

R. H. WHISLER,
IGNITION SYSTEM.
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1,376,846.

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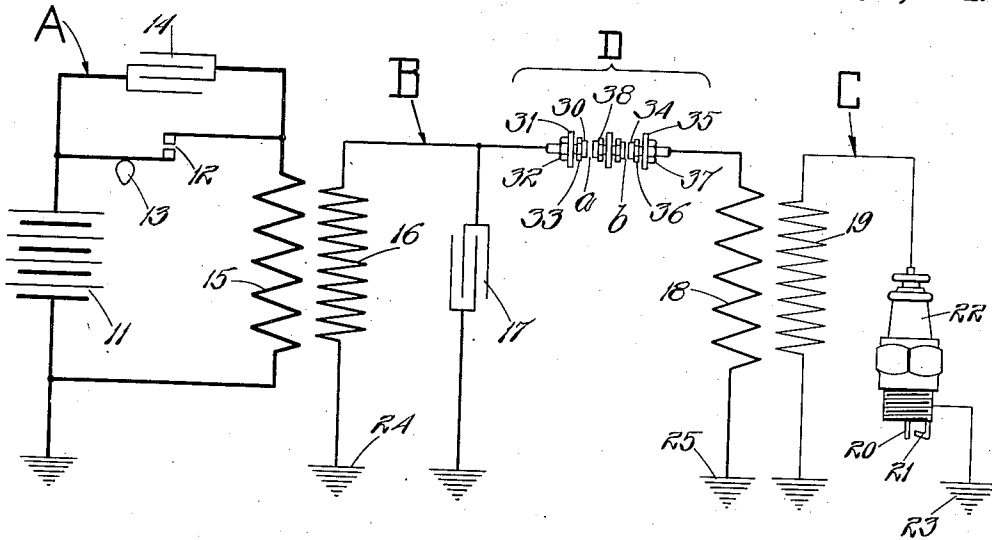


Fig. 1.

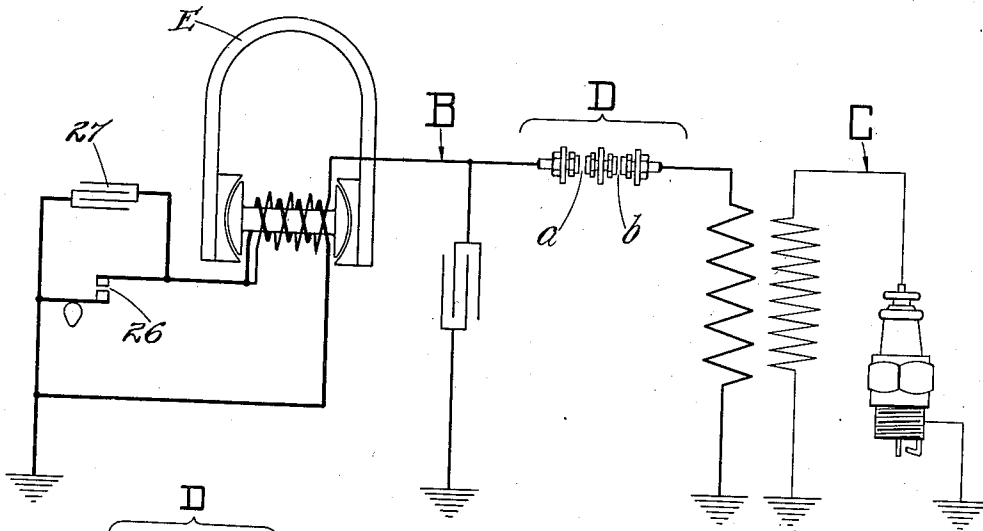


Fig. 2

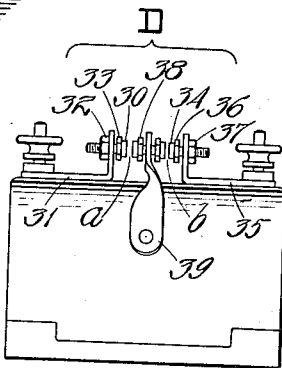


Fig. 3.

