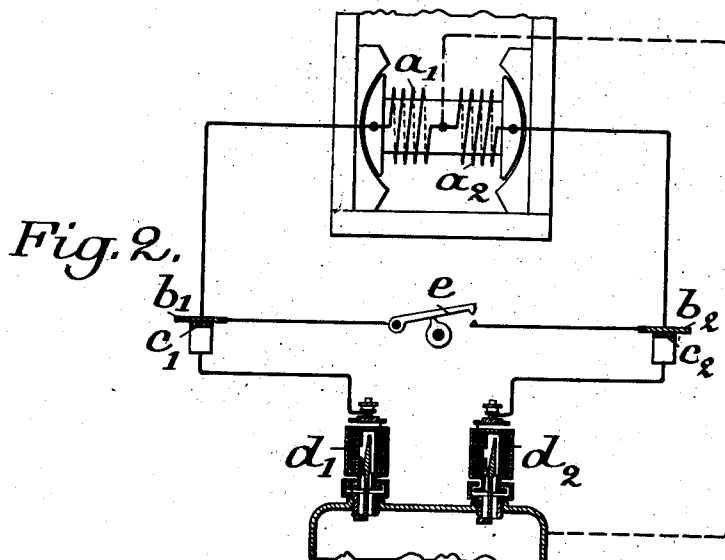
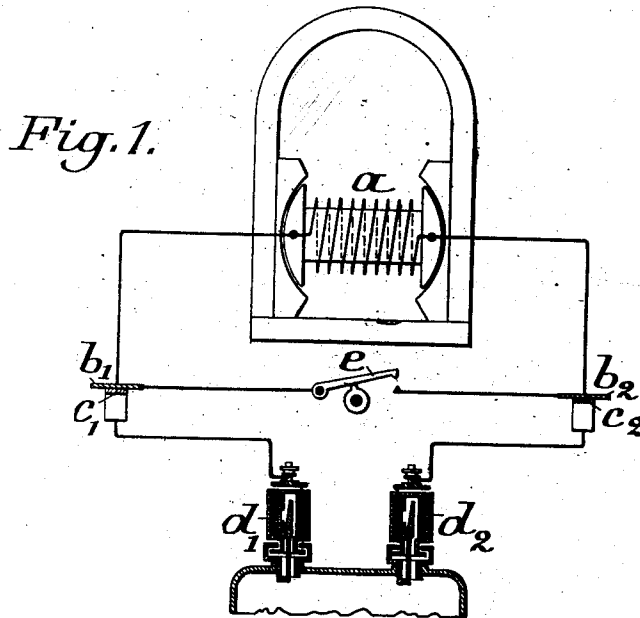


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IGNITION APPARATUS FOR LARGE INTERNAL COMBUSTION ENGINES.
APPLICATION FILED JULY 27, 1908.

1,047,891.

Patented Dec. 17, 1912.

