

Sept. 16, 1930.

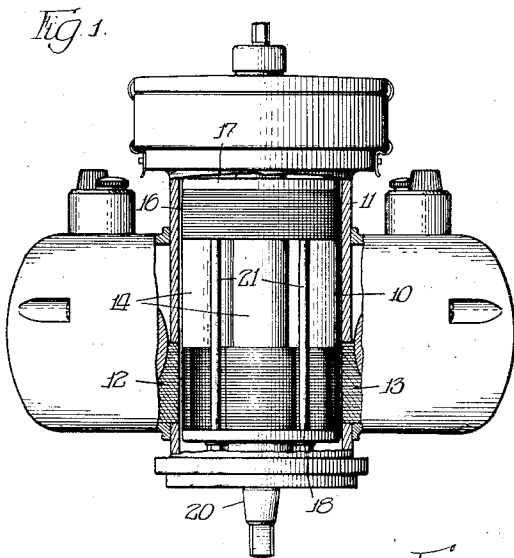
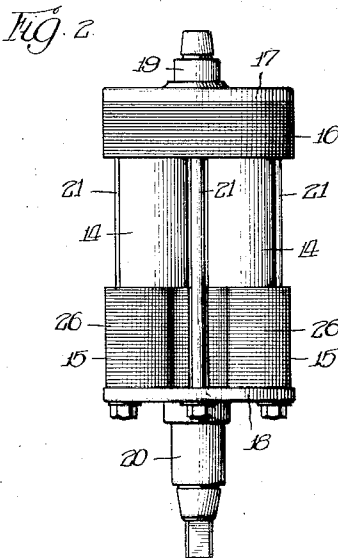
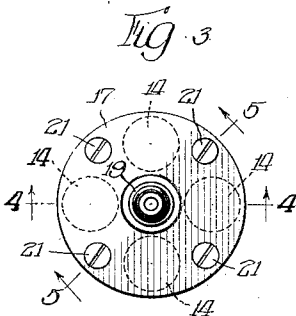
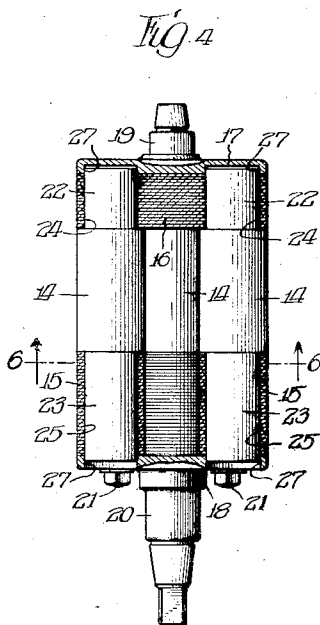
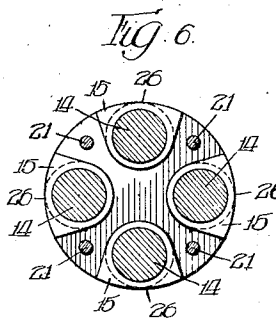
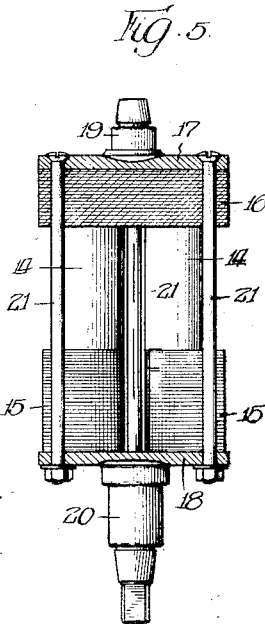
W. J. SPENGLER

1,776,013

MAGNETO

Filed Jan. 25, 1926

3 Sheets-Sheet 1



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Fig. 7.

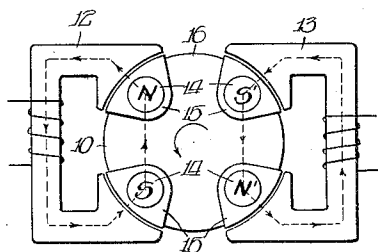


Fig. 8.

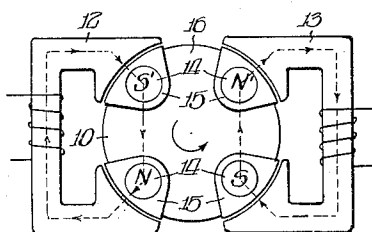


Fig. 9.

