No. 696,297. Patented Mar. 25, 1902.

V. G. APPLE.

ELECTRIC IGNITING DEVICE FOR EXPLOSION ENGINES.

(Application filed July 25, 1900.)

(No Model.)

Fig. 1.

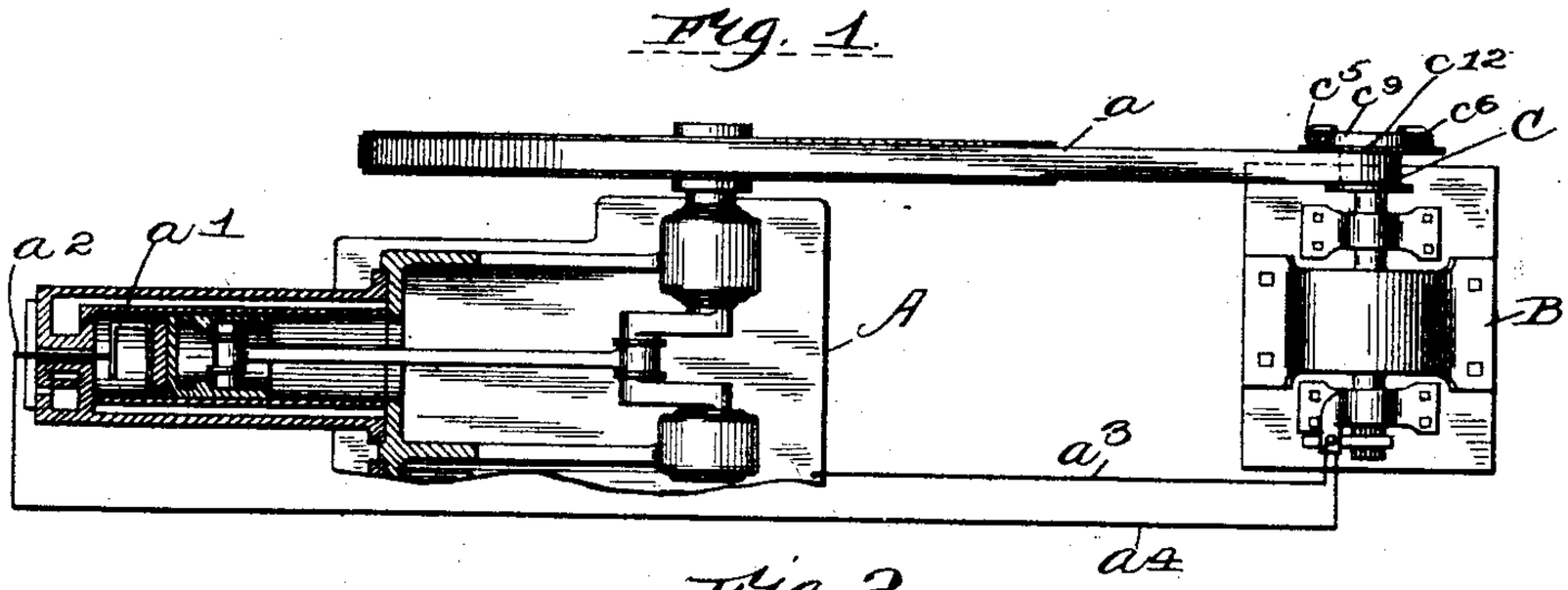


Fig. 2.

