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EDDY CURRENT BRAKES

2,911,550

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2 Sheets-Sheet 1

Fig. 1.

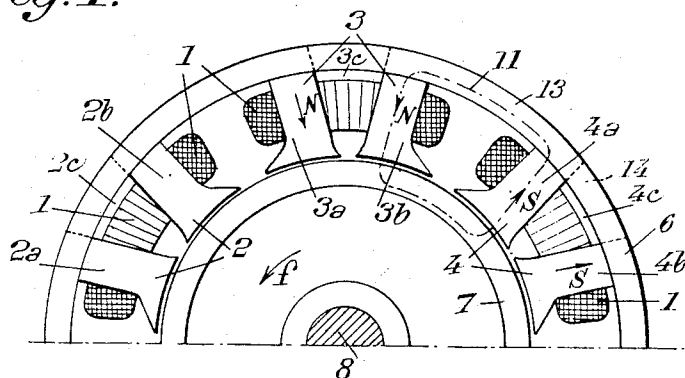


Fig. 2.

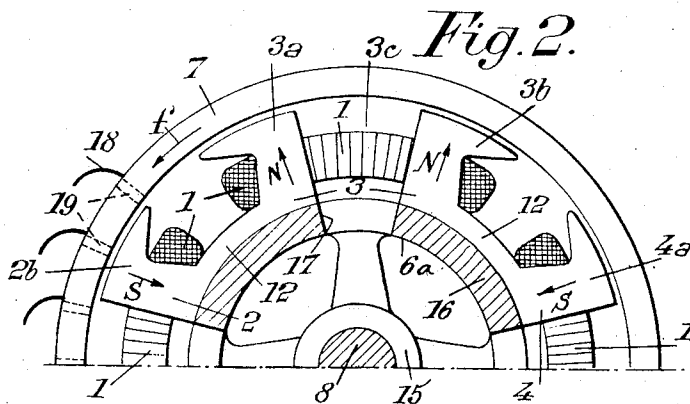


Fig. 4.

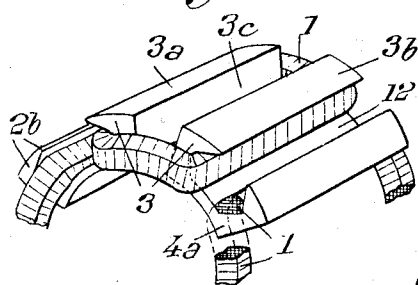
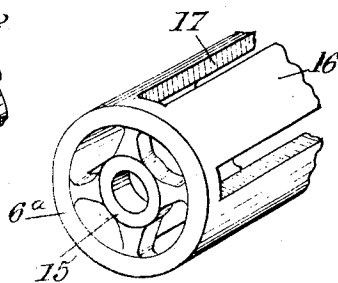


Fig. 3.



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Fig. 5.

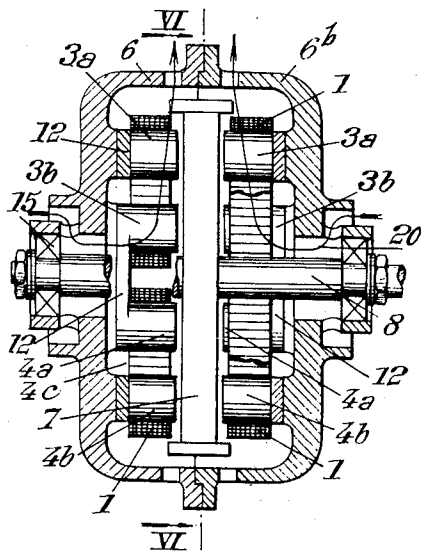


Fig. 6.

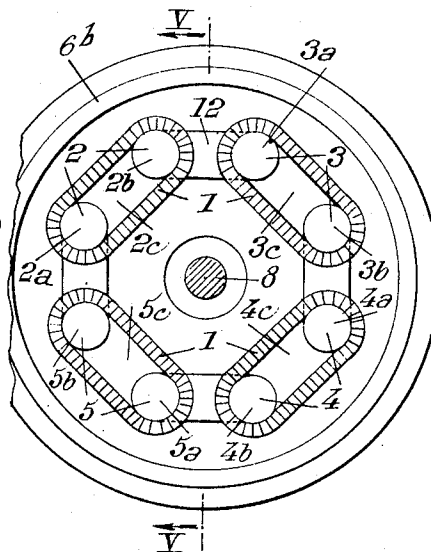


Fig. 7.

