

W. S. LIMING.
SPARKING DEVICE FOR EXPLOSIVE ENGINES.
APPLICATION FILED FEB. 20, 1907.

1,063,455.

Patented June 3, 1913.

2 SHEETS—SHEET 1.

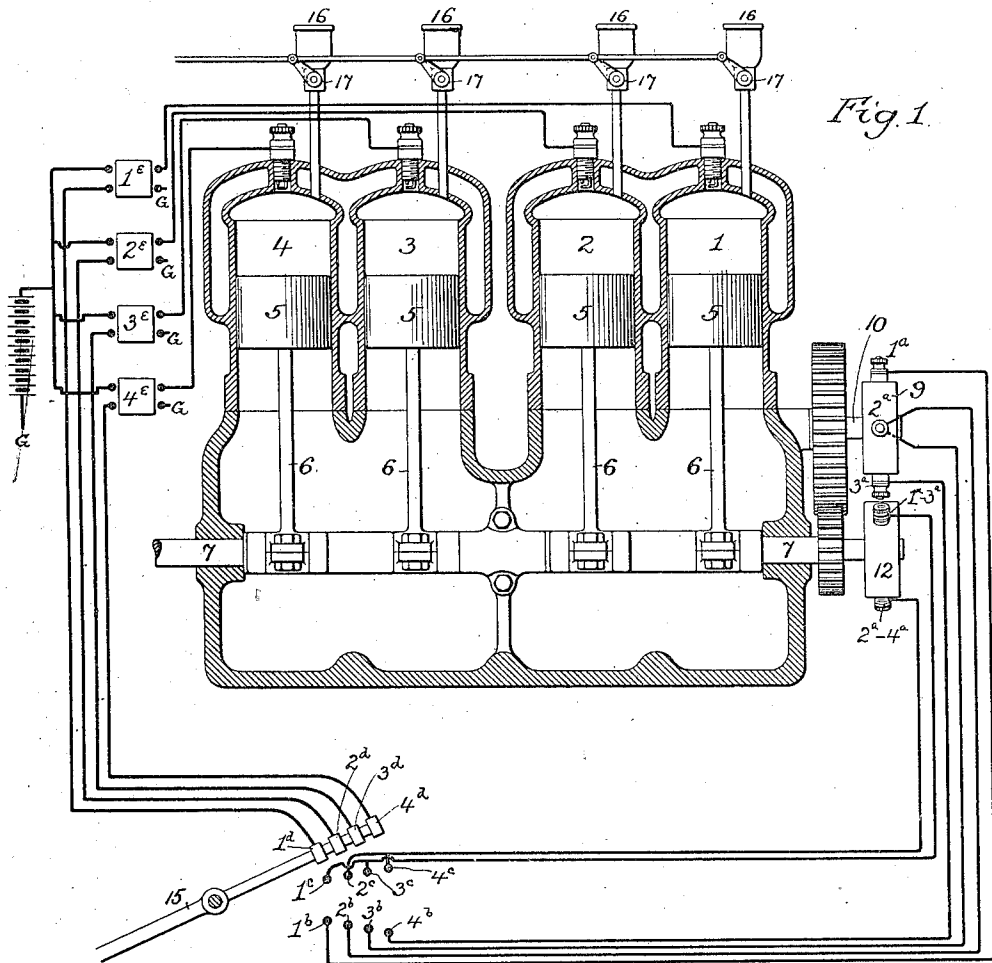


Fig. 1.

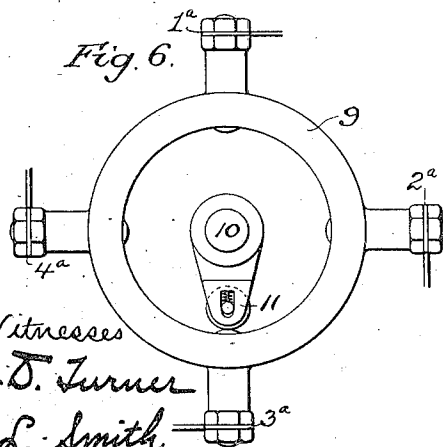


Fig. 6.

