Aug. 29, 1961 S. R. McCLURE 2,998,470

IGNITION SYSTEM

Filed Aug. 24, 1959 2 Sheets-Sheet 1

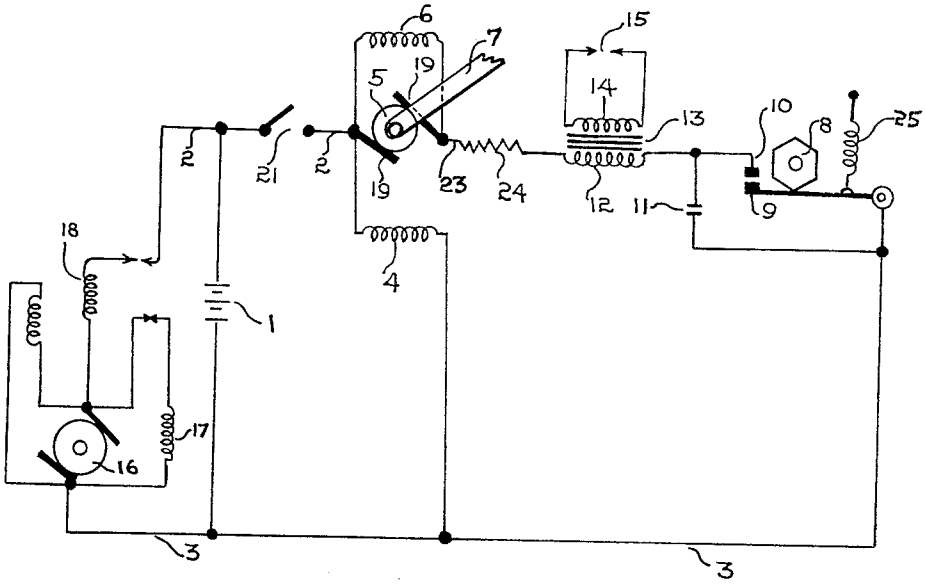


FIG. 1

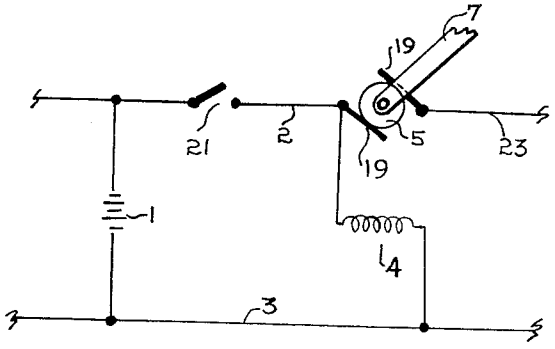


FIG. 2

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IGNITION SYSTEM

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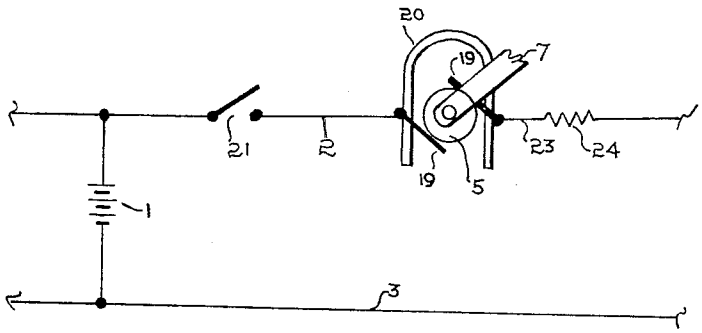


FIG. 3

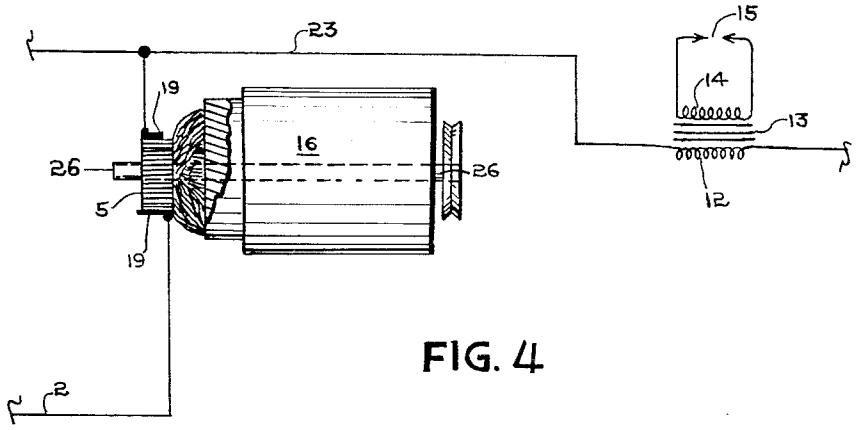


FIG. 4

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United States Patent Office 2,998,470 Patented Aug. 29, 1961

2,998,470

IGNITION SYSTEM

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Filed Aug. 24, 1959, Ser. No. 835,521
2 Claims. (Cl. 123—148)

This invention relates to an improved ignition system for internal combustion engines.

