Oct. 7, 1941. T. TOGNOLA 2,257,824

ROTOR

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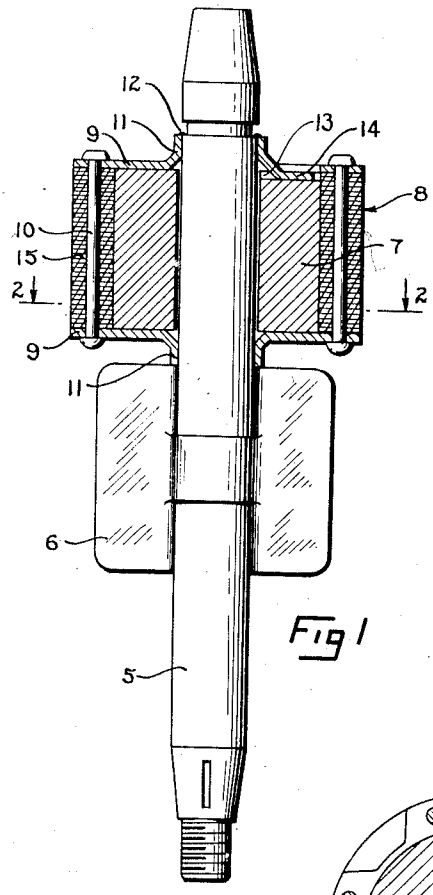


Fig 1

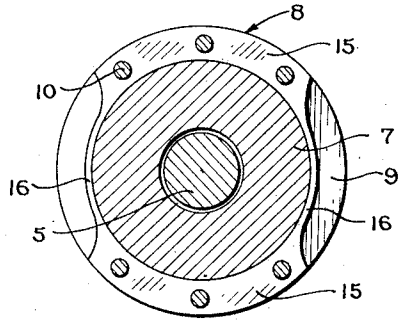


Fig 2

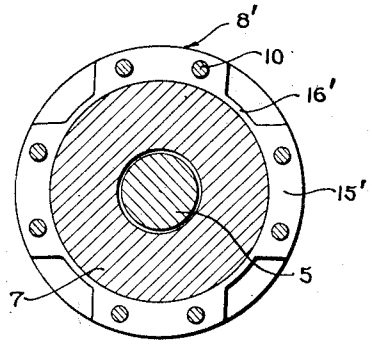


Fig 3

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ROTOR

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1 Claim. (Cl. 171—209)

This invention relates to electrical apparatus and more particularly to rotors adapted for use in magneto generators and the like.

Rotors for magneto generators and like electrical apparatus are rotated at high speed for long periods of time and the parts thereof are accordingly subjected to large and persistent centrifugal forces. As a result of this fact, known rotors of the above character have been constructed from relatively heavy and expensive castings which require considerable machining before assembly. Prior rotors have also been made up of a comparatively large number of such parts and have accordingly been expensive to manufacture and assemble. Rotors that are so constructed are heavy, thereby requiring relatively large amounts of energy for rotation thereof, and also bulky, thereby requiring a relatively large housing space for a given output capacity. From the electrical point of view, magnetic rotors heretofore provided have not been entirely satisfactory in that the same have not been able to produce a large enough current at low speed nor a sufficiently constant current over a broad range of speeds beginning with a relatively low speed.

It is accordingly one of the objects of the present invention to provide a novel magnetic rotor which is adapted for use in a magneto generator to render the same capable of generating a substantially constant maximum current over a wide range of speeds.

Another object is to provide a novel magnetic rotor which is so constructed as to have a high coercive force and, hence, to produce relatively high current at low speeds when employed as part of a magneto generator.

A further object is to provide a novelly constructed magnetic rotor which is mechanically simple, strong and durable and electrically efficient.

Still another object is to provide a novel multipolar magneto rotor which comprises only a small number of simple parts which may be readily and inexpensively manufactured and assembled.

A still further object is to provide a novel magnetic rotor which is smaller and lighter than prior rotors of like capacity.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawing. It is to be expressly understood, however, that the drawing is for the purpose of illustration only and is not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claim.

In the drawing wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a side elevation, partly in section, of one form of two-pole magnetic rotor embodying the present invention;

Fig. 2 is a transverse section taken substantially on line 2—2 of Fig. 1; and,

Fig. 3 is a similar sectional view of a four-pole rotor embodying the invention.

One form of rotor embodying the present invention is illustrated in Figs. 1 and 2, by way of example, as a two-pole rotor adapted for use in a magneto generator and comprising a simple cylindrical shaft 5 which may be rotatably journalled in any well-known manner in a suitable generator housing. If desired, a cooling fan 6 may be secured to the central portion of shaft 5.

In order to facilitate assembly, minimize the cost and number of necessary parts, and reduce the weight thereof and space occupied thereby, without affecting the efficiency and durability thereof, the magnetic portion of the illustrated rotor is constructed in the form of a novel unit comprising a permanent magnet 7 which is preferably cylindrical with magnetic poles of opposite polarity alternately arranged around the periphery thereof in a known manner. Surrounding magnet 7 and contacting the entire outer surface thereof are a plurality of annular laminations 8 of comparatively soft, flux-conducting metal which are constructed in a novel manner to hereinafter appear. Laminations 8 and magnet 7 are held together as a part of a unitary structure and centered with respect to shaft 5 by a pair of novel retaining plates 9 engaging the ends of the magnet and a plurality of bolts or rivets 10 extending longitudinally of shaft 5 through said end plates and laminations.

