No. 649,441. Patented May 15, 1900.

C. E. DURYEA.

SPARKING IGNITER FOR EXPLOSIVE ENGINES.

(Application filed Aug. 25, 1898.)

(No Model.)

Fig. 7.

Fig. 1.

Fig. 3.

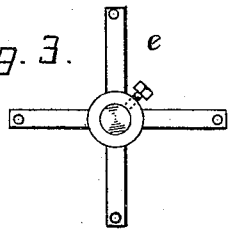


Fig. 2.

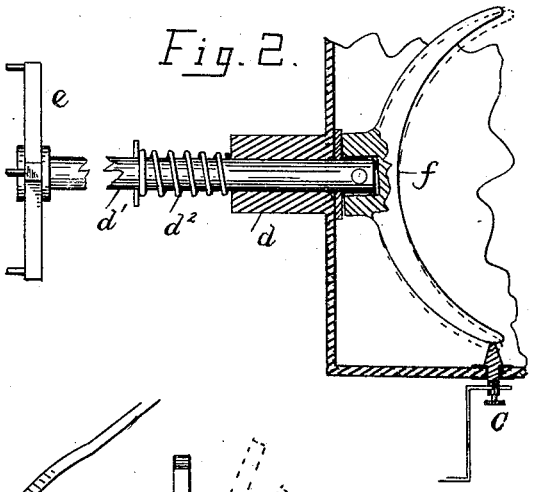
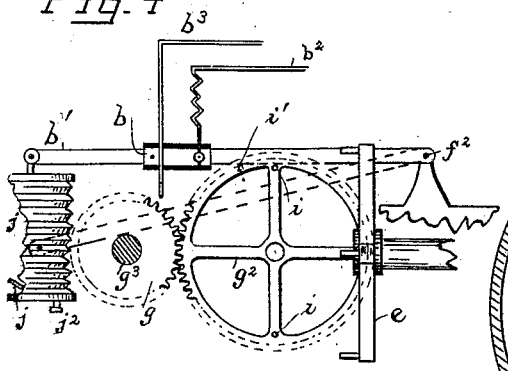


Fig. 4



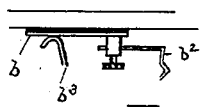
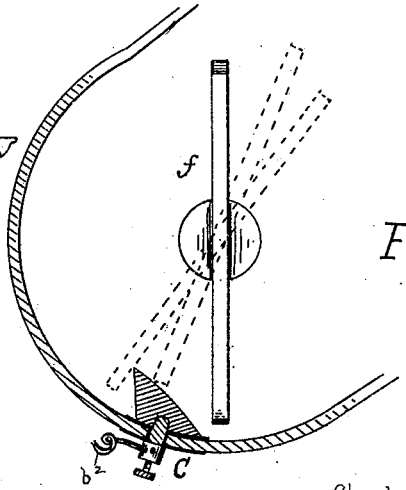


Fig. 5.

Fig. 6.



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CHARLES E. DURYEA, OF PEORIA, ILLINOIS, ASSIGNOR TO THE DURYEA MANUFACTURING COMPANY, OF SAME PLACE.

SPARKING IGNITER FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 649,441, dated May 15, 1900.

Application filed August 25, 1896. Serial No. 603,886. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. DURYEA, of Peoria, Illinois, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a full and clear description, reference being had to the accompanying drawings, of which—

Figure 1 is a plan view showing the crank-shaft, cylinder, and alternating gear of the ordinary form of engine with the improved sparker and circuit-breaker hereinafter described. Fig. 2 is a detail plan of the rotary sparker, of which Fig. 6 is an end elevation. Fig. 3 is an end elevation of the four-arm cross or wheel of the sparker-shaft. Fig. 4 is an elevation of the circuit-breaker and alternating gear and means for rotating the sparker. Fig. 5 is a detail of the insulation of the circuit-breaker, and Fig. 7 is a detail of the adjustable escapement-orifice j^2.

This improvement refers more particularly to that class of engines in which the internal combustion is started or caused to take effect by means of an electric spark; and it consists in the arrangement of the electric circuit, means for closing and breaking same at the proper time, together with means for insuring that said circuit shall not remain unbroken for more than a short time.