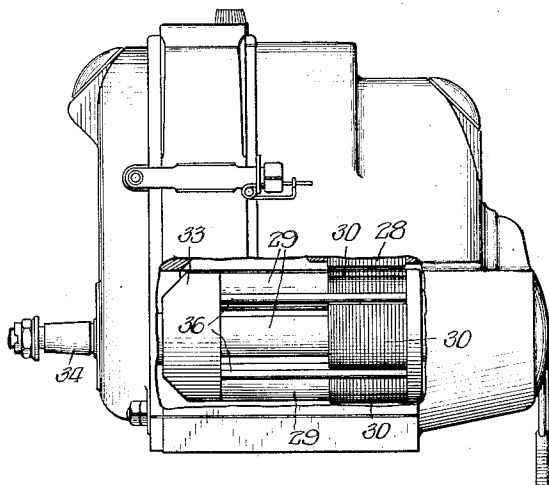


Fig. 11.

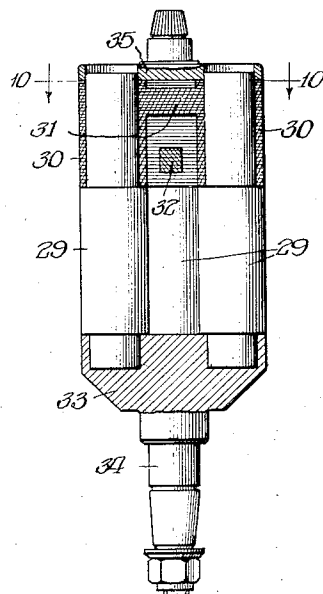


Fig. 12.

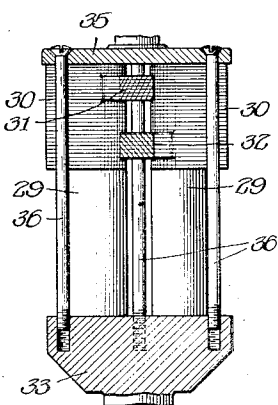
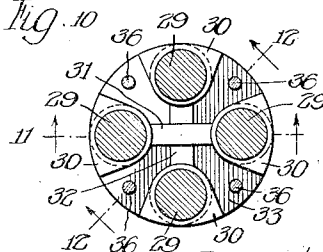


Fig. 10.



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MAGNETO

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Fig. 13.

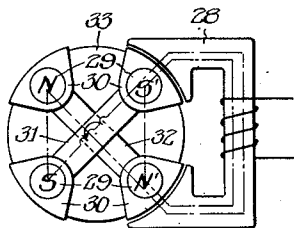


Fig. 14.

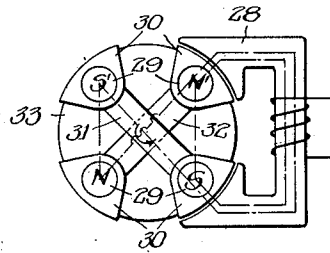


Fig. 15.

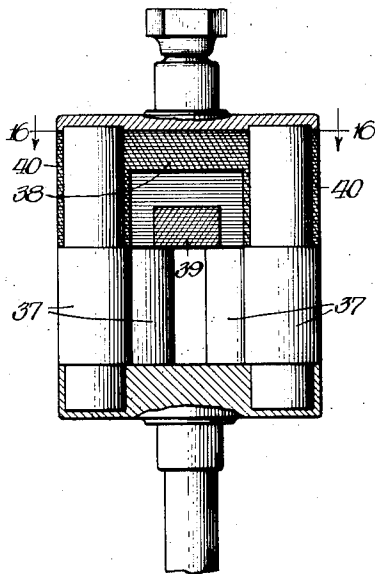
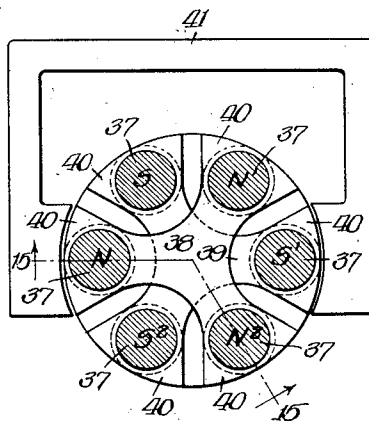


Fig. 16.



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UNITED STATES PATENT OFFICE

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MAGNETO

Application filed January 25, 1926. Serial No. 83,480.

The invention has to do with magnetos for internal combustion engines, and is particularly concerned with that type of magneto in which the permanent magnet constitutes the rotor.

In the ordinary magnet rotor, the magnet is so shaped as to present a plurality of integrally associated pole pieces which extend longitudinally of the rotor in spaced relation to each other, but such a construction, while capable of producing satisfactory results in operation, requires a considerable amount of machining in its manufacture, and consequently necessitates the use therein of only those magnet steels which may be worked without difficulty into special shapes.