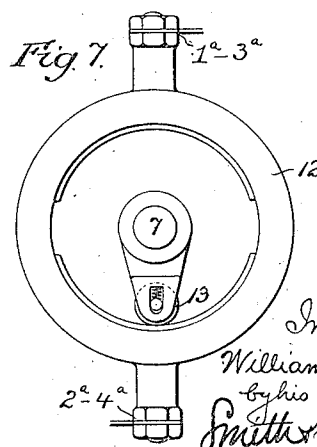


Fig. 7.

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2 SHEETS-SHEET 2.

Fig. 2.

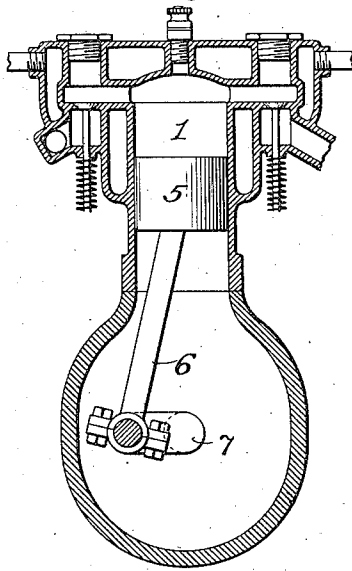


Fig. 3.

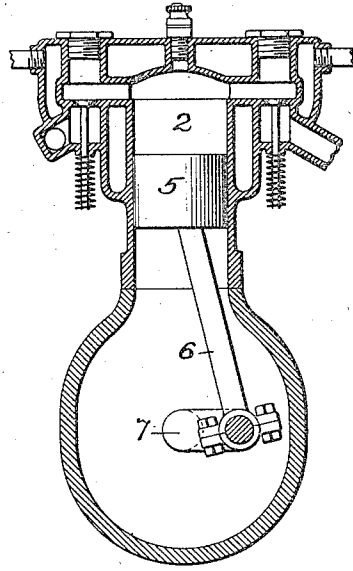


Fig. 4.

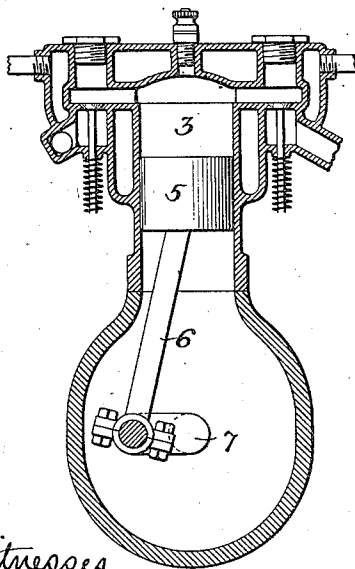
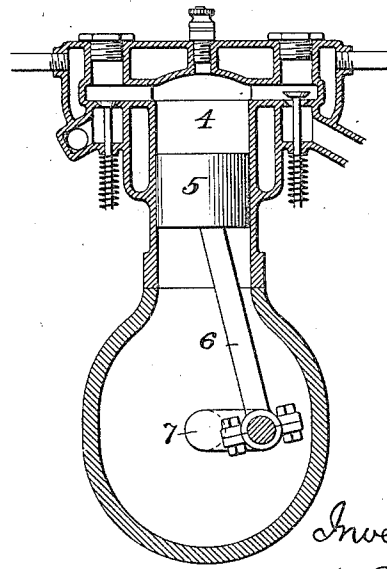


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM S. LIMING, OF SCRANTON, PENNSYLVANIA.

SPARKING DEVICE FOR EXPLOSIVE-ENGINES.