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IGNITION SYSTEM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RALPH H. WHISLER, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Ignition Systems, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention has for its object an improvement in an ignition system of the type ordinarily employed for igniting the charge of an internal combustion engine. The particular object of the invention is to provide a system which will be less liable to be short circuited at the spark plug by the accumulation of oil, carbon, soot and the like, and furthermore to provide a system, the sparks produced by which will be best adapted to produce a complete and instantaneous ignition of the explosive charge.

Heretofore especially in multiple cylinder internal combustion engines, great difficulty has been experienced owing to the fact that carbon and oil accumulates on the spark plugs and short-circuits the spark plug so that the system fails to operate. This tendency is particularly troublesome in the present high speed internal combustion engines operating on a liquid hydrocarbon of relatively poor quality. The fouling of the spark plugs is especially noticeable in the end cylinders of six and twelve cylinder engines.

It has already been proposed to produce at the points of the spark plug, a spark of extremely high frequency and high voltage since such a spark is not affected by the accumulation of carbon and oil, but I have found that while such a spark jumps the air gap between the spark plug points in preference to passing through the carbon deposit and therefore is not short circuited by the carbon deposit the spark so produced is so thin and weak that it will not afford satisfactory ignition of the charge.

My present invention provides an ignition system which overcomes the difficulties I have heretofore experienced with a high frequency high voltage ignition system and produces a spark at the plug which is very heavy and hot and which is much more effective in igniting the mixture.

The invention will be fully understood from the following description when taken

in connection with the accompanying drawings, and the novel features thereof will be pointed out and clearly defined in the claims at the close of this specification.

In the drawings Figure 1 is a diagram showing my invention embodied in an ignition system supplied with current from a storage battery.

Fig. 2 shows my invention embodied in a system supplied with current from a high tension magneto.

Fig. 3 is a detail view of the double spark gap unit.

Referring now to the drawings, Fig. 1, the ignition system embodying my invention comprises three circuits conveniently designated A, B and C. The circuit A in the form shown in the drawings contains a storage battery 11, a circuit breaker 12 operated in time with the engine, as for instance, by a cam 13, a condenser 14 connected across the terminals of the circuit breaker and the primary winding 15 of an induction coil. The second circuit contains the secondary winding 16 of said induction coil, a condenser 17, the primary winding 18 of a disruptive discharge coil and a fixed spark gap D the construction and functions of which will be hereinafter described. The third circuit C contains the secondary winding 19 of said disruptive discharge coil and the electrodes 20, 21 of a spark plug 22. The shell of the spark plug is grounded as shown at 23. The second circuit B is preferably grounded as shown at 24 and 25. It will be understood that I do not limit myself to the details of arrangements of the three circuits since certain variations will naturally occur to those skilled in the art.

The system just described operates in general as follows:

The current from the battery being broken in time with the engine by the circuit breaker 12, energizes the primary winding 15 of the induction coil. This produces in the secondary winding 16, forming part of circuit B, a current of higher voltage which charges the condenser 17 and discharges through the double spark gap D and the primary winding 18 of the disruptive discharge coil. The spark gap D and condenser 17 have the effect of producing a high frequency oscillation in the primary winding 18. This high frequency oscillation of moderate voltage in the primary winding 18 of

circuit B produces in the secondary winding 19 in the third circuit C a corresponding current of equal frequency and extremely high voltage, and this current is discharged across the points 20, 21 of the spark plug.

In Fig. 2 is shown an exactly similar system except that the moderate voltage current of circuit B is produced by means of a magnet E having a circuit breaker 26 and condenser 27 in the usual form.

The spark gap D previously referred to is a double spark gap. It comprises a point 30 mounted on a bracket 31 and adjustable by nuts 32, 33. At 34 is shown another similar point mounted on a bracket 35 and similarly adjustable by nuts 36, 37. Between the two points 30 and 34 is located another spark point 38 also mounted on a bracket 39. The space between points 30 and 38, which space I have designated *a* is very much greater than the space between the points 38 and 34 which space has been designated *b*. In practice, the gap *b* is made about one thousandth (.001) of an inch, while the gap *a* is about fifteen thousandths (.015) of an inch.

