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J. W. PACKARD.

IGNITING DEVICE FOR HYDROCARBON ENGINES.

(Application filed Mar. 10, 1900.)

(No Model.)

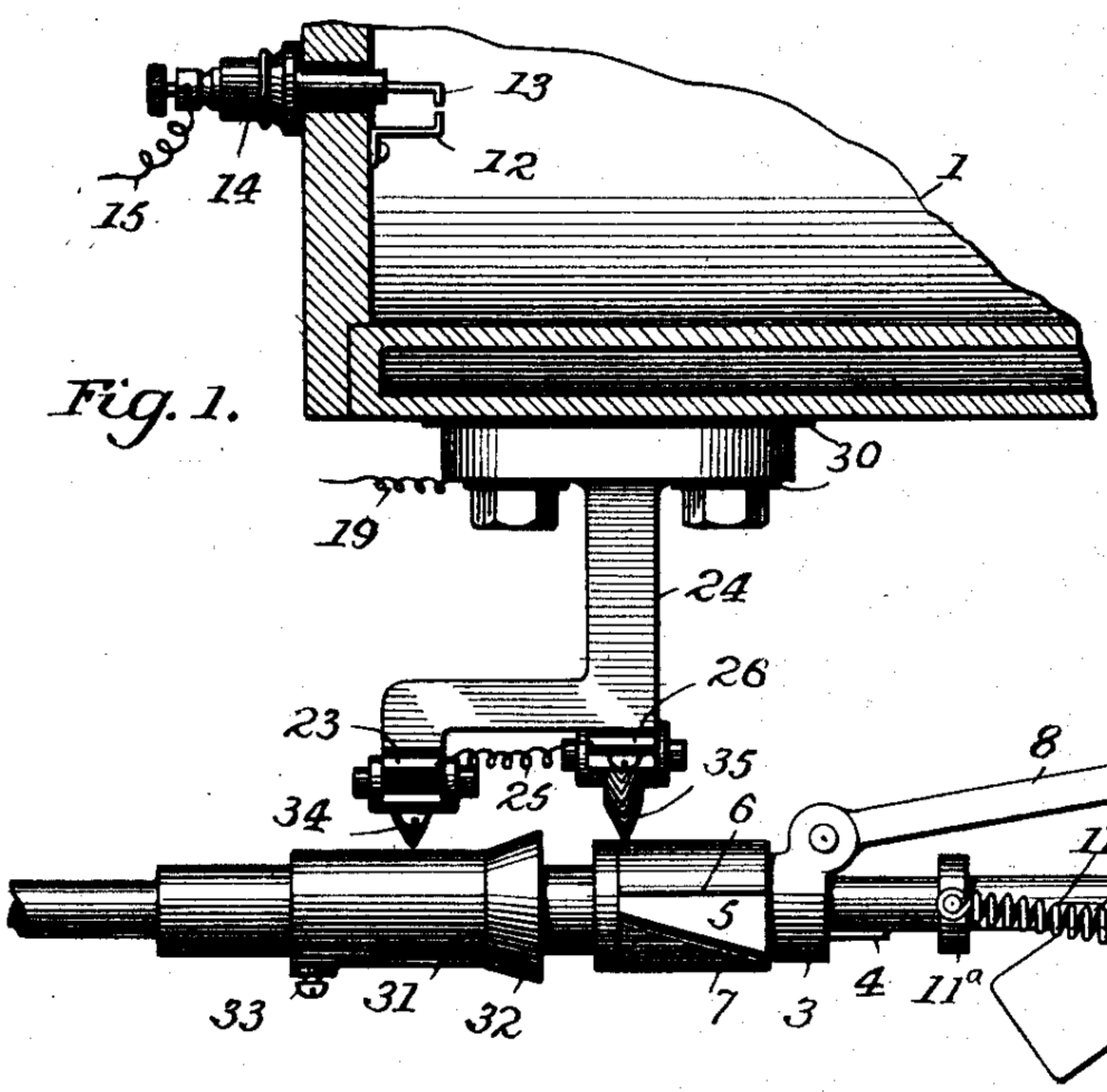


Fig. 1.

Fig. 3.

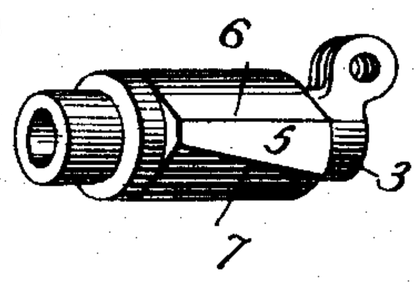


Fig. 2.

