R. F. HALL.

MAGNETO MACHINE FOR USE IN CONNECTION WITH THE IGNITION SYSTEMS OF INTERNAL COMBUSTION ENGINES.

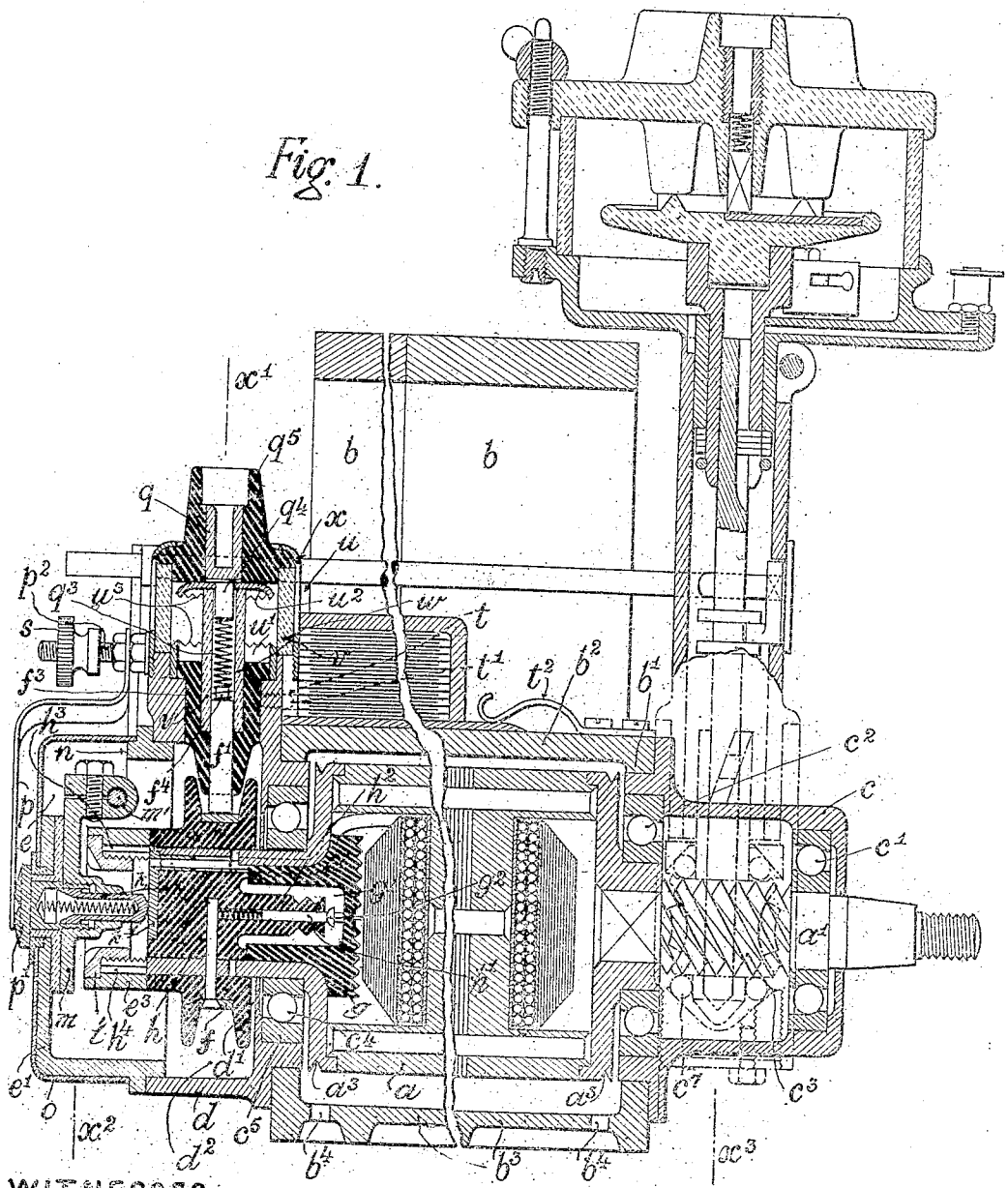
APPLICATION FILED AUG. 24, 1908.