When employed with the double spark gap adjusted as described with one gap very much narrower than the other, a very remarkable improvement in the system is found. The spark produced is very heavy, fat and hot, and will not only pierce paper but ignite it. The difference in the running of the engine is also very noticeable.

While it is not possible to state with absolute certainty the reason why the insertion of this double spark gap in the second circuit of a three circuit ignition system produces the remarkable improvement in the results which I have described, I believe it results from the following facts:—

The operating voltage of the system is controlled by the gap *a* since the condenser 17 must be charged to a potential sufficient to jump the gap. This gap is therefore adjusted so as to produce a spark at the plug under all working conditions. If a single spark gap is employed, the air path between the two contact points is heated by the first discharge to such intensity that it practically forms a short circuit between the two points and the remainder of the energy stored in the coil 16 and condenser 17 is discharged across the points. When a second spark gap, adjusted as described, is employed, the points are so near together that after the passage of the first series of high frequency sparks has occurred, the heat is carried away so rapidly by the relatively large masses of the gap points that no short circuit can be built up and the circuit is almost immediately interrupted. However, since the coil 16 still contains energy, it again charges the condenser until the gaps *a* and *b* break down and another

shower of sparks occurs both at the gap and at the spark plug. This flow is, however, again interrupted by the absorption of heat by the gap points. These occurrences are repeated until the energy remaining in the secondary coil 16 is insufficient to jump the wide gap *a*. All of these occurrences which are practically instantaneous take place in a period of time too short for ordinary observation, but if observed by means of rotating mirrors, it is found that when a single gap is used, one spark is produced followed by what appears to be a purple or bluish streak which I believe to be the discharge produced by the short circuiting of the gap points. On the contrary, when the double spark gap, arranged as described, is employed, there are seen in the mirror successive bright sparks which correspond to the sparks observed when the single gap is used and instead of the bluish streak formed by the short circuit discharge, there are a series of from ten to one hundred additional sparks. In other words, the energy which was wasted by reason of the short circuit discharge, is now employed in producing what for convenience may be termed a series of secondary high frequency sparks which give to the sparks at the spark plug the heavy, fat appearance which, as is well known, is extremely desirable.

But whether the foregoing explanation of the operation be correct or not, I have found by observing the operation of the device under different positions of the gap points, first that the voltage of the discharge is controlled by the adjustment of the wide gap, and second, that the number of secondary sparks produced can be varied by changing the adjustment of the narrow gap.

The introduction into the three circuit high frequency high tension ignition system of the double discharge gap herein described, converts the system into a highly effective and thoroughly practical ignition system for general use. Practical experience with this ignition system has proved that it will fire the mixture under almost any condition which may obtain in the cylinders and that so far as I have been able to discover, no accumulation of oil or soot will prevent this operation.

What I claim is—

1. An ignition system of an internal combustion engine comprising three circuits, spark timing means in one of said circuits, there being in the first circuit the primary of an induction coil and means for producing therein a varying flow of current; there being in the second circuit the secondary of said induction coil a condenser charged thereby, a discharge gap and the primary of a disruptive discharge coil; and there being in the third circuit the secondary of

the discharge coil and the electrodes of a spark plug in the combustion chamber of the engine, said discharge gap comprising pairs of gap points in series, one pair of
5 said gap points being spaced farther apart than another pair.

2. An ignition system of an internal combustion engine comprising three circuits, spark timing means in one of said circuits,
10 there being in the first circuit the primary of an induction coil and means for producing therein a varying flow of current; there being in the second circuit the secondary
of said induction coil a condenser charged

thereby, a discharge gap and the primary 15
of a disruptive discharge coil; and there being in the third circuit the secondary of the discharge coil and the electrodes of a spark plug in the combustion chamber of the engine, said discharge gap comprising
20 pairs of gap points, one pair being adjusted wide enough to cause the condenser to discharge at the desired voltage and another of said pairs of gap points being adjusted relatively close together to increase the num-
25 ber of sparks at the desired voltage.

In testimony whereof I affix my signature.
RALPH H. WHISLER.