R. H. CUNNINGHAM.

COMBINED IGNITION SYSTEM.

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1,200,592. Patented Oct. 10, 1916.

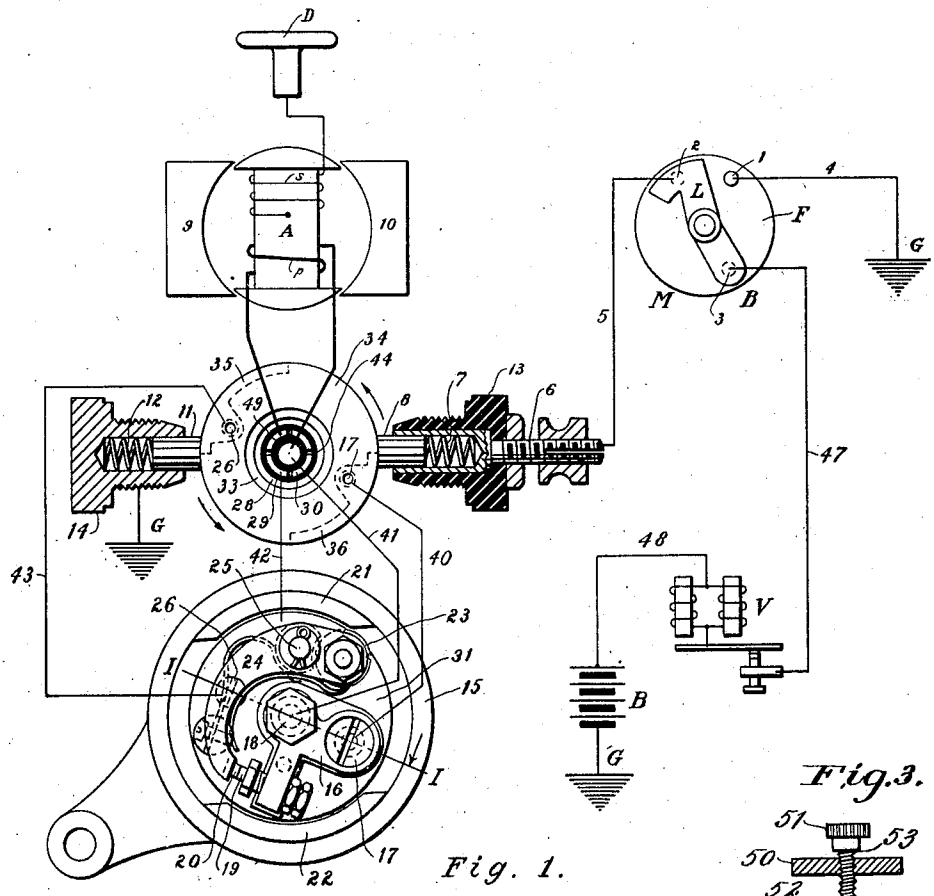


Fig. 1.

Fig. 3.

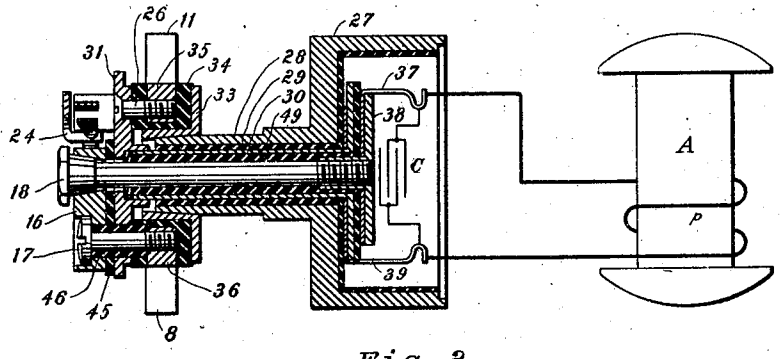


Fig. 2.

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COMBINED IGNITION SYSTEM.

1,200,592. Specification of Letters Patent. Patented Oct. 10, 1916.

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To all whom it may concern:

Be it known that I, RICHARD H. CUNNINGHAM, a citizen of the United States, residing at the city of New York, in the borough of Manhattan and State of New York, have invented certain new and useful Improvements in Combined Ignition Systems, of which the following is a specification.

This system relates to combined ignition systems and more particularly to a system in which a high tension magneto is used for firing charges in an internal combustion engine.