972,692.

Patented Oct. 11, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2

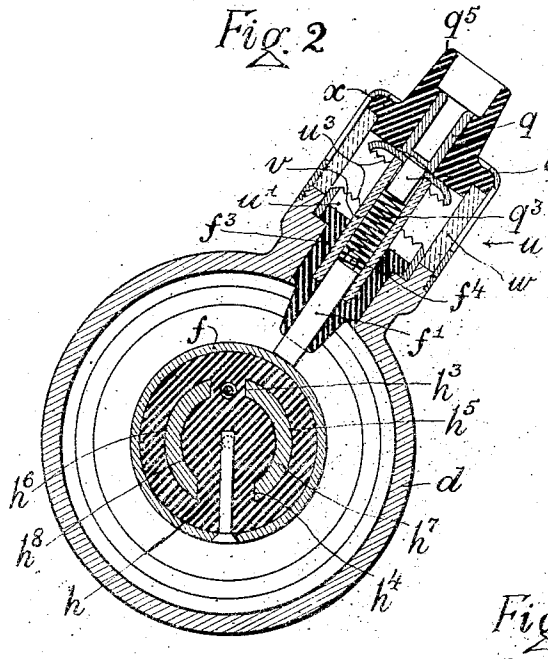


Fig. 4.

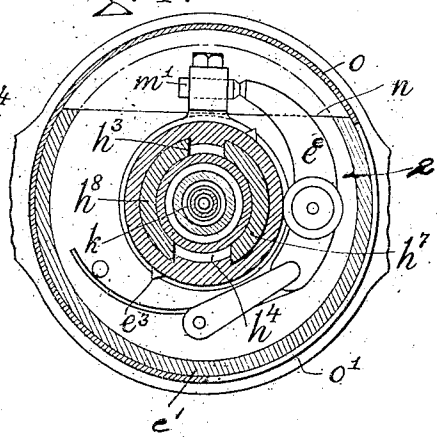


Fig. 5.

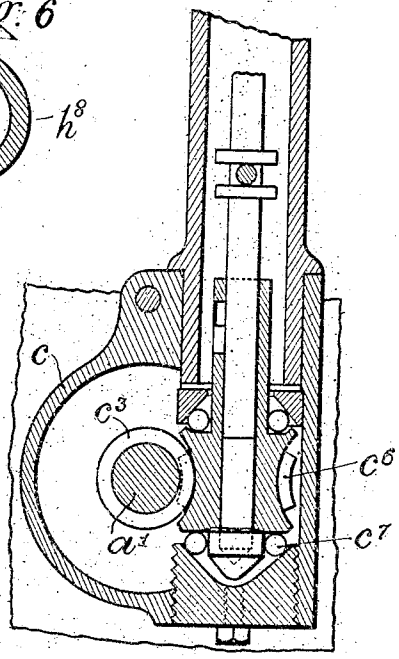


Fig. 6

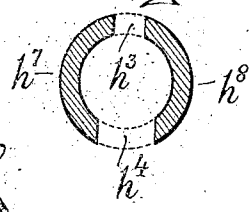
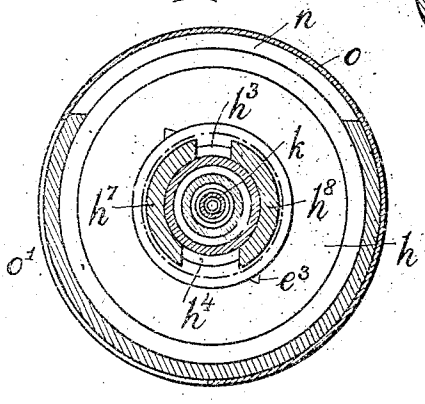


Fig. 3.



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MAGNETO MACHINE FOR USE IN CONNECTION WITH THE IGNITION SYSTEMS OF INTERNAL COMBUSTION ENGINES.

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3 SHEETS—SHEET 3.