In the form illustrated, novel end plates 9 are constituted by non-magnetic sheet-metal stampings which are of light weight and yet strong and which may be rapidly and inexpensively manufactured. Each of said end plates has an integral axially extending hub portion 11 formed at the center thereof for close sliding engagement with shaft 5 and a plurality of openings stamped therein for receiving rivets 10. Magnet 7 which preferably has a bore therethrough slightly larger than the outside diameter of shaft 5, is centered relative to the latter by end plates

9 and laminations 8. The rigid magnetic unit thus provided may be readily assembled, slipped into position on shaft 5 and secured against rotation, and axial movement relative to said shaft by brazing, as at 12, or other suitable means. In order to prevent rotation of magnet 7 relative to the other parts of the rotor, said magnet may be provided with a radial slot 13 or other suitable indentation in the end thereof into which a tongue 14 extends, said tongue being punched from and integral with one of the end plates 9.

In order that a magneto generator embodying the above described rotor will be enabled to produce a relatively large primary current at low speeds and a substantially constant maximum current over a wide range of speeds, each of the laminations 8 is stamped out from flux-conducting sheet metal in the form of a ring having an inner diameter substantially equal to the outside diameter of magnet 7 and alternate large and small radial thicknesses 15 and 16, respectively, circumferentially thereof, a thick portion 15 being provided for each magnetic pole of the magnet. Laminations 8 are mounted on magnet 7 in such a manner that thick portions 15 thereof constitute pole shoes while the thinner portions 16 constitute, in effect, keeper bars whereby the permanence and coercive force of the magnet are enhanced. With pole shoes 15 joined by bars 16, a closed magnetic flux path is provided for magnet 7 thereby materially reducing the loss of magnetism therefrom when the rotor is removed from the magnetizing machine. The residual magnetism of the present rotor is thus higher than it is in rotors heretofore made of like materials and the current generated by a magneto embodying the present rotor will accordingly reach a maximum or nearly maximum at a slower speed of rotation of the rotor.

Additionally, due to the flux shunting effect of bars 16, the same effectively limit the maximum current generated by a magneto embodying the above described rotor and materially reduces stray flux and hence the losses which may be attributed to the latter. Connecting bars 16 are preferably quite thin in a radial direction and the saturation thereof is accordingly very high so that the loss of flux therethrough under working conditions in a magneto, for example, is very small. Substantially all the flux of the magnet under working conditions, flows through the stator poles and coil core of the magneto which offer less resistance thereto than do the narrow bars 16. As the primary current generated by the magneto and, hence, the counter-electromotive force increase with increased speed of the rotor, more of the magnetic flux from magnet 7 is shunted through connecting bars 16 due to the increased resistance to the flow thereof through the stator poles, thereby limiting the maximum primary current and making said current substantially constant over a wide range of speeds. By thus limiting the maximum current generated, excessive wear or burning of the breaker contact points of the magneto is prevented. In one successful embodiment of the invention a nickel-aluminum-iron alloy magnet having an outside diameter of approximately one and three-quarters inches was employed with laminated soft-iron pole shoes of the character illustrated, the portions 15 of the laminations having a radial thickness of approximately one-quarter of an inch and the portions 16 thereof having a radial thickness of approximately one-sixteenth of an inch.

In Fig. 3 there is shown a four-pole rotor which is identical with the two-pole rotor above described except that laminations 8' are formed with twice as many equally-spaced thick and thin portions 15' and 16' respectively. The operation of the four-pole rotor is the same as above described except that more flux reversals through the magneto coil occur for each revolution of the rotor.

There is thus provided a novel magnetic rotor which is light, durable and inexpensive and which is so constructed that the detrimental effects of centrifugal forces during rotation thereof are substantially eliminated. The novel rotor comprehended by the invention also materially enhances the electrical characteristics of a magneto with which the same is employed, the current output of said magneto rising rapidly at low rotor speed and leveling off at a substantially constant maximum as the rotor speed increases. The novel rotor provided comprises only a small number of very simple parts which may be readily and quickly manufactured and assembled into a smaller unit than rotors of like capacity heretofore known. The reduced weight of the present rotor also permits greater, yet safe, speed with less driving energy.

Although only a limited number of embodiments of the invention have been illustrated and described, it is to be expressly understood that the invention is not limited thereto. For example, the pole shoes 15 and the connecting bars 16 therefor need not be laminated. A limited number of non-magnetic rings may also be used in place of some the laminations 15, 16 if desired. Various other changes, such as in the design and arrangement of parts illustrated, will now be apparent to those skilled in the art and may be made without departing from the spirit and scope of the invention. For a definition of the limits of the invention, reference is had primarily to the appended claim.

What is claimed is:

A magnetic rotor comprising a shaft, a cylindrical magnet surrounding said shaft, said magnet having poles of opposite polarity alternately arranged around the periphery thereof, annular laminations of magnetic material surrounding and engaging said magnet entirely around the periphery thereof, each of said laminations having radially thick portions adjacent the poles of said magnet joined by radially thin connecting portions, a non-magnetic sheet metal plate at each end of said magnet having a centrally disposed integral hub portion engaging said shaft, means extending through said end plates and laminations for securing the same together, and means for securing at least one of said end plates to said shaft.

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