Feb. 23, 1943. K. A. KILLAM ET AL 2,312,101

DYNAMO-ELECTRIC MACHINE

Filed May 28, 1941

Fig. 1.

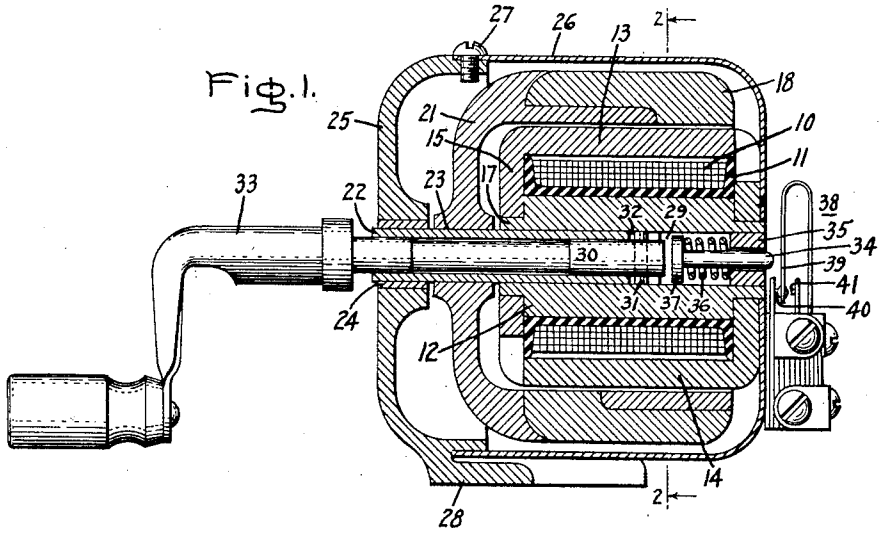


Fig. 2.

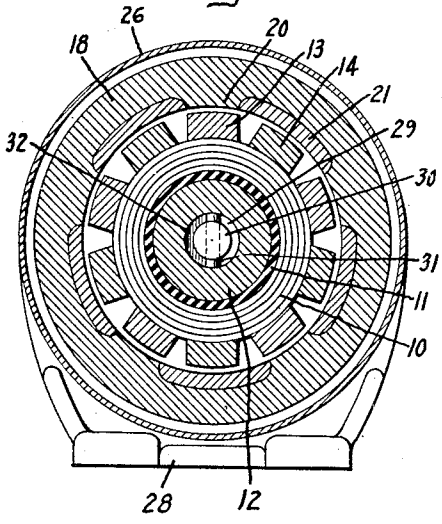


Fig. 3.

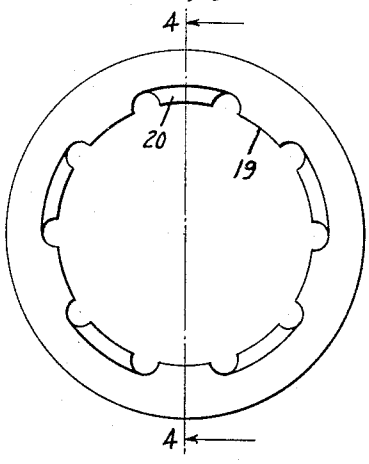


Fig. 4.

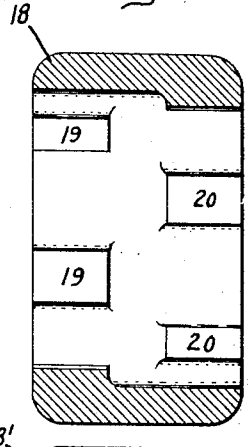


Fig. 5.

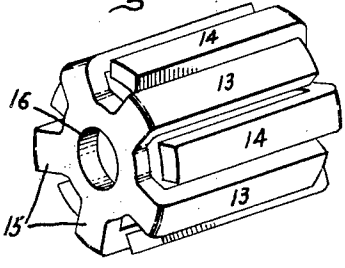


Fig. 6.

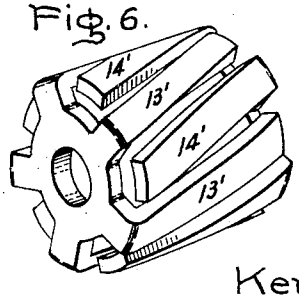
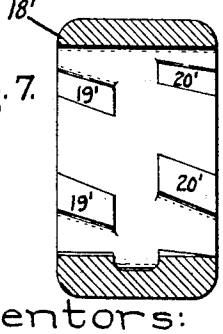


Fig. 7.



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Kenneth A. Killam,
Frank W. Merrill,
by Harry E. Dunham
Their Attorney.