The principal object of the invention is to provide an improved magnet rotor in which the magnet is of composite as distinguished from integral construction, is composed of but a few simple and easily manufactured parts, becomes when assembled a very rigid and durable structure, may be formed from cobalt steel or other highly desirable magnet materials which heretofore have not gone into practical use in magnet rotors because of the difficulty experienced in working the same into special shapes, is capable of producing an extremely intense magnetic flux through the associated armature, and permits of a substantial reduction in both the weight and size of the magneto in which incorporated. The foregoing are but a few of the more salient advantages characteristic of a rotor constructed in accordance with the invention.

Another important object of the invention is to provide such a rotor which is capable of being so constructed and assembled as to constitute what is in effect two or more magnets for energization of an equal number of independent armatures.

Other objects and advantages of the invention will be evident to those skilled in the

art upon a full understanding of the nature of a rotor embodying the same.

In order that the invention may be readily understood, three slightly different forms of the same are hereinafter presented. The structural details necessarily used in the presentation of such forms are of course susceptible of much variation, and are not intended to restrict in any way the practical application of the principles underlying the construction of the rotor short of the true and intended scope of the invention as defined in the appended claims.

In the drawings:

Fig. 1 is a side view of a dual magneto equipped with one form of the rotor of the invention, portions of the magneto casing being broken away to show the position of the rotor;

Fig. 2 is a side view of the rotor;

Fig. 3 is an end view of the same;

Fig. 4 is a longitudinal section through the rotor, taken on the line 4—4 of Fig. 3;

Fig. 5 is a similar section, taken on the line 5—5 of Fig. 3;

Fig. 6 is a transverse section, taken on the line 6—6 of Fig. 4;

Fig. 7 is a diagrammatic view, showing the manner in which the rotor cooperates with two independent armatures in a dual magneto;

Fig. 8 is a similar view, showing the re-establishment of such cooperation after the rotor has turned through an angle of 90°;

Fig. 9 is a side view of a single magneto equipped with another form of the rotor of the invention, portions of the magneto casing being broken away to show the position of the rotor;

Fig. 10 is a transverse section through the rotor, taken on the line 10—10 of Fig. 11;

Fig. 11 is a longitudinal section, taken on the line 11—11 of Fig. 10;

Fig. 12 is a similar section, taken on the line 12—12 of Fig. 10;

Fig. 13 is a diagrammatic view, showing the manner in which the rotor cooperates with the armature in a single magneto;

Fig. 14 is a similar view, showing the re-establishment of such cooperation after the rotor has turned through an angle of 90°;

Fig. 15 is a longitudinal section through still another form of the rotor of the invention, taken on the line 15—15 of Fig. 16; and

Fig. 16 is a partially diagrammatic view, taken on the line 16—16 of Fig. 15, showing the manner in which the rotor cooperates with the armature in a single magneto.

The first form of the invention to be described—that illustrated in Figs. 1 to 8 inclusive—is one which is designed particularly for use in dual magnetos. In Fig. 1 is shown such a magneto, wherein a rotor 10 constructed in accordance with the invention is journaled vertically in a casing 11 for rotation between two independent armatures 12 and 13.

The rotor 10 is of composite as distinguished from integral construction, and includes four separate bar magnets 14, four pole shoes 15 connected with the magnets, a base 16 also connected with the magnets, two end plates 17 and 18 provided with bearing spindles 19 and 20, and four bolts 21 for clamping the parts of the assembly as a rigid unit.

The magnets 14, which are preferably of cylindrical form, are arranged longitudinally of the rotor in diametrically spaced pairs, and corresponding ends thereof are provided with slightly reduced end portions 22 and 23 which fit into conforming apertures 24 and 25 in the shoes and the base, respectively. The shoes 15 are sector-shaped stacks of soft iron laminations, and are arranged on the ends 23 of the magnets with the curved surfaces 26 of the shoes in concentric relation to the axis of the rotor. The base 16 is a cylindrical stack of soft iron laminations, and is arranged on the ends 22 of the magnets with the periphery of the base likewise concentric with the axis of the motor. The end plates 17 and 18 are positioned against the shoes and the base, and are provided with apertures 27 into which corresponding ends or extremities of the magnets extend after passing through the apertures 24 and 25 in the shoes and the base. The plate 17, which contacts with the spaced shoes, is formed of a material which will not magnetically bridge such shoes. The tie bolts 21 are also formed of a non-magnetic material, and are arranged longitudinally in the spaces between the magnets. The bolts pass through apertures in the end plates and the base, and are drawn up against the end plates, thus compressing the shoes and the base on the ends of the magnets and holding all of the parts in fixed relation to each other.