Fig. 7

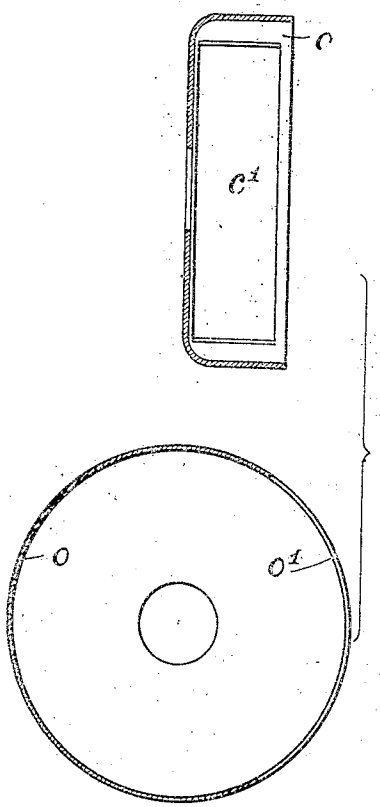
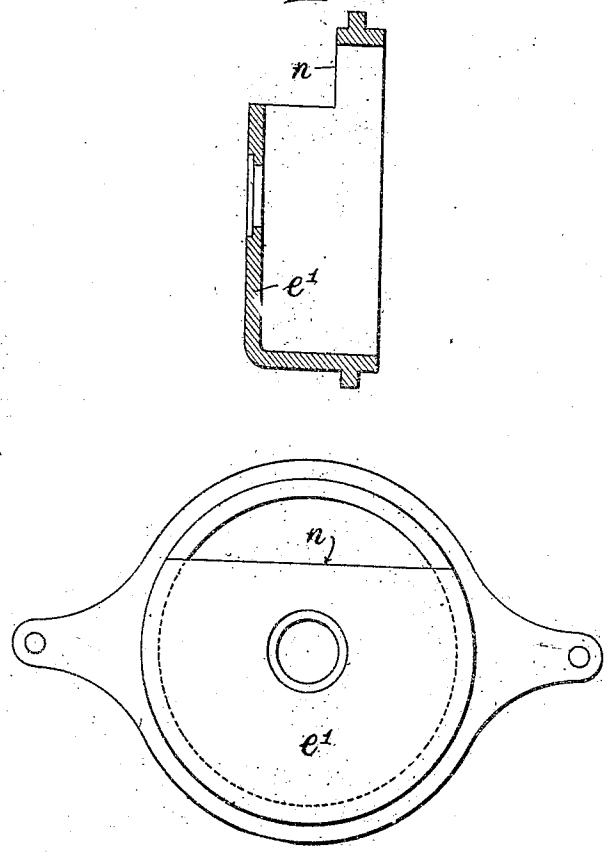


Fig. 8.



WITNESSES

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UNITED STATES PATENT OFFICE.

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MAGNETO-MACHINE FOR USE IN CONNECTION WITH THE IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES.

972,692. Specification of Letters Patent. **Patented Oct. 11, 1910.**

Application filed August 24, 1908. Serial No. 450,077.

To all whom it may concern:

Be it known that I, ROBERT FREDERICK HALL, a subject of the King of Great Britain, residing at Ferndale, Church Road, Moseley, near Birmingham, England, have invented certain new and useful Improvements in Magneto-Machines for Use in Connection with the Ignition Systems of Internal-Combustion Engines, of which the following is a specification.

This invention has reference to magneto machines for use in connection with the ignition systems of internal combustion engines, and the improvements are principally applicable to machines of the high-tension type in which both the primary and secondary windings are carried on the magneto armature.

The principal object of the said invention is to provide an improved magneto machine which, although capable of being used alone as the generator of a simple high-tension ignition system, is mainly adapted for use as part of a dual or double ignition system and in connection with a combined and self-contained machine or apparatus such as described in the specification of my concurrent application for Letters Patent dated the 22nd day of August 1908 No. 449,854 wherein the magneto is combined with a high-tension distributer which is capable of being used for distributing current that is generated either by the magneto itself or by an alternative coil and accumulator system, and wherein also the shaft of the said common distributer drives a cam for operating a supplementary contact breaker that is combined in the machine but is adapted to be connected up in the primary circuit of the said alternative system.