Patented Feb. 23, 1943

2,312,101

UNITED STATES PATENT OFFICE

2,312,101

DYNAMOELECTRIC MACHINE

Kenneth A. Killam, Schenectady, N. Y., and Frank W. Merrill, Fort Wayne, Ind., assignors to General Electric Company, a corporation of New York

Application May 28, 1941, Serial No. 395,596

7 Claims. (Cl. 171—209)

This invention relates to dynamo-electric machines, and although not limited thereto it has application to magnetos.

An object of our invention is to provide an improved dynamo-electric machine construction which will have efficient operation and which will be easy to manufacture.

Another object of our invention is to provide an improved dynamo-electric machine construction so that a large number of flux reversals in the coil member thereof may be obtained for one complete revolution of the rotatable member.

A further object of our invention is to provide an improved manually operable bell-ringing magneto which will be simple in construction and economical to manufacture.

A still further object of our invention is to provide an improved rotatable member structure for a dynamo-electric machine.

Further objects and advantages of our invention will become apparent from the following description referring to the accompanying drawing, and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In the drawing Fig. 1 is a sectional side elevation of a manually operable bell-ringing magneto which is provided with an embodiment of our invention; Fig. 2 is a sectional end view taken along the line 2—2 of Fig. 1; Fig. 3 is an end view of the rotatable magnet structure of the magneto illustrated in Figs. 1 and 2; Fig. 4 is a sectional side elevation of the magnet structure taken along the line 4—4 of Fig. 3; Fig. 5 is a perspective view of the core structure employed in the magneto illustrated in Figs. 1 and 2; Fig. 6 is a perspective view of a modification of the core structure shown in Fig. 5; and Fig. 7 is a sectional side elevation of a modification of the magnet structure shown in Fig. 4 and forms the cooperating magnet structure for the core of Fig. 6.

In the drawing we have illustrated our invention as applied to a manually operable bell-ringing magneto. However, it is to be understood that our invention may be employed in any other type of a dynamo-electric machine structure. The magneto illustrated in the drawing includes a coil member, and a core member magnetically coupled therewith and having a portion threading the core member and another portion including a plurality of interlaced and spaced apart fingers extending from opposite sides of the threading portion of the core member. Surrounding the core member and adapted to react magnetically therewith is a ring-shaped magnet having a pair of axially spaced groups of inwardly extending pole pieces, and the pole pieces of one group may be spaced apart circumferentially or angularly with respect to those of the other group. The magnet is magnetized so that one group of pole pieces will be north poles and the other group south poles, and, when in one position, one of the groups will overlie one set of interlaced fingers of the core member, while the other group will overlie the other set of interlaced fingers, so the flux may cross the air gap and pass through the threading portion of the core member and link the coil member. When the magnet rotates a distance equal to the pole pitch of the magnet, the first-mentioned group of poles will cooperate with the second-mentioned interlaced fingers of the core member and the second-mentioned group of pole pieces will cooperate with the first-mentioned fingers so that the flux will pass through the threading portion and link the coil member in a direction opposite to that produced when the magnet assumes its first-above-mentioned position. It will be seen that rotation of the magnet will cause an alternating voltage to be generated in the coil. Instead of spacing the pole pieces of one group circumferentially apart from the pole pieces of the other group they may be substantially in axial alignment and the fingers of the core member placed at an angle to the longitudinal axis so that one group of pole pieces may cooperate with one set of fingers, and the other group with the other set of fingers. Since my invention may be employed in a manually operable dynamo-electric machine, a crank is provided in the illustrated embodiment for rotating the magnet structure and an axially movable shaft is also provided for actuating a switch when the crank is rotated so that the coil may be connected in a conventional bell-ringing circuit to ring a subscriber's line.

Referring more particularly to Figs. 1 and 2 of the drawing, I have illustrated a dynamo-electric machine construction including a coil member 10 which is wound on a suitable spool 11 composed of any suitable insulating material. A core member is provided having a steel or soft iron hub portion 12 which supports and threads the coil member 10. The core member is also provided with a plurality of interlaced and circumferentially spaced apart sets of finger portions 13 and 14, as is more clearly shown in Fig. 5. The interlaced portions 13 and 14