The shoes constitute the heads of the magnets, and the portions of the base between

the magnets constitute magnetic conductors between adjoining magnets. The polarity of the magnets at the shoes is different for adjoining magnets, that is to say, one shoe is of north polarity, the next is of south, the next is of north again, and the next is of south.

The magnets are formed of cobalt steel, a material of exceedingly high magnetic qualities which heretofore has not been used commercially in multiple pole magnet rotors because of the difficulties experienced in working such a hard and tough material into the special shapes required. The use of cobalt steel in the present rotor, however, is made possible because of the extremely simple construction, shape and arrangement of the individual magnets therein, which magnets are nothing more than straight bars of stock on which the only shaping present is the reduction of the end portions, and that may be accomplished easily in a simple grinding operation.

The rotor is capable of cooperating with the two independent armatures 12 and 13 in the manner illustrated in Figs. 7 and 8. The two shoes of each of such armatures are set apart from each other a distance equal to that between adjoining shoes on the magnets, so that when the shoe N, for instance, on one of the magnets is in opposition to one of the shoes of the armature 12, the adjoining shoe S of opposite polarity is in opposition to the other shoe of that armature, and the shoes N¹ and S¹ are at the same time in opposition to the two shoes of the armature 13, thus forming two entirely independent magnetic circuits through the armatures 12 and 13, along the paths indicated by the dotted arrow lines in Fig. 7. It will be evident that four alternating impulses are set up in each of the armatures during each revolution of the rotor.

The magnetic flux, in passing from the shoes S and S¹ to the shoes N and N¹ before jumping across the air gaps into the armatures 12 and 13 and back again, passes down through the intervening portions of the base, so that each magnet coacts with one of the adjoining magnets to form temporarily through the base a U-shaped magnet, different magnets pairing off in this manner upon each quarter revolution of the rotor. This is possible without hysteresis and eddy currents such as would hinder the use of an integrally formed multiple-pole magnet in this connection because the bridging portion or base of the U-shaped magnet is not a part of the magnet itself, but is instead composed of soft iron laminations which offer practically no impedance to rapidly shifting currents. The way in which such currents shift upon one quarter revolution of the rotor is clearly shown in Figs. 7 and 8, with the rotor moving in the direction indicated by the curved arrow.

The second form of the invention to be described—that illustrated in Figs. 9 to 14 inclusive—is somewhat similar to the first one, but is designed for use in single as distinguished from dual magnetos.

The rotor, which is shown in Fig. 9 as being journaled horizontally in a magneto casing for rotation below an armature 28, includes four bar magnets 29 not unlike the magnets 14 in the first form. The shoes 30 on the ends of the magnets are not independent, however, as in the first form, but are connected in diametrically opposed pairs by bridges 31 and 32 which are formed by extending certain of the laminations of the shoes transversely across the intervening space. The bridges, which extend at right angles to each other, are spaced longitudinally of the rotor to prevent jumping of the magnetic currents therebetween, and are made quite narrow where they have to pass between the other shoes, likewise to prevent leakage of the flux at those points. The base 33, instead of being a stack of soft iron laminations, may be formed solid of soft iron, and may have the adjoining end plate and spindle 34 integrally combined therewith. The remaining parts in the assembly are not materially changed. The end plate 35 is about the same as the end plate 17 of the first form, and the tie rods 36 serve, like the bolts 21, to hold the parts rigidly together.

The manner in which the rotor cooperates with the single armature 28 is illustrated in Figs. 13 and 14. The two shoes of the armature 28 are set apart from each other a distance equal to adjoining shoes on the magnets, so that upon each quarter revolution of the rotor two adjoining shoes on the magnets, will be brought into cooperation with the shoes of the armature, giving four alternating impulses upon each revolution. The two magnets which are in positions with their shoes in opposition to the armature exert their combined magnetic influences upon the armature, while the other two shoes on the side of the rotor away from the armature, are not idle but also exert their combined influences upon the armature through the conducting bridges 31 and 32, so that the impulses in the armature are materially intensified. With the magnets formed of cobalt steel and connected up in this manner, the rotor may be exceedingly small and yet produce the necessary effect, permitting reduction to be made in both the weight and size of the magnets in which the rotor is used.

