Aug. 14, 1934. T. G. LOUIS 1,970,327

MAGNETO

Filed April 7, 1933

Fig. 1.

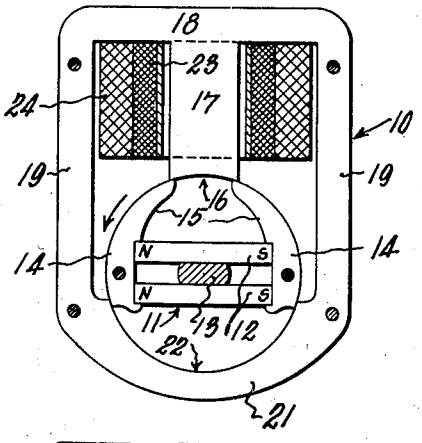


Fig. 5.

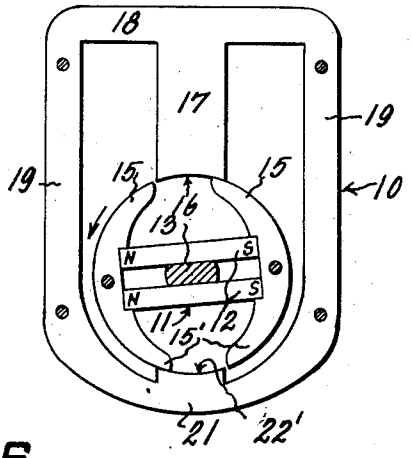


Fig. 2.

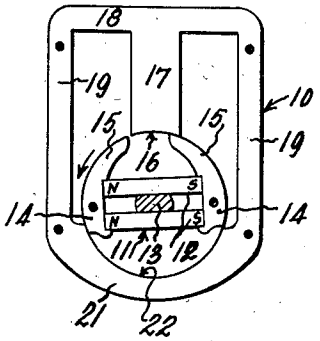


Fig. 6.

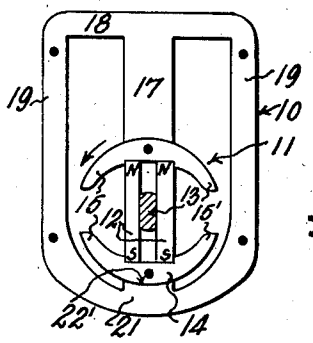


Fig. 7.

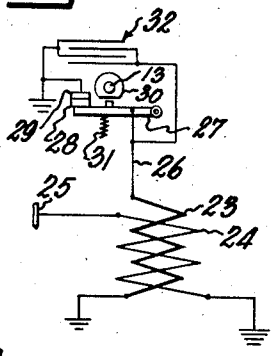


Fig. 3.

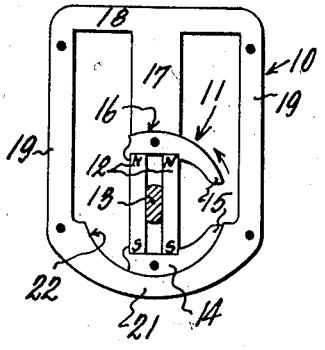
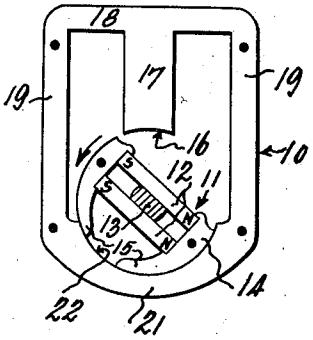


Fig. 4



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UNITED STATES PATENT OFFICE

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MAGNETO

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Application April 7, 1933, Serial No. 664,876

3 Claims. (Cl. 171—209)

This invention relates to improvements in magnetos of the rotary magnetic inductor type.

In my U. S. Letters Patent No. 1,932,978, granted October 31, 1933, I disclose a magneto of this same general class. That magneto is designed for exceptionally high efficiency when operated at normal running speeds of the engine from which it is driven. For very slow speeds and on starting, a spring impulse mechanism is used in order to impart intermittently to the rotor a movement of sufficient speed to cause the production of a spark of the desired intensity. Under certain conditions, the impulse driving mechanism cannot always be relied on to function properly. For example, in some installations, where the magneto and impulse driving mechanism are lubricated from the engine crankcase, it sometimes happens that when the engine oil is cold and does not flow freely, the impulse driving mechanism will stick and not perform its intended work.

