A. G. McCALEB.

IGNITION MECHANISM.

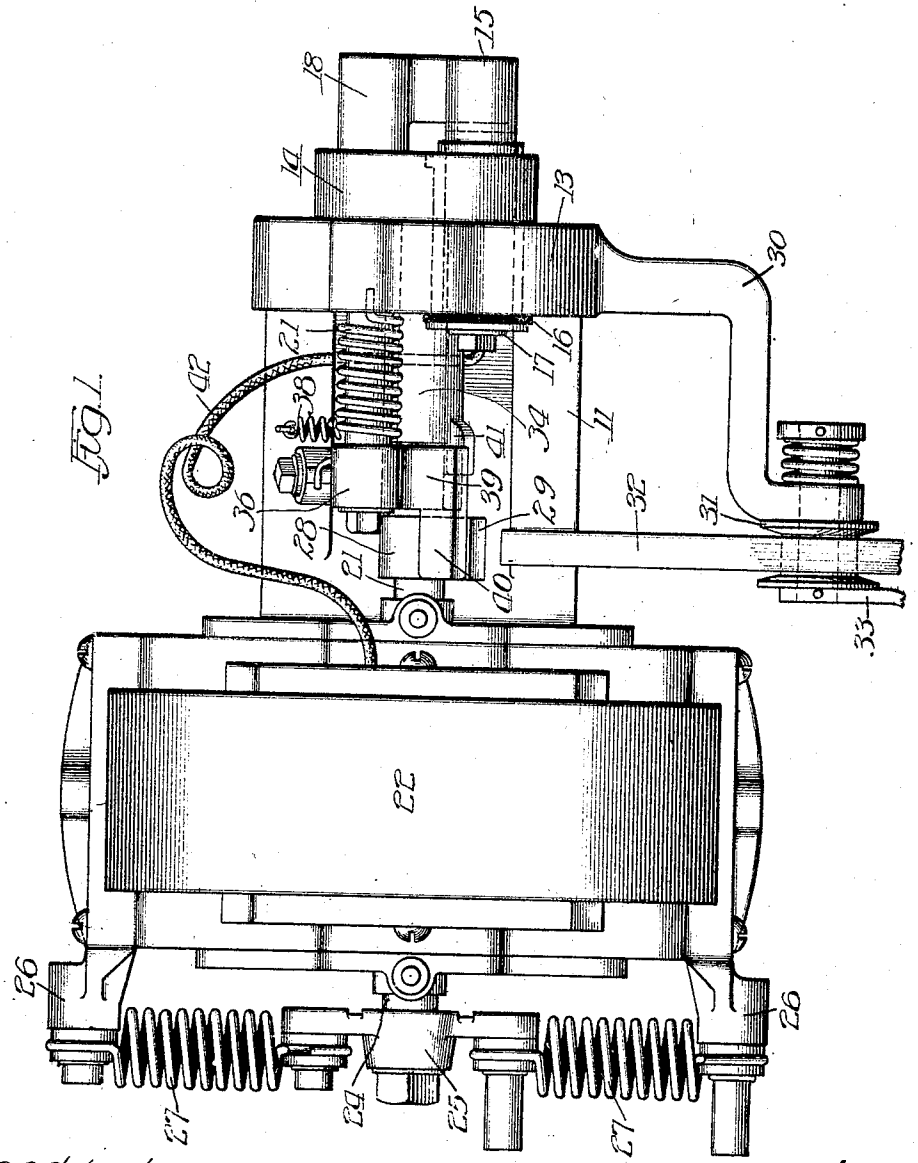
APPLICATION FILED JULY 31, 1916.

1,246,128.

Patented Nov. 13, 1917.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

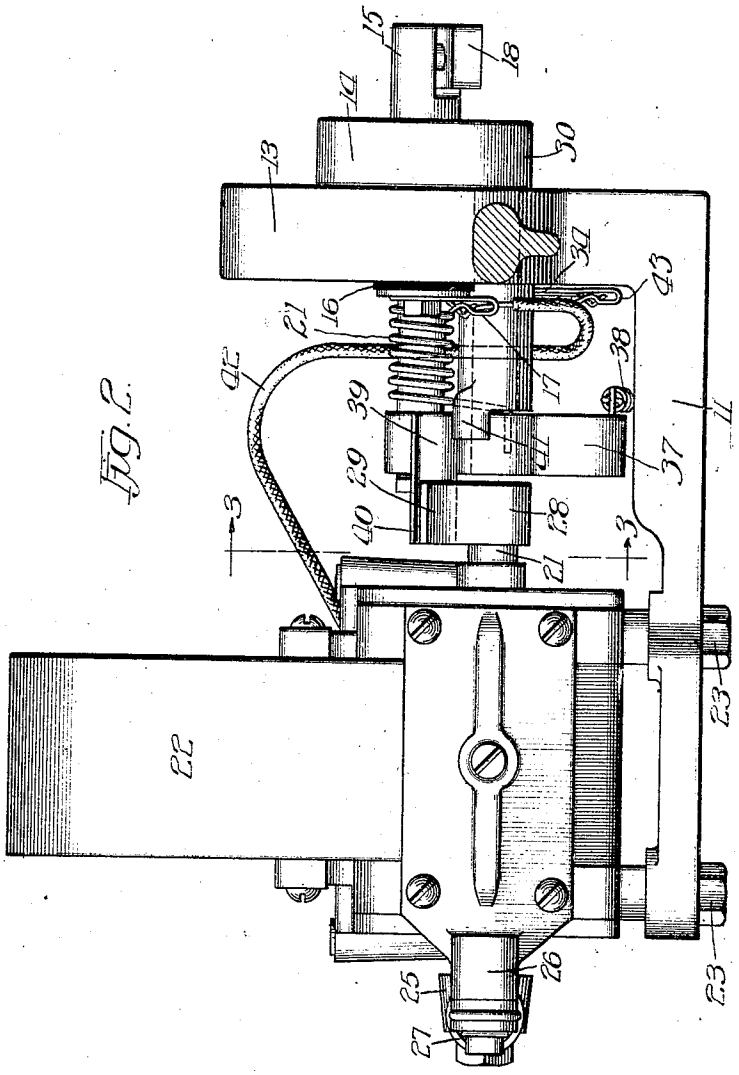

FIG. 2.