of the core member are connected together respectively at opposite ends of the core 12 by radially extending portions 15 which have bores 16 which fit over cooperating shoulders 17 of the core hub portion 12. The interlaced finger portions 13 and 14 are, therefore, supported by the steel hub, and a magnetic circuit is provided from either of the interlaced fingers 13 or 14 through the center of the coil by way of the steel core hub 12. A ring-shaped, circular, or cylindrical magnet 18 composed of any suitable magnetic material such as an iron, nickel, aluminum alloy having a high coercive force surrounds and is radially spaced from the core fingers 13 and 14 by a small air gap. The magnet has inwardly extending pole pieces 19 at one end of the magnet and inwardly extending pole pieces 20 at the other end of the magnet, thus providing axially spaced apart poles of opposite polarity. The pole pieces 19 and 20, therefore, provide a pair of groups of axially spaced apart pole pieces, and the pole pieces of each group are circumferentially or angularly spaced apart around the magnet. It will also be noted that the pole pieces 19 and 20 of the two groups of pole pieces are angularly or circumferentially spaced from each other so that they are not axially in line but are staggered. Any suitable number of pole pieces 19 and 20 may be provided, and in the arrangement illustrated in the drawing we have provided five pole pieces 19 and five pole pieces 20 so that there will be ten flux reversals for a complete revolution of the rotatable magnet. Furthermore, the pole pitch of the magnet poles is equal to the pole pitch of the interlaced fingers 13 and 14 so that when the fingers 13 are opposite the pole pieces 19 the fingers 14 will be opposite the pole pieces 20. The magnet may be supported in any suitable manner, and in the arrangement illustrated in the drawing magnetizable material is die cast into a supporting bracket 21 of non-magnetic material and the material making up the bracket extends into the spaces between the pole pieces 19 and 20 providing an integral supporting bracket for the magnet. A sleeve 22 is provided which extends through a bore 23 in the bracket so that the bracket 21 is carried by the sleeve 22 and this sleeve is rotatably mounted in a bearing 24 carried by a supporting member 25. A cup shape cover 26 covers the remainder of the magneto structure and is secured to the supporting member 25 in any suitable manner, such as by screws 27. A flange 28 is provided at one side of the supporting member 25 so that the magneto may be mounted on any suitable base member. The sleeve 22 extends into a bore 29 of the core hub 12 and supports a shaft 30 provided with a transversely extending pin 31 through the inner end thereof, which extends into a V shaped cam slot 32 in the sleeve member. A manually operable crank 33 is attached to an end of the shaft 30 which extends through the supporting or cover member and drives the magnet 18 through the pin 31 which connects the shaft 30 to the sleeve 22.

In order to provide an arrangement for closing an electric circuit when the operator rotates the crank 33, the shaft 30 is axially movable and its inner end is adapted to cooperate with a pin 34 which projects through a hole in the opposite side of the machine through the cover 26 for operating a switch. The pin 34 may be composed of any suitable material, such as fiber, and is slidably mounted in a collar 35 which is supported in the bore 29 of the steel core hub 22. A spring 36 is arranged between the collar 35 and a shoulder 37 on the end of the fiber pin 34 so as to bias the pin in an inwardly direction. The outward end 34 of the fiber pin is adapted to cooperate with a switch, indicated generally by the numeral 38. The switch 38 may be of any suitable type and in the arrangement illustrated in the drawing includes a movable contact arm 39 having a plurality of contacts adapted to cooperate with stationary contacts 40 and 41.

Operation of our improved magneto is as follows: The switch 38 of the magneto may be connected in any suitable circuit such as a standard telephone magneto bell-ringing circuit. When it is desired to ring a subscriber's line the magneto is cranked, which causes the magnet with the pole pieces 19 and 20 to rotate with respect to the cooperating stationary core structure. When the poles of one group, such as the pole pieces 19, are opposite or overlying one group of fingers, such as the fingers 13, the flux will pass from the pole pieces 19, assuming that they are north poles, through the fingers 13, through the core hub 12, and then to the fingers 14 and back to the south poles 20 which overlie at that particular instant the fingers 14. When the magnet has been rotated a distance equal to a pole pitch, the pole pieces 19 will overlie the fingers 14, so that the flux will pass through these fingers and then through the steel core hub 12 in the opposite direction, to the fingers 13, and back to the south poles 20. In this manner, there will be ten flux reversals for one complete revolution of the magnet, since the magnet has five north poles and five south poles which cooperate with ten fingers of the core member. It will also be seen that since the shaft 30 is movable in an axial direction, the operator may operate a switch by pushing the handle 33 axially until the fiber pin 34 presses the movable contact arm 39 into engagement with the stationary contact 41, which connects the coil 10 in the proper electrical circuit. As soon as the hand of the operator is removed from the crank it flies back so that the contact 39 contacts the stationary contact 40 which is the talking position of the switch.

