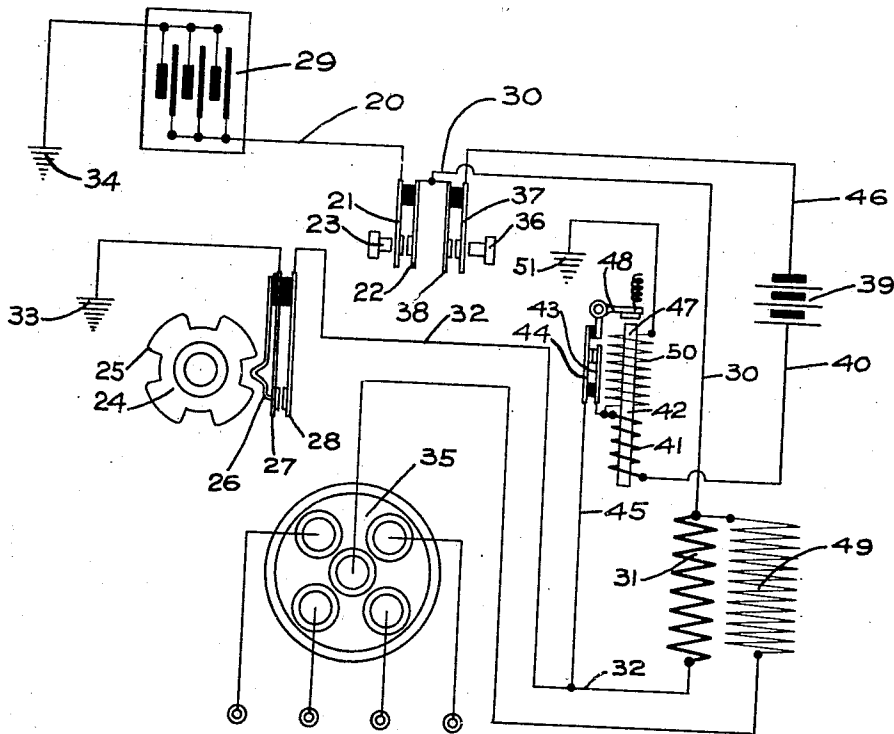


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UNITED STATES PATENT OFFICE.

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ENGINE-STARTING SYSTEM.

1,258,785.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, CHARLES F. KETTERING and WILLIAM A. CHRYST, citizens of the United States of America, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Engine-Starting Systems, of which the following is a full, clear, and exact description.

This invention relates to a system of devices adapted for supplying power to start an engine, and the engine when thus started, is arranged to store up power for similar future starting operations, and this same power source may then be used to supply current for the ignition system of the engine and for any other purposes which may be desired.

The present application is a division of our co-pending application, Serial No. 789,641, filed September 13, 1913, for engine starting system.

Among the objects of the present invention is to provide an electrical system, including ignition systems which may be brought into operation, either independently to meet certain engine conditions more advantageously, or in combination, to meet other engine conditions.

In carrying out the above object, there may be provided an ignition system of the vibrating spark type and an ignition system of the single spark type. This vibrating spark ignition being controlled, in operation, by the engine timer.

It is generally desirable to employ this vibrating spark ignition, during the starting operation, while after the engine is started the same engine timer which controls the vibrating spark ignition, may be used to furnish single spark ignition for the running of the engine.

The type of ignition system to be brought into use, may be controlled by means of a selective switch device, which may be so actuated by the operator that the proper type of ignition may be selected.

Further objects and advantages of the present invention will appear from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is set forth.

The drawing sets forth a diagrammatic

view of one embodiment of the present invention.

The present improvements include ignition systems which are so combined that a single timing mechanism can be utilized in combination with other means to furnish either vibrating spark ignition, or single spark ignition of the engine timer type.

By single spark ignition of the engine timer type, we mean ignition produced by the engine timer breaking the primary circuit, as distinguished from single spark ignition produced by the holding coil of an interrupter relay, such as is described in the co-pending application of Charles F. Kettering, Serial No. 548,921, filed March 12, 1910.

In accordance with a preferred embodiment of this feature of our invention, we so arrange that when single spark ignition is desired, the engine timer, upon closing the aforesaid contact, causes a flow of current through the primary winding of the induction coil, while upon opening the said contact, the break of current causes the generation of a single sparking impulse by the ignition device.

When the vibrating spark ignition is desired, we so arrange that during the time the aforesaid contact is open, an interrupter relay included in one of the main circuits will operate to make and break the primary circuit in rapid sequence, with the result that vibrating spark impulses will be generated throughout the time that the aforesaid contact member is open, provided of course that the main controlling switch has first been operated to select the circuit which includes the interrupter relay.

Referring to the drawing, it will be noted that the wire 20 is connected to the contact plate 21, which is brought into engagement with the contact plate 22, by the operation of the button or other controlling element 23. It will of course be supposed that the engine is operating and that the cam 24 is being rotated thereby.

Now, as soon as one of the lobes of the said cam 24 engages with the finger 26, the contact plates 27 and 28, respectively, will be closed and current will be permitted to flow from the battery 29, through the wire 20, switch plates 21 and 22, wire 30, through the primary winding 31 of the induction coil,

to the plate 28, via wire 32, and across the plate 27 to the ground connection 33, back to the battery via ground 34.