This invention has for its general object a modification in the magneto construction shown in my prior patent with the end in view of securing, at low engine speeds and at starting, a spark of sufficient intensity without necessitating the use of an impulse driving mechanism.

More particularly, the invention provides, by the use of extensions from one side of the pole shoes of the rotary bar magnets, for efficient operation at low speeds by the use of a reversal of the magnetic flux. This reversal of flux is utilized very effectively on low speed operation but on operation at higher speeds is less effective. The efficiency at high speed is lowered to a certain extent over that obtained in the magneto of my prior patent but the efficiency at low speeds is materially increased and so much so that reliance on impulse driving mechanism is no longer necessary and such driving mechanism may be eliminated, thus effecting a saving in the cost of the magneto. The magneto of this invention may be said to be a compromise designed to meet the needs of a particular situation, where high efficiency at low speeds without reliance on impulse drive is more important than the highest efficiency at high speed operation.

There are other features contributing to the attainment of the above general objects. These features will best appear as the detailed description proceeds and they will be pointed out in the appended claims.

The invention will be disclosed with reference to the accompanying drawing, in which:

Fig. 1 is a cross sectional view of a magneto showing one design for the stationary and movable elements of the magnetic circuit;

Figs. 2, 3 and 4 are similar views drawn to a smaller scale showing the movable element in different positions;

Fig. 5 is a view taken similarly to Fig. 1 but showing another form of the invention;

Fig. 6 is a small scale view showing the movable element of Fig. 5 in a different position; and

Fig. 7 is a diagrammatical view of the electric circuit of the magneto.

In the drawing, the illustration has been confined to so much of the magneto as is necessary for an understanding of the improvements of this invention. In Figs. 1 to 6, the elements of the magnetic circuit are shown and in Fig. 7 the elements of the electric circuit are shown. The details relating to the mounting of these parts are unnecessary to an understanding of the invention, especially in view of the disclosure in the patent above identified and my prior U. S. Patent No. 1,827,323, granted Oct. 13, 1931, to which reference may be had for a more complete disclosure of such details if such is necessary or desired.

Referring to Fig. 1, which shows a magneto designed to produce one ignition spark for each revolution of the inductor, 10 indicates the stationary laminated iron element of the magnetic circuit and 11 the movable element thereof,—a rotatable magnetic inductor. The inductor includes two short bar magnets 12 mounted in parallel relation on opposite sides of a drive shaft 13 which is flattened as shown to enable the magnets, near their central and neutral portions, to bear against it for an operable driving engagement after the manner disclosed in said patent. Like ends of the magnets are interconnected by pole shoes 14 of laminated soft iron construction. These shoes are recessed to receive the magnets and form with them a box-like enclosure for shaft 13. The parts of the inductor are or may be held together in the manner disclosed in said patent and the inductor is or may be mounted and driven as therein disclosed. Each pole shoe 14 has a curved extension 15,—the two extensions projecting from the same sides of their shoes and converging in a direction away from the magnets. The tips of these extensions are separated by an angular distance less than the angular extent of the pole face 16 of the central and core forming part 17 of the stationary element 10.

The stationary element includes in addition to core 17 a box-like part, comprising a horizontal element 18 connected intermediate its ends to the

upper end of the core, vertical parts 19 which extend downwardly in parallel relation one from each end of the element 18, and a lower and curved connecting part 21. This box-like element completely encloses the rotor, the core and the coils carried thereby. The part 21 has an arcuate surface 22 for cooperation with the pole shoes of the rotor and this surface is many times greater in angular extent than the surface 16 and somewhat greater in angular extent than either of the pole shoes 14.