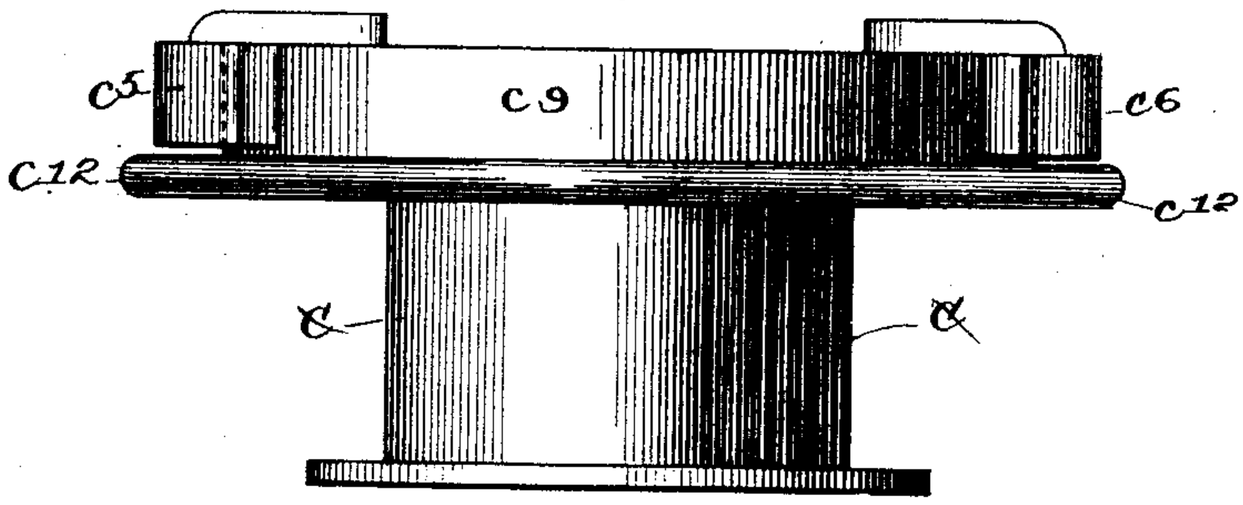
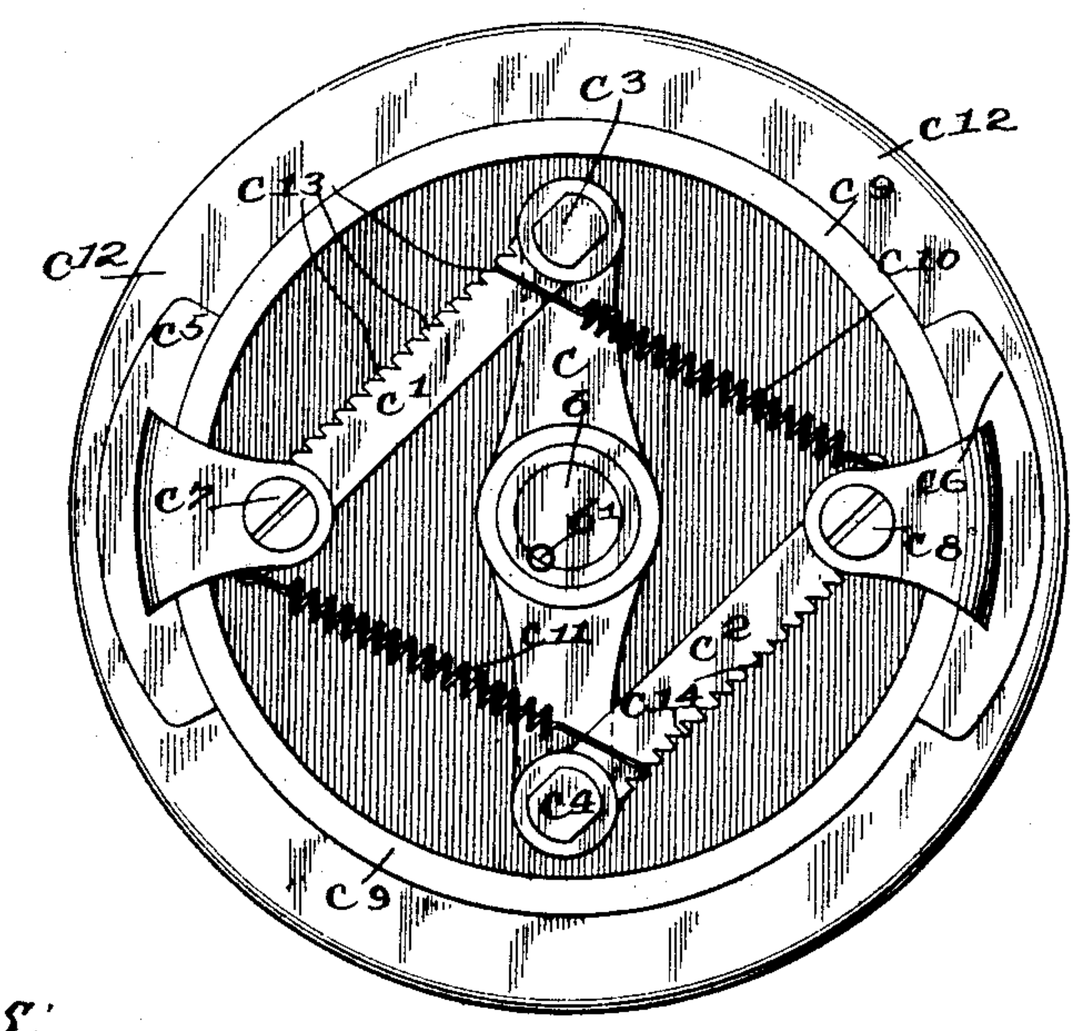


Fig. 3.



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UNITED STATES PATENT OFFICE.

VINCENT G. APPLE, OF DAYTON, OHIO, ASSIGNOR TO DAYTON ELECTRICAL MANUFACTURING COMPANY, A CORPORATION OF OHIO.

