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DYNAMO-ELECTRIC MACHINE FIELD MAGNET CONSTRUCTION WITH SPLIT POLES

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Fig. 1

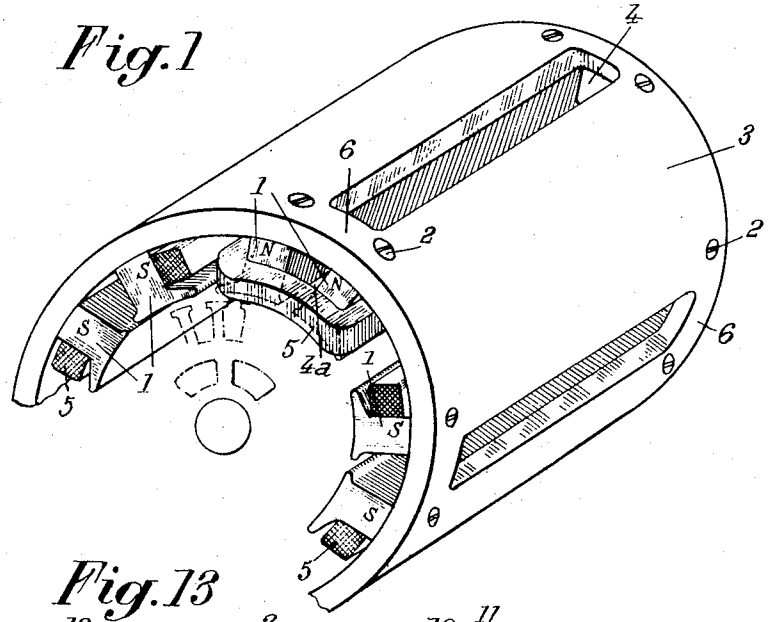

Fig. 13

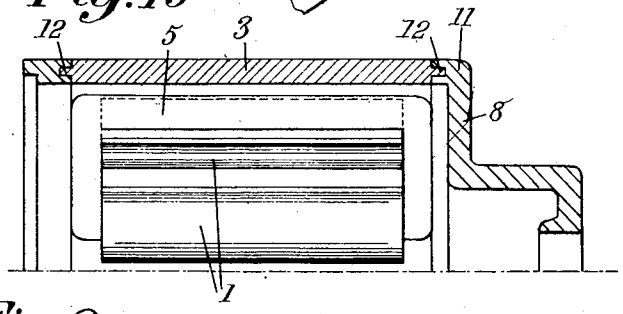

Fig. 2

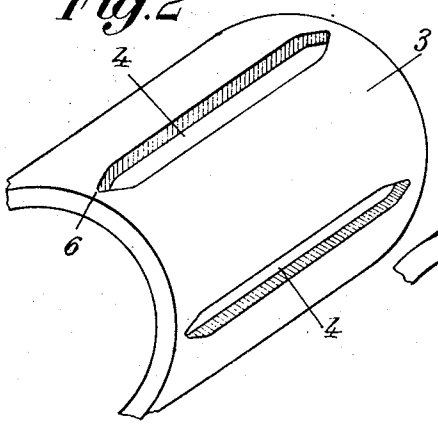

Fig. 5

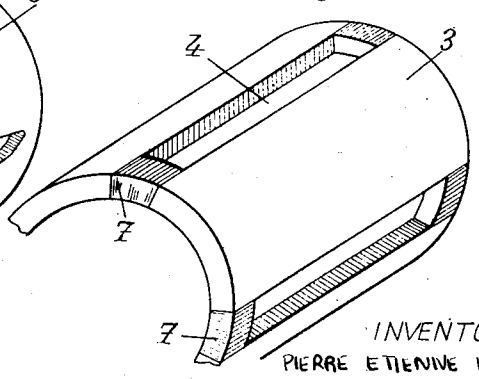