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4 SHEETS—SHEET 3.

Fig. 3.

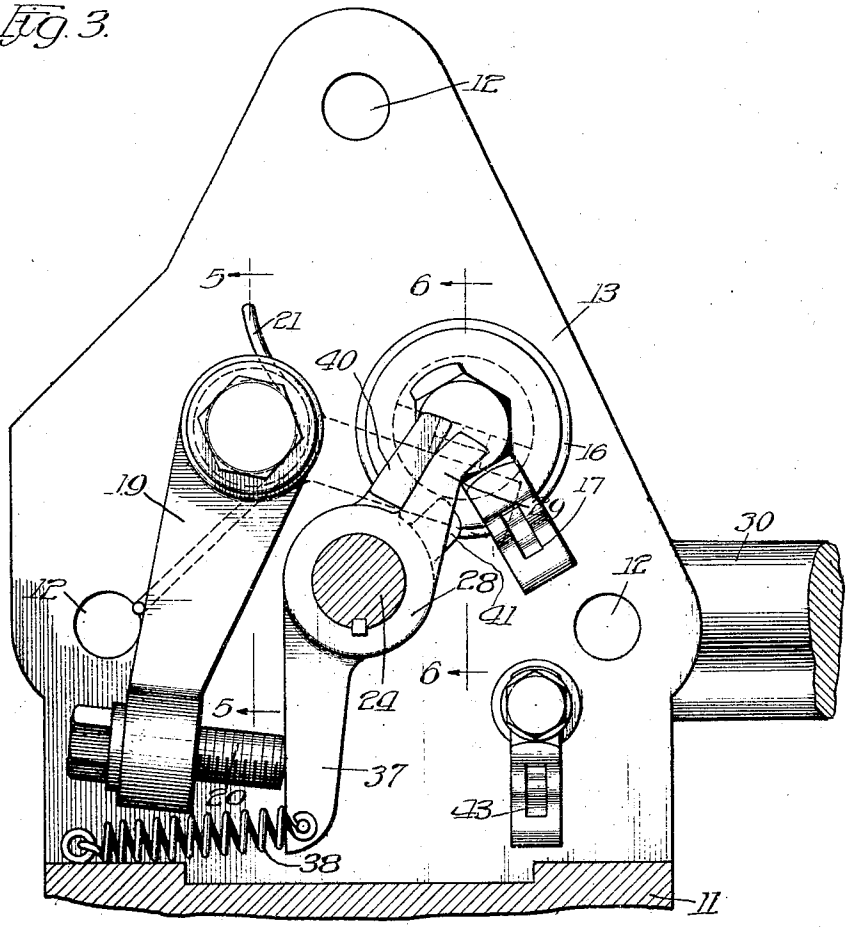
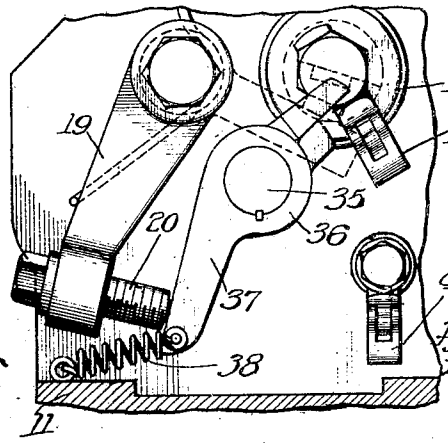


Fig. 4.



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4 SHEETS—SHEET 4.

Fig. 5.

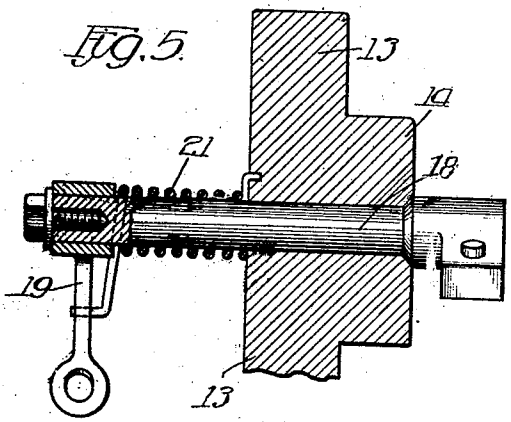


Fig. 6.

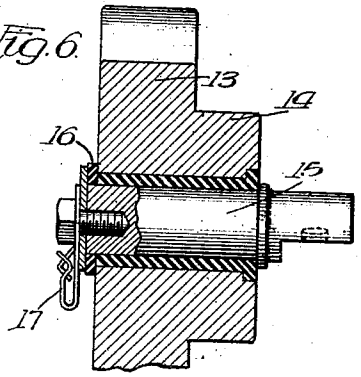


Fig. 8.

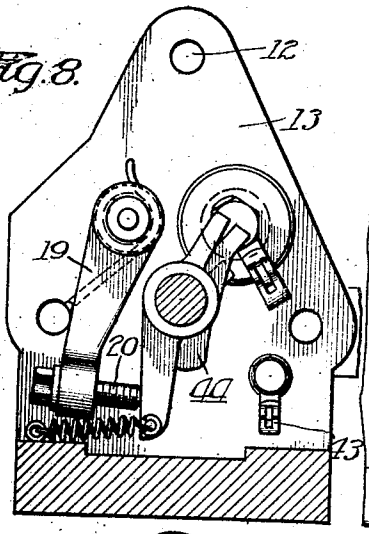


Fig. 7.

