April 8, 1958 P. E. BESSIERE 2,830,206

FOUCAULT CURRENT APPARATUS AND IN PARTICULAR BRAKING APPARATUS

Filed Nov. 23, 1954 2 Sheets-Sheet 1

Fig. 1.

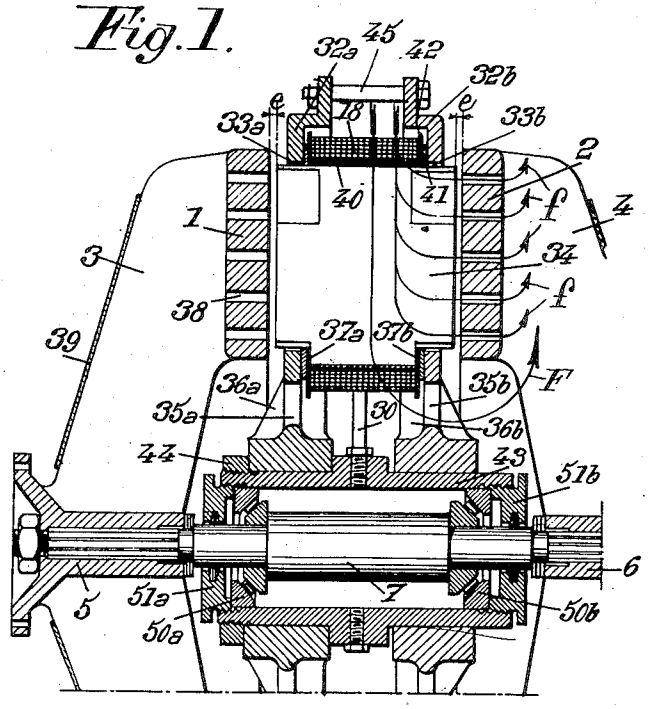


Fig. 3.

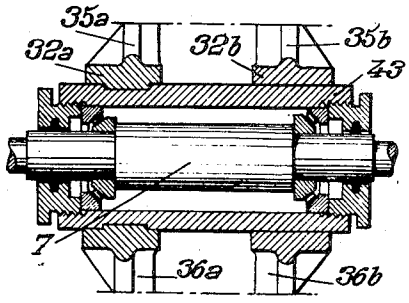
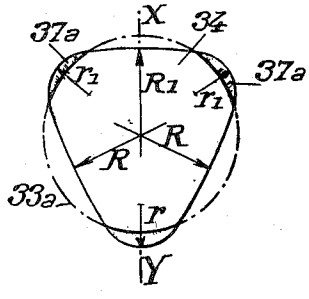


Fig. 2.



INVENTOR
Pierre, Etienne Bessiere
BY
Bailey, Stephens and Huettig
ATTORNEYS

April 8, 1958 P. E. BESSIERE 2,830,206

FOUCAULT CURRENT APPARATUS AND IN PARTICULAR BRAKING APPARATUS

Filed Nov. 23, 1954 2 Sheets-Sheet 2

Fig. 4.

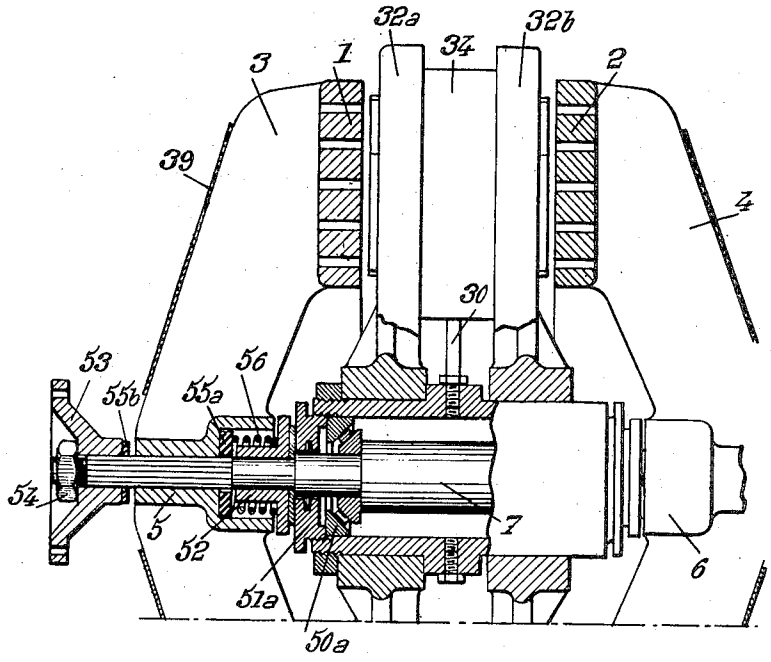
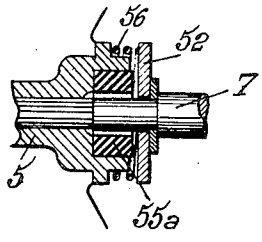


Fig. 5.