In my patents, Numbers 1022828 and 1026565, I have shown and described means for augmenting or boosting the current produced by the high tension armature, by means of an external source of current. Also in these patents, I have shown means for producing a spark from the secondary high tension winding of the armature when the engine is at rest.

One of the objects of my present invention is to simplify the means for producing the results as set forth in part in the two patents mentioned above. I also aim to produce a means of boosting the armature current at starting in such proportion that the reactions of the primary, with its own current plus that from the external source, on the field due to the magnets will never exceed, and preferably will be less than the reactions produced by the primary alone when the armature is being turned at its maximum speed. So far as I am aware, no one heretofore has aimed at this feature which I have found to be exceedingly desirable; for if, the current through the primary is made greater than as set forth above, the magnets become demagnetized in a short time and the whole efficiency of the magneto impaired.

I am also aware that numerous attempts have been made to boost the armature current by means of an external current but these attempts have not accomplished the result in the simplest and most direct manner. For example, so far as I am aware, in none of the proposed systems of this type, can the auxiliary source of current be grounded direct, as such a procedure will make these systems inoperative, hence, a non grounded battery must be used and therefore a further object of my invention is to make the system adaptable to modern automobile systems in which it is common practice to use the storage battery for starting, lighting and ignition purposes, one end of the storage battery often being grounded direct on the frame of the car. It will be noted here that in my present system the battery may or may not be grounded directly.

Further objects of my inventoin will be hereinafter set forth and particularly pointed out in the appended claims.

Referring to the drawing which forms part of this specification, Figure 1 shows a diagrammatic arrangement of the different pieces of apparatus which enter directly into my invention and the connections there-between. Fig. 2 is a part sectional view on the line 11 of Fig. 1, the same being drawn through the breaker box, commutator and cam end of the magneto, the armature being shown diagrammatically to the right. Fig. 3 is a view of the special means used for regulating the vibrator shown in Fig. 1.

In the different views of the drawing, like numerals refer to corresponding parts.

Referring now particularly to the details, F is a switch adapted to be mounted on the dash of an automobile and having two operative positions, one marked B, for battery and the other M, for magneto. As indicated in Fig. 1, the lever L of the switch is in battery position across the contacts 2 and 3, the third contact 1 is connected by a wire 4 to the ground G. The switch stud 2 is connected by wire 5 to a brush holder stud 6, which is carried by the insulating bushing 13, which bushing also carries the brush 8 and spring 7. The brush insulator 13 is adapted to be mounted in any suitable manner on the frame of the magneto. Opposite to the brush 13 is a metallic brush holder 14 carrying the brush 11 and a spring 12. It is seen that this brush holder is grounded through the frame of the magneto, but a brush similar to 13 may be used with a grounded or non grounded battery. The magneto pole pieces are represented by 9 and 10. The magnets are not shown as their function is well understood.

Rotating within the poles 9 and 10 is the armature A, having a heavy primary winding and a finer winding or secondary S which is connected to the distributer D, which is also well understood and not necessary to be described further.

Adapted to be mounted on one end of the armature A is a member 27, usually termed the cam end and having a cylindrical pro-

jection 28. The end of the projection 28 is slightly tapered and adapted to receive the mounting plate 33, also tapered to fit. On the plate 33 is assembled a suitable insulating member 34 upon which is carried two metal segment 35 and 36. The segment 35 is connected to the breaker face plate 31 by means of a screw 26. The segment 36 is connected to a terminal block 16 by means of a screw stud 17. The terminal block 16 is insulated from the breaker face plate 31 by the insulator 45 and the screw 17 is insulated therefrom by the bushing 46. Mounted on the breaker face plate 31 is a stud 25 upon which is pivoted the breaker arm 24, which carries an adjustable member 23, adapted to engage the cams 21 and 22, contained within the breaker box 15. The lever 24 also carries the contact 20, which engages an adjustable contact 19, mounted on the block 16. This construction makes a "unit" of the commutator and the circuit breaker. The cam end 27 of the armature has mounted within it a condenser C, which is represented diagrammatically in Fig. 2. The ends of the condenser are connected across the terminals 37 and 39, to which are also attached the two ends of the primary winding of the armature A. The spindle or projection 28 has mounted within it an insulating bushing 29 and within this bushing is assembled a metallic sleeve or thimble 30 which connects with the terminal 39. Inside the sleeve 30 is another insulating bushing and within this is carried a special screw 18 having a tapered head and a threaded end, which engages a member 38 with which the terminal 37 is in direct connection.