ELECTRIC IGNITING DEVICE FOR EXPLOSION-ENGINES.

SPECIFICATION forming part of Letters Patent No. 696,297, dated March 25, 1902.

Application filed July 25, 1900. Serial No. 24,760. (No model.)

To all whom it may concern:

Be it known that I, VINCENT G. APPLE, a citizen of the United States, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Apparatus for Producing and Maintaining an Electric Spark for Igniting Devices; and I do hereby declare the following to be a full, clear, and exact description, such as will enable persons skilled in the art to which it appertains to make and use the same.

The object of my invention is to provide a means whereby a current of electricity may be generated, and which may be used for producing an igniting-spark within a cylinder of a gas-engine, and which may be evolved from any well-known source, preferably a dynamo driven by the said engine. The electromotive force of the said source of current will be greatly increased at the instant and during the time when the circuit therefrom is being opened at the terminals of the sparking device, and thereby the potential difference existing between the said terminals at the time when they are so separated will continue to increase within a given limit during the time such terminals are being mechanically separated until the current is reduced practically to zero.

The invention consists, substantially, in the organizations and combinations of devices and parts, as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

In carrying my invention into practical operation I may make use of an ordinary dynamo, which may be either shunt wound, series wound, or compound wound. The latter consists in being partially shunt and partially series wound, or it may be a magneto-dynamo, wherein the fields are derived from a permanent magnet. To the shaft of this dynamo I attach a friction speed-regulator, such as described and claimed in my application filed August 16, 1900, Serial No. 26,999, and shown in Fig. 3 of this application, which is designed to exert a given adjustable friction between the members thereof in a ratio inversely to the speed of the armature, to which the friction device is attached. This friction speed-regulator is preferably provided with a gear-wheel or a pulley, by which it is connected to the revolving part of the engine. The driving member of the regulator—that is, that portion thereof which is more or less positively connected with the revolving portion of the engine—is connected to the driven member of said regulator (the latter is positively connected to the armature of the dynamo) by means of a variable friction contact. The driving effect of this contact will be decreased as the speed of the armature is increased, or, in other words, the centrifugal effect of the armature at a high velocity will serve to reduce the frictional coefficient that would otherwise exist between the two members of the said regulator. The dynamo is wound so as to produce current of a desired value at a relatively low number of revolutions of its armature with reference to the number of revolutions that it would run if positively connected to the engine when the engine is running at its full speed.

For the purpose of making my invention more clearly understood I will illustrate in the following manner: Suppose that the dynamo is wound so that it will produce the desired current for making the spark within the cylinder of a gas-engine when the armature thereof is running at a speed of, say, one thousand revolutions per minute. Suppose also that the normal speed of the engine is three hundred revolutions per minute. Then I will gear the dynamo to the engine so that the dynamo-armature will be rotated one thousand revolutions, its normal speed when the engine is running not to exceed fifty revolutions per minute—that is to say, if the dynamo were positively connected to the engine without the intermediary speed-governor. When the engine is running fifty revolutions the armature will be driven one thousand revolutions per minute, and the desired current required for the sparking device will be generated by the dynamo. Suppose now that the dynamo will generate a current at this speed, say, of one ampere. If the elements of the friction-clutch are properly adjusted with reference to the speed and current desired the current that the dynamo will generate at

any time will not exceed in value one ampere even when the engine is running at more than fifty revolutions per minute or at its normal rate of speed of three hundred revolutions per minute, the difference in the two speeds being accounted for by the slip between the two members of the friction-clutch. In other words, the dynamo may be maintained on a short circuit for an indefinite time without danger of the current increasing to a point that will burn or destroy the winding thereof.

When the dynamo is producing a current of, say, one ampere in a circuit of a given resistance, there will be a speed at which there is very little, if any, slip between the two members of the speed-controlling device; but when the speed of the driving member is increased there will be constant slipping between the rapidly-revolving pulley of the speed-controller and the relatively slowly revolving dynamo-shaft carrying the two members of the controller, so that when the current is interrupted by breaking the circuit, the load being thereby removed from the dynamo, the force previously insufficient to drive the dynamo at the same speed as the pulley of the controller will at once cause the dynamo to increase in speed, approaching and probably equaling the speed of the pulley, and the increased speed of the dynamo will produce an electromotive force sufficient to maintain a current across the gap resulting from the separated electrodes of the igniting device within the cylinder of the engine. At such times the current will be decreased in value in some proportion as the electromotive force is increased in the manner described.