Fig. 5

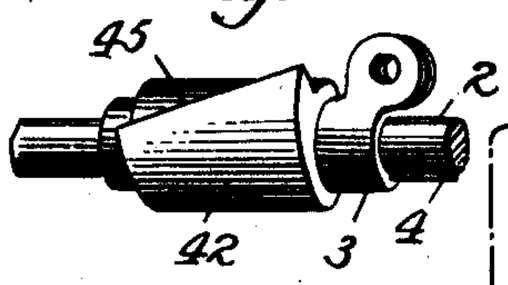
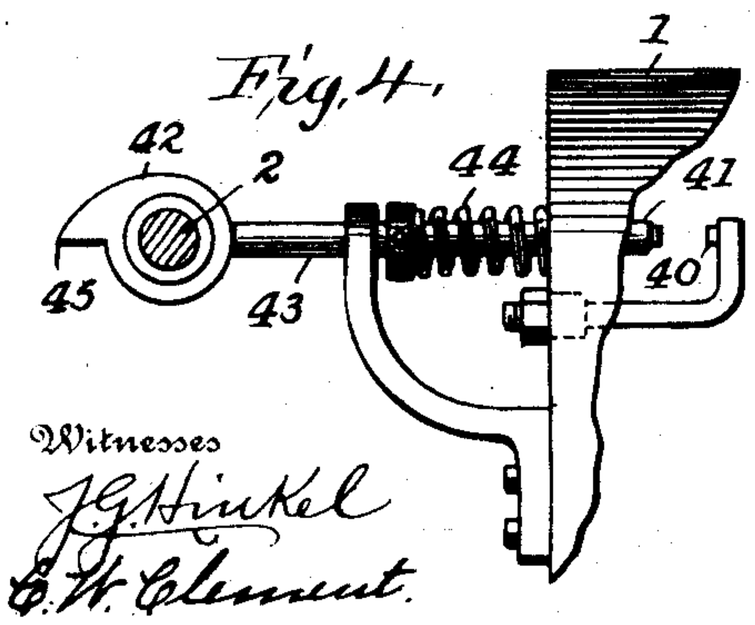


Fig. 4.



Witnesses
J. G. Hinkel
C. H. Clement.

Inventor
J. W. Packard
By
Watson & Watson
Attorneys

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO.

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IGNITING DEVICE FOR HYDROCARBON-ENGINES.

SPECIFICATION forming part of Letters Patent No. 667,792, dated February 12, 1901.

Application filed March 10, 1900. Serial No. 8,182. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Igniting Devices for Hydrocarbon-Engines, of which the following is a specification.

The present invention has for its objects, first, to provide an electric igniter which will produce a spark of substantially constant duration regardless of the speed of the engine; secondly, to provide automatic means for controlling the time at which the spark-circuit is closed with reference to the time at which the crank passes the dead-center, the circuit being closed more and more in advance of the dead-center as the engine increases its speed, and, thirdly, to provide an automatic cut-out for the igniter-circuit which may be set to break the circuit at any given speed of the engine, thereby constituting a governor to limit the engine to any desired speed.

In carrying out my invention I preferably use a cam arranged to rotate with and slide upon a shaft which is driven from the crank-shaft of the engine, and a speed-governor connected with said shaft and arranged to slide the cam thereon. The cam operates upon a contact device which is arranged to make or break the circuit according to the nature of the igniter. Another device, which is also under control of the governor, is adjustable and adapted to be set to break the igniter-circuit when the speed of the engine reaches the number of revolutions per minute which is desired as a maximum.

While the present invention is adapted for the control of any variable-speed hydrocarbon-engine, it is particularly valuable in connection with motors used for motor-vehicles. I am enabled by its use to maintain the speed of the engine, and therefore of the vehicle, automatically at any desired rate. I have found that an instantaneous spark sometimes fails to ignite the explosive charge in the cylinder and that the spark provided by the governing devices, hereinafter described, which is of substantially constant duration regardless of the speed of the engine, will ignite every explosive charge with certainty.

In the accompanying drawings, Figure 1 is a plan view, and Fig. 2 an end elevation, illustrating the preferred form of my invention, the parts being shown in connection with a fragment of a hydrocarbon-engine. Fig. 3 is a perspective view of the cam. Fig. 4 is a view illustrating a modification. Fig. 5 is a perspective view of the cam shown in Fig. 4.