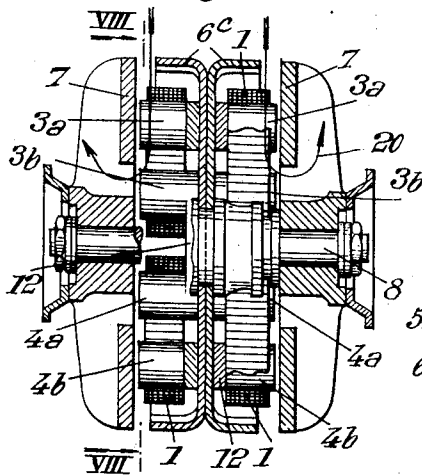
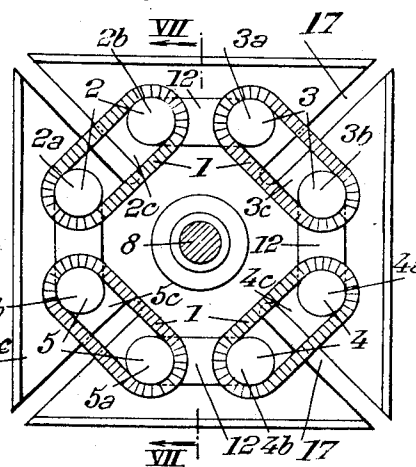


Fig. 8.



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EDDY CURRENT BRAKES

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2 Claims. (Cl. 310—93)

The present invention relates to braking or slowing down devices of the eddy current type.

Such a device includes a frame carrying an inductor essentially constituted by a plurality of electro-magnets distributed about the axis of a part rotatable with respect to said frame so as to create a magnetic field in an armature made of a piece of a conducting material rigid with said part so as to set up therein eddy currents which brake the relative movement of rotation between said part and said frame.

The object of this invention is to provide a device of this kind which is better adapted to meet the requirements of practice than those existing at the present time.

For this purpose, according to the present invention, the cores of the electro-magnets each include two core elements insulated from each other, from a magnetic point of view, by a non magnetic space, each of said two core elements of one core being connected with the adjoining core element of opposed polarity of the core of the next electro-magnet through magnetic means extending between the ends of said core elements located on the other side thereof from the armature, the core elements being rigid with a support from which they project in a direction transverse to the portion of the armature adjacent to them, and the electro-magnet coils surrounding the respective pairs of core elements forming the electro-magnet cores and having their turns substantially at right angles to the direction in which said core elements are projecting from said support.

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

Fig. 1 is a half elevational view with parts in cross-section of a braking device according to the invention.

Fig. 2 is a similar view of a modification.

Fig. 3 is a perspective view of the framework of the inductor of the braking device of Fig. 2, and Fig. 4 shows the arrangement of the electro-magnets of these inductors.

Figs. 5 and 6 show respectively in axial section on the line V—V of Fig. 6 and in cross-section on the line VI—VI of Fig. 5 (the armature being cut away) a braking device made according to another embodiment of the invention.

Figs. 7 and 8 show, respectively in axial section on the line VII—VII of Fig. 8 and in cross-section on the line VIII—VIII of Fig. 7, a braking device made according to still another embodiment of the invention.

The braking or slowing down device according to the present invention essentially comprises a fixed inductor or stator including electro-magnets constituted by coils 1 surrounding cores 2, 3, 4, 5 projecting from a support 6.

A rotating armature or rotor, constituted by a piece 7 of a conducting material is located close to said inductor, so that the magnetic fields created by said electro-magnets can close through said armature.

Said fields produce eddy currents in the conducting

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mass of the rotating armature 7. The electric energy spent by these eddy currents, which is transformed into heat, is supplied from the mechanical energy of the rotor and therefore of the shaft 8 to be braked (which is rigid with said rotor), thus causing said shaft to be braked.

Cooling means are provided for evacuating the heat created by this braking system.

Every electro-magnet core such as 2, 3, 4, 5 is constituted by two core elements 1a and 1b, 2a and 2b, 3a and 3b, 4a and 4b respectively, the two core elements of every pair being practically insulated from each other from a magnetic point of view and being, for this purpose, separated from each other by a non magnetic space such as 2c, 3c, 4c, 5c, forming a gap which may be an air gap or be made of a solid material.

The root of every core element is magnetically connected with the root of the adjacent core element of opposed polarity of the next electro-magnet, so that the inductor flux such as 11 (Fig. 1) can pass through the magnetic path thus produced. Such a magnetic connection may be constituted by individual bridges 12 (Fig. 2), the whole of two core elements and of such a bridge having the shape of a horseshoe. It may be constituted by a single piece or by the juxtaposition of identical sheets (laminated core). Every bridge element 12 may also be screwed or otherwise fixed to the corresponding core element. The magnetic connection between the root portions of the core elements may also be achieved by magnetic portions 13 (Fig. 1) of support 6 on which the cores are secured, for instance by screwing. In order to prevent the formation of an armature flux, these portions 13 are separated from one another by parts 14, made of a non magnetic material, located opposite the non magnetic spaces such as 2c, 3c, 4c, 5c above referred to, which are provided between the two core elements of every core.