Another object is to so construct a magneto machine that the whole of the parts are thoroughly accessible and may be readily inspected or adjusted in position, even when the machine is running; also to provide for the ready detachment and replacement of the principal parts without involving any disturbance of the machine as a whole or affecting the general efficiency of the same.

A further object is to provide an improved system of bearings for supporting the armature so that sagging is effectually prevented, and the proper air-gap is always maintained between said armature and the pole-pieces of the magneto; also for supporting the gearing that drives the high-tension distributer and for taking the thrusts and stresses which are exerted by the said gears when the machine is running, it being understood that when the improved magneto is used as a part of combined appliance such as above referred to one and the same set of gears is used for driving the distributer, both when the high-tension current is being generated by the magneto and when the ignition is being worked off the battery and coil, so that the effectual supporting of the gears and the resistance of the gear thrusts are important factors to provide for.

And an additional object which is sought to be realized is to provide for both the high and low tension currents from the double-wound armature to be led away from the same end of the said armature, viz., the end farthest removed from the driving gear, and thus enable the low-tension contact breaker and the high-tension current collector to be also arranged at the said end which is farthest removed from the gear and so admit of these parts being afforded a maximum protection from oil, dust and the like.

A further object is to provide in connection with the primary and secondary armature windings, improved means of collecting both the high and low tension currents and for conveying said currents respectively to the high-tension distributer and to the low-tension circuit breaker; also to facilitate the correct assembling of the various parts, to insure perfect insulation of the different circuits and to protect the collectors and connections against the leakage of oil from the armature and driving gear bearings.

Other and incidental objects are to provide improved means for detachably mounting the condenser upon the armature casing and connecting same in shunt across the low tension circuit; also a simple means for short-circuiting the magneto to earth when using battery ignition or when the system is out of action; also an improved safety spark-gap arrangement.

Figure 1 of the accompanying drawings represents a longitudinal vertical section of a self-contained high-tension magneto and distributer arrangement in which the magneto part and its accessories are constructed and arranged in accordance with my present invention. This view shows the arrangement of the armature and its driving gear

and bearing; also the arrangement of the low-tension contact breaker and high-tension current collector and of their respective connections with the primary and secondary windings of the armature. Fig. 2 is a cross section taken on the dotted line x' Fig. 1 through the high-tension current collector. Figs. 3 and 4 are two cross sections taken upon the dotted line x^2 Fig. 1, through the contact-breaker but looking in opposite directions. Fig. 5 is a section through the armature driving gear upon the dotted line x^3 Fig. 1. Fig. 6 is a cross section of the armature shaft at the contact-breaker end of the machine. Figs. 7 and 8 are details of the contact-breaker cover.

The same letters of reference indicate corresponding parts in the said Figs. 1 to 8.

a is the armature, which carries both the primary and the secondary windings of the system, and is mounted to run between the pole pieces of the magnets b in the usual way. In conjunction with these pole pieces, suitable detachable top and base plates b^2, b^3 are arranged so as to entirely inclose the armature, which is supported on special ball bearings that are arranged so as to prevent the sagging of the armature and also to admit of the conductors of both the primary and secondary windings being led away from the same end of the armature and of the disposition of the various electrical connections as far as possible away from the gearing which drives the armature and distributer. Thus, at one end of the armature casing (which I will refer to as "drive" end to distinguish the same from the other "contacts" end) I arrange a bearing and gear box c which is a self-contained and bodily-detachable element, and contains two laterally-separated sets of ball bearings c^1, c^2 for supporting the drive end a^1 of the armature shaft, and also (in the case of a combined machine) the skew or worm gear c^3 which is mounted on said shaft and drives the distributer. The said sets of bearings are disposed respectively upon opposite sides of the said gear, the inner set being arranged as close as possible to the armature so as to effectually support the same, while the outer set is adapted to take the pull of the drive and relieve the armature bearings proper from the driving strains.