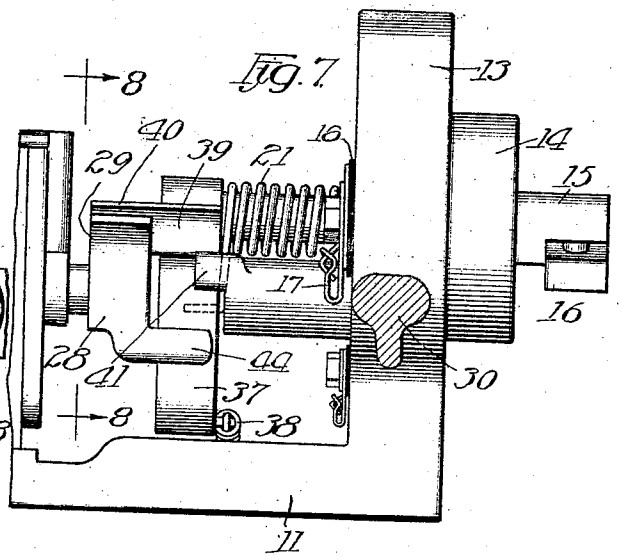


Fig. 10.

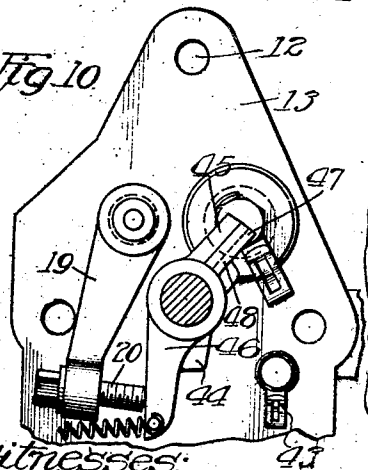
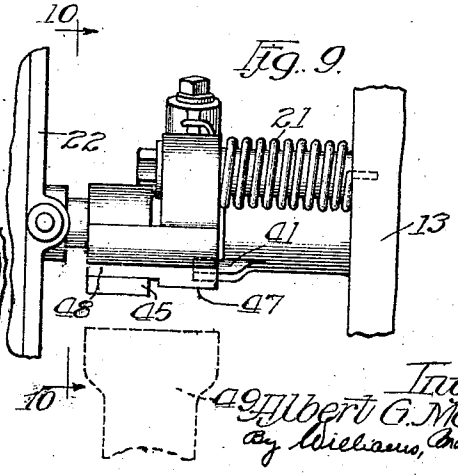


Fig. 9.



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UNITED STATES PATENT OFFICE.

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IGNITION MECHANISM.

1,246,128. Specification of Letters Patent. Patented Nov. 13, 1917.

Application filed July 31, 1916. Serial No. 112,252.

To all whom it may concern:

Be it known that I, ALBERT G. McCALEB, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Ignition Mechanism, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to ignition apparatus for internal combustion engines, and particularly to that class of apparatus wherein an oscillating magneto and a pair of make and break spark electrodes are caused to operate in timed relation to each other to produce sparks at the proper times within the combustion chamber of an associated internal combustion engine.

In preferred forms of apparatus of the class to which my invention relates the magneto and spark electrodes are mounted upon an integral bracket in such manner, that to all intents and purposes the ignition apparatus constitutes a unitary structure. In this type of apparatus an engine driven actuator, preferably a reciprocating push rod, operates at intervals to oscillate the magneto rotor against the tension of a strong spring, or pair of springs, and then to release the rotor whereupon the said spring means operates quickly to return the rotor to normal position and thus to generate a current in the generating windings of the magneto, means being provided to effect the operation of the electrodes to permit the passing of a spark at the peak of the current wave generated in the magneto windings. The several parts are, of course, so arranged and operated that the spark passes at the proper instant in the cycle of engine operation.

One of the objects of my invention is to provide an arrangement and combination of parts whereby the spark electrodes are not only properly actuated when the magneto is positioned upon the bracket, but are also properly actuated and may be used with battery current when the magneto and its operating spring means are removed from the bracket for repairs, or any other purpose.

Another object of my invention is to provide means whereby when the magneto is removed from the structure the spark electrodes are automatically adjusted for battery ignition or, in other words, so arranged that they normally stand quite widely separated when batteries are the source of current.

A further object of my invention is to provide an arrangement and combination of parts whereby to obviate the excessive pounding of the movable electrode heretofore inherent in apparatus of the class to which my invention relates.

A further object of my invention is to provide an arrangement such that the improvements of my invention may be adapted to existing forms of oscillating magnetos.

These and other features of my invention are more fully set forth in the following detailed description wherein reference is made to the accompanying drawings in which,

Figure 1 is a top plan view of an apparatus embodying the improvements of my invention;

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1, that portion of the bracket which supports the guide roller for the reciprocating push rod being broken away more clearly to reveal those parts of the mechanism with which my invention is more particularly concerned;

Fig. 3 is an enlarged detail view, partly in section and partly in elevation, taken on the line 3—3 of Fig. 2 and looking in the direction indicated by the arrows;

Fig. 4 is a view similar to Fig. 3 illustrating the positions assumed by the several parts when the magneto is removed and the apparatus is in condition to be operated with battery current;

Fig. 5 is a detail view taken on the line 5—5 of Fig. 3 illustrating how the movable electrode is journaled in the bracket;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3 and illustrating how the stationary electrode may be mounted in the bracket;

Fig. 7 is a fragmentary elevational view of a modified embodiment of my invention;

Fig. 8 is a detail view partly in section and partly in elevation taken on the line 8—8 of

Fig. 7 and looking in the direction indicated by the arrows;

Fig. 9 is a fragmentary elevational view of a further modification of my invention; and

Fig. 10 is a detail view, partly in section and partly in elevation, taken on the line 10—10 of Fig. 1 and looking in the direction indicated by the arrows.

Similar characters of reference refer to similar parts throughout the several views.