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Fig. 4

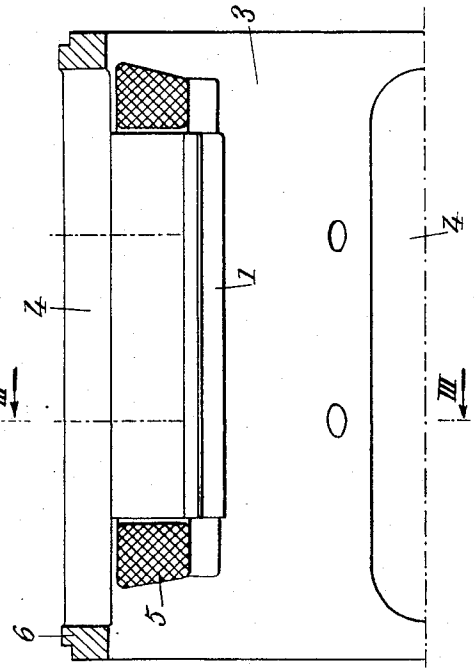

Fig. 3

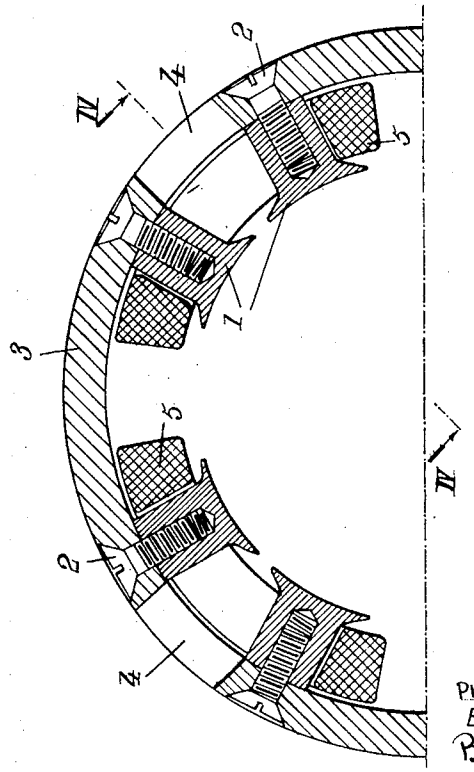

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Fig. 8.

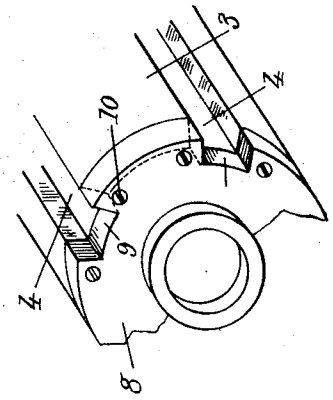


Fig. 11

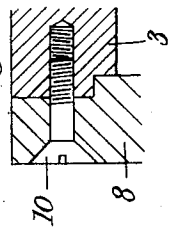


Fig. 7

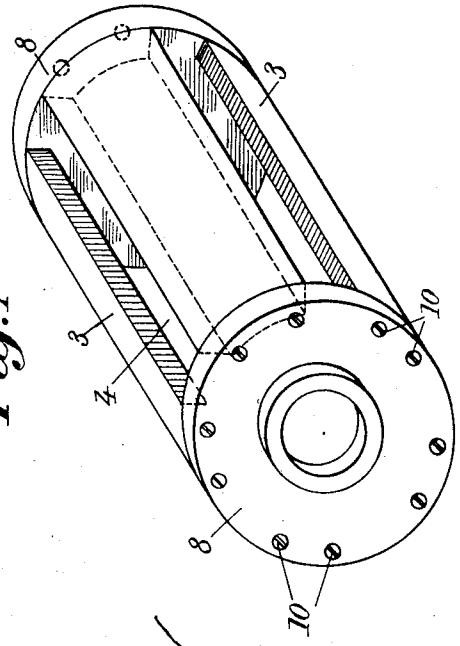


Fig. 10.