The tapered head of the screw 18 serves to hold the breaker face plate 31 and the mounting member 33 connected to the breaker face plate 31 as heretofore described, onto the sleeve 28 and when the screw 18 is "drawn up", the breaker face plate 31 makes direct connection with the end of the metallic sleeve 30. The end of the sleeve 30 is indicated in Fig. 1 as having four slots 44 which are used for the purpose of spreading the end of the sleeve in order to make a good contact with the breaker face plate 31.

It is thus seen that the terminal 37 to which one end of the primary winding is connected, is carried out by means of screw 18 to the terminal block 16 and by means of screw 17, the connection is carried to the segment 36. This connection is indicated by the line 40, in Fig. 1. Further, it is seen that the terminal 39 to which the other end of the primary winding is connected, is brought out by means of metallic sleeve 30 to the breaker face plate 31 and by means of the screw 26 connection is carried to the segment 35. This connection is indicated by line 43 of Fig. 1. The connection of screw 18 to the terminal 37 is indicated by the line 41, in Fig. 1 and the connection of the breaker face plate 31 to the terminal 39 is diagrammatically illustrated in Fig. 1 by the line 42.

Connected to the post 3 of the switch F by a wire 47 is a vibrator V which is connected by the wire 48 to the battery B, one terminal of which is grounded at G.

I have shown in the drawing the magneto armature commutator and cam holder in the position for delivering the maximum effect, *i. e.* in the advance position which, however, is only used when running at high speed when the boosting apparatus, would be in practice cut out by the switch, but I wish to point out that the system will operate at high speed and at low speed. Another object of showing the parts in the advance position is that it may be seen that the magneto breaker can be shunted out by the switch F and the car stopped when running at high speed.

I will now describe the operation of my combined system.

When it is desired to start the engine, the breaker box is retarded and the magneto switch F is thrown to the position as indicated in Fig. 1. Then as the engine is cranked, the armature of the magneto is turned in a well known manner, not shown nor described herein. The direction of rotation is assumed to be counter-clockwise as indicated by the small arrow placed along side of the member 34, shown diagrammatically in the central part of Fig. 1. On account of the breaker box being retarded, the armature A will be farther from the tips of poles 9 and 10 than shown on drawing and the brushes 8 and 11 will be farther on the segments 36 and 35 respectively than shown. When the member 23 strikes the cam 21, the circuit is broken, the primary winding, in connection with the condenser, shown only in Fig. 2, induces a current in the secondary winding of the armature. Previous to the opening of the contacts 19 and 20 of the breaker, a circuit can be traced from battery B, wire 48, vibrator V, wire 47, contact 3, lever L, contact 2, wire 5, brush stud 6, brush 8, segment 36, screw 17, block 16, contacts 19 and 20, breaker arm 24, breaker face plate 31, screw 26, segment 35, brush 11, brush holder 14 to ground G. In consequence of which the vibrator will be working through the circuit as above traced, before the primary armature circuit is broken. It is seen that there are two electrical circuits in which a mechanical interrupter is common to both. At the instant when the contacts 19 and 20 are separated, the current from an external source of power through the vibrator is added to that delivered by the primary of the armature and as the effect of the current generated in the primary winding itself, diminishes as

the armature continues to rotate to a horizontal position, the vibratory current from the external source continues its boosting effect through the said primary winding and thereby strengthens and continues the current delivered by the secondary winding so that a shower of sparks is delivered by the distributer D to the various plug circuits. Attention is here called to the feature that the commutator segments bear such a relation to the cams that the segments do not pass from under their respective brushes until after the primary current has become zero and the breaker points have closed. The object of this feature is to get the full benefit of the external source of current and to prevent a destructive sparking at the commutator brushes, as the spark would be augmented by the inductive effect of the primary winding of the armature if the winding was in circuit with the external source of current when the brushes left the segments of the commutator but since the breaker points close before the segments pass from under the brushes, the armature is thereby shunted out of circuit. As soon as the engine has started under its own power, the switch lever L is thrown to a position M, whereby one end of the lever L rests only on the stud 1. When it is necessary to stop the engine, the magneto is short circuited by throwing the switch lever L to a position in which the studs 1 and 2 will be connected across the blade of the switch, at which time the circuit breaker is cut out of action and no spark is produced at the plugs.