Referring first to Figs. 1 to 6 inclusive at 11 I have illustrated an integral bracket arranged to be secured to an engine cylinder by bolts, or other suitable securing means, extending through apertures 12—12 in the vertical plate 13 of the bracket, the plate 13 having formed integral therewith a plug 14 arranged to extend through an aperture in the engine cylinder in a manner well known to those skilled in the art. Supported by the bracket and extending through the plug 13 is a stationary electrode 15 suitably insulated from the bracket, as by a sleeve of insulation indicated at 16. The electrode 15 carries a suitable contact point arranged to coöperate with a corresponding contact point carried by a movable electrode presently to be described and at its outer end the electrode 15 is provided with a suitable terminal clip 17. Disposed adjacent the stationary electrode 15 is a movable electrode 18 journaled in the bracket, as is, perhaps, most clearly illustrated in Fig. 5. Fixed upon the outer end of the movable electrode 18 is an arm 19 which, at its free end, carries an adjustable screw or anvil 20. A helical spring 21 disposed around the outer end of the movable electrode and acting between the bracket and the arm 19, as is most clearly shown in Fig. 5, serves to retain the beveled shoulder at the inner end of the movable electrode in engagement with the corresponding beveled seat of the plug 14 and thus effectually serves to prevent loss of compression around the movable electrode. The spring 21, moreover, tends to hold the contact point at the inner end of the movable electrode in engagement with the corresponding contact point carried by the stationary electrode 15.

It will be noted that the bracket 11 affords a laterally projecting shelf upon which is mounted an oscillating magneto, indicated by the reference character 22, removably secured to the bracket by a plurality of nuts 23—23 which coöperate with stud bolts carried by the magneto framework and extending downwardly through apertures in the shelf afforded by the bracket. Although the magneto may be of any suitable construction, I prefer that it shall be of the unwound rotor or inductor type now generally known in the trade. The magneto rotor comprises a shaft 24 upon the outer end of which (Fig. 5) is fixed a yoke 25. Acting between the yoke 25 and stationary posts 26—26 carried by the magneto frame work are the comparatively heavy and strong helical springs 27—27 which normally retain the magneto rotor in a certain position and which operate the rotor to generate an ignition current whenever the rotor is moved by a suitable engine driven actuator against the action of the springs 27 and then released.

Mounted upon the inner end of the rotor shaft 24 and keyed, or otherwise rigidly secured, thereto is a collar 28 having a push finger 29 formed integral therewith. It will thus be seen that the magneto, its operating springs 27—27, and the collar 28 and its push finger 29 may be removed from the bracket by removing the nuts 23—23 by which the magneto is secured upon the bracket. Extending laterally from the bracket, as is most clearly illustrated in Fig. 1, is an arm 30 which serves to support a guide roller 31 on which rides an engine driven push rod 32. The push rod 32 is reciprocated from the engine, in a manner well known in the art, to engage the push finger 29, move the latter through an angle of approximately 30° and there release it, whereupon the springs 27—27 associated with the magneto rotor serve quickly to move the rotor to normal position and thus to generate a current within the generating windings of the magneto. I will state that the push rod 32 is in practice provided with a cam, not shown, which engages with the roller 31 to throw the push rod out of engagement with the trip finger 29 when the trip finger has reached the position at which it is to be released. Moreover, the roller 31 is desirably eccentrically mounted and provided with an adjusting lever 33 whereby the instant at which the push finger 29 is released from the push rod 32 may be varied within certain limits to advance or retard the operation of the magneto. These last mentioned features are, however, well known in the art and need not, therefore, be fully described and illustrated by me in this specification.

As is most clearly illustrated in Figs. 1, 2, and 4, the vertical plate 13 of the bracket has formed integral therewith a hollow boss or bearing 34 in which is journaled a short shaft 35 the axis of which is coincident with the axis of the magneto rotor shaft 24. Keyed upon the shaft 35 is a member 36 which we may term a hammer and which has formed integral therewith an arm 37 disposed in alinement with the adjustable screw or anvil 20 carried by the movable electrode operating arm 19. A spring 38 acting between the bracket and the arm 37 of the hammer normally tends to move the arm 37 into engagement with

the screw or anvil 20, as is most clearly illustrated in Figs. 3 and 4. Attention is directed to the fact that the spring 38 is of greater strength and tension than the spring 21 associated with the movable electrode, but that the spring 38 is of much less tension and strength than the relatively large springs 27—27 associated with the magneto rotor shaft.

The hammer 36 comprises an upwardly extending finger 39 having a portion 40 arranged normally to extend over the gap between the adjacent ends of the alining shafts 24 and 35 to lie behind the magneto push finger 29, as is most clearly illustrated in Figs. 2 and 3. Carried by the bracket bearing 34, as is most clearly illustrated in Figs. 2, 3, and 4, is a lug 41 lying in the path of the hammer finger 39. The purpose of this lug 41 will presently be made apparent.

When the magneto is positioned upon the bracket, as shown in Figs. 1 and 2, and when the laterally extending portion 40 of the hammer finger 39 lies behind the rotor push finger 29, as illustrated in Fig. 3, the hammer is held in the position shown in Fig. 3 due to the fact that the spring 38 associated with the hammer is of less tension than the comparatively strong springs 27—27 associated with the rotor shaft.

When the magneto is made use of an insulated conductor 42 connects the insulated electrode 15 with one side of the magneto generating winding or windings, it being understood that the other side of the generating winding or windings is grounded to the magneto frame and thence to the bracket and movable electrode in a manner well known in the art.

