valve casing 19. This valve casing is made up of sections, namely, a lowermost section 20 having an inlet 21, into which the first section of the return conduit 16 is screwed, as shown in Fig. 3. A second section 22 has a nipple 23 threaded into the upper end of the section 20, and provided with a valve seat 24. The section 22 furthermore has a lateral outlet 25 into which the second section of the return conduit 16 is screwed. Said section 22 is furthermore provided with a central upstanding boss 26, on to which is threaded a third section 27 having an upwardly extending portion 28 provided with a valve seat 29. It will be observed that the valve seat 24 is disposed between the inlet and outlet of the casing, while the valve seat 29 is located on the opposite side of the outlet 25 to the valve seat 24, and is oppositely disposed to said valve seat. A cap section 30 completes the valve casing, being threaded on to the upwardly extending portion 28. A reciprocatory valve stem 31 operates longitudinally in the valve casing, and has its upper end slidably projecting through the cap 30, as shown at 32. A controlling valve 33 is detachably mounted on the lower end of the stem, and is held in place by a nut 34. The valve 33 coöperates with the valve seat 24, and opens downwardly against the pressure of motive fluid in the conduit 16, as hereinafter explained. A packing valve 35, secured to or forming an integral part of the upper portion of the valve stem 31, is movable into and out of coöperation with the upper valve seat 29. These valves are so arranged that when the valve 33 is seated, the valve 35 is out of coaction with the seat, but when said valve 33 is open, then the valve 35 will be moved into coaction with the seat 29. This will be clearly evident by reference to Fig. 3. The valve stem 31 is normally held in its uppermost position, and consequently the valve 33 is normally held closed by a spring 36 located upon the exposed end 32 of the stem, said spring having its lower end bearing upon the upper end of the cap 30 and having its upper end bearing against a nut 37 or head carried by the stem. The

pump is supported upon the engine by a suitable bracket 38 or other device, and mounted on this bracket is the frame 39 of a centrifugal governor. While said governor may be of any desirable character, in the present embodiment, it comprises a plurality of centrifugal balls 40 carried by arms 41 that are pivotally connected, as shown at 42 to a gear wheel 43 journaled on the frame. These balls have link connections 44 with a head 45 carried by the upper end of a vertically movable stem 46. The stem is yieldingly supported by a spring 47, and has a bearing at its lower end upon a swinging arm 48, which arm in turn bears upon the nut 37 or upper end of the valve stem 31. The frame 39 of the governor includes a bracket 49, in which is journaled a shaft 50 having at its inner end, a gear wheel 51 meshing with the gear 43 and having at its outer end a pulley 52 around which passes a belt 53, said belt being driven from the engine shaft 15. A swinging weighted arm 54, journaled on the shaft 50, has an idler pulley 55, normally resting on the belt, said arm being provided with an offset projection 56 in the path of movement of which is located the crank arm 57 of a rock shaft 58, said rock shaft carrying the swinging arm 48. The rock shaft 58 is journaled in bearings formed in projecting portions of the frame 39.

The operation of the mechanism is substantially as follows: As already explained, while the engine is running, the pump 10 is delivering charges from the tank or reservoir through the supply conduit 7 and sprayer cap 9 into the engine. Normally the valve 33 is held closed by the spring 36, as already explained, and when the engine is running, the centrifugal governor will also be in operation. Consequently if the engine reaches a predetermined speed, the outwardly moving balls 40 will cause a depression of the stem 46. This will force the arm 48 downwardly and open the valve 33. As is well known to those skilled in the art, the ordinary sprayer cap 9 has a very small discharge orifice, and a check valve. Therefore it requires considerable force to spray the fluid into the engine, and when the valve 33 is open, a path of less resistance is afforded for the motive fluid. Therefore a portion of the motive fluid supply can pass through the conduit 16, and return to the tank or reservoir. This proportion varies according to the distance the valve 33 is opened, and if the engine for instance, races, the valve will be opened so far, that practically no motive fluid will enter the engine. Consequently the speed will be reduced from lack of motive fluid charges to operate said engine. If the governor belt should break, the weight of the arm 54 and pulley 55 will cause the said arm to swing downwardly. Consequently the projection 56 will strike the crank arm 57, and turning the shaft 58, will cause the downward movement of the stem 31 and the consequent opening of the valve 33. In order that the governing mechanism shall promptly respond to the variation in speed, as much friction as possible must be avoided. Consequently it has been found that a stuffing box for the valve stem 31 is objectionable. To avoid a stuffing box, and permit free and easy movement of the stem 31, the packing valve 35 and valve seat 29 have been provided. It has been found that when the valve 33 is opened only a slight distance, the amount of oil or fluid that flows through the conduit 16 can be easily taken care of by the second section of said conduit and that it will flow out of the valve casing, as rapidly as it can enter the same. However, when the valve is opened to its fullest extent in order to avoid the oil being forced around the valve stem, and thus leaking from the casing, the valve 35 is provided. This valve is seated when the valve 33 is fully opened, and consequently there can be no escape or leakage. Experience has demonstrated that the mechanism is highly effective and thoroughly accurate, both in controlling the speed of the engine and in preventing its racing in case of a sudden decrease of load.