To support the "contacts" end of the armature, a third set of ball bearings c^4 is provided, the same being fitted between the shaft and a bearing-cup c^5 that is carried with a casting d that constitutes one of the ends of the armature casing and is provided with a partition d^1 that serves to isolate the armature and its bearings from the high-tension current collecting devices and the low-tension contact breaker which are inclosed in a separate chamber d^2 in the front of the said casting d, and are thereby effectively protected from oil, dust and the like. This bearing arrangement, in addition to facilitating the connection of the primary and secondary windings, keeps the armature out of contact with the faces of the pole-pieces and preserves the proper air-gap between these parts.

In order to obviate the risk of the terminals of the armature windings being insulated by leaking oil, the opposite ends of the armature are provided with oil-throwing protector rings a^3, but any oil thrown off at the contacts end is intercepted or trapped by the diaphragm or partition d^1 above referred to, and instead of passing into the chamber d^2 that contains the contact devices, is led back from the said trap into the armature chamber from whence the said oil can escape through suitable drainage holes b^4 in the base or bottom-plate b^3.

In the case of a combined machine such as shown in the drawings, the inclosed and ball-supported skew or worm gear at the drive end of the armature shaft is arranged to mesh with a similar gear c^6 on the lower part of a vertical distributer shaft whose lower extremity is also inclosed in the gear and bearing box c and is supported by foot step ball-bearings c^7.

The contact-breaker e in the primary or low tension magneto circuit is mounted in a rotatable casing e^1 at the front of the chambered attachment d on the armature casing. The arm e^2 of the said contact-breaker does not revolve with the armature but is operated for the make-and-break action by a cam e^3 on the armature spindle, while the high tension slip ring f and the collector brush f^1 are arranged at an intermediate point between the cam and the armature. And to make the various circuit connections between the leading out ends of the two armature windings and the collector and contact breaker devices, and also to insure effective insulation of the various parts of the two circuits, I prefer to employ an arrangement such as follows:—The armature spindle at the contact breaker end is of considerable diameter and is hollow, or is bored through axially from end to end, and within the inner portion of the said hollow spindle is fitted a plug or bush of vulcanite g that is also chambered out axially or made hollow at g^1 for a distance from the outer toward the inner end, which is left solid and carries a metallic contact or stud g^2 wherein the secondary winding of the armature terminates and is insulated from metallic contact with spindle (which is live to the low-tension circuit) by the non-conducting material of the bush. The hollow spindle, of course, extends through the oil-tapping diaphragm of the chambered attachment d at the contacts end of the armature casing, and upon this extended part of the spindle there is

mounted a second vulcanite or like block h which serves as an insulating carrier for a spring brush h^1 that makes contact with the secondary-winding terminal g^2 and for the high-tension slip ring f to which said brush is electrically connected and from which the high-tension current is picked up and conveyed to the distributer by the brush f^1. The center portion of this vulcanite carrier is arranged to fill up the interior of the hollow spindle and preferably, in order to render the insulation more perfect, the brush that contacts with the terminal of the secondary winding is mounted in a laterally-protecting sleeve-like part h^2 which extends axially into the chamber of the bush g that carries the winding terminal, but is surrounded by considerable air space so that the contacting parts of brush and terminal are insulated by air as well as by the vulcanite bush and carrier from the metallic spindle.

To facilitate the mounting of the brush and slip-ring carrier h, two slots h^3 h^4 may be machined for a suitable distance along the hollow spindle while the carrier itself is slotted through with two curved clearances h^5 h^6 which correspond in shape to the solid portions h^7 h^8 of the spindle that intervene between the slots. The slip ring and brush are first fitted to the carrier and then the latter is introduced into position by sliding the same laterally onto the spindle, the curved clearances admitting of the center portion of the said carrier passing into the hollow interior of the spindle and abutting against the vulcanite terminal bush.

Preferably to prevent confusion and error in assembling the parts, the two slots h^3 h^4 in the spindle and the clearances h^5 h^6 in the carrier are machined to different widths so that the said carrier can only be slid on in one position relative to the spindle. After the slip-ring carrier, the metallic bush or ring which carries the cams of the low-tension circuit breaker is introduced onto the spindle and both devices are secured by a flanged ring nut i which is screwed into the internally threaded extremity of the said spindle.