My system for operating a dynamo for producing the results desired contains two useful features. The first is that of increasing the electromotive force as the igniter-circuit is being opened for the purpose of producing the spark and proportionately increasing the electromotive force as the space between the electrodes is increased; second, the ease with which the desired current for the purpose of making the spark is produced when the engine is operating at a very low rate of speed. The dynamo may be revolved sufficiently fast by moving the fly-wheel by hand for a part of a revolution, by means of which the rate of speed may be easily made equal to that of the engine when the engine is running at about one-sixth of its normal speed.

Referring to the drawings, Figure 1 shows an engine of the class described, a dynamo belted thereto, a friction-clutch or speed regulator on the end of the said dynamo-shaft, an electric circuit from the said dynamo to the sparking or igniting device in the cylinder of the said engine. Fig. 2 is an enlarged plan view of the clutch or regulator. Fig. 3 is a side elevation of the same.

In all of the views the same letters of reference are used to indicate similar parts.

A is an engine provided with a wheel for driving the dynamo. a is a belt passing over the said wheel and the pulley of the clutch or regulator, which is connected to the shaft of the dynamo.

a' is one of the electrodes of the circuit-breaking igniting device within the cylinder of the engine. a^2 is a similar electrode insulated from the metal portion of the engine. Between these two electrodes the spark is made as usual with devices of this character. a^3 and a^4 are circuit-wires which connect the frame portion of the engine and the electrode a^2 with the circuit of the dynamo.

B is the dynamo.

b is the dynamo-shaft, to which the driven portion of the friction-clutch is fixedly attached by means of the key b'.

c is a bar which is fixed to the shaft in this manner and which constitutes the positive portion of the clutch. Notched arm c' is pivoted to the bar c at c^3, and in a like manner the notched arm c^2 is pivoted to the opposite end of the same bar at c^4. Friction-shoes c^5 and c^6 are pivoted to the respective arms c' and c^2 at c^7 and c^8 in the manner shown. These friction-shoes have bearings upon the friction-rim c^9 of the pulley. Springs c^{10} and c^{11} hold the friction-shoes c^5 and c^6 in contact with the rim c^9 and cause a friction contact between the said shoes and rim, whereby the power to drive the armature may be transmitted from the pulley to the shaft of the armature.

c^{12} is a flange of the pulley, which is an integral part of the rim c^9 and presents an effective means for carrying off any heat that may be evolved by the friction of the shoes on the said rim. The flange c^{12} presents considerable surface to the air when the pulley is being revolved for the purpose of dispersing the heat.

The mode of operation will be readily understood from the foregoing description.

The dynamo may be belted to the engine in the manner shown in Fig. 1 after their relative speeds and the current to be produced have been determined in the manner heretofore described.

When the armature of the dynamo is not in motion, the frictional contact between the shoes c^5 and c^6 and the rim c^9 of the pulley c are at their maximum. The springs c^{10} c^{11} are the means for holding the said shoes in contact with the said rim.

When the armature begins to revolve, the centrifugal motion tends to cause the shoes c^5 and c^6 to fly off at a tangent, controlled by the pivoted levers or arms c' and c^2. This effect decreases the power of the springs to hold the shoes in contact with the rims, and the friction-driving coefficient is thereby decreased. The tension of the springs may be adjusted by placing them in the notches c^{13} and c^{14}, so that the critical speed may be correspondingly varied.

The tension of the springs c^{10} and c^{11} or equiva-

lent devices may be adjusted by a series of trials or by any other method found expedient until the value of the current, the speed of the dynamo, and speed-regulator may be satisfactorily arranged, after which the igniting circuit-breaking device is connected to the dynamo in the usual manner.

Having now set forth the object and nature of my invention and the manner of carrying the same into practical operation, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. A means for making and maintaining an electric spark for igniting devices, within the cylinder of a gas-engine, which consists of a dynamo, a circuit-opening device within said cylinder, a circuit connecting said device to said dynamo, a means for driving said dynamo by said engine, and a centrifugal device associated with said dynamo, adapted to increase the electromotive force simultaneously with the separation of the terminals of said sparking device, substantially as and for the purpose set forth.

2. A means for making and maintaining an electric spark for igniting devices, within the cylinder of a gas-engine, which consists of a dynamo, a circuit-opening device within said cylinder, a circuit connecting said device to said dynamo, a means for driving said dynamo by said engine, and a centrifugal speed-controlling device adapted to increase the speed of said dynamo to increase the electromotive force thereof simultaneously with the separation of the terminals of said sparking device, substantially as and for the purpose set forth.

In testimony whereof I have signed this specification, in the presence of two subscribing witnesses, this 17th day of July, A. D. 1900.

VINCENT G. APPLE.

Witnesses:
H. L. WARNER,
H. F. APPLE.