When the magneto is in the position shown in the drawings and the engine is running the operation of the mechanism is as follows: The reciprocating push rod is moved through suitable mechanism, not shown, to engage the magneto push finger 29 and to move the latter and the magneto rotor against the tension of the relatively heavy magneto rotor springs 27—27 and through an angle of approximately 30°. When the magneto push finger 29 is thus moved by the engine push rod the hammer 36 is likewise moved through an angle of 30° due to the fact that the portion 40 of the hammer finger 39 lies behind and against the magneto push finger 29. This movement of the hammer is, of course, accomplished in opposition to the tension of the spring 38 which is interposed between the bracket and the arm 37 of the hammer. When the magneto is employed I prefer to have the electrode contacts normally closed, or substantially closed, and it will be understood that when the hammer and magneto push finger are moved through an angle of 30° by the reciprocating push rod, as just explained, the electrode contacts are permitted to remain closed. After the magneto push rod and the hammer have been moved through an angle of substantially 30°, as just explained, the push rod slips off of the push finger 29 whereupon the magneto rotor and parts connected therewith are quickly returned to normal position and this movement of the rotor serves to generate a current in the windings of the magneto. As the rotor moves toward normal the push finger 29 is, of course, returned to normal and as the push finger 29 returns to normal the hamer is also returned toward its normal position, the spring 38 associated with the hammer serving to keep the portion 40 of the hammer finger 39 closely in engagement with the rear side of the push finger 29 as the parts return to normal. Due to the inertia of the rotor it not only returns to normal position, but goes slightly therebeyond and thus the push finger 29 and the hammer are carried slightly past normal on their return movement. As soon as the hammer 37 reaches its normal position, or reaches a position slightly past normal, it engages the adjustable screw or anvil 20 of the movable electrode arm 19 and thus effects the separation of the electrodes and permits the passing of a spark. It will be understood that the several parts of the mechanism are so timed and operated that the spark occurs when needed within the engine cylinder and that the separation of the electrode contacts occurs at the peak of the current wave generated by the magneto. It will thus be seen that the hammer 36 serves to effect the separation of the electrode contacts in timed relation to the rotor. However, the separation of the electric contacts is accomplished by the energy stored in the comparatively weak spring 38 and not by the energy stored in the heavy magneto springs 27—27. Thus the movable electrode is not subjected to the excessive pounding which would be present were the energy stored in the large springs 27—27 utilized to effect the separation of the electrode contacts. It will be understood that in the normal running of the engine the operation described is repeated to produce an ignition spark whenever required. I may say at this point that in order to produce the "starting" spark I prefer to employ a starting lever of the type shown and described in United States Letters Patent No. 1,169,612 granted to Walter Brown on January 25, 1916.

Whenever it becomes necessary or desirable to remove the magneto and its operating springs 27—27 for repairs, or for any other purpose, the retaining nuts 23—23 are removed and the magneto structure lifted off of the bracket. When the magneto is thus

removed the push finger 29 is, of course, taken away with it and when the push finger is thus removed from in front of the portion 40 of the hammer finger 39 the spring 38 associated with the hammer moves the latter in a clockwise direction (Fig. 4) until the hammer arm 39 engages the lug 41 carried by the bearing for the shaft 35. When the hammer has assumed this position it will be seen that the arm 37 thereof holds the movable electrode arm 19 in such a position that the electrode contacts are quite widely separated. It is, of course, understood that it is desirable that the electrode contacts be normally open when the igniter is used in connection with battery current. Attention is directed to the fact that when the hammer lies in the position shown in Fig. 4, that is, with the finger 39 thereof in engagement with the lug 41 the portion 40 of the hammer finger 39 occupies the same position as was formerly occupied by the magneto push finger. The apparatus is now in condition to be operated with battery current and one side of the battery may be electrically connected with the stationary or insulated electrode 15 and the other side of the battery may be connected with the bracket, as by leading a conductor to a clip 43 which is in electrical contact with the bracket, as shown in Fig. 3.

With the mechanism adapted for battery current, as just explained, when the engine is running the operation is as follows: The reciprocating push rod 32 engages the portion 40 of the hammer arm 39 in precisely the same manner as the push rod engaged the push finger 29 when the magneto was employed. The push rod serves to move the hammer through an angle of approximately 30° and against the tension of its associated spring 38 and then to release the hammer. When the hammer is moved under the action of the push rod, as just explained, the electrodes are permitted to engage and thus close a circuit through the electrode contacts. When the hammer is released from the reciprocating push rod the spring 38 associated with the hammer quickly moves the hammer to the position shown in Fig. 4 and this movement of the hammer causes the arm 37 thereof to again engage the screw or anvil 20 and move the movable electrode arm 19 to the position shown in Fig. 4, thereby opening the electrode contacts and causing a spark to pass. When the apparatus is used in connection with battery in order to produce the initial or "starting" spark it is only necessary to manually move the arm 37 against the action of its spring 38 and then release it. Due to the fact that the spring 38 is comparatively light this is a simple matter to accomplish.

Referring now to the modification shown in Figs. 7 and 8, I will say that this modification does not differ essentially from the arrangement of Figs. 1 to 6 inclusive, except in the fact that the magneto push finger is provided with a laterally extending lug indicated at 44 arranged to engage the adjacent portion of the electrode hammer. Otherwise the mechanism of Figs. 7 and 8 is substantially like that of Figs. 1 to 6 and I have applied the same reference characters to corresponding parts. By employing the lug 44 the magneto push finger and the anvil are positively connected during their movement in both directions.

In the arrangement shown in Figs. 9 and 10 the magneto push finger is illustrated at 45 and the electrode hammer at 46. The upwardly extending finger of the hammer is provided with a face 47 arranged to lie beside and slightly behind the forward face of the magneto push finger. A laterally extending portion 48 formed integrally with the upwardly extending finger of the hammer engages behind the push finger when the magneto is employed. When this arrangement is used I prefer to employ a reciprocating push rod having an end as wide as the distance across both the push finger and the surface 47 of the upwardly extending finger of the hammer. In operation, when the magneto is employed, the push rod shown at 49 engages the push finger and operates the mechanism in precisely the manner hereinbefore explained in connection with Figs. 1 to 6. When the magneto is removed the lug 41 normally retains the surface 47 of the upwardly extending hammer finger in the position formerly occupied by the magneto push finger. When the magneto is removed the reciprocating rod 49 coöperating with the surface 47 of the hammer serves to operate the mechanism in the manner described in connection with Figs. 1 to 6.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. An ignition mechanism of the class described comprising a bracket, spark electrodes carried by the bracket, a magneto and spring means for operating the same, both removably supported by the bracket, an engine driven push rod for moving the magneto rotor in opposition to said spring means, and means controlled by the magneto for operating the electrodes and determining the time of operation thereof, the several parts being so related that the push rod operates the electrodes and determines the time of operation thereof when the magneto and the spring means for operating the latter are removed.