With regard to the part of the primary winding that is led out from the contacts end of the armature, this is passed along a groove in the vulcanite bush g and through a hole in the slip-ring carrier h and terminates in a contact plate k^1 that is detachably mounted on the front face of the said carrier and extends to the center thereof. From this contact, the low-tension current is collected by the insulated brush k that is mounted in the front of the contact breaker cover and is in electrical connection both with the contact breaker and with the condenser of the system.

The metallic piece that carries the brush k consists of an arm m, which is mounted on the inner face of the rocking contact-breaker case so that it moves with the latter when the ignition advance and retard mechanism is actuated. This arm carries a platinum tipped screw at m^1 for adjusting the distance between the contact points of the contact-breaker, which is of the make-and-break type. And to provide for the visual adjustment of this screw or for the inspection of the device when the magneto is running, the upper part of the case is cut away at n, and a metallic cap o having a similar cut-away part or gap o^1 is arranged to inclose the contact-breaker case so as to be rotatable thereon and also detachable.

Normally the clearance n in the case is closed by the solid part of the cap, but by turning the latter so as to bring the clearance o^1 into register with the clearance n, the interior of the case is rendered accessible and the contact-breaker may be inspected or adjusted, even when in action.

The cap or cover o is held in position by the pressure exerted by a spring arm such as p, which can be turned aside when it is required to detach the said cap. This spring is also used, in the arrangement represented in the drawings, as a circuit connection between the contact breaker and the condenser, in which case, one end of the said spring is arranged to bear on an external metallic stud p^1 which has an electrical connection with the low tension brush k. A screw or fitting p^2 connects the said spring with the condenser terminal s. The condenser is detachably mounted on top of the armature casing and is secured in position by a hole t in one end of its case engaging a peg t^1 on the body of the machine and being retained in such engagement by the thrust of a retaining spring such as t^2. The condenser case has a metallic base which conducts to earth through the armature casing or otherwise, and the peg and spring affixing devices admit of the condenser being pushed into position and automatically locked, and again detached, without the use of tools.

The brush f^1 which takes up the high-tension current from the slip ring f is mounted in a vulcanite insulating piece f^3 that is fitted into the top of the attachment d that incloses the slip ring carrier and is connected with a terminal q from which the high-tension conductor is led away to the feed brush of the distributer. But between the said brush f^1 and terminal q, there is arranged a safety spark gap device u whose function is to protect the armature windings from damage, in the event of any interruption of the high-tension circuit, by providing an alternative path for the high tension spark in the event that same cannot pass between the pole pieces of either the cylinder plugs. The said device consists of two me-

tallic rings or circular pole pieces u^1, u^2 whose edges are presented toward one another and are formed with a number of points or serrations u^3 and which are fixed at a suitable distance apart in such a manner that the upper pole piece is in metallic contact with the high-tension terminal while the lower one surrounds the insulating piece f^3 but is also in direct contact with the metallic part d which is carried by the magneto frame or otherwise "earthed."

The stem or inner end f^4 of the brush f^1 is electrically connected with the shank q^4 of the terminal q by means of the interposed brush spring q^3, although any other suitable connection may be used, while the earthed pole-piece u^1, in addition to being insulated from the said brush f^1 by the vulcanite piece f^3, is further insulated from both the brush and terminal by a tube or sleeve v, of glass or other unburnable and non-conducting material, which is interposed between the top pole piece u^2 and the brush carrier f^3 so that its opposite ends respectively engage over and inclose the brush stem f^4 and terminal shank q^4, which effectually prevents any short circuiting and leaves only one path for the passage of the safety spark in the event of any interruption of the high-tension circuit, viz., from the points or edge serrations of the pole piece u^2 which is in direct contact with the terminal q, to the opposed points of the lower and "earthed" pole-piece u^1.