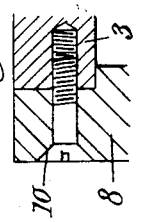


Fig. 6

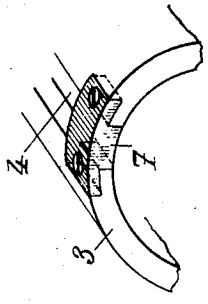
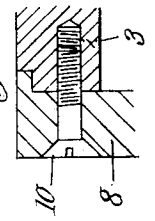


Fig. 9



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DYNAMO-ELECTRIC MACHINE FIELD MAGNET CONSTRUCTION WITH SPLIT POLES

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Fig. 12.

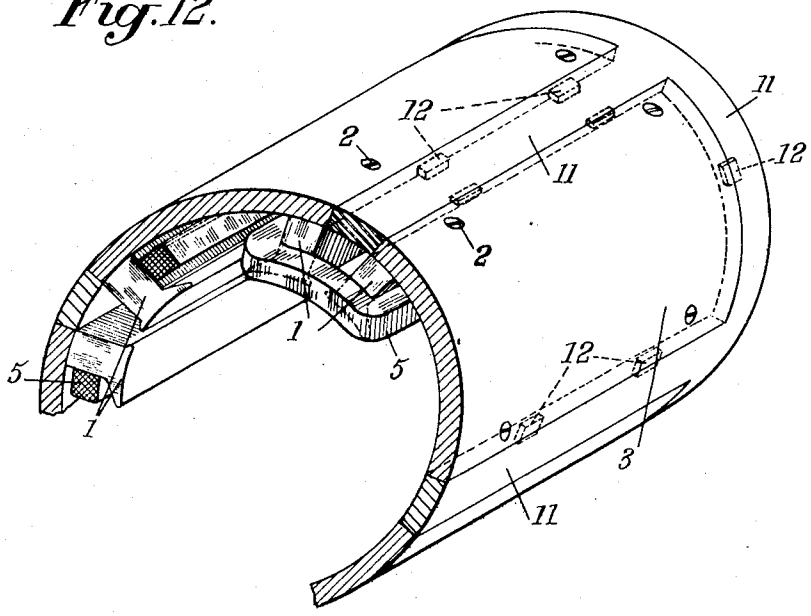


Fig. 14

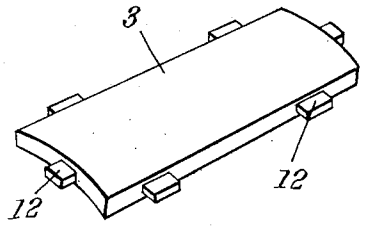
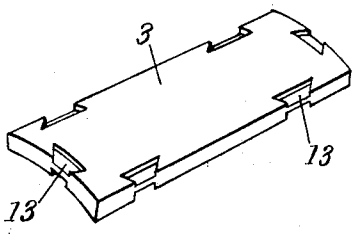


Fig. 15



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2,903,610

DYNAMO-ELECTRIC MACHINE FIELD MAGNET CONSTRUCTION WITH SPLIT POLES

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Application July 22, 1957, Serial No. 673,344

Claims priority, application France August 22, 1956

9 Claims. (Cl. 310—254)

The present invention relates to inductor devices for electric rotating machines having projecting field poles, that is to say in which the coils which create the inductor flux are wound around pole cores projecting radially from a supporting framework. The invention is more especially concerned with devices of this kind in which every pole core is constituted by two core elements practically insulated from each other, from the magnetic point of view, by a non magnetic space extending radially over at least most of the height of the core.

The chief object of the present invention is to provide a device of this kind which is better adapted to meet the requirements of practice, in particular from the point of view of easy construction and assembly.

The invention consists essentially in constituting the supporting framework of such a device by a kind of rigid closed cage the bars of which are made of a magnetic material, said bars being parallel to and distributed around the axis of the cage, each bar supporting, along its longitudinal edges, two respective core elements of opposed polarities, the intervals or gaps between said bars consisting of a non magnetic material (either gaseous or solid), and being respectively disposed opposite the intervals between the pairs of core elements which constitute the respective poles.

Preferred embodiments of this invention will be hereinafter described with reference to the appended drawings given merely by way of example and in which:

Fig. 1 is a perspective view, with parts cut away, of a dynamo inductor device made according to the invention.