2. An ignition mechanism of the class described comprising in combination spark electrodes, a magneto positioned adjacent

the spark electrodes, an engine driven actuator arranged to engage the magneto rotor, spring actuating mechanism for the magneto rotor arranged to snap the latter to normal after it has been oscillated by the engine driven actuator and released, and operating means for the electrodes normally controlled by the magneto rotor but arranged to be operated by the engine driven actuator when the magneto and the spring actuating means for the rotor thereof are removed from the combination.

3. An ignition mechanism of the class described comprising a bracket, spark electrodes carried by the bracket, a magneto supported by the bracket, spring means normally holding the magneto rotor in a certain position, an engine driven actuator arranged to move the magneto rotor against the action of said spring means and then release it whereupon the magneto rotor is returned to normal by its associated spring means, means whereby the electrodes are operated whenever the rotor is thus moved under the action of said spring means, and a member arranged to be engaged and released by the engine driven actuator similarly to the magneto rotor to effect the operation of the electrodes when the magneto and its aforesaid spring means are removed from the bracket.

4. An ignition mechanism comprising a bracket, spark electrodes supported by the bracket, a magneto removably mounted upon the bracket, said magneto having a rotor shaft, means normally tending to hold the rotor shaft in a certain position, a push finger on the rotor shaft, an engine driven actuator arranged to engage said push finger to move the rotor shaft and release it whereupon the rotor shaft is returned to normal by its associated spring means, means for separating the electrodes when the rotor shaft is returned to normal, as aforesaid, and a member carried by the bracket arranged to be engaged and released by the engine driven actuator similarly to said push finger to control the operation of said electrodes when the magneto, its push finger, and the spring means for operating the magneto rotor are removed from the bracket.

5. An ignition mechanism comprising a bracket arranged to be secured to an engine cylinder, a movable spark electrode carried by the bracket, a magneto removably mounted on said bracket, spring means normally holding the magneto rotor in a certain position, engine driven means arranged to engage the rotor, move and release it, whereupon said spring means returns the rotor to normal, and means whereby the movable electrode is actuated when the rotor is thus returned by its spring means aforesaid, together with means carried by the bracket arranged to be engaged by the engine driven actuator, moved and released, similarly to the rotor to control the operation of said movable electrode when the magneto and its aforesaid spring means are removed from the bracket.

6. An ignition mechanism comprising in combination a bracket adapted to be secured to an engine cylinder, a movable electrode supported by the bracket, a magneto removably mounted upon the bracket, spring means associated with the magneto rotor, engine driven means arranged to oscillate the rotor against the action of its associated spring means and then to release it whereupon said spring means returns the rotor to normal, means whereby the movable electrode is operated when the rotor is returned by its spring means, and means carried by the bracket arranged to be operated and released by the engine driven means similarly to the movable electrode to operate the rotor when the magneto and its associated spring means are removed from the bracket.

7. An ignition mechanism comprising in combination stationary and movable spark electrodes, a magneto, spring means normally retaining the magneto rotor in a certain position, engine driven means adapted to move the magneto against said spring means and then to release it whereupon the magneto rotor is returned to normal by its associated spring means, means whereby the movable electrode is operated when the rotor is returned to normal as aforesaid, and means permanently associated with the movable electrode arranged to be engaged, moved and released by the engine driven means similarly to the rotor when the magneto and its associated spring means are removed from the combination.

8. A mechanism of the class described comprising in combination a bracket, a movable electrode carried by the bracket, a magneto removably supported by the bracket, spring means acting between the magneto framework and rotor adapted to retain the latter in a certain position, engine driven means adapted to move the rotor against the action of said spring means and then to release it whereupon the rotor is returned to normal by the spring means aforesaid, means whereby the movable electrode is operated when the rotor is thus moved by the spring means aforesaid, and means permanently carried by the bracket arranged to be engaged, moved and released by the engine driven actuator similarly to the rotor when the magneto is removed from the bracket.

9. Mechanism of the class described comprising in combination a bracket adapted to be carried by an engine cylinder, a movable electrode carried by the bracket, a mag-

neto removably mounted on the bracket, spring means normally tending to hold the magneto rotor in a certain position, engine driven means adapted to engage the rotor, move and release it whereupon said spring means returns the rotor to normal, means for actuating the movable electrode carried by the bracket and normally controlled by the rotor, but arranged to be engaged, moved and released by the engine driven means similarly to the rotor when the magneto and its associated spring means are removed from the bracket.

10. A mechanism of the class described comprising in combination with spark electrodes a magneto, spring means normally tending to hold the magneto rotor in a certain position, engine driven means arranged to engage the rotor, move and release the same whereupon the rotor is returned to normal by said spring means, a spring impelled member for operating said electrodes permanently associated with the electrodes and normally controlled by the magneto rotor, but arranged to be engaged, moved and released by the engine driven means and retracted by its spring means to operate the electrodes when the magneto and spring means associated with the rotor thereof are removed from the combination.

11. In an ignition mechanism the combination with a bracket adapted to be secured to an engine cylinder of a movable electrode carried by the bracket, a magneto removably supported by the bracket, spring means acting between the magneto framework and rotor arranged normally to retain the rotor in a certain position, a push finger on the rotor on that side of the magneto adjacent the electrode, engine driven means arranged to engage, move and release the rotor push finger, a hammer for the movable electrode supported by the bracket, said hammer normally lying against the rotor finger and movable therewith when the latter is moved by the engine driven means, spring means normally tending to cause the hammer to engage the movable electrode, said hammer arranged to be engaged, moved, and released by the engine driven means similarly to the rotor push finger to effect the operation of the electrode when the magneto is removed.

