

1,319,330.

Patented Oct. 21, 1919.

FIG. 1.

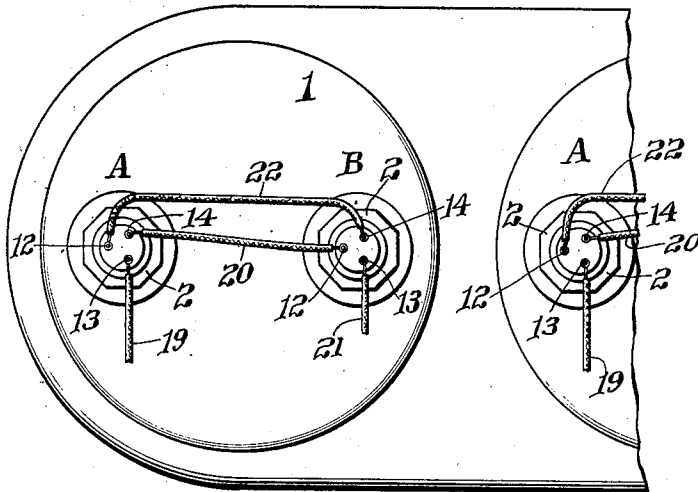


FIG. 2.

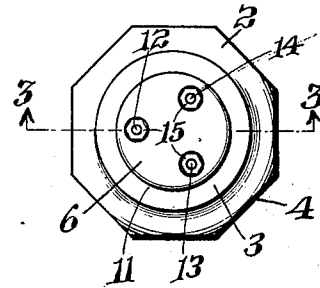


FIG. 3.

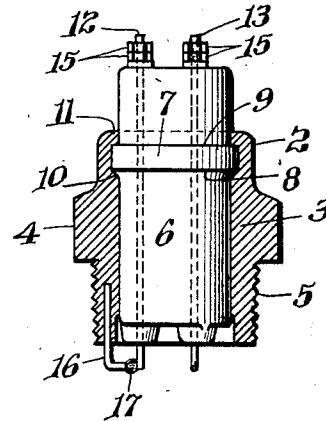


FIG. 5.

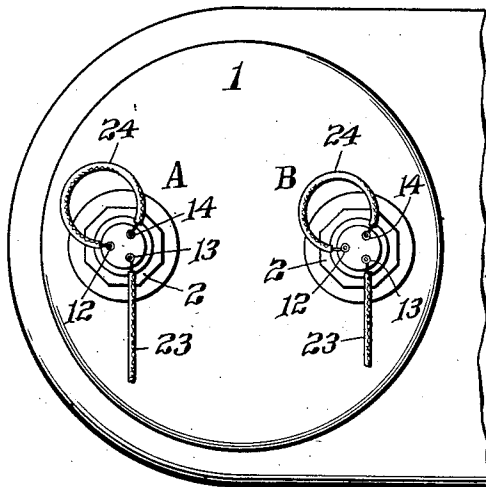


FIG. 6.

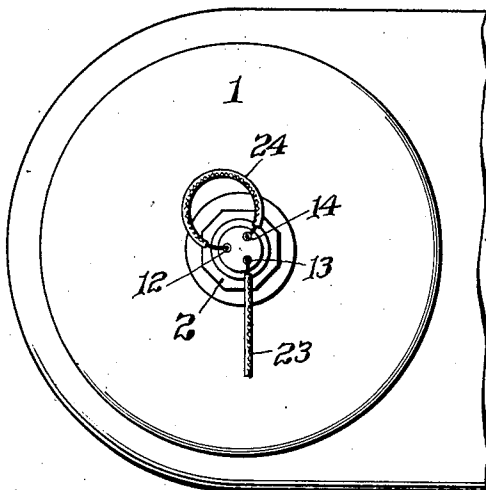
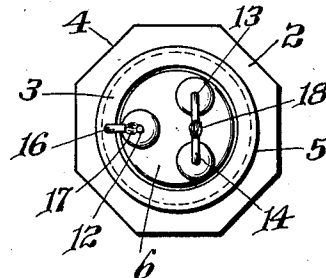


FIG. 4.



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SPARK-PLUG.

1,319,330.

Specification of Letters Patent.

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Application filed May 28, 1918. Serial No. 236,977.