2 SHEETS—SHEET 1.



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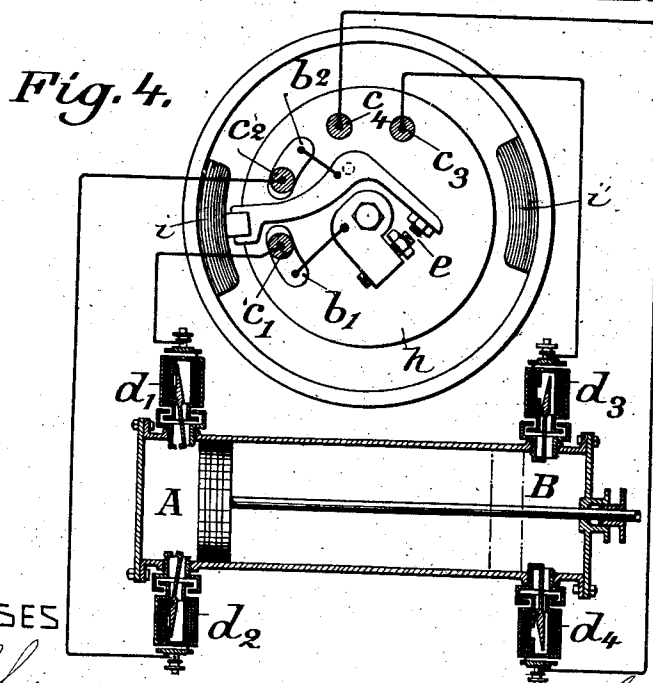
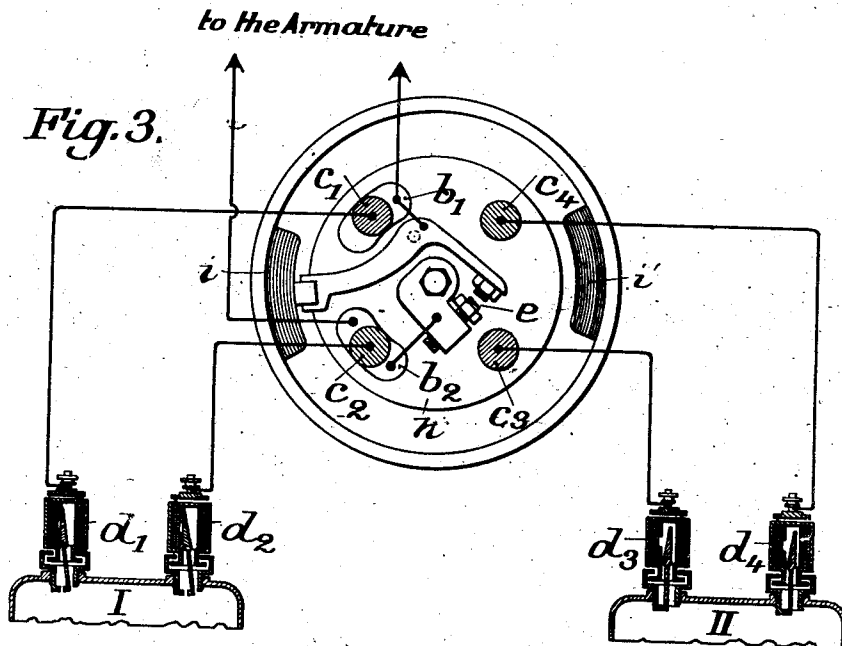
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2 SHEETS—SHEET 2.



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IGNITION APPARATUS FOR LARGE INTERNAL-COMBUSTION ENGINES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GOTTLÖB HONOLD, engineer, a subject of the German Emperor, residing at 11 Hoppenlaustrasse, Stuttgart, Germany, have invented certain new and useful Improvements in Ignition Apparatus for Large Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

For the working of large internal combustion engines it is desirable that the ignition in each cylinder should occur simultaneously at several places, in order that the combustion of the gaseous mixture may be more uniform and more rapid. The application of this idea by connecting up in series two or more high tension sparking plugs offers such great difficulties that experiments in this direction have not succeeded. The high tension current has in this case to overcome not only the normal air resistance of the spark-gaps placed in series but also the resistance caused by the compression. For example if the electrodes of two plugs in series have each a gap of 0.5 mm. then with a compression of 6 atmospheres a voltage sufficient to bridge two air gaps of 6 mm. each at atmospheric pressure is necessary. To insulate efficiently and continuously such an apparatus, especially as both ends of the coils must be insulated, is impracticable. Besides this, if the magneto or other source of electric current decrease in power in the slightest degree, the voltage limit sufficient to bridge the gap is soon reached. According to the present invention these disadvantages are removed by arranging in each cylinder two or more electromagnetically operated sparking plugs in series so that the compression has no effect on the formation of the spark and no difficulties occur as regards insulation. In this manner, as compared with high tension devices, effective sparks are obtained with certainty in all cases. If the plugs are connected up in series then the control of the ignition device has to fulfil certain conditions, and is made possible with the connections to be hereinafter described.

In the accompanying drawings, Figure 1 is a diagrammatic representation of the invention as applied to a single cylinder engine. Fig. 2 is a similar view showing a

modified form of connection. Fig. 3 is a diagram showing the invention applied to two cylinders, by means of a suitable distributor. Fig. 4 is a similar view representing the invention applied to a double acting engine.