From the foregoing, it is thought that the construction, operation, and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. The combination with an explosive engine, of a source of fuel supply, means for feeding fuel from the source to the engine, a normally-closed by-pass, a speed responsive mechanism driven by the engine and operating to open the by-pass when the demand for fuel at the engine is light, and means arranged to be held in inoperative position during the operation of the said mechanism and controlled by the latter to fully open the by-pass and automatically shut down the engine when the said mechanism becomes inoperative.

2. The combination with an explosive engine, of a fuel reservoir, a pump connected with the reservoir and engine, a by-pass between the pump and reservoir, a speed responsive device for controlling the flow of fuel through the by-pass, operative connections between the device and engine, and an emergency means automatically operated independently of the speed responsive device

when the said connections between the latter and engine become deranged to fully open the by-pass.

3. The combination with an explosive engine, of a supply conduit leading from a source of motive fluid supply to the engine, a pump in the conduit, a separate return conduit leading from the supply conduit between the pump and engine and back to the source of supply, a valve acting to direct the motive fluid through the return conduit, a governor operating this valve, a belt connection between the engine and the governor, and means for automatically opening said return valve to direct the motive fluid back to the source of supply upon the breaking of said belt connection.

4. The combination with an explosive engine, of a reservoir for motive fluid, a supply conduit leading from the reservoir to the engine, a pump in said conduit, a return conduit leading from the supply conduit between the pump and engine, a valve in the return conduit, a spring for normally holding the valve closed, a centrifugal governor for opening the valve against the action of the spring, a belt connection between the engine and governor for operating the former, and a weighted arm normally supported by the belt and having connections with the valve to open the same if said belt breaks.

5. The combination with an engine, of a reservoir for motive fluid, a supply conduit connecting the reservoir and engine, a pump located in the supply conduit, a return conduit connected to the supply conduit between the pump and engine, and a controlling device located in said return conduit, said device comprising a casing, opposed valve seats through one of which said motive fluid passes and having an outlet passage between the valve seats, and a controlling valve co-acting with one of said seats and having a spindle passing through the valve casing and acting, when moved in one direction, to close against said seat, and a packing valve mounted on the spindle and acting to move toward the other valve seat when the controlling valve moves away from its seat.

6. The combination with an explosive engine, of a motive fluid reservoir, a supply conduit connecting the reservoir engine, a pump located in the supply conduit, a return conduit connected to the reservoir and having its inlet end communicating with the supply conduit between the pump and engine, and means for controlling the flow of fluid through the return conduit, said means including a valve casing having an inlet and an outlet, and oppositely disposed valve seats located on opposite sides of the outlet, a reciprocating valve stem operating in the valve casing, a controlling valve connected to the stem and coöperating with one of the valve seats, said valve opening against the direction of the flow of motive fluid through the casing, a packing valve carried by the stem and coöperating with the valve seat in said casing opposed to the controlling valve seat, said latter valve being movable toward its seat upon the opening movement of the controlling valve, a spring for normally holding the stem with the controlling valve seated, and a governor having an actuating portion engaged with the valve stem to open the controlling valve and seat the packing valve.

7. The combination with an explosive engine, of a reservoir for motive fluid, a supply conduit connecting the reservoir and engine, a pump located in said supply conduit, a return conduit having its inlet end communicating with the supply conduit between the pump and engine and having a discharge communicating with the reservoir, and means in the return conduit for controlling the flow therethrough, said means comprising a valve casing including a lower inlet and a lateral outlet, a controlling valve seat located in said casing between the inlet and outlet, a packing valve seat located on the opposite side of the outlet and disposed oppositely to the controlling valve seat, a reciprocating stem operating in the casing and having an exposed end, a controlling valve carried by the lower end of the stem and coöperating with the controlling valve seat, a packing valve carried by the upper portion of the stem and coöperating with the upper valve seat, said packing valve being movable toward its seat upon the opening of the other valve, a spring for normally holding the controlling valve against its seat, a centrifugal governor mounted on the valve casing and including an actuating element that engages the stem to move it against the action of the spring, and driving means for the governor connected to the engine.