Fig. 1 shows a braking device in which the armature 7 is constituted by a hollow tube coaxially located inside the annular inductor.

This inductor includes a cylindrical support 6 from which the core elements 2a and 2b, 3a and 3b, 4a and 4b, rigidly fixed thereto, project radially toward the axis of shaft 8.

A cooling air circulation is, for instance, obtained in this case by a fan (not shown) mounted at the end of shaft 8 and carrying blades rigid therewith which send cooling air into recesses provided in the mass of the rotor in radial, longitudinal or other directions.

Figs. 2, 3 and 4 show a modification in which the inductor is located inside the armature 7. The rotor including said armature is for instance bell-shaped. It is rigid with shaft 8 which is journaled in bearings 15 carried by the stator.

As shown by Fig. 3, the support member 6b of the inductor is constituted by a kind of cage, the longitudinally extending bars 16 of which are made of a magnetic material, said bars being separated by slots 17 containing a non magnetic material (air, in this case). Each of these slots or air gaps 17 is located opposite the non magnetic interval, such as 3c, which separates from each other the two core elements of every core.

The unit constituted by two core elements of two consecutive electro-magnets, said core elements being connected together by a part 12 of a magnetic material, are made separately. Then the coils 1 are mounted around the adjacent core elements of two consecutive units and the ring-shaped structure thus formed (Fig. 4) is stretched and slipped longitudinally on support 6a (Fig. 3) on which it is then fixed.

If the core elements are made individually, the cores

may be mounted around the two core elements of every pair before fixing said core elements to the support.

The core elements, instead of being mounted on a cylindrical support may be fixed on the end discs of said support.

In this embodiment, cooling air circulation is ensured by blades 18 (Fig. 2) fixed to the outer face of the rotor and sending air into holes 19 provided in said rotor.

In this case, as in the preceding embodiment, in order to obtain a better transformation of the mechanical energy into eddy currents, the rotor is advantageously coppered either wholly or partly.

In the embodiment of Figs. 5 and 6, the armature 7 consists of a disc fixed on shaft 8 and the inductor includes two bell-shaped supports 6b opposed to each other and located on either side of said disc 7, each of said supports 6b carrying electro-magnets the cores of which project toward disc 7 and extend to a close distance therefrom, the electro-magnet coils 1 surround pairs of core elements such as 2a and 2b extending in directions parallel to the axis of disc 7. Of course, shaft 8 extends through at least one of the bell-shaped supports 6b, so as to be secured to the part to be braked. In this construction, the adjacent core elements of opposed polarities are connected together by bridge elements 12 and every support 6b is made of a non magnetic material (for instance aluminium or an alloy thereof) or it is separated from said bridge elements 12 by a layer of non magnetic material.

In the construction of Figs. 7 and 8, the armature 7 consists of two external annular discs fixed on shaft 8. The inductor includes electro-magnets disposed between said discs 7 and constituted by coils 1, each surrounding a pair of core elements such as 2a and 2b projecting from supports 6c in a direction parallel to the axis of the shaft. Supports 6c may be made of a magnetic material, provided that non magnetic gaps (for instance air gaps) 17 are supplied opposite the spaces such as 2c provided between the two core elements of every core. These air gaps 17 may be constituted by radial slots in support 6c, as shown on Fig. 8.

The cooling air circulation is indicated by arrows in the top portions of Figs. 5 and 7.

Of course, both the inductor and the armature might

be rotatable or the armature might be fixed and the inductor rotatable with respect thereto.

What I claim is:

1. An eddy current brake for retarding the movement of a rotating part journalled in a frame about an axis which comprises, in combination, an inductor rigid with one of the two above mentioned elements, an armature constituted by a piece of a conducting material rigid with the other of said elements, so that said armature and said inductor have a relative movement of rotation with respect to each other about the axis of said rotating part, said inductor including a support rigid with said frame and extending around said axis and a plurality of electro-magnets carried by said support and distributed about said axis, each of said electro-magnets comprising two core elements insulated from each other from a magnetic point of view by an air gap between them, said two core elements being rigid with said support and projecting therefrom in a direction transverse to the portion of the armature adjacent to them, and a coil surrounding both of said core elements and the turns of which are substantially at right angles to the direction in which said core elements are projecting from said support, and magnetic means for connecting together every two consecutive core elements of opposed polarities belonging to two consecutive electro-magnets, said magnetic connecting means being interposed between the ends of the core elements located on the other side thereof from said armature, said armature and said support being provided with passages for the circulation of air through said air gaps, and means for causing air to circulate through said apertures and said air gaps for cooling purposes.

2. An eddy current brake according to claim 1, in which said support is made of a magnetic material provided with slots forming air gaps located in line with the air gaps between said core elements.

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