(No Model.)

C. K. MacFADDEN & E. F. LLOYD.

FUEL ENGINE.

No. 595,324. Patented Dec. 14, 1897.

Fig. 1.

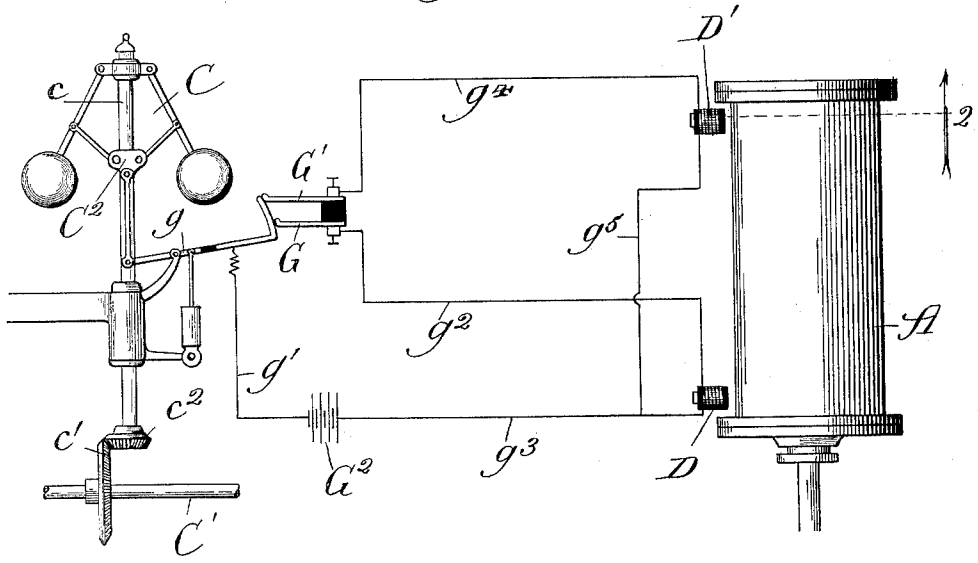
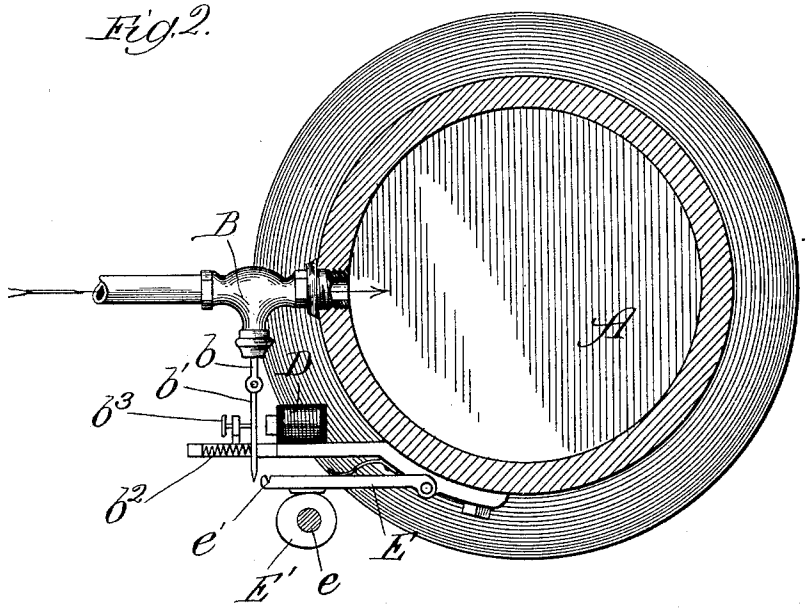


Fig. 2.



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UNITED STATES PATENT OFFICE.

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FUEL-ENGINE.

SPECIFICATION forming part of Letters Patent No. 595,324, dated December 14, 1897.

Application filed May 14, 1896. Serial No. 591,474. (No model.)

To all whom it may concern:

Be it known that we, CARL K. MACFADDEN, of Chicago, Cook county, Illinois, and ERNEST F. LLOYD, of Fort Wayne, Indiana, citizens of the United States, have invented certain new and useful Improvements in Fuel-Engines, of which the following is a specification.

Our invention relates especially to that class of engines in which the fuel is introduced directly into the engine-cylinder, and particularly to that class of engines known as "explosion-engines," in which the heat or energy is formed by the explosion of a mixture of hydrocarbons and air within the engine-cylinder.

The object of our invention is to provide a simple, economical, and efficient fuel-engine of the explosive type provided with an automatic electromechanical governor for regulating the admission of fuel; and the invention consists in the combination of an engine-cylinder provided with a reciprocating piston and a governor operated by electromechanical means.

It consists, further, in providing the cylinder with a supply valve or valves operated by mechanical means which supply one or more cylinder ends with fuel, and an electrical relay controlling magnets or means for regulating the several admissions of fuel.

It consists, finally, in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation, in diagrammatic form, of an engine-cylinder fitted with our electrical mechanical governor; and Fig. 2, a transverse section taken on line 2 of Fig. 1, showing an enlarged view of a portion of the mechanism hereinafter described and claimed.

In the art to which this invention relates it is usual to control or attempt to control the speed of the engine by shutting off the supply of fuel at one or both ends of the cylinder by mechanical means. This necessitates a large amount of mechanism between the different styles of governors and the valves, which are sluggish in action, in that there are numerous bearings, pivotal points, and mechanism that make considerable friction, so that the governor is not very sensitive, and consequently the speed or speeds must vary considerably before the governor has a chance to act. This is a serious objection in this class of engines, in that they cannot be used successfully for electric-lighting plants, where the variation in speed should be very small. To overcome this objection and provide a sensitive electro-workable governor that will act with very slight variations in speed is the principal object of our invention.