The armature of the magneto carries either a simple winding a as in Fig. 1 or a coil divided into halves a_1 and a_2 as shown in Fig. 2. In both these cases the coil ends insulated from the body are electrically connected in a suitable manner by segments and slip brushes, which if desired may act as throw over switches, with the leads of the sparking plugs $d_1, d_2 \dots$, and also with the two contact pieces of an interrupter e operated by the engine shaft. This interrupter serves to short circuit the coil a , or a_1, a_2 which short circuit should not be broken until the moment of ignition.

In Figs. 1 and 2 the arrangement for a single cylinder motor is shown diagrammatically, b_1 and b_2 being the contact pieces or segments which rotate with the armature and c_1 and c_2 the fixed contacts or brushes connected with the sparking plugs. The spark gap of each plug is in the same cylinder.

When there is more than one cylinder to fire, a distributor must be used in the usual manner. Fig. 3 shows as an example such an arrangement for a two-cylinder motor, the cranks of which are rotatively displaced through 180° . In all other cases various alterations are necessary but these are obvious and do not affect the essentials of the invention.

The reference letters in Fig. 3 are the same as those in Figs. 1 and 2. I and II are the two cylinders. The contact pieces (segments b_1, b_2) rotating with the armature at the same velocity as the crank shaft are in this case 90° apart, and are connected respectively with the insulated ends of the armature winding and also with the interrupter contacts e respectively which also rotate. Opposite the segments are four slip brushes c_1, c_2, c_3, c_4 symmetrically arranged in a circle, which take up the current impulses and distribute them to the sparking plugs d_1, d_2, d_3, d_4 arranged in pairs in series in such a manner that ignition occurs first in cylinder I and then in cylinder II.

The rotary interrupter e is of a well known type whose operation is well understood, and therefore requires no further ex-

planation, other than to say that the armature current is maintained closed through the contacts of the interrupter e , until the pivoted contact arm is moved by one of the cam blocks, as i to separate the contacts e so that the magneto current will then pass by way of segment b_1 , and brush c_1 to spark plug d_1 , thence through the metal of the engine cylinder to spark plug d_2 , to brush c_2 , segment b_2 back to the armature of the magneto. Similarly in order to effect ignition in the cylinder II, the pivoted member of the interrupter e passes into engagement with the cam block i_1 and interrupts the shunt circuit at the contacts of the interrupters so that the current flows directly from the magneto, by way of the segments b_1 , b_2 , brushes c_3 and c_4 , through the spark plugs d_3 and d_4 in series.

With double acting single cylinder motors whose two ignitions are at one time displaced 180° at the other time $3 \times 180^\circ$, an arrangement such as shown in Fig. 4 may be used.

The distributor disk h rotates at the same speed as the cam shaft, it being immaterial whether the armature has the same speed or whether the speed of the distributor is reduced to one half that of the armature by intermediate gearing. In this manner the operation distributed over two complete revolutions of the motor can be transferred to a revolution of the distributor disk, so that one pair of contacts c_1 , c_2 , for the plugs d_1 , d_2 , are at 90° to the second pair c_3 , c_4 , for the plugs d_3 , d_4 , thus causing ignition first in the cylinder space A then in the cylinder space B. Also in double acting internal combustion engines, the above described

arrangement can be adopted with suitable structural alterations which are necessary on increasing the number of cylinders or on adopting another order of the individual ignitions.

In all constructions means for adjusting the time of ignition can be attached in the usual manner. They do not however form part of the invention and are therefore not shown in the drawings.

Having thus described the nature of my invention and the best means I know of carrying the same into practical effect, I claim:—

1. In large internal combustion engines, the combination with each cylinder, of a plurality of electromagnetically operated sparking plugs in series, a source of electric current, rotary contacts, conductively connected to the terminals of said source of electric current, means whereby the rotating contacts are brought into electrical connection with the said sparking plugs at the proper moment, and an interrupter.

2. In large internal combustion engines the combination with each cylinder, of a plurality of electromagnetically operated sparking plugs in series, a generating coil, rotary contacts connected to the terminals of said coil, means whereby the contacts are brought into electrical connection with the said sparking plugs at the proper moment, and an interrupter.

In testimony whereof I have affixed my signature, in presence of two witnesses.

GOTTLOB HONOLD.

Witnesses:

R. ELWERT,

E. ULMER.