Fig. 2 is a perspective view of a portion of such a device made according to a modification.

Figs. 3 and 4 show respectively in cross-section on the line III—III of Fig. 4 and in longitudinal section on the line IV—IV of Fig. 3, another modification of the inductor device according to the invention.

Figs. 5 to 8 are perspective views illustrating other modifications of this invention, respectively.

Figs. 9 to 11 are longitudinal sections of three modifications of a detail of a cage made according to Figs. 7 and 8.

Figs. 12 and 13 show, respectively in perspective views and in longitudinal section, still another modification of the invention.

Figs. 14 and 15 show two modifications of an element of the device of the Figs. 12 and 13.

It will be supposed in the following description that the invention is applied to the construction of an inductor for a dynamo or a starter having a high power for a given weight.

It should first be reminded that, chiefly for purposes of reducing the weight and eliminating the armature reaction, it has already been proposed, in inductor devices having projecting poles and for use in electrical rotating machines, to constitute each of the poles by two core elements practically insulated from each other, from the magnetic point of view, by a non magnetic space,

the roots of two consecutive core elements of opposed polarities being connected together by a magnetic piece, so that the whole of these two core elements and of said magnetic piece forms a single unit the cross section of which is substantially in the form of a horseshoe.

The manufacture of such units, either made of a single piece or of several identical pieces juxtaposed in the longitudinal direction (case of laminated poles), and the mounting of the inductor coils on such units are delicate and costly operations. Furthermore, these units must be accurately secured on a rigid supporting framework so that their relative positions are quite correct.

In order to obviate this drawback, according to the present invention, the supporting framework on which are mounted said core elements, which are made separately, is constituted by a kind of rigid closed cage the bars of which are made of a magnetic material, said bars being parallel to and distributed around the axis of the cage, each of said bars supporting, along its longitudinal edges respectively, two core elements of opposed polarities, the intervals or gaps between the bars, which intervals are made of a non magnetic material (either gaseous or solid), being disposed respectively in radial alignment with the spaces between the two magnetic core elements which constitute every pole.

On the drawings, reference numeral **1** designates the core elements of each pole, said elements being advantageously laminated, as known, and being manufactured separately.

These core elements are fixed directly, for instance by means of screws **2**, on the bars of magnetic material **3** the assembly of which forms the above mentioned cage. Every bar **3** is in the form of a prism or cylinder having longitudinal generatrices, that is to say extending parallel to the axis of the machine. The circumferential dimension of every bar is greater than its thickness. Advantageously, as shown by the drawings, each bar **3** is in the form of an annular sector.

Two core elements **1** of opposed polarities are carried by the longitudinal edges of every bar **3**, said core elements projecting radially toward the axis of the cage. Each bar **3** is separated from the adjacent one by an interval **4** which constitutes a gap between these bars, said gaps **4** being in radial alignment with the non magnetic spaces *4a* provided between the two core elements of every pole.

The provision of such a gap **4** has the following advantages:

It prevents an undesirable armature reaction flux from being closed through the cage, thus practically eliminating such flux,

It permits of reducing the weight of the cage.

The non magnetic material which constitutes said gaps may be either gaseous (air for instance) or solid (stainless steel, aluminium, and so on . . .).

The assembly of the bars of such an inductor is very easy. It suffices, for this purpose, to slip the coils **5** on the respective pairs of core elements forming the poles, and then to fix said pairs of core elements with the coils mounted thereon on the bars **3** of the cage by means of screws **2**.

In the construction of Fig. 1, the cage as a whole is constituted by a tubular piece of a magnetic material in which are provided slots **4** which form the air gaps (such slots being formed by milling or by cutting with a blowpipe), the bars **3** consisting of the portions of said tubular piece that are left between said slots **4**. It will be seen that the undesirable armature reaction flux which tends to propagate in a circumferential direction in every pole can in the present case be formed only by passing through the "bridges" **6** of magnetic material which are left at

the ends of air gaps 4 and which of course serve to assemble the bars 3 which form the cage.