The objects of this improvement are, first, to provide a satisfactory means for igniting the charge inside the firing-chamber; second, to insure a spark of sufficient size to accomplish properly this ignition; third, to secure this spark with as little battery as will, if properly used, accomplish the desired end, and, fourth, to secure permanency of the said battery by guarding against and positively preventing the battery from remaining on a closed circuit for more than a short time, whereby it is impossible for the battery to be "run down" in a short while and leave the engine incapable of being started, because of lack of battery force. This arrangement is especially designed for intermittent work, such as is found in connection with motor-vehicles, where the motor is apt to be started and stopped often and where it is more or less exposed to the meddling of strangers or persons not familiar with its workings. I accomplish these objects by the mechanisms shown in the drawings aforesaid and hereinafter described.

The battery a is connected with the engine through a spark-coil a' in any common or desired manner, so that the engine itself becomes one pole of the circuit intended to give the spark. The other wire or pole passes from the battery or coil, as the case may be, to the insulated piece of metal b. (Shown in detail in Figs. 4 and 5.) This piece of metal is attached to the lever b' in such a manner that the current cannot escape through the lever either by the use of a non-conducting lever or by inserting insulation between the lever and the piece of metal aforesaid in any well-known manner. From the piece of metal b the current is carried, by means of insulated wire b^2, to the insulated anvil c, placed in the wall of the engine, as shown in Figs. 1, 2, and 6.

Mica, asbestos, or similar packing that will withstand heat, prevent the escape of the working gases, and at the same time insulate and prevent the electricity from short-circuiting through the wall of the engine is placed under and around the anvil, its stem, and the nut which fastens the same in place.

Mounted in bearings d d, Fig. 1, is a shaft d', adapted to revolve, carrying at one end a four-arm cross or wheel e (shown in Figs. 1, 2, 3, and 4) and at the other end the two-arm sparker f. (Shown in Figs. 1, 2, and 6.) This sparker is pivoted to the end of the shaft d', so that it may oscillate in its own plane. It is provided with a circular face normally seated against the wall of the engine or some projection therefrom, which seating is carefully fitted by grinding or otherwise made practically gas-tight.

In motors of the alternating type (which is most commonly used) the charge is fired at every other revolution of the crank-shaft, and in this type it is common to use alternating gears—that is to say, a gear mechanism which operates the exhaust-valve, the firing mechanism, and sometimes the inlet-valves at the proper intervals—which gearing consists, usually, of a gear of fixed size g on the crank-shaft g^3 meshing into a gear of double size g^2, mounted on a stay connected with the framework. Such an arrangement is herein

shown, although the exhaust and inlet mechanisms are not shown, inasmuch as they are not essential to this description. Should it be desired to apply this invention to the type of engines which fire at every revolution of the crank-shaft g^3, the two gears g g^2 shown need not be used; but the operating-pins i i for driving the sparker and the pin which operates the circuit-breaker would in that case be attached directly to the crank-shaft of the engine. Otherwise the arrangement of the parts would be the same as herein shown and described.