The third and last form of the invention to be described is that illustrated in Figs. 15 and 16. It is designed for use in a single magneto, and is substantially the same, in general features of construction and principles of operation, as the second form, with the exception that six bar magnets 37 are employed instead of four, and each of the

two bridges 38 and 39 between the shoes 40 on the magnets connect three alternate shoes of like polarity together, as clearly shown in Fig. 16. The shoes of the single armature 41 with which the rotor cooperates are set diametrically opposite each other across the rotor, so that when one of the three interconnected shoes N , N^1 or N^2 is in opposition to one of the shoes of the armature, one of the other three interconnected shoes S , S^1 or S^2 is in opposition to the other shoe of the armature, and the combined effects of all six magnets are exerted simultaneously upon the armature 41, giving six alternating impulses in the armature upon each revolution of the rotor.

I claim:

1. In a magneto device, a rotor comprising a number of separate bar magnets positioned longitudinally of the rotor in spaced relation to each other, an equal number of laminated magnet pole shoes to which corresponding ends of the magnets are connected, and a laminated soft iron base to which the other ends of the magnets are connected.

2. In a device of the class described, a rotor comprising a number of separate bar magnets positioned longitudinally of the rotor and disposed in spaced relation to each other and having reduced end portions, an equal number of laminated soft iron pole shoes having apertures receiving the reduced portions at corresponding ends of the magnets, and a laminated soft iron base having apertures receiving the reduced portions at the other ends of the magnets.

3. In a device of the class described, a rotor comprising a number of separate bar magnets positioned longitudinally of the rotor in spaced relation to each other, an equal number of laminated magnet pole shoes associated with the magnets and disposed at corresponding ends thereof, a laminated soft iron base associated with the magnets and disposed at the other ends thereof, end plates disposed respectively at the ends of the shoes and the base, and a number of tie rods connecting the end plates for clamping all of the interposed parts together.

4. In a device of the class described, a rotor comprising a number of separate bar magnets, an equal number of magnet pole shoes associated with the magnets and disposed at the ends on one side thereof, a soft iron base associated with the magnets and disposed at the other ends thereof, end plates disposed respectively at the ends of the shoes and the base, aligned bearing spindles associated with and extending in opposite directions from the end plates, and tie rods connecting the end plates and clamping all of the interposed parts rigidly together.

5. In a magneto device, a rotor comprising a base having laminations extending transversely to the rotor axis, a plurality of bar

- magnets extending longitudinally from one side of said base and having corresponding ends positioned thereby, end plates positioned respectively against the free ends of the bar magnets and the base, an aligned bearing spindle associated with and extending from one of said end plates, and a plurality of tie rods connecting the plates and clamping the interposed parts rigidly together.
6. A multiple spark magneto comprising a stator having a plurality of armature units with distinct spark coils thereon, a permanent magnet rotor cooperating with said stator to induce distinct currents in the several spark coils comprising a laminated soft iron base, and a plurality of permanently magnetized separate pole projections extending from said laminated base.
7. In a multiple spark magneto, a stator comprising a plurality of armature units having distinct spark coils and pole members associated therewith, a rotor having a plurality of permanent magnet bars having pole shoes arranged to cooperate with said stator pole members, and a laminated soft iron base joining the ends of said bars opposite said pole shoes to complete the magnetic circuit between rotor pole shoes of opposite polarity, the pole shoes of said rotor being so arranged that in the course of rotation thereof different pairs of bars successively constitute U-shaped inducing magnets cooperating with the pole members of said stator.
8. In a magneto device, a rotor comprising a plurality of separate bar magnets, and a laminated magnetically-permeable member connecting and supporting all of said magnets in spaced relation.
9. In a magneto device, a rotor comprising laterally-spaced bar magnets, and means providing a base to hold adjacent end portions of said magnets in fixed spaced relation, said base being laminated and each lamination connecting a plurality of said magnets.
10. In a magneto device, a rotor comprising laterally-spaced magnets having the adjacent end portions reduced in size, and a base member common to said magnets and provided with apertures for receiving said reduced end portions.
11. In a magneto device, a rotor comprising laterally-spaced bar magnets having the end portions reduced in size, a base member having apertures to receive said magnet end portions, and magnetically-permeable members secured to the ends of said magnets opposite said base.
12. In a magneto, a rotor unit supported for rotation; said unit comprising magnetic members disposed in substantially parallel relation with respect to the axis of rotation of said unit and in spaced relation with respect to each other about said axis, elements associated with said members to constitute therewith said unit, certain of said elements providing pole shoes disposed at one end portion of said unit, certain other of said elements providing a base at the other end portion of said unit, and means engaging with the endmost elements in said unit and operating by virtue of such engagement to exert a clamping action on all of said elements to hold the same rigidly in assembled relation with respect to themselves and said members.
- In testimony whereof I have hereunto subscribed my name.
- WALTER J. SPENGLER.

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