Referring to Figs. 1 and 2, 1 indicates the cylinder of a hydrocarbon-engine, and 2 a shaft arranged parallel with the cylinder. The shaft 2 is connected with the crank-shaft of the engine in some suitable manner, so as to rotate in fixed relation therewith. Upon the shaft 2 is a sleeve 3, which is free to slide longitudinally on the shaft, but compelled to turn therewith by means of a groove in the sleeve coöperating with a feather 4 upon the shaft or other equivalent device. The sleeve 3 has fixed thereon a cam 5, the operative face of which is tapered, said cam having, preferably, a rear edge 6, which is parallel with the shaft, and an inclined edge 7 for a purpose to be hereinafter explained. The sleeve 3 is connected by a link 8 with a governor 9, which consists of a block centrally pivoted at 10 to the shaft 2. The governor-block is normally held inclined to the shaft by a spring 11, which connects it with a collar 11^a. As the speed of the shaft increases, however, centrifugal force acting upon the governor causes it to move toward a position at right angles to the shaft. The cam 5 is therefore made to slide back and forth on the shaft as the speed of the engine increases and diminishes.

In Fig. 1 I have shown a "jump-spark" igniter, consisting of a terminal 12, connected to the cylinder-head, and a terminal 13, separated from terminal 12 and mounted in an insulating-plug 14. The terminal 13 is connected to one branch 15 of the secondary circuit of an induction-coil 16. The other branch 17 of said secondary circuit connects the induction-coil with the engine at 18, thus completing the circuit, with the exception of a gap between the terminals 12 and 13.

One branch 19 of the primary circuit of the induction-coil is for convenience connected to a bracket 24, hereinafter mentioned, and the other branch 20 is connected to a stationary contact-point 21. A second contact-point 22, carried by a spring-arm 23, normally abuts against the contact 21. The arm 23 is

carried by but insulated from the bracket 24. From spring-arm 23 the circuit passes through a conductor 25 to a spring-arm 26, which is also carried by but insulated from the bracket 24. The spring-arm 26 carries a contact-point 27, which is normally separated from a fixed contact 28, carried by the bracket 24. The contact 28 is preferably provided with an adjusting-screw 29. The bracket 24, as shown, is insulated from the engine by suitable insulating material 30. In the circuit 19 I have shown a switch 19^a and a battery 19^b.

Upon the sleeve 3 is a collar 31, having a tapered surface 32, and means, such as the set-screw 33, for fastening it in any desired adjustment upon the sleeve. The tapered surface 32 coöperates with an antifriction-roller 34, carried by but insulated from a spring-arm 23. It will be evident that when the tapered surface 32 engages the roller 34 the circuit will be broken at the points 21 22 and the igniter thrown out of action. By suitably adjusting the collar 31 upon the sleeve 3 the circuit may be broken at any predetermined speed of the engine. Thus, for instance, the collar 31 may be adjusted to break the igniter-circuit when the engine reaches one hundred or two hundred or any other desired number of revolutions per minute.

The spring-arm 26 carries an antifriction-roller 35, which coöperates with the cam 5. This cam rotates with the shaft in the direction of the arrow, Fig. 1, and the inclined edge 7 of the cam comes first into contact with the roll 35. When the engine is running slowly, the roll 35 will contact with the cam approximately at the time when the crank is on the dead-center, this being the time at which the spark or ignition should take place. The face of the cam 5 is sufficiently broad at its narrow end to give the spark necessary duration for efficient ignition at slow speed. The cam moves back the spring-arm 26, bringing the points 27 28 into contact, and thus completing the primary circuit. In the form of the invention shown in Figs. 1 and 2 the coil is provided with a vibrator (not shown) in the usual manner, and the secondary circuit produces a spark between the terminals 12 13 during the time the circuit is closed at the points 27 28.

An important feature of the invention is that the duration of the spark is substantially the same for all speeds. If the cam-surface 5 were a parallelogram, the duration of the spark would decrease as the speed increased; but by making said cam-surface tapered, as shown in Figs. 1 and 3, the circuit is closed during a greater angular part of each revolution of the shaft 2 when the engine is running fast than when it is running slow—that is, if the face of cam 5 is one-eighth of an inch at the point traversed by the roll 35 when the engine is making one hundred revolutions per minute it should be two-eighths at the point traversed when the engine is running two hundred revolutions, three-eighths for three hundred revolutions, &c. The inclined forward edge 7 of the cam closes the circuit earlier in the course of each revolution of the shaft as the speed increases, and the spark is thereby advanced with reference to the dead-center. Thus by one and the same cam I provide for advancing the spark with reference to the dead-center as the engine increases its speed and for producing a spark of the same duration at all speeds. The cam 5 is also arranged to limit the speed of the engine and prevent it from racing. This is effected by limiting the length of the cam so that after the engine reaches a certain speed the cam will pass beyond the roll 35, and thereafter the circuit will not be closed at the points 27 28 until the speed is reduced.