On the larger gear g^2 (shown in Figs. 1 and 4) are affixed two projecting pins or arms which as the gear rotates engage and drive the arms of the cross e on the sparker-shaft d'. There are two (2) of these arms or pins i i and four (4) arms on the cross, so that for each revolution of the larger gear g^2 the sparker-shaft is revolved one half-revolution, and as the sparker is double-pronged it is evident that at each half-revolution one prong of the sparker will revolve, so as to strike the insulated anvil c before mentioned. This anvil is triangular in shape in the plane of revolution of the sparker and projects one corner of this triangle into the circle described and trips the said sparker in such a manner that the sparker is forced to one side as it passes the anvil. This contact and forced action accomplishes two objects. The forced action insures that any oxid which may form on either the sparker or the anvil is rubbed off or abraded, so that bright metal and good contact are insured for the passage of the electric current. It is found by experience that a moment of time is needed for the spark-coil to become fully saturated, and unless it is fully saturated and the spark made sufficiently strong before the circuit is broken it is small in size and weak in action and may fail to properly ignite the charge. Therefore to give the proper amount of time the insulated anvil is made of such length in the line of motion of the sparker-tip as will insure this contact for the required length of time. This length makes the triangle of the anvil an easy angle for the sparker to slide across with but little resistance. After the sparker passes the innermost point of the anvil, which is also farthest along in the line of travel of the sparker, it is free to return to its original position, and that it may do this a spring d^2 is provided. This is shown at d^2 in Fig. 2 as a simple spiral coil placed between the engine-casing and a pin placed so as to pass through the sparker-shaft. Any suitable form of spring, however, may be used to effect this result. The spring causes the sparker to resume its proper place, and the joint becomes again gas-tight. The shaft is placed to fit its bearings as tight as will permit it to revolve freely, and while the sparker is operating there may be a slight loss of gas around the sparker-shaft; but as soon as the sparker resumes its seat at the instant of firing it is in place to hold the gas-pressure during the working stroke, so that the slight amount of loss, if any, while it is being lifted out of place by the angle previous to making the spark is not a serious objection. It is evident now that this sparker will produce a break in the electric circuit at regular intervals, as may be determined by the position of the various parts connecting the crank-shaft with the anvil through the gears g g^2, shaft d', and sparker f. It is also evident that if the engine should stop with the sparker in contact with the anvil and no means of disconnecting the battery be provided the electric current would continue to pass through the various connections and the strength of the battery be expended uselessly. To prevent this, the circuit-breaker mentioned and shown is used. This consists of a bellows j of any common shape, provided with an inlet-valve j' and having an adjustable outlet-opening j^2. This bellows is in the form of a dash-pot, and other forms of dash-pot may be substituted therefor, if desired; but this is preferred for use in motor-vehicles because of its light weight. It is connected to one end of the lever b', which is pivoted to the engine-frame at f^2 or other suitable support. The projecting pin or arm i' on the large gear-wheel g^2 is arranged to strike the lever b' and lift it, so as to open the bellows and draw in a charge of air. This pin makes a revolution so quickly when the engine is running that the lever, being supported by the bellows, from which the air escapes slightly, cannot fall far until it is again raised to its highest position, and this action is kept up so long as the engine continues to run. While the lever is in its highest position—in fact, while it is anywhere except in its lowest position—the electric circuit is continued and the sparker works uninterruptedly; but if the engine stops the air escapes from the bellows in a few moments and the lever falls down sufficiently far to cause the metal piece b to slip off the connection b^3 and so break the circuit.

To start the engine, all that is necessary is to revolve the gear g^3 once, which lifts the lever and again closes that broken portion of the circuit, and the engine is ready for use. This does not involve extra labor with gas or gasolene engines as commonly constructed, because it is necessary to start them by revolving the crank-shaft and draw in the charge of gases anyhow. It is evident that the pin i' may be so placed as to hold the lever up when the sparker is in contact with the insulated anvil; but it will be seen that the relation of the gear-wheel to the sparker is constant in that one makes two (2) revolutions while the other makes one, (1,) so that it is evident that the pin may be placed at such a position on the gear-wheel as to lift the lever only when the sparker is not in contact with the anvil, and this will permit the lever to fall and break the circuit at such times as the sparker is in said contact. Thus it will

be seen that this arrangement of lever and sparker permits the proper firing of the charges by a satisfactory spark and yet insures that the engine can be stopped, so as not to leave the battery short-circuited for more than the time required for the air to escape from the bellows or dash-pot, and this time is regulatable by the adjustable orifice j^2.

Substitutes for the dash-pot, such as some form of governor, may be used, the essential feature being that the device shall automatically break the circuit very quickly after the engine stops, especially if it chance to so stop that the sparker is in contact with the anvil.

I claim—

1. In combination with the electric firing mechanism of an internal-combustion engine, an auxiliary circuit-breaker consisting of wires b^2 b^3 with connection b mounted on lever b' which lever is controlled by a normally-closed bellows j adapted to be opened intermittently by revolution of the engine-shaft substantially as and for the purpose described.

2. In combination with the electric firing mechanism of an internal-combustion engine, an auxiliary circuit-breaker, means for closing the said breaker mechanically by the operation of a part of the engine designed to act only when the circuit is broken through the sparker, and other means for breaking the said circuit within a short time after said closing, substantially as and for the purpose described.

3. In a battery-fired explosion-engine the combination with the electrodes of an auxiliary circuit-breaker normally open, means for closing same operated by the engine when the sparking circuit-breaker is open, and an expansible fluid-receptacle operated by the said closing means and acting by its collapsing when the engine stops to open the auxiliary circuit-breaker.

4. In an internal-combustion engine, a revolving sparker-shaft extending through the walls of the engine, a sparker pivoted to the inner end thereof, a spring arranged to keep the sparker in contact with the engine-wall and an insulated anvil adapted to obstruct the sparker as it revolves and force it aside substantially as and for the purpose described.

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