1,063,455.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed February 20, 1907. Serial No. 358,356.

To all whom it may concern:

Be it known that I, WILLIAM S. LIMING, a citizen of the United States, residing at Scranton, Pennsylvania, have invented certain Improvements in Sparking Devices for Explosive-Engines, of which the following is a specification.

The object of my invention is to provide an engine of the explosive or internal combustion type with means whereby it can be started without the necessity of first turning the crank shaft by hand or other power independently applied thereto. This object I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of sufficient of an engine of the explosive type to illustrate the application of my invention thereto, those features which constitute the subject of my invention being illustrated in a diagrammatic way; Figs. 2, 3, 4 and 5 are transverse sections through the respective cylinders of the engine; Fig. 6 is a view of the ordinary circuit closer used in connection with the engine, and Fig. 7 is a similar view of a special or supplementary circuit closer which I employ.

In the drawing, 1, 2, 3 and 4 represent, respectively, the cylinders of an explosive engine of the four-cycle type, each cylinder having a piston 5 with a rod 6 connected to a crank on the shaft 7, these cranks being in two pairs and the cranks of each pair coinciding, but being set at an angle of 180° in respect to those of the other pair.

The pistons of the engines 1 and 2 are connected to oppositely set cranks, as are likewise the pistons of the engines 3 and 4, although this particular disposition of engines, cylinders, pistons, and cranks is not essential to my invention. In fact, the type of engine selected for illustration has been so selected simply for convenience, for my invention is not limited in this application to engines of the four-cylinder four-cycle type but is applicable as well to engines having a lesser or greater number of cylinders, and to engines in which the cycle of operations is different from that described.

In an ordinary engine of the type illustrated the circuit closer 9 for controlling

the formation of the igniting sparks in the cylinders is carried by a shaft 10, geared to the crank shaft 7, so as to rotate at lesser speed, such circuit closer having four circuit terminals 1^a, 2^a, 3^a and 4^a connected, respectively, to the sparking devices of the cylinders 1, 2, 3 and 4, the circuit being completed through these terminals in succession by contact therewith of a rotating arm 11 carried by the shaft 10. (See Fig. 6.) With this arrangement it is impossible to start the engine from a position of rest without first turning or partially turning the crank shaft by hand or other independent power, for the circuit closer is so adjusted as to produce a spark only in that cylinder in which the compression stroke is made and only at the time of full completion of said stroke, or immediately preceding or following the same. The tendency of the engine, however, is never to stop with the pistons at the ends of the stroke but always with the pistons at or about mid-stroke, for when the engine is running by momentum after the power has been cut off there will be certain of the cylinders in which both the inlet and exhaust valves will be closed, and as a consequence of this there will be, in such cylinders, either a partial vacuum above the piston and a consequent tendency to raise the piston in the cylinder, or there will be a compression of the fluid above the piston and a consequent tendency to force the latter downwardly in the cylinder. There can, therefore, be no production of an igniting spark in the cylinder in which the compression has taken place and which would be, in the normal operation of the engine, the one in which the explosion would be effected, for, with the ordinary circuit closer a spark can not be formed in said cylinder with the piston in a position at or approaching mid-stroke. For this reason I employ a special circuit closer 12, located on the crank shaft of the engine and constructed as shown in Fig. 7, with two circuit terminals operating in conjunction with a rotating arm 13 of the crank shaft.