The core 17 receives primary and secondary windings 23 and 24, respectively. These windings and the associated electric connections are shown diagrammatically in Fig. 7. As there shown, one end of the secondary winding is grounded and the other end is connected to the high tension terminal 25 of the magneto, to which terminal the spark plug wire of the engine is adapted to be connected. The primary winding 23 has one end grounded and the other end connected by a wire 26 to a lever 27 which carries the movable breaker point 28. The cooperating stationary breaker point 29 is grounded. The usual condenser 32 is bridged across the breaker points, as shown. The lever 27 is operated by a cam 30 which is driven from shaft 13 and by a spring 31,—the latter tending to hold the points 28 and 29 engaged and the cam serving to periodically disengage the points against the tension of the spring. As shown, the breaker points are opened once during each revolution of shaft 13 and held open for an interval of approximately three quarters of a revolution. The details of the breaker point mechanism, above briefly described, are shown in the first named patent to which reference is made for a more complete disclosure, if such is necessary or desired. For the present purposes it should suffice to state that the breaker points are separated by cam 30 when the rotor 11 reaches the position shown in Fig. 2, and that they remain separated until the rotor reaches the position shown in Fig. 3, when they are engaged and remain engaged during the travel of the rotor from the position shown in Fig. 3 to that shown in Fig. 2.

The operation of the magneto will next be described. Assuming that the rotor 11 is turning in the direction of the arrow as the rotor approaches the position shown in Fig. 3, it will bridge across and directly interconnect the polar surfaces 16 and 22 and a magnetic flux will be rapidly built up in core 17 while the breaker points 28 and 29 are open, such flux as shown herein passing upwardly through the core. Directly following the establishment of flux in core 17, the breaker points close, say for example at or about the time when the rotor occupies the position shown in Fig. 3, for the purpose of short circuiting the primary or choking winding, the effect of which is to resist change of flux in the core. The breaker points remain closed during the travel of the rotor from the position shown in Fig. 3 to that shown in Fig. 2. Just prior to the time when the rotor reaches the position shown in Fig. 2, it assumes momentarily a position such as shown in Fig. 1, in which both pole shoe extensions 15 engage the polar surface 16 and both shoes 14 engage the polar surface 21. This condition, however, is of such short duration as not to materially affect the results, having in mind that the flux built up in core 17 is held by the short circuited choking winding 23. Immediately after this momentary position of transition, the rotor moves into the position shown in Fig. 2, in which only the right hand pole shoe extension 15 (say for example of south polarity) engages the polar surface 16 and the other pole shoe engages the surface 22. The rotor is then positioned for a downward flow of flux through core 17 and, on opening the breaker points 28 and 29, the flux formerly built up in core 17 in an upward direction is released and a flow of flux in the opposite direction occurs. There is thus a reversal of flux in core 17 and a change of flux of a very substantial degree is produced for the generation of the ignition spark.

Later in the revolution of the rotor, it assumes a position such as is shown in Fig. 4, wherein the flux last established in core 17 in a downwardly direction is broken and a second flux change is produced in the core. This is what is called the "maverick spark" position of the rotor. Owing to the inefficient treatment of the flux immediately preceding this last named position of the rotor, the electromotive force produced is not sufficient to cause the production of a spark which would be bothersome because of its occurrence at an undesired time. For one thing, the change of flux is gradual rather than sudden because the choke winding 23 is open and unable to hold the flux previously built up in the core. Before the pole shoe 14 of south polarity leaves surface 16, its extension 15 has engaged surface 22 and much of the flux from the magnetic source is shunted away from the core before the break in the magnetic circuit, which includes core 17, is effected. Then, since the breaker points are open, the flux gradually decreases as the pole shoe 14 leaves surface 16, as distinguished from being held in the core 17 by a short circuited choking winding until the rotor had moved far enough to create a substantial air gap between the shoe 14 of south polarity and core 17 and then suddenly released. Thus, the flux change is not a rapid one nor of great degree and, although a break in the magnetic circuit through core 17 occurs in the Fig. 4 position of the rotor, no spark, or at least none sufficient to be troublesome, occurs.