When the lobe of the cam moves so as to permit the return of the contact plate 27 to its normal position, the circuit will be broken and a sparking impulse will be generated in the induction coil in the ordinary manner, thus resulting in a spark occurring in the engine cylinder which may be selected by the distributing device 35.

It will therefore appear that a single spark will be generated for each time that the above mentioned circuit is closed and opened by the operation of the timer cam 24.

When it is desired to secure the vibrating spark type of ignition, the element 36 will be operated to close the contact plates 37 and 38, which will have the effect of closing the following circuit, provided that the timer cam 24 is in such position as to permit the contact plate 27 to assume its normal position: from the battery 29 to the wire 40, thence through the heavy winding 41 of the ignition relay or interrupter device 42, across the contact plates 43 and 44, thence through the wire 45, the primary winding 31 of the induction coil, through the wire 30, switch plates 38 and 37, back to the battery, via wire 46.

However, as soon as the core 47 of the ignition relay 42 becomes sufficiently energized, it will attract the armature 48 into such position as to break the contact between the contact plates 43 and 44, thus breaking the circuit above described, and giving a sparking impulse in the secondary winding 49 of the induction coil.

Of course, upon the breaking of the circuit, the core 47 will become demagnetized and will permit the armature to assume its normal position, which in turn will have a similar effect relative to the contact plates 43 and 44, so that the circuit will again be made and again be subsequently broken in a manner similar to that just described.

This operation will continue during the period that the timer cam is in such position as to permit the contact plate 27 to remain in its normal position.

When the cam moves so as to close the contact plates 27 and 28, the armature of the ignition relay operates to open the plates 43 and 44, and a flow of current will immediately pass through the fine winding 50 of the relay 42, to the ground connection 51, and thence to the timer contact, via ground 33, back through the contact plates 27 and 28, to the primary winding of the induction coil, via wire 32. From the induction coil, the current will flow through wire 30, across the contact plates 38 and 37, to the opposite side of the battery 29, via wire 46. As long as the cam 24 maintains the plates 27 and 28 closed, this circuit will be maintained and

the armature held so as to break the main circuit by holding the contact plates 43 and 44 apart.

The fine winding 50 of the ignition relay or interrupter 42 is so proportioned that only a sufficient amount of current will be permitted to flow therethrough, as will continue to energize the core 47 of the relay 42, sufficiently to maintain the armature 48 in position to hold the contact plate 44 away from the plate 43. This amount of current is not sufficient to cause an additional spark to be generated when the lobe of the timer cam is so moved as to permit the circuit to again be broken.

Instantly upon the break of the last mentioned circuit, at the contact points 27 and 28, the vibrating spark effect will again be commenced.

While the form of the invention herein shown and described constitutes a preferred embodiment of the invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What we claim is as follows:

1. An ignition system comprising in combination, a source of current; primary and secondary circuits connected therewith; a vibrating spark generating means connected with the said primary circuit; and a timing device operating to close said primary circuit intermittently to interrupt the generation of vibrating sparks by said spark generating means at determined intervals.

2. In an ignition system, the combination with a current source, having a main circuit connected therewith, including an induction coil and timing device for intermittently opening and closing said circuit; another circuit to which the above mentioned induction coil is also connected; and means for effecting a vibrating spark by the use of said other circuit, only at such times as the timing device is in position to open the first named circuit.

3. In an ignition system, the combination with a source of current, a main circuit connected therewith, including an induction coil and timing device; a supplemental circuit having a vibrator connected therewith, and controlled by the timing device, whereby a vibrating spark effect will be produced in the secondary circuit of the induction coil only at such times as the main circuit is opened by the timing device and the supplemental circuit closed by the effect of the timing device on the vibrator.

4. In an ignition system, the combination with a source of current, a main circuit connected therewith including an induction coil and timing device; a supplemental circuit having a vibrator connected therewith; whereby a vibrating spark effect will be produced in the secondary circuit of the

induction coil only at such times as the supplemental circuit is closed and the main circuit is opened by the timing device; and means brought into operation concurrently with the closing of the main circuit by the timing device to prevent the operation of said vibrator.

5 5. An ignition system comprising in combination a source of current; a contact making means; a vibrating spark generating means; a magnetically operated means for cutting out said vibrating spark generating means; and a circuit connected with said magnetically operated means, adapted to be closed intermittently by said contact making means to interrupt the generation of vibrating sparks at determined time intervals.

10 6. In an ignition system, the combination with a source of current having a main circuit connected therewith, including an induction coil and timing device for intermittently opening and closing said circuit to generate sparking impulses; another source of current having circuit connection with
25 said induction coil; a current interrupter included in said circuit connections for effecting vibrating sparks in said coil at such times as the timing device is in position to open said first mentioned main circuit, said

interrupter including a coil energized at such times as the timing device is in position to close the main circuit, whereby the current interrupter will be rendered inoperative to generate vibrating sparking impulses at intermittent intervals.

35 7. In an ignition system, the combination with a plurality of circuit connections, of a spark generating means; an interrupter of the vibrator type for said spark generating means; a timing device; a contact adapted to be closed intermittently by said timing device to interrupt the generation of vibratory sparks at determined time intervals; means for completely cutting the aforesaid interrupter out of action; and means for closing one of said circuit connections so that the actuation of said contact by the timer will effect the generation of single sparking impulses by said spark generating device.

50 In testimony whereof we affix our signatures in the presence of two subscribing witnesses.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."