To all whom it may concern:

Be it known that I, JOSEPH B. HAGAN, a citizen of the United States, residing in Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

My invention relates to certain new and useful improvements in spark plugs, such as are used in the operation of internal combustion engines. This spark plug is especially adapted to use in engines where it is essential that the spark should not fail, such as in aeroplanes.

The objects of my invention are to provide a simple and indestructible spark plug; to insure a fat spark in the combustion chamber at the proper time; to construct the plug so that it may be used as a single or double sparking plug; to be able to use a plurality of plugs connected in series to a plurality of sources of current supply, or each connected individually to a source of current supply, and located in the same combustion chamber.

These and other objects will be more fully described and illustrated in the following specification and accompanying drawings, in which—

Figure 1 is a partial plan view of an internal combustion engine provided with my invention in its preferred form;

Fig. 2 is an enlarged plan view of one of my improved spark plugs;

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 2;

Fig. 4 is a bottom plan view of Fig. 3;

Fig. 5 is a view similar to Fig. 1 showing each plug connected individually to a supply current, the plugs themselves having no connection with each other; and

Fig. 6 is a view showing a single plug being used in a cylinder.

Similar numerals refer to similar parts throughout the several views.

The internal combustion engine 1 is of the type used in aeroplanes, automobiles, etc., and while I have shown the plugs 2 as being inserted in the head of the cylinder, it is understood that they may be inserted in the side or other convenient place. The metallic shell or casing 3 is of the type generally used in the present form of spark plug, and is provided with a hexagonal portion 4 to which a wrench may be applied

when applying or removing the same to and from the cylinder. Threads 5 are provided which engage similar threads tapped in the casing of the cylinder, and provide a means of securing the plug to the engine. The porcelain or internal insulating member 6 is held in the shell 3 by the enlarged portion 7 forming shoulders 8 and 9. The shoulder 8 rests upon the seat 10 on the inside of the shell 3, and the shoulder 9 is engaged by the inturned lip or flange 11. If desired a gasket may be inserted between the shoulder 8 and the seat 10 to prevent leakage, but it has been found that this is not necessary where the porcelain members are well made, and I have therefore not shown the same.

While I have shown what is termed a one-piece plug, I do not wish to confine myself to this particular construction as shown. A two-piece plug or one from which the porcelain may be removed and another inserted could just as readily be adapted.

It will be seen upon reference to the drawing that I prefer to use three electrodes 12, 13 and 14, all of which are firmly held in the porcelain 6. The upper ends of these electrodes extend above the top of the porcelain and are provided with screw threads to receive the nuts 15. These nuts are used to connect the ends of the conducting wires from the source of current, such as the magneto or battery. Any known form of connection may be used. The lower ends of the electrodes extend below the porcelain and it is here that the sparking occurs. To the lower end of the shell 3, I have fastened what I will term a ground electrode 16; that is, an electrode which receives the last spark 17 and along which the current passes into the body of the engine and finally back to its source, the circuit being thereby completed. The point of the electrode 16 is bent toward the lower end of the electrode 12, and receives the spark 17 from the same. While I have shown the lower end of the electrode 12 as straight, it will be understood that I may also bend this, leaving straight or that both may be bent. The first spark 18 occurs between the lower points of the electrodes 13 and 14 providing the wiring is so arranged that we are producing two sparks with the one plug. This will be further described in the operation, which is as follows.

Referring to Fig. 1, in which we are using

two spark plugs 2, connected in series: For clearness I will refer to these assembled plugs as A and B. The current from a source of supply, such as a magneto, not shown, passes through the wire 19 into the electrode 13 in plug A, and thence down and across the gap between the lower end of said electrode and the lower end of electrode 14, causing the spark 18. The current then passes up the electrode 14 in plug A and along the connection 20 to the top of the electrode 12 in plug B, down the same and across the gap between the lower end thereof and the ground electrode 16 in said plug B, causing spark 17, thus completing the circuit. The wire 21 receives its current from a magneto which is separate and independent from that which supplies the wire 19 with its current and is connected to the top of the electrode 13 in plug B, the current passing thence down and across the gap between the lower end of said electrode 13 and electrode 14 in said plug B, causing the spark 18. The current then passes up the electrode 14 and along the connection 22 to the top of the electrode 12 in plug A, down the same and across the gap between the lower end of the said electrode 12 and the ground electrode 16, plug A, causing or producing spark 17, thus completing the circuit. It will be seen from the above operation that there are four separate sparks occurring simultaneously at different points in the same cylinder. Should trouble develop in either plug or in any part of either circuit there would still be two sparks working, one for each plug.