This application is a continuation in part of my co-pending application Serial No. 758,523 for: Dynamo Compensator for D.C. Jump Spark Ignition filed September 2, 1958.

It is well known that in the conventional ignition system ordinarily utilized in automotive vehicles that the time allowed for producing necessary spark varies inversely with the speed of the engine. Consequently under low speed the sparking interval is relatively long while under high speed it is relatively short. An inherent weakness in such a system is that spark current diminishes as the engine speed increases at high speeds decreases to such an extent that the effectiveness of the spark is seriously impaired. This phenomenon is termed "spark fade" and is due to reactance caused by the high frequency of spark required at high speed. This action occurs because magnetic flux can be built up in the core of the induction coil only during the intervals when the breaker points are closed. The time length of these intervals diminishes as the engine speed increases. The sparking interval at high speed is not sufficient long to enable magnetism to build up in the core of the induction coil to the same degree that it can in the longer interval available at lower engine speed. Thus when the engine is running at high speed the sparking interval is reduced to such an extent as to cause corresponding reduction of intensity and resultant inefficiency of the spark with a proportional decrease in the power of the engine.

An important object of the present invention is to provide a simple and automatic means for maintaining a uniform sparking efficiency in the ignition circuit under varying conditions of speed of the engine than has heretofore been practiced.

Another important object of this invention is to provide a means for use with conventional battery ignition systems which provides a higher spark voltage as speed increases.

Still another object of this invention is to provide a compensating means for the conventional battery ignition system that at a predetermined speed will become stable in output.

The difficulties referred to above i.e. fading of spark voltage with frequency in speed due to the reactance of the induction coil is overcome by the use of the apparatus of my invention. This device in one embodiment consists of a small dynamo installed in a conventional battery ignition system with its armature driven by the engine and its electromagnetic field furnished by a winding across the battery. Since the armature is driven at a speed proportional to the speed of the engine the voltage produced is proportional to the speed of the engine. Thus as the frequency increases due to high engine speed the voltage increases to compensate for increased reactance at the induction coil. Due to the small size of the dynamo, at idling speeds an inconsequential amount of voltage is produced so that the system compensates automatically to variations in engine speed.

The magnetic field for the dynamo is, as indicated above, in one embodiment provided by a field winding across the battery. In this case an essentially stable electric magnetic field is produced since the winding derives its magnetic strength from the battery. As a consequence, disregarding fluctuations in the strength

of the battery, the electric magnetic field provided by the field winding is stable.

In another embodiment, a second electromagnetic field winding, connected in shunt across the brushes of the dynamo is utilized. This winding derives its strength from the dynamo so that the strength of the magnetic field provided by this winding is proportioned to the speed of revolution of the armature. At zero r.p.m. of the armature the strength of the magnetic field is zero, however, at high speeds the strength of the magnetic field is great. Thus, if this field winding is polarized to aid the first field winding, the spark voltage impressed on the spark coil is increased progressively with an increase in engine speed, since as has been previously indicated the armature is driven by an available shaft of the engine, as for example the generator shaft, the crank shaft, the fan shaft, etc. Thus, it is possible to increase the voltage potential at the spark gap progressively with an increase in speed, which, according to some authorities, is beneficial to engine performance.

In another embodiment, the second field winding, connected across the brushes of the dynamo, is polarized in opposition to the field winding across the battery. Thus, at low speeds the spark voltage is increased because of the voltage produced by revolution of the armature. However, when the engine speed reaches a predetermined point, the strength of the magnetic field produced by the second field winding (in shunt across the brushes of the dynamo), in opposition to the magnetic field produced by the first winding, (connected across the battery) acts to stabilize the magnetic field and thus limit the maximum voltage produced.

Therefore, at lower engine speeds the spark intensity is increased so that full horsepower is attained on hills, for fast acceleration and with heavy loads. However, the maximum voltage is limited when a predetermined speed is reached.

In still another embodiment, the magnetic field of the dynamo is provided by a permanent magnet. A preferred permanent magnet may be made from the so called Alnico alloy, which is an alloy of aluminum and nickel, although other permanent magnets may be utilized.

The invention will be better understood by reference to the attached drawings.

Referring now to the drawings,

FIG. 1 is a diagrammatic view of an electric ignition system embodying the various features of my invention.

FIG. 2 is a diagrammatic view of a portion of a modified system in which a second field winding in shunt connection across the brushes of the auxiliary dynamo has been omitted.

FIG. 3 is a diagrammatic view of a portion of another modification in which the accessory dynamo is of the permanent magnet type.

FIG. 4 is a semi-diagrammatic drawing of a portion of a modification of the ignition system showing the auxiliary dynamo driven by an extension of the shaft of the generator.