In connection with the two circuit closers I employ switching mechanism having two sets of terminals, those of one set being numbered 1^b, 2^b, 3^b and 4^b, and those of the other

set being numbered 1^c, 2^c, 3^c and 4^c, the terminals 1^b, 2^b, 3^b and 4^b being connected respectively to the terminals 1^a, 2^a, 3^a and 4^a of the regular circuit closer, and the terminals 1^c and 3^c being connected to one of the terminals of the special circuit closer and the terminals 2^c and 4^c being connected to the other terminal of the same. In connection with these two sets of terminals operates a switch having terminals 1^d, 2^d, 3^d and 4^d connected respectively to poles of the primary coils of the vibrators 1^e, 2^e, 3^e and 4^e, one pole of the secondary coil of each vibrator being connected to its respective spark plug on the cylinder of the engine. The other pole of each of the primary coils of the vibrators is connected directly to one pole of the battery, the other pole of said battery being grounded through the frame of the engine and hence making connection with the vibrators through the circuit closers and switch, one pole of each of the secondary coils of the vibrators being grounded through the frame of the engine, the various grounds being represented at G.

The terminals of the special circuit closer 12 has much longer segments than those of the regular circuit closer, hence the arm 13 of said special circuit closer is adapted to maintaining a closed circuit throughout the greater portion of a stroke, and even though the piston occupies a mid position in the cylinder a spark can be produced therein in order to ignite the explosive mixture between the piston and the head of the cylinder.

The terminals of the special circuit closer are so disposed in respect to the rotating arm that sparks will be produced only in those cylinders in which the pistons are on the down stroke, and as either of these two cylinders is liable to be the one in which the compression has previously taken place each terminal of the special circuit closer controls two cylinders.

The switch lever 15 may be located in any position in respect to the engine for convenient operation, for instance, in the case of a motor car engine it will be located conveniently to the front seat and so as to be readily operated either by hand or foot.

When the engine is at rest the terminals of the switch are free from contact with either of the circuit closer terminals, but the first movement of the switch lever in starting the engine brings its terminals into connection with those of the special or supplemental circuit closer in order to start the engine, and, as soon as the engine has thus been started, a further movement of the switch lever will bring its terminals into connection with those of the regular circuit closer, a reversal of these operations attending a reverse movement of the lever.

It may happen after an engine has been

standing idle for a considerable time that the explosive mixture contained in the cylinder in which the last compression stroke was made may have been dissipated by leakage or otherwise, and for this reason I prefer to provide each of the cylinders with a priming device in order that a charge of the explosive mixture may be forced into or permitted to enter the cylinder preparatory to the formation of the ignition spark therein by the operation of the switch lever 15. As shown in the drawing this priming device consists of a cup 16 mounted above the cylinder and having communication with the upper end of the latter through a valved connection 17, the valves of all of the priming cups being connected for joint and simultaneous operation, as shown in Fig. 1. By this means a supply of liquid hydro-carbon from which the explosive gas or vapor is produced can be simultaneously projected into each of the cylinders in order to insure the presence of an explosive vapor in that one of said cylinders in which the spark will be produced as soon as the switch 15 makes connection with the terminals of the special circuit closer 12, all of the cylinders being charged, since this spark is liable to be produced in either of them.

The liquid may be maintained under pressure in each of the priming cups, or, instead of the latter, explosive vapor under pressure from a suitable source of supply may be conveyed to the cylinders in the manner described, and the valves which control the priming devices may, if desired, be connected to the switch lever in order that said priming devices may be operated in consonance with the operations of the switch.

I have described, and prefer to use in carrying out my invention, a supplementary circuit closer on the crank shaft as a means of controlling the special operation of the sparking devices in order to start the engine when the pistons are in a position other than that necessary for starting the same with the regular circuit closer.