In describing our improvements and illustrating the same we will only show a portion of the engine—viz., the cylinder in connection with the new portions. As to the old portions left out, they are well understood by those skilled in the art, and we do not desire to be limited either to the class of engines or the mechanism herein shown and described any further than is pointed out in the claims, for it is evident that it can be varied to suit different circumstances and conditions by the exercise of mechanical skill.

In constructing our improved engine we provide a cylinder A of the desired type having a reciprocating piston therein, and prefer to use an engine having valves B at each end of the cylinder for the admission of the requisite supply of gas or fuel. We use an ordinary centrifugal governor C and connect its rotating shaft *c* with the operative parts of the engine by means of the shaft C′ and the bevel-gears c' c^2, so that the rotations of the crank-shaft are transmitted to the governor, it being understood, of course, that the higher the speed the more rapidly will the governor-balls revolve. The fuel-admission valves B are provided with the usual valve-stem *b* and an extensible auxiliary pivoted valve-stem *b*′, both of which are set with the valve normally closed. A magnet D is provided and connected with a source of electric energy, as hereinafter described, for the purpose of pulling over the pivoted valve-stem until contacted therewith, so that it may be operated by the vibrating lever E, arranged to be contacted by a cam E′ on a revolving shaft *e*. This revolving shaft is connected with the crank-shaft of the engine (not shown) for the purpose of opening the admission-valve at the proper time. When the auxiliary valve-stem is brought into contact with

the magnet, its end enters a notch e' in the vibrating lever, so that the admission-valve is opened. The auxiliary valve-stem is held in its normal "off" position by means of a small spiral spring b^2, while a set-screw b^3 is used for the purpose of limiting the motion of the pivoted valve-stem. To supply current to this magnet at the desired time, we provide one or more contact-points G G', arranged to be contacted by a vibrating lever g on the governor. The normal positions of these points are such that this vibrating contacting-lever contacts both of the contact-points, so that current will flow from the battery G^2 through wire g', through contact G, thence by wire g^2 through the magnet D at the front end of the cylinder, and back by wire g^3 to the battery. Current will also flow from the battery through wire g', contacting-lever g, contact-point G', wire g^4, magnet D', and back by wires g^5 and g^3 to battery. This action furnishes current to both magnets, so that the pivotal valve-stem b' may be brought into contact with the magnets to be operated by the vibrating levers E as the crank-shaft rotates to open the admission-valve at the proper time and admit the proper quantity of fuel. When the speed of the engine increases, the governor-arms will fly out, so as to lift the sleeve C^2, thereby lifting up the inner end of the contacting-lever g and breaking contact between it and the contact-point G', thus cutting off the current from the magnet at the rearward end of the cylinder and allowing the admission-valve at such end of the cylinder to close, which consequently shuts off the fuel at that end when the cam E has made a rotation, so as to permit the vibrating lever E to move away from contact or engagement with the pivotal valve-stem. If the engine exceeds its regular speed and attains a higher speed, the vibrating contacting-lever will be further operated to break contact between both of the contact-points, thus shutting off current from both of the magnets until the speed drops to the regular point and permits contact to be again made.

It will be seen, therefore, that the advantages accruing from the use of our improvements are that the influence of the governor is instantaneously felt at the admission-valves, the governor only acting to make and break the electric circuits, which is done instantaneously, thus avoiding friction of all kinds. These contact-points can be so set that a very small percentage of variation in the speed of the engine is felt in the governor and transmitted back again to the admission-valves.

We claim—

1. In a fuel-engine, the combination of a centrifugal governor, a cylinder provided with a reciprocating piston, a valve for admitting fuel to the cylinder and arranged to be kept normally closed, mechanical means for positively opening such valve, and an electric circuit embracing an electromagnet for connecting such valve with the mechanical means, such circuit being arranged to be opened and closed by the movements of the governor, substantially as described.

2. In a fuel-engine, the combination of a centrifugal governor, a cylinder provided with a reciprocating piston, a valve for admitting fuel into the cylinder, a vibrating lever arranged to be actuated by mechanical means, and an electric circuit embracing an electromagnet arranged to bring the valve mechanism into contact with the vibrating lever so that such valve may be opened by positive mechanical means, such circuit being arranged to be opened and closed by the movements of the centrifugal governor, substantially as described.

3. In a fuel-engine, the combination of a centrifugal governor, a cylinder provided with a reciprocating piston, a valve for admitting fuel into the cylinder and provided with a projecting pivotal stem portion, said pivotal stem provided with or forming the armature for the electromagnet, mechanical means for positively acting on the valve-stem to open the valve and hold it open a predetermined time, and an electromagnet for bringing the pivotal valve-stem into the working range of the mechanically-operating mechanism, substantially as described.

4. In a fuel-engine, the combination of a centrifugal governor, a cylinder provided with a reciprocating piston, a valve for admitting fuel into such cylinder and arranged to be normally closed and provided with a pivotal stem portion forming the armature-lever of an electromagnet, a vibrating lever arranged to be operated by the movements of the engine, an electric circuit embracing an electromagnet arranged when energized to bring the pivotal armature-lever of the valve into operative connection with the vibrating lever, such circuit being arranged to be opened and closed by the movements of the centrifugal governor, and spring mechanism for normally holding the pivotal stem away from the magnet and vibrating lever, substantially as described.

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