In Figs. 6 and 7, I have illustrated a modification of the magneto illustrated in Figs. 1 to 5, inclusive. A core is shown in Fig. 6 provided with sets of interlaced fingers 13' and 14' which are skewed relative to the axis of the core. By placing these fingers at a sufficient angle with the longitudinal axis, the pole pieces may be placed in substantial axial alignment. The pole pieces 19' and 20' on a magnet 18', as illustrated in Fig. 7, are nearly in alignment in an axial direction. With such a construction when the fingers 13' overlie the pole pieces 19' the fingers 14' will overlie the pole pieces 20' so as to provide the desired magnetic flux path similar to that provided with the construction illustrated in Figs. 1 to 5, inclusive. The operation of a magneto provided with a core and magnet structure as illustrated in Figs. 6 and 7 is similar to that illustrated in Figs. 1 to 5, inclusive.

It will be seen that we have provided an improved dynamo-electric machine construction which may be employed in any dynamo-electric machine construction and in the arrangement illustrated in the drawing it is applied to a hand operated bell-ringing magneto. With such an improved structure, it is possible with approx-

imately 200 revolutions per minute of the crank to induce a current of sufficient magnitude and frequency in the coil so as to provide the desirable bell-ringing current. It is to be understood that if desired, the core and coil assembly may be mounted for rotation while the magnet structure remains stationary.

Modifications of the particular arrangements which we have disclosed embodying our invention will occur to those skilled in the art, so that we do not desire our invention to be limited to the particular arrangements set forth and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. A dynamo-electric machine including a stationary member having a coil member and a core member magnetically coupled therewith, and a concentric cylindrical rotatable magnet member having a pair of axially spaced apart groups of pole pieces and providing axially spaced apart poles of opposite polarity being adapted to react electrodynamically with said stationary member, the pole pieces of one group being circumferentially spaced apart from the pole pieces of the other group.

2. A dynamo-electric machine including a stationary member having a coil member and a concentric core member magnetically coupled therewith, and a concentric cylindrical rotatable magnet member having a pair of axially spaced apart groups of pole pieces and being adapted to react electro-dynamically with said stationary member, the pole pieces of one group being circumferentially spaced apart from the pole pieces of the other group.

3. A dynamo-electric machine including a stationary member having a coil member and a surrounding core member magnetically coupled therewith, and a cylindrical rotatable member including a permanent magnet adapted to react electro-dynamically with said stationary member, said magnet, having a pair of axially spaced groups of inwardly extending circumferentially spaced apart pole pieces.

4. A dynamo-electric machine including a coil member, a core member having a portion threading said coil member and a plurality of interlaced fingers surrounding said coil member and extending from opposite ends of said threading portion, and a magnet having a plurality of inwardly extending pole pieces adapted to cooperate magnetically upon relative rotation with said fingers, some of said pole pieces being axially spaced apart from other of said pole pieces providing axially spaced apart poles of opposite polarity and said pole pieces being circumferentially spaced apart.

5. A dynamo-electric machine including a coil member, a core member having a portion threading said coil member and a portion surrounding said coil member, a cylindrical magnet surrounding said core member and having an integral supporting bracket and a plurality of inwardly extending pole pieces adapted to cooperate magnetically with said core member, a supporting member, and a sleeve rotatably mounted in said supporting member for rotatably mounting said magnet bracket.

6. A dynamo-electric machine including a coil member, a core member having a portion threading said coil member and a plurality of spaced apart interlaced fingers surrounding said coil member and extending from opposite ends of said threading portion, and a rotatable substantially cylindrical magnet having an integral supporting bracket and a plurality of inwardly extending pole pieces adapted to cooperate magnetically with said fingers, a supporting member, and means rotatably mounted in said supporting member for rotatably supporting said magnet.

7. A dynamo-electric machine including a coil member, a core member having a portion threading said coil member and a portion surrounding said coil member, a cylindrical magnet surrounding said core member and having an integral supporting bracket and a plurality of inwardly extending axially spaced apart pole pieces adapted to cooperate magnetically with said core member, a supporting member providing axially spaced apart poles of opposite polarity, a sleeve rotatably mounted in said supporting member for rotatably mounting said magnet bracket, and means including a shaft projecting from said cover and connected to said sleeve for rotating said magnet bracket.

KENNETH A. KILLAM.
FRANK W. MERRILL.

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CERTIFICATE OF CORRECTION.

Patent No. 2,312,101. February 23, 1943.

KENNETH A. KILLAM.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 23, after the word "pieces" strike out --and--; and line 24, before "being" insert --and--; line 45, after the word "magnet" strike out the comma; and second column, lines 42 and 43, strike out the comma and words ", a supporting member providing axially spaced apart poles of opposite polarity, a sleeve" and insert instead --providing axially spaced apart poles of opposite polarity, a supporting member, a sleeve--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of April, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

4

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