In Fig. 5, I have shown a modified construction in which two plugs designated as A and B are shown working independently of each other. The current from the source of supply, such as a magneto, enters the top of the electrode 13, plug A, through the wire 23 and passes down the same and across the gap between the lower ends of the electrodes 13 and 14, causing the spark 18. The current then passes up the electrode 14 and along the conductor 24 to the top of the electrode 12 in said plug A, down through the latter electrode and across the gap between the lower end of said electrode 12, and the ground electrode 16, causing the spark 17. The plug B receives and discharges its current and produces its sparks in exactly the same way as plug A, and it will thus be seen that four sparks are being formed in the same cylinder at the same time. As in the arrangement shown in Fig. 1 there may be either a single source or two separate sources for the currents.

As stated in the objects of this invention, my plug may be used as a single or double sparking plug, and as such I will refer to Fig. 6, in which I have shown one plug applied to one cylinder. In this form, if a double sparking is desired, the supply wire

23 is attached to the upper terminal of the electrode 13 and the current passes down and across the gap between the lower ends of electrodes 13 and 14 and causes the spark 18. It then passes up the electrode 14 and along the conductor 24 to the top of the electrode 12, down the latter and across the gap between the lower end of the same and the ground electrode 16, causing the spark 17, and completing the circuit.

If a single sparking is wanted connect the feed wire 23 directly to the upper terminal of the electrode 12, and the current will then pass down the latter and across the gap between the lower end of the same and the ground terminal 16 and cause the spark 17.

This operation would eliminate the spark 18, and only one spark would occur in the cylinder. The same form of connection may be employed in the arrangement shown in the previous figures of the drawing in which two plugs are provided for each cylinder of the engine.

While I have shown one form in which my spark plug may be constructed, I do not wish to be limited to this particular construction, as the construction may be varied widely without departing from the spirit or scope of my invention.

I claim:

1. A plurality of spark plugs each having an insulating member, a metallic shell surrounding and secured to each of said members, a plurality of electrodes secured in the respective insulating members, means for attaching ignition wires to the electrodes, two gaps formed in the ignition circuit at and near the ground terminal, means for using two plugs in series, or separately, and means for dispensing with the use of one gap in one or both plugs, as and for the purpose described.

2. In an ignition system for internal combustion engines, the combination of a plurality of spark plugs, each having a plurality of electrodes, and a plurality of electric circuits, each circuit including in series certain of the electrodes in each of the said plugs.

3. In an ignition system for internal combustion engines, the combination of two spark plugs, each spark plug being provided with three electrodes and a ground terminal and two circuits, each circuit including two of the electrodes in one plug and one of the electrodes in the other plug, and a ground terminal of the latter in series.

4. In combination, two spark plugs, each spark plug comprising three electrodes and a ground terminal, the lower ends of two of the said electrodes in each of the said plugs being spaced from each other to form a spark gap and the lower end of each of the other electrodes being spaced from the

ground terminals of the respective plugs to
form spark gaps and two electric circuits,
one of the said circuits having connection
with the said two electrodes of one of the
5 plugs and with the electrode of the other
plug, the lower end of which is spaced from
the ground terminal thereof to form a spark
gap and the other of said circuits having
connection with the two electrodes of the
10 other plug and with the electrode of the
first named plug, the lower end of which is
spaced from the ground terminal thereof to
form a spark gap, substantially as described.

5. A spark plug comprising three elec-

trodes and a ground terminal, the lower 15
ends of two of the said electrodes being
spaced to form a spark gap and the lower
end of the third electrode being spaced with
respect to the said ground terminal to form
a spark gap and means for connecting the 20
said electrodes so as to provide either a
single or a double spark, substantially as
described.

In testimony that I claim the foregoing
as my invention, I have hereunto signed my 25
name this 20th day of May, A. D. 1918.

JOSEPH B. HAGAN.