Referring now to FIG. 1 the battery or direct current source is indicated by numeral 1. Connected to the battery are lines 2 and 3 and connected across lines 2 and 3 is first electro magnetic field winding 4. The electro magnetic field produced by this winding energizes the two brush dynamo, the armature of which is designated by numeral 5 and the brushes of which are designated by numeral 19. Connected to the two brushes is a second field winding 6 which in one embodiment may be polarized to aid the first field winding 4. In this embodiment, i.e., field winding 6 polarized with field winding 4, the magnetic strength varies in proportion to the speed of revolution of the armature 5. This increases the voltage impressed on the spark coil as the armature speed in-

creases. Numeral 7 designates a shaft connected to any accessory engine driven shaft not shown. Line 23 connects brush 19 of the dynamo via resistance element 24 to the primary of spark coil 12. Numeral 11 designates a conventional condensor connected across contacts 9 and 10. Numeral 12 designates the primary of spark coil, numeral 13 designates the iron core of spark coil and numeral 14 designates the secondary of spark coil. Numeral 15 designates the spark plug. 8 designates a cam conventionally utilized in conjunction with spring 25, in actuating the breaker points. 16 designates the armature of the standard two brush generator; 17 designates the field winding and 18 designates the conventional voltage regulator of the generator. 21 designates the ignition switch.

As previously indicated shaft 7 is a mechanical means which connects with the armature 5 of the auxiliary dynamo and an accessory engine driven shaft. In FIG. 4 that shaft is shown to be an extension of the shaft of the standard generator. The armature 5 of the auxiliary dynamo may be driven by a V belt drive connected to an engine driven shaft, such as the crank shaft, the fan shaft, etc., so that the speed of the armature is in proportion to the speed of the engine. In this manner the output of the dynamo is proportional to the speed of the engine and the system automatically compensates to variation in engine speed.

As previously indicated another embodiment of my invention which is shown in FIG. 1 involves second field winding 6, polarized in opposition to field winding 4. It will be understood that the magnetic strength of field winding 6 is nil at zero r.p.m. of the armature 5. The magnetic strength produced by field winding 4 is essentially the same at all engine speeds deriving its strength from the battery. In the lower speed range the output of the dynamo produces a hotter spark so that full horsepower is available for the engine on hills and for fast acceleration. However, as speed is increased to a predetermined point magnetic field winding 6 in opposition to magnetic field winding 4 stabilizes the voltage output, so that further increase in speed does not increase the voltage output of the system.

In FIG. 2 the second electromagnetic field winding 6 has been omitted. In this embodiment the entire output of the auxiliary dynamo is led via line 23 to spark coil (not shown).

FIG. 3 indicates another modification of the system wherein magnetic field winding 4 is replaced by permanent magnet designated by numeral 20.

FIG. 4 illustrates the auxiliary dynamo connected and directly adjacent to the generator 16, and having its driving means common to that of the generator 16 being simply an extension of the generator shaft 26. Portions of the dynamo housing have been broken away to show brushes 19, connected to line 2 and line 23 respectively and a portion of the armature 5.

It is obvious that many modifications can be made from those shown in the illustrations, the size, i.e., the potential output, of the dynamo may be varied to produce an essentially stable spark at all engine speeds and alternately to produce an increased spark at increased engine speeds. The latter embodiment may be also achieved by the addition of the second field winding 6 when polarized to aid the first field winding 4. In another embodiment the second field winding 6 may be polarized in opposition to field winding 4, so as to allow increased spark at lower engine speeds while limiting the voltage at high engine speed. I have found that the invention increases engine efficiency, and increases gas mileage.

It is evident that the system shown may be further modified from the scope of the invention, therefore, I do not wish to limit the invention to the precise details herein illustrated and described.

I claim:

1. An auxiliary direct current dynamo, for use with a principal variable speed, engine driven direct current dynamo, and a direct current battery source, for a spark coil which is connected at its primary in series with the armature of the direct current dynamo and the principal direct current source, and at its secondary to the spark in an ignition system for an internal combustion engine, said auxiliary direct current dynamo comprising an armature and brushes, the armature of said auxiliary dynamo being operatively connected to and driven by said engine, one brush of said auxiliary dynamo being connected to the primary of the spark coil and another brush of said auxiliary dynamo being connected to said direct current source, a first electro-magnetic field winding connected across the direct current source at a point between the direct current source and said auxiliary dynamo, and a second electro-magnetic field winding in shunt connection across the brushes of said auxiliary dynamo so as to be polarized with said first electro-magnetic field winding.

2. An auxiliary direct current dynamo, for use with a principal variable speed, engine driven direct current dynamo, and a direct current battery source, for a spark coil, which is connected at its primary in series with the armature of the principal direct current dynamo and the direct current source, and at its secondary to the spark in an ignition system for an internal combustion engine, said auxiliary direct current dynamo comprising an armature and brushes, the armature of said auxiliary dynamo being operatively connected to and driven by said engine, one brush of said auxiliary dynamo being connected to the primary of the spark coil and another brush of said auxiliary dynamo being connected to said direct current source, a first electro-magnetic field winding connected across the direct current source at a point between the direct current source and said auxiliary dynamo, and a second electro magnetic field winding in shunt connection across the brushes of said auxiliary dynamo, so as to be polarized in opposition to said first electro-magnetic field winding.

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