I may construct my vibrator in such a manner that it can be regulated to hold the current therethrough to a value such that this current added to what is delivered by the primary winding itself will not produce a reaction against the field set up by the magnets in excess of the reactions produced by the primary alone when the armature is driven at high speed. The above construction referred to is shown more clearly in Fig. 3 in which 52 is the vibrating member, 50 the bridge carrying an adjustable contact 51 having a shoulder 53 which limits the movement of the screw in one direction so that the vibrator can not be adjusted to pass only a definite amount of current therethrough. I therefore provide means for limiting the armature reaction due to the combined action of the primary current and the current from the external source. By arranging my parts in this manner, I prevent demagnetizing the magnets. It will be noted that when the circuit breaker contacts 19 and 20 are open which might occur when the engine stops in the right position, it is possible to produce a shower of sparks from the secondary just by closing the switch F to the position shown in the drawing and under this condition, if there is gas in the corresponding engine cylinder, it will explode and the engine will start "on the spark."

It will be understood that numerous changes and alterations can be made in the details herein shown and hence I do not wish to be limited to the precise details shown in my drawing.

Having thus described my invention what I claim is:

1. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on one end of said armature, said cam end carrying a condenser, a breaker, a commutator and means for connecting said parts in proper relationship; a switch, a grounded source of power and means for connecting said grounded source of power to the primary winding of said armature through said commutator substantially as described.

2. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a tapered projection, a commutator adapted to engage the said tapered projection and means for holding it in place thereon, a circuit breaker mounted on said commutator, means for bringing the end of said primary winding through the cam projection to said circuit breaker, a source of external current and means for connecting the same to the commutator and means for connecting the segments of said commutator to the two working parts of said circuit breaker, for the purpose described.

3. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a tapered projection, a commutator adapted to engage the said tapered projection and means for holding it in place thereon, a circuit breaker mounted on said commutator, means for bringing the end of said primary winding through the cam projection to said circuit breaker, a source of external current and means for connecting the same to the commutator and means for connecting the segments of said commutator to the two working parts of said circuit breaker and means for opening said circuit breaker at the proper time, whereby the primary armature current is augmented by the external source of power for the purpose described.

4. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, a pri-

mary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a projection, a commutator adapted to mount on said projection, a circuit breaker attached to the front side of said commutator in working relation thereto and means passing through an element of said circuit breaker and through said cam projection for holding both the commutator and circuit breaker in position on said projection, said means serving to connect one end of the primary winding to a part of said circuit breaker and means for bringing the other end of the primary winding to the opposite part of said circuit breaker and means for connecting an external source of current to said circuit breaker through said commutator, substantially as described.

5. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a projection, a commutator adapted to mount on said projection, a circuit breaker attached to the front side of said commutator in working relation thereto and means passing through an element of said circuit breaker and through said cam projection for holding both the commutator and circuit breaker in position on said projection, said means serving to connect one end of the primary winding to a part of said circuit breaker and means for bringing the other end of the primary winding to the opposite part of said circuit breaker and means for connecting an external source of current to said circuit breaker through said commutator, and a vibrator in circuit with said external source of current.

6. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a projection, a commutator adapted to mount on said projection, a circuit breaker attached to the front side of said commutator in working relation thereto and means passing through an element of said circuit breaker and through said cam projection for holding both the commutator and circuit breaker in position on said projection, said means serving to connect one end of the primary winding to a part of said circuit breaker and means for bringing the other end of the primary winding to the opposite part of said circuit breaker and means for connecting an external source of current to said circuit breaker through said commutator, and an inductive device in circuit with said external source of current, as described.

7. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a projection, a thimble mounted within said projection and between two concentric insulating tubes, the outer end of said thimble having slots therein, said slotted portion adapted to be expanded and to receive a circuit breaker mounting plate thereon, a contact block mounted on said plate but insulated therefrom, a commutator adapted to be mounted on the end of said cam projection, and means passing through said contact block and through the inner of said insulating tubes for holding the circuit breaker plate and commutator in place on said cam projection, said retaining means and said thimble serving to connect the two ends of the primary winding to the two parts of the circuit breaker and means for connecting an external source of current with the circuit breaker through the commutator, substantially as and for the purpose described.

8. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on said armature, said cam end having a projection, a thimble mounted within said projection and between two concentric insulating tubes, the outer end of said thimble having slots therein, said slotted portion adapted to be expanded and to receive a circuit breaker mounting plate thereon, a contact block mounted on said plate but insulated therefrom, a commutator adapted to be mounted on the end of said cam projection, and means passing through said contact block and through the inner of said insulating tubes for holding the circuit breaker plate and commutator in place on said cam projection, said retaining means and said thimble serving to connect the two ends of the primary winding to the two parts of the circuit breaker and means for connecting an external source of current with the circuit breaker through the commutator, and an inductorium in circuit with said external source of current, substantially as and for the purpose described.

9. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate therebetween, primary and secondary windings on said armature, a cam end adapted to be mounted on one end of said armature, said cam end carrying a condenser, a breaker, a commutator, and means for connecting said parts in proper relationship; a switch, a grounded source of power and means for connecting said grounded source of power to the pri-

mary winding of said armature through said commutator and a vibrator in circuit with said source of power, as described.

10. In an ignition system for internal combustion engines, a magneto having a primary and a secondary winding, two electrical circuits, a mechanical interrupter common to both of said circuits, said primary winding being connected in one of said circuits and a source of direct current connected in the other of said circuits, and means for limiting the armature reactions against the magnetic field to a predetermined value.

11. In an ignition system for internal combustion engines, a magneto having a primary and a secondary winding, two electrical circuits, a mechanical interrupter common to both of said circuits, said primary winding being connected in one of said circuits and a source of direct current and a vibrator connected in electrical series in the other of said circuits, and means associated with said vibrator for limiting the armature reactions, while said source of direct current and vibrator are connected thereto.

12. In an ignition system for internal combustion engines, a magneto having a primary and a secondary winding two electrical circuits, a mechanical interrupter common to both of said circuits, said primary winding being connected in one of said circuits and a source of grounded direct current, a commutator and a vibrator in electrical series in the other of said circuits, as described.

13. In an ignition system for internal combustion engines, a magneto having a primary and a secondary winding, two electrical circuits, a mechanical interrupter common to both of said circuits, said primary winding being connected in one of said circuits and a source of grounded direct current in electrical series with a commutator, the said primary winding being so connected in one of said electrical circuits that its current is augmented by the direct current source in the other of said circuits, substantially as described.

14. In an ignition system for internal combustion engines, a magneto having a primary and a secondary winding, two electrical circuits, a mechanical interrupter common to both of said circuits, said primary winding being connected in one of said circuits and a source of grounded direct current connected in the other of said circuits, and a commutator electrically connected to the magneto and to the source of direct current in such a manner that the rectified current from the magneto is augmented by the direct current source whereby demagnetization of the magneto is prevented when the mechanical interrupter is open, as described.

15. In a combined ignition system, a magneto having a plurality of poles, an armature to rotate between said poles, said armature having primary and secondary windings, a cam end adapted to be mounted on said armature, said cam end carrying a unit type commutator and circuit breaker, an external source of current and means for connecting it to said primary winding through said commutator and means for limiting the current through said primary winding to a predetermined value, as described.

16. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate between said poles, said armature having primary and secondary windings, a cam end adapted to be mounted on said armature, said cam end carrying a unit type commutator and circuit breaker, an external source of current and means for connecting it to said primary winding through said commutator and means for limiting the armature reactions against the magnetic field to a predetermined value, as described.

17. In a combined ignition system, a magneto having a plurality of poles, an armature adapted to rotate between said poles, said armature having primary and secondary windings, a cam end adapted to be mounted on said armature, said cam end carrying a unit type commutator and circuit breaker, an external source of current and means for connecting it to said primary winding through said commutator and means for limiting the armature reactions due to the combined action of the primary current and the current from said external source to a value not in excess of the armature reactions due to its own current at high speeds, substantially as described.

18. In a combined ignition system, a magneto having a primary and secondary winding on its armature and a unit type commutator and circuit breaker mounted on one end of said armature, a source of external current and means for connecting said external source of current to the primary winding of said armature through said commutator and means in circuit with said external source of current for regulating the said armature reactions, while said external source is connected thereto, substantially as described.

In testimony whereof, I affix my signature in the presence of two witnesses.

RICHARD H. CUNNINGHAM.

Witnesses:

IVAR W. BRÖGGER,

M. W. BARTLETT.