The pole pieces, the glass insulating tube and the terminal, with its vulcanite terminal cap q^5, are inclosed in a cylindrical glass casing w, which provides for the inspection of the spark-gap device when the magneto is running. This cylinder is interposed between the chambered attachment d of the machine and the socketed vulcanite cap q^5 that carries the high-tension terminal and serves as a top to the cylinder. The whole of the said inclosed parts are readily separable from one another but are firmly secured in position by a perforated or gapped inclosing ring x, which is passed over the terminal cap and glass cylinder and is screwed at its lower end to the body part d. The ring x has at its upper end an inwardly projecting flange for retaining engagement with the terminal cap. The fact that the safety gap device is inclosed in this manner obviates any risk of the inadvertent ignition of free petrol vapors by the sparks that pass between the pole pieces.

Having fully described my invention, what I desire to claim and secure by Letters Patent is:—

1. In a magneto machine in which the armature carries primary and secondary windings, the combination with a hollow armature spindle having end slots affording a bifurcation, of a non-conductive bushing having clearances to receive the bifurcated end of the spindle and having solid portions which pass through the slots and contact means associated with the bushing, and having electrical connections with the windings.

2. In a magneto machine, the combination with an armature casing of a chambered casting fitted to the end thereof and having an oil intercepting partition and a carrier for an armature bearing, a high tension slip ring disposed within the casting, a collector brush for engagement with the slip ring, a casing for the collector brush and fitted to the casting at one side thereof, a contact breaker, and a casing for the latter and fitted to the end of the casting.

3. In a magneto machine, in which the armature carries primary and secondary windings, the combination with a contact breaker and its casing and a condenser, of a low tension collector brush having electrical connection with the contact breaker, an insulated metallic stud set into the casing and electrically connected to the brush and an exteriorly located spring bearing against the stud and electrically connected to the condenser.

4. In a magneto machine, the combination with the armature housing, of a contact breaker, a casing for the latter, the casing having an open portion providing for the adjustment and inspection of the contact breaker when in action and a rotatable cover provided on the casing and having an opening which may be alined with the opening in the latter.

5. In a magneto machine, a contact breaker, a casing therefor, an armature housing to which the casing is fitted, an external contact stud provided on the casing, a condenser arranged at one side of the armature housing and an exterior spring bearing against the stud to hold the casing in position and connected to the terminal of the condenser.

6. In a magneto machine, a combined and self-contained high tension collector and safety spark gap device comprising a high tension collector brush, a terminal, a connection between the brush and the terminal and a pair of safety spark gap pole pieces consisting of disks surrounding the brush and connection and having separated but opposed serrated edges, one pole piece being arranged in the high tension circuit and the other pole piece being grounded and insulated from the other parts of the combined device.

7. In a magneto machine, the combination with a safety spark gap device comprising separate serrated pole pieces, one of which is grounded, of a sleeve of glass or equivalent insulating transparent material with relation to which the serrated edges of the pole pieces are surroundingly concentric, and a

collector brush and its terminal inclosed in the sleeve and insulated thereby from the grounded pole piece.

8. In a magneto machine, the combination with a stationary part of the armature casing, of a collector brush and a collector brush carrier fitted to the stationary part, a casing removably fitted to the stationary part, a terminal cap removably fitted to the casing and connected to the collector brush and a ring threaded to the stationary part, inclosing the casing and having a flange engaging and retaining the terminal cap and therewith the casing.

9. In a magneto machine wherein the armature has both primary and secondary windings, the combination with an armature casing and an armature spindle of a high tension collector ring, a carrier therefor fitted on the spindle, a primary winding terminal provided on the carrier, a contact breaker for the low tension circuit, a cam for actuating the breaker, the cam being fitted to the end of the spindle, and a dust and oil excluding casing fitted to the end of the armature casing and inclosing the carrier, the contact breaker and the cam.

10. In a magneto machine wherein the armature has both primary and secondary windings, the combination with a hollow armature spindle, of a non-conductive plug fitted in the inner end of the spindle and having a secondary winding terminal, a second non-conductive plug fitted in the other end of the spindle and having a brush for engagement with the terminal, a collector ring connected to the brush, and a primary winding terminal, a low tension collector engaging the latter and a high tension collector engaging the ring.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ROBERT FREDERICK HALL.

Witnesses:
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HENRY NORTON SKERRETT.