12. An ignition mechanism of the class described comprising in combination with a bracket adapted to be secured to an engine cylinder a movable electrode carried by the bracket, a magneto removably supported by the bracket, spring means normally tending to hold the magneto rotor in a certain position, a push finger on that side of the magneto adjacent the electrode, a hammer for the movable electrode carried by the bracket, a spring tending to move the hammer toward the movable electrode, a reciprocating rod adapted to engage, move, and release the rotor push finger, said hammer normally lying against and slightly behind the rotor push finger, but adapted to take the position normally occupied by the rotor push finger and to be operated by the reciprocating rod similarly to the rotor push finger when the magneto is removed.

13. An ignition mechanism of the class described comprising in combination with a bracket adapted to be secured to an engine cylinder, a movable electrode carried by the bracket, a magneto removably mounted on the bracket, spring means normally retaining the magneto rotor in a certain position, a push finger on the magneto rotor, an engine driven push rod arranged to engage, move, and release the push finger, a hammer mounted on the bracket, a spring associated with the hammer normally tending to cause the hammer to engage the movable electrode, said hammer normally being held against and slightly behind the rotor push finger and movable therewith, and an abutment carried by the bracket adapted when the magneto is removed to stop the hammer at the position normally occupied by the rotor push finger whereby said hammer is rendered capable of being engaged, moved, and released by the engine driven means similarly to the rotor push finger.

14. In combination with a bracket adapted to be secured to an engine cylinder, a movable electrode carried by the bracket, a magneto supported by the bracket, spring means acting between the magneto framework and rotor normally holding the latter in a certain position, a push finger on the rotor on that side of the magneto adjacent the electrode, a hammer mounted on the bracket on an axis substantially co-incident with the axis of the rotor, spring means acting between the hammer and bracket tending to move the hammer against the electrode and normally holding the hammer against the rotor push finger, and an engine driven push rod normally adapted to engage, move, and release the rotor push finger, but arranged similarly to engage, move and release the hammer when the magneto is removed.

15. An ignition apparatus comprising movable and stationary electrodes, a magneto, spring means normally holding the magneto rotor in a certain position, a push finger on the rotor on that side of the magneto adjacent the electrodes, a hammer mounted on an axis substantially coincident with the axis of the rotor, spring means tending to move the hammer toward the movable electrode and normally holding the hammer against and slightly behind the rotor push finger, and an engine driven member arranged normally to engage, move,

and release the rotor push finger, but adapted similarly to engage, move, and release the hammer when the magneto is removed from the combination.

16. In an apparatus of the class described the combination with a bracket adapted to be secured to an engine cylinder, of stationary and movable spark electrodes, an arm on the movable electrode, spring means tending to move the movable electrode into engagement with the stationary electrode, a magneto removably mounted on the bracket, relatively strong spring means normally tending to hold the magneto rotor in a certain position, a hammer mounted on a bracket, a push finger on the rotor shaft, an engine driven actuator arranged to engage, move, and release said push finger, spring means tending to move the hammer against the movable electrode arm but normally holding the hammer against the push finger, and an abutment carried by the bracket for normally retaining the hammer at the position previously occupied by the push finger when the magneto is removed whereby the engine driven actuator may operate said hammer similarly to said push rod, said hammer when lying in the position last mentioned engaging the movable electrode arm and holding the movable electrode arm out of engagement with the stationary electrode.

17. In an ignition apparatus the combination with stationary and movable spark electrodes, an arm on the movable electrode, spring means tending to hold the movable electrode in engagement with the stationary electrode, a magneto positioned adjacent said movable electrode, spring means tending to hold the magneto rotor in a certain position, a hammer positioned adjacent said movable electrode arm, a push finger on the rotor shaft adjacent said hammer, and an engine driven actuator arranged to engage, move, and release said push finger, spring means tending to move the hammer toward the movable electrode but normally holding the hammer against the rotor push finger, and a stationary abutment for retaining the hammer at the position previously occupied by the push finger when the magneto is removed from the combination whereby the engine driven actuator may operate said hammer similarly to the push finger, said hammer when lying in the position last mentioned engaging the movable electrode arm and holding the movable electrode out of engagement with the stationary electrode.

18. In combination with a bracket adapted to be secured to an engine cylinder, stationary and movable electrodes carried by the bracket, a magneto removably supported by the bracket, spring means engaging the magneto rotor and retaining the same in a certain position, a push finger on the rotor shaft, an engine driven actuator adapted to engage, move, and release the push finger, a spring impelled hammer on the bracket normally controlled by the rotor to effect the operation of said electrode in timed relation to said magneto, but adapted to be operated by the engine driven actuator similarly to said push finger when the magneto and spring means associated with the rotor thereof are removed from the combination.

19. In combination with stationary and movable spark electrodes, a magneto positioned adjacent said electrodes, spring means normally tending to hold the magneto rotor in a certain position, a push finger on the magneto rotor, an engine driven actuator arranged to engage, move, and release said push finger, and a spring impelled hammer mounted adjacent said electrodes and normally controlled by the magneto rotor to effect the operation of the spark electrodes in timed relation to the magneto rotor, but adapted to be moved and released by the engine driven actuator similarly to said push finger when the magneto and spring means associated with the rotor thereof are removed from the combination.

20. In combination with a bracket adapted to be secured to an engine cylinder, a movable spark electrode journaled in the bracket, a magneto removably mounted on the bracket, spring means normally tending to hold the magneto rotor in a certain position, an engine driven actuator adapted to move and release the magneto rotor, and a spring impelled hammer normally controlled by the magneto rotor to effect the operation of said movable electrode in timed relation to the magneto rotor and adapted to be moved and released by the engine driven actuator similarly to the rotor when the magneto is removed from the bracket.

21. In an ignition mechanism stationary and movable electrodes, a magneto adjacent said electrodes, spring means normally tending to hold the magneto rotor in a certain position, an engine driven actuator adapted to move and release the magneto rotor, and a spring impelled hammer normally controlled by the magneto rotor to effect the operation of said electrodes in timed relation to the magneto rotor and adapted to be moved and released by the engine driven actuator similarly to said rotor when the magneto is removed from the combination.