The igniting device, consisting of the governor, the cam 5, and other coöperating parts, may be used without the speed-governing device 32, the cam 5 being relied upon to prevent the engine from running away. The speed-governing device, however, will be found very valuable for various purposes, especially for automobiles, in which it is often desirable—for instance, in crowded cities or with inexperienced operators—to limit the speed of the motor.

In Figs. 4 and 5 I have shown a modification in which a standard single circuit-sparking device is used in place of the induction-coil. In this instance the spark takes place as the circuit is broken. The circuit has a fixed terminal 40 within the cylinder, and a movable terminal 41, which is forced into contact with the fixed terminal once during each cycle of the engine by a cam 42, the plunger 43, carrying the terminal 41, being pressed into contact with the cam by a spring 44. The edge 45 at the highest point of the cam is spirally arranged with reference to the shaft 2 and so located that the spark will take place earlier in each revolution as the speed of the engine increases. This cam is intended to be controlled by a governing device exactly as the cam 5 in Fig. 1 is controlled.

It will be evident that my invention is susceptible of embodiment in various forms of mechanism and that various changes in construction and arrangment may be made without departing from its spirit and scope. For instance, instead of sliding the cam upon the shaft the cam may be fixed thereon and the governor connected to the roll or other part which coöperates with the cam. The governor is preferably of the form shown; but it will be evident that any other form of governor may be substituted which is sensitive to changes in speed. I do not, therefore, limit myself to the precise construction and arrangement of parts illustrated and described.

What I claim, and desire to secure by Letters Patent, is—

1. An igniting device for hydrocarbon-en-

gines comprising, in combination, a sparking-circuit, a circuit-closer, a governor, and means, controlled by the governor, for causing the circuit-closer to produce a spark of constant duration at different speeds of the engine, for the purpose set forth.

2. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer, a rotating shaft, a cam arranged to rotate with and slide on said shaft, said cam having an operative face constructed to control the circuit-closer so as to produce a spark of constant duration as the speed of the engine varies, a governor driven by the engine, and connections between said governor and said cam whereby the cam is moved longitudinally of the shaft as the speed increases or decreases, for the purpose set forth.

3. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer, a cam governing the circuit-closer having a tapered operative face, and means for bringing different parts of said face into operation to effect and control the duration of the spark, for the purpose set forth.

4. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer, a cam governing the circuit-closer having a tapered operative face to control the duration of the spark, and a governor arranged to bring different parts of said face into operation as the speed varies, for the purpose set forth.

5. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a rotating cam having a tapering operative face, the initial edge of which is inclined to the axis of rotation, a circuit-closing device operated by said cam, a governor, and connections between the governor and the cam whereby the latter is moved relatively to the circuit-closing device as the speed of the engine increases or decreases.

6. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer therefor, a rotating shaft, a cam arranged to slide on and turn with said shaft, and a centrifugal governor operated by said shaft and connected to said cam, said cam having a tapering operative face, said governor being arranged to bring the wider portion of said face into operation as the speed increases and the narrower portion as the speed decreases, for the purpose set forth.

7. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a rotating cam having a tapering operative face, a circuit-closer operated by said cam, and a governor arranged to move the cam relatively to the circuit-closer, said cam being so related to the circuit-closer and governor that it will become inoperative when the engine exceeds its maximum allowable speed, for the purpose set forth.

8. A combined igniting device and speed-governor comprising, in combination, a sparking-circuit, a normally closed switch or contact therein, a rotating shaft, a centrifugal governor driven by said shaft, a collar sliding on said shaft and provided with a tapering surface, and connections between said governor and said collar whereby said surface is made to open said switch or contact when the engine reaches a predetermined speed, for the purpose set forth.

9. A combined igniting device and speed-governor comprising, in combination, a sparking-circuit, a normally closed contact therein, a normally open contact, a rotating shaft and governor, a sleeve arranged to slide on and turn with said shaft, a connection between the governor and the sleeve, a cam on said sleeve arranged to periodically close said circuit, and a device adjustably mounted on said sleeve and adapted to break said circuit when the engine reaches a speed predetermined by the adjustment of said device, for the purpose set forth.

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

JAMES W. PACKARD.

Witnesses:
ROBT. E. GERTON,
M. S. ANDREWS.