I claim:—

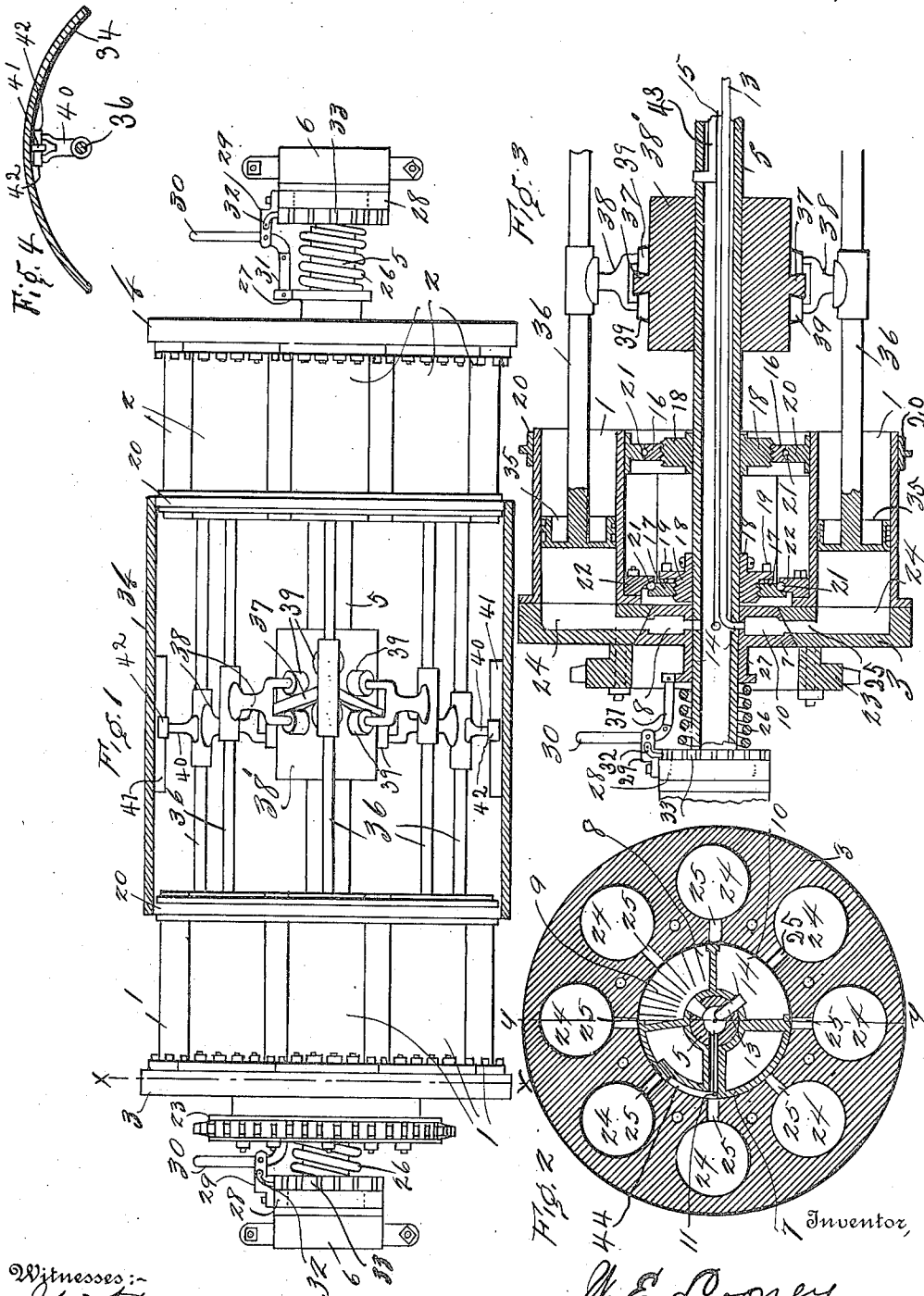
1. The combination, in an engine of the explosive type, of sparking devices having, as elements, a branched circuit, two circuit closers with means for rotating the same at different speeds, one of said circuit closers being in one branch of the circuit and the other in the other branch of the same, and a switch movable into engagement with either branch terminal whereby either branch may constitute part of the operative circuit.

2. The combination, in a multiple-cylinder engine of the explosive type, of sparking devices with independent circuit closers, one circuit closer having an independent terminal for each cylinder and the other

W. E. LOONEY.
 ROTARY MULTIPLE CYLINDER FOUR CYCLE ENGINE.
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