The detrimental action of these bridges is reduced, for instance by reducing their longitudinal dimensions in their middle part, as shown by Fig. 2, where the ends of the air gaps are wedge-shaped.

In order to obtain the same result, the air gaps 4 may be made of a length equal to or even greater than that of the core elements 1, as shown by Figs. 3 and 4, so that the cage extends longitudinally beyond said cores and even beyond coils 5. With such an arrangement, the bridges 6 are practically outside of the path which the armature reaction flux would follow and only a negligible portion of the flux can pass through said bridges.

Another way of eliminating the armature reaction flux consists in making bars 3 of a magnetic material and interconnecting them by bridges 7 of a non magnetic material, as shown by Fig. 5.

Said bridges 7 may be made of a metal such as stainless steel which is welded to the mild steel which constitutes bars 3. This is the arrangement illustrated by Fig. 6.

In the construction of Fig. 6, the bridges 7 are fixed by screws to bars 3.

According to another embodiment of this invention, bars 3 are directly fixed on end discs 8 (as shown on Fig. 7) which constitute bearings for the rotor of the machine.

These discs may be made of a non magnetic material but this is not necessary, especially when they are provided with notches 9 (Fig. 8) in line with air gaps 4.

Bars 3 are preferably fixed to discs 8 by means of screws 10, the relative radial position of said bars with respect to said discs being accurately determined by suitable shoulders, as shown on Figs. 9, 10 and 11.

According to another embodiment illustrated by Figs. 12 and 13, bars 3 are caught in a framework 11 of a non magnetic material such as aluminium or an alloy thereof, when said framework is cast or moulded, said framework forming the gaps 4 and the bridges 7. One of the end discs 8 may even be constituted by a portion of said framework (Fig. 13).

Said framework might even include both of the end discs 8 of the cage by making said framework of two portions assembled together along a diametral plane of the machine.

In order to have bars 3 securely held in framework 11, the edges of said bars 3 may be provided with projections or lugs 12 (Fig. 14) adapted to be caught in the non magnetic material of the framework, when the latter is cast or moulded. Notches or recesses such as 13 (Fig. 15) may also be provided into which said non magnetic material of the framework penetrates.

When the gaps 4 instead of being air gaps are constituted by a non magnetic solid material, the rigidity of the system is improved.

What I claim is:

1. For use in a rotating electric machine, an inductor device which comprises, in combination, a rigid closed cage including a plurality of bars parallel to and distributed around the axis of said cage, said bars being made of a magnetic material, the gaps between said bars consisting of a non magnetic material, a plurality of field poles projecting radially from said cage, each of said poles consisting of two elongated core elements extending respectively along the respective facing edges of two of said bars adjacent to each other, with a non magnetic space between said two core elements, said spaces being in line with said gaps, said core elements being distinct pieces rigidly secured to said magnetic bars, and a plurality of coils surrounding said field poles, the two core elements forming each of said poles being surrounded by one of said coils, respectively.

2. An inductor device according to claim 1, in which said gaps between the bars are air gaps.

3. An inductor device according to claim 1, in which said gaps between the bars are filled with a non magnetic solid material.

4. An inductor device according to claim 1, in which said bars are portions of a tubular unit of a magnetic material provided with longitudinal slots forming said air gaps between said bars, the portions of said tubular unit on either sides of said slots forming magnetic bridges of small dimensions.

5. An inductor device according to claim 4, in which the length of said slots is at least equal to that of said core elements.

6. An inductor device according to claim 1, in which said bars of a magnetic material are assembled together by parts of a non magnetic material.

7. An inductor device according to claim 1, further including end discs at right angles to the axis of said cage for supporting and assembling said bars of a magnetic material.

8. An inductor device according to claim 1, including a framework of a non magnetic material, said bars being embedded in said framework.

9. An inductor device according to claim 1 including a framework of a non magnetic material, said bars being secured in said framework by a molded construction, the edges of said bars being toothed, so as to ensure a secure assembly with the framework.

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