Where two sparks per revolution of the rotor are desired, the rotor may be provided with a second set of pole shoe extensions 15' from the opposite side thereof as shown in Fig. 5. In such case, the stationary laminated structure is modified by the substitution for the large arcuate surface 22 of a much smaller surface 22' of about the same extent as surface 16 and located oppositely thereto. With this arrangement, the cam 30 would be changed to provide for two cycles of operation of the breaker points. For example, a cam like that shown in Fig. 13 of the first named patent would be used. The breaker points will close when the rotor moves into the position shown in Fig. 6 and remain closed until the rotor assumes the position shown in Fig. 5. Then the breaker points will again close when the rotor assumes a position diametrically opposite to that shown in Fig. 5. In operation, when the rotor is positioned as shown in Fig. 6, an upward flow of flux in core 17 is established. The breaker points then close to hold the flux until the rotor reaches the position shown in Fig. 5. Here the rotor is positioned so as to create a downward flow of flux through core 17. Thus, when the breaker points open, there is a change in flux from a maximum in one direction to a maximum in the other direction and a very effective ignition spark is thus produced. The operation, just described, is repeated during the second half rev-

olution and two flux reversals are obtained during each revolution of the rotor and two ignition sparks produced.

The invention has been disclosed herein for illustrative purposes, but the scope of the invention is defined by the appended claims rather than by the foregoing description.

What I claim is:

1. In a magneto, a magnetic rotor, a core with one end of which said rotor cooperates, primary and secondary windings on said core, an electric circuit including the primary winding, means for opening and closing said circuit, an extension from the other end of said core having means for cooperation with said rotor and located opposite said first core end and of a larger angular extent than the first named end of said core, said rotor comprising spaced shoes and a single permanent bar magnet source of magnetic flux interconnecting them and curved extensions one from each shoe and both extending away from the same side of said source a substantial distance, said shoes and their extensions presenting peripheral surfaces disposed substantially concentric with the axis of the rotor, said rotor in one position arranged to interconnect said core and its extension means and establish flux in one direction through said core, said rotor in another position arranged through one of said curved extensions to establish flux in an opposite direction through said core, and means actuated by movement of the rotor for closing said circuit when the rotor assumes the first position and for holding it closed until the rotor assumes the second position and then opening said circuit.

2. In a magneto, a magnetic rotor, a stationary element of magnetic material completely surrounding the rotor and having diametrically opposed projections with which said rotor cooperates, primary and secondary windings on said element between said projections, an electric circuit including the primary winding, means for opening and closing said circuit, said rotor comprising diametrically-opposed, spaced pole shoes of substantially segmental form each having an angular extent comparable to that by which said projections are separated and each having each end spaced from the corresponding end of the other shoe by an angular extent comparable to that of said projections, said shoes having peripheral surfaces disposed concentric with the axis of revolution of the rotor to cooperate with said projections, and a single permanent bar magnet source of magnetic flux interconnecting said shoes, said rotor twice during each revolution moving into a position such as to interconnect said projections and establish magnetic flux in one direction through said element and windings and intermediate said positions moving into a second position to connect said projections and establish flux in an opposite direction through said element and windings, and means actuated by movement of the rotor to close said circuit as the rotor moves into either of the first named positions and to hold it closed until the rotor moves into the succeeding second position and then to open said circuit and hold it open until the rotor moves into the other of the first named positions.

3. In a magneto, a magnetic rotor, a stator of magnetic material including a core having at one end a surface for cooperation with said rotor, primary and secondary windings on said core, an electric circuit including the primary winding, means for opening and closing said circuit, said stator including an element of closed loop formation fixed to the other end of said core and encompassing said windings and said rotor, said element having a surface for cooperation with said rotor which is much greater in angular extent than the first named surface and disposed substantially diametrically opposite thereto, said rotor comprising pole shoes having surfaces which are curved for cooperation with said surfaces and have an angular extent greater than the first and less than the second surface, and a single bar magnet source of magnetic flux interconnecting them at diametrically opposite points, all said surfaces being substantially concentric with the axis of revolution of the rotor, one end of one shoe being separated from the corresponding end of the other shoe by an angular distance comparable to the angular extent of the first named surface, the other end of one shoe being separated from the corresponding end of the other shoe by an angular distance comparable to the angular extent of the second named surface, said rotor in one position arranged to interconnect the first and second named surfaces and establish flux in one direction through said core and in another position to interconnect such surfaces and establish flux in an opposite direction through said core, and means actuated by movement of the rotor for operating said circuit opening and closing means to close said circuit when the rotor assumes the first position, hold it closed until the rotor assumes the second position and then open it.

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