8. The combination with an explosive engine, a source of fuel supply, a pump connected with the source and engine, a by-pass between the pump and said source, a valve in the by-pass, a speed responsive device for opening the valve as the speed of the engine accelerates to thereby diminish the supply of fuel to the engine, driving connections between the speed responsive device and moving parts of the engine, and an emergency device tending constantly to open the valve independently of the speed responsive device and arranged to be supported in inoperative position by the driving connections and adapted to be automatically thrown into operation when the said driving connections become deranged.

9. In a fuel supply system for explosive engines, a by-pass, a valve controlling the flow of fuel through the by-pass, a stem con-

nected with the valve, a rod disposed in cooperative relation with the stem, centrifugally-acting speed-responsive means for operating the rod and stem, and means for independently operating the stem to open the valve under emergency conditions, said last-mentioned means including a gravity-acting device for imparting an impact to the valve to suddenly open the same when the centrifugally-actuated device is rendered inoperative.

10. The combination with an explosive engine, of a pump, a supply conduit leading from the pump to the engine, a return conduit connected to the supply conduit between the pump and engine, a bracket secured to the engine, said bracket having a depending valve casing into which said return conduit opens, an upstanding governor frame mounted on the bracket, a valve located in the casing and having an upwardly projecting stem, a governor mounted on the frame and having a portion that engages the stem for effecting the movement of the valve to open or close the return conduit as the speed of the engine changes, a bracket projecting from said governor frame, a shaft mounted in said bracket and having a pulley whereby the governor is driven, a belt passing over said pulley, and means whereby upon the breaking of the belt, the valve spindle may be moved to open the valve and permit the return of motive fluid.

11. The combination with an explosive engine, of a pump, a supply conduit leading from the pump to the engine, a vertically disposed valve casing arranged alongside the engine and above the pump, a return conduit comprising sections, one of which is connected to the lower end of the valve casing and to the supply conduit between the pump and engine, and the other of which is connected to the side of said valve casing, a reciprocatory valve located in the casing, a governor supported above said valve and having a governor spindle, the lower end of said spindle engaging with the upper end of the valve spindle but independent thereof, said governor effecting the operation of the valve when the speed of the engine reaches a predetermined limit, a shaft for driving said governor, a belt driven by the engine and engaging said shaft, and means whereby upon the breaking of said belt the aforesaid valve spindle shall be operated.

12. The combination with an explosive engine, of a pump, a supply conduit leading from the pump to the engine, a return conduit leading from the supply conduit between the pump and engine, a valve in the return conduit, a centrifugal governor operatively-connected with the valve for bypassing fuel in varying quantity as the speed of the engine varies, a belt connection between the engine and centrifugal governor, a rock shaft having a crank arm arranged to operate the valve independently of the governor, and a weighted arm for actuating the rock shaft upon derangement of the belt, said arm having a pulley that rests on the belt and normally supports said arm out of coaction with the rock shaft.

13. The combination with an explosive engine, of a pump, a supply conduit leading from the pump to the engine, a return conduit leading from the supply conduit, a valve in the return conduit, means for normally holding the valve in closed position, a centrifugal governor acting to open said valve when the speed of the engine reaches a predetermined limit, a belt connection between the engine and governor, a weighted arm having a pulley that normally rests upon the belt to support the arm in raised position, said arm having a projection movable therewith when the arm drops upon derangement of the belt, a shaft mounted adjacent the weighted arm and located in the path of the said projection to be moved thereby, and a swinging arm secured to the shaft and coöperating with the valve to open the same when the said arm drops.

14. The combination with an explosive engine, of a supply conduit leading thereto, a return conduit leading from the supply conduit, a governor actuated by engine and having a downwardly disposed stem, and a controlling device in the return conduit operated by the governor and comprising a casing inclosing a chamber having a port in one side, a removable cup-shaped bottom portion having its internal diameter larger than that of said chamber and provided with an opening, a puppet valve movable in the said cup-shaped bottom portion of the casing including a stem having a diameter smaller than that of the chamber, said valve being adapted to close the bottom of the chamber, the upper end of the stem projecting above the casing, and a spring for normally urging the valve upwardly.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

GARFIELD H. HAYES.

Witnesses:

JOHN B. SIGGERS,

BLANCHE J. KALDENBACK.