22. An ignition mechanism comprising a bracket adapted to be secured to an engine cylinder, a movable electrode carried by the bracket, an arm on the movable electrode, a magneto removably mounted upon the bracket, spring means acting between the magneto framework and rotor normally retaining the latter in a certain position, a

push finger on the rotor, an engine driven actuator arranged cyclically to engage, move, and release said push finger, a hammer journaled on the bracket and movable on an axis co-incident with the rotor axis, spring means associated with said hammer tending to move the latter toward the movable electrode arm and holding the hammer in engagement with the rotor push finger, said hammer normally controlled by the rotor push finger to operate the movable electrode in timed relation to the rotor, but adapted to be engaged and operated by the engine driven actuator similarly to said push finger when the magneto is removed from the bracket.

23. In combination with a bracket adapted to be secured to an engine cylinder, a movable electrode journaled in said bracket, a magneto supported by the bracket, relatively strong spring means normally holding the magneto rotor in a certain position, means for cyclically moving the rotor against the action of said spring means and for releasing it, a hammer for operating said electrode, and relatively weak spring means tending to cause the hammer to engage said movable electrode, said hammer being controlled by the magneto rotor but operated by its relatively weak spring means to effect the operation of the movable electrode in timed relation to the rotor.

24. In combination with stationary and movable spark electrodes, a magneto disposed adjacent said electrodes, relatively strong spring means tending to hold the magneto rotor in a certain position, means adapted cyclically to move the rotor against the action of said spring means and release it, a hammer for engaging the movable electrode, and relatively weak spring means tending to move the hammer against the movable electrode but holding it in engagement with the rotor, said hammer controlled by the rotor but operated by its associated relatively weak spring means to effect the separation of the electrodes in timed relation to the rotor.

25. In combination with an oscillating magneto, stationary and movable spark electrodes, means for cyclically oscillating the magneto rotor, a hammer for operating said movable electrode, and spring means tending to move said hammer toward the movable electrode but holding the hammer against the magneto rotor whereby said hammer is controlled by the magneto rotor but operated by its associated spring means to effect the separation of the electrodes in timed relation to said rotor.

26. In an ignition mechanism comprising stationary and movable spark electrodes, an oscillating magneto, and a spring impelled hammer separate from the magneto controlled by the magneto but actuated by its associated spring means to effect the operation of the electrodes in timed relation to the magneto rotor.

27. In combination with a bracket adapted to be secured to an engine cylinder, a movable electrode journaled in the bracket, an oscillating magneto supported by the bracket, a hammer mounted on the bracket, a spring acting between the hammer and bracket and holding the hammer against the magneto rotor, said hammer controlled by the magneto rotor but operated by its associated spring means to effect the operation of the movable electrode in timed relation to said magneto rotor.

28. In combination with a bracket adapted to be secured to an engine cylinder, a movable electrode journaled in the bracket, an oscillating magneto mounted on the bracket, relatively strong spring means normally tending to hold the magneto rotor in a certain position, means for cyclically oscillating and releasing the magento rotor, a projection on the magneto rotor, a hammer on the bracket, and comparatively weak spring means tending to move the hammer toward the movable electrode but holding it against the rotor projection whereby the hammer acts as a follower for the rotor and is actuated by its associated comparatively weak spring means to operate the movable electrode in timed relation to the magneto rotor.

29. In combination with stationary and movable spark electrodes, an oscillating magneto, an engine driven actuator for engaging, moving and releasing the magneto rotor, a hammer controlled by the magneto rotor to operate the movable electrode in timed relation to the rotor, and means on the hammer arranged to be engaged by the actuator, moved and released similarly to the rotor when the magneto is removed from the combination.

30. In combination with a bracket, a movable electrode journaled therein, an oscillating magneto carried by the bracket, an engine driven actuator for engaging, moving and releasing the magneto rotor, a hammer carried by the bracket controlled by the magneto rotor to operate the movable electrode in timed relation to the rotor and means on the hammer adapted to be engaged, moved and released by the actuator similarly to the rotor when the magneto is removed from the bracket.

31. In combination with a movable electrode, an oscillating magneto the rotor of which is normally held in a certain position by relatively strong spring means, a spring impelled hammer normally engaging the magneto rotor and controlled by the latter to operate the electrode in timed relation to

the rotor, an actuator arranged normally periodically to operate the rotor, said hammer comprising means arranged to be operated by the actuator similarly to the rotor when the magneto is removed.

32. In combination with an oscillating magneto, an actuator therefor, relatively strong spring means normally holding the magneto rotor in a certain position, a movable spark electrode, a spring impelled electrode hammer controlled by the magneto rotor, and comparatively weak spring means for operating said hammer in timed relation to the rotor when the rotor and hammer are moved from their normal positions and released.

33. An ignition mechanism of the class described comprising in combination with spark electrodes, a magneto, spring means for operating the magneto, an engine driven actuator for moving the magneto rotor in opposition to said spring means, and electrode operating mechanism controlled by the magneto for operating the electrodes and determining the time of operation thereof, the several parts being so related that when the magneto is removed from the combination said electrode operating mechanism is operated and controlled by the engine driven actuator.

34. An ignition mechanism of the class described comprising in combination with spark electrodes a magneto having an oscillatory rotor, and a spring operated impact member controlled by the magneto but impelled by its own spring means to effect the operation of the electrodes in timed relation to the magneto rotor.

35. An ignition mechanism of the class described comprising in combination a magneto having an oscillatory rotor, a movable electrode, a hammer separate from the rotor, spring means for operating said hammer, and an engine driven actuator for engaging, moving, and releasing the rotor, said hammer controlled by the rotor but impelled by its associated spring means to operate the movable electrode in timed relation to the rotor.

In witness whereof, I hereunto subscribe my name this 28th day of July, A. D. 1916.

ALBERT G. McCALEB.

Witnesses:
ROBERT F. BRACKE,
ROBERT M. SEE.