INVENTOR
Pierre Etienne Bessiere
BY
Bailey, Stephens and Hiuttig
ATTORNEYS

United States Patent Office 2,830,206 Patented Apr. 8, 1958

2,830,206

FOUCAULT CURRENT APPARATUS AND IN PARTICULAR BRAKING APPARATUS

Pierre Etienne Bessiere, Paris, France, assignor to Compagnie Telma, Paris, France, a society of France

Application November 23, 1954, Serial No. 470,720

Claims priority, application France November 25, 1953

5 Claims. (Cl. 310—93)

The present invention relates to a Foucault current apparatus and in particular to a slowing down or braking device comprising a rotating armature essentially constituted by two discs of a ferro-magnetic material, fixed at a distance from each other on the shaft of the apparatus and a fixed inductor located in the space between said discs and including a plurality of electro-magnets forming a circular row around the shaft of the apparatus, the whole being arranged in such manner that when the electro-magnets are energized, the two discs of the rotor rotate in the electric fields of said electro-magnets and Foucault currents are produced in said armature discs.

The object of my invention is to provide an apparatus of this kind which is better adapted to meet the requirements of practice than those used up to the present time.

For this purpose, in the apparatus according to my invention, the cores of the electro-magnets are constituted by substantially cylindrical bars of drawn or rolled iron supported by two fixed discs or plates parallel to each other and perpendicular to the apparatus shaft, each of said cores extending through said fixed discs or plates.

According to a preferred embodiment of my invention, the parts which form said electro-magnet cores are constituted by sections from a soft steel drawn bar and the two plates which carry said cores also support a central sleeve in which the bearings of the apparatus shafts are supported.

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

Fig. 1 is an axial sectional view of an apparatus according to my invention.

Fig. 2 is a front view of one of the electro-magnet cores.

Fig. 3 is a partial view showing a modification of the device of Fig. 1.

Fig. 4 shows another embodiment of a Foucault current apparatus according to my invention.

Fig. 5 is a part view showing a detail modification of the device of Fig. 4.

The apparatus of Figs. 1 to 4 includes an armature constituted by two discs **1** and **2** of a magnetic metal coaxial and rigid with a shaft **7** and disposed on either side of a fixed inductor system **18—34**.

Discs **1** and **2** are connected through radial arms **3** and **4** with hubs **5** and **6** keyed on shaft **7**. Said radial arms **3** and **4** are shaped to form fan blades. The shaft to be braked is made rigid with shaft **7**.

The inductor system includes a plurality of electro-magnets the cores of which, made of a magnetic metal, have a general cylindrical shape, with their generatrices parallel to the axis of shaft **7**. Said cores are carried by two discs of a non magnetic metal at right angles to said axis and through which said cores extend, said discs being, for this purpose, each provided with a circular row of holes in which said cores are engaged.

Advantageously said cores are constituted by small bars

of soft drawn steel, obtained for instance by cutting a bar of soft drawn steel into sections. Such cores have a high regularity of texture and an excellent permeability to magnetic flux.

In the example of the invention illustrated by the drawings, the cores are shown at **34** and the discs at **32***a* and **32***b*. These discs may have a circular or polygonal outline.

Each of these discs is provided with two concentric circular rows of holes. The holes of the outer row (**33***a* for disc **32***a* and **33***b* for disc **32***b*) form housings for the ends of cores **34**. The holes of the inner row (**35***a* for disc **32***a* and **35***b* for disc **32***b*) form passages for the flow of air streams travelling radially and inwardly through the space between discs **32***a* and **32***b* and, after passage through said holes **35***a*, **35***b*, outwardly on the outer sides of said discs, as shown by arrow F for one of them.

Discs **32***a* and **32***b* are reinforced by radial ribs **36***a* and **36***b* provided between said holes **35***a* and **35***b*. Advantageously, discs **32***a*, **32***b* are made of cast metal.

Cores **34**, in the form of cylinders of suitable cross section, have their ends of smaller section so as to engage in holes **33***a*, **33***b* and to form shoulders **37***a*, **37***b* applied against the inner faces of discs **32***a*, **32***b* (with the interposition of elements **41** and **42** as hereinafter explained).

Cores **34** may be assembled with discs **32***a*, **32***b* in any suitable way, for instance as follows:

In the construction illustrated by Fig. 1, disc **32***a* is engaged on a sleeve **43** and fixed thereon by means of a nut **44**. Then cores **34**, provided with their windings **18**, are fitted in holes **33***a*. Disc **32***b* engaged on sleeve **43**, is forced toward disc **32***a* so that said cores are also engaged in the holes **33***b* of said disc **32***b*. The shoulders **37***a* of the cores form abutments limiting the movement of discs **32***a* and **32***b* toward each other. These discs are then assembled together by means of bolts **45** and fixed to the frame of the apparatus, for instance a vehicle, which is to be fitted with the braking device.

With the construction of Fig. 3, the assembly is performed similarly but disc **32***a* is fixed to sleeve **43** by being cast around it.

Shaft **7** is mounted in sleeve **43** through bearings which will be more fully described hereinafter.

Advantageously, cores **34** are made of a cross section as shown by Fig. 2, i. e. in the form of an isosceles triangle having curvilinear sides. These sides include two circular arcs having a radius R and a circular arc having a radius R_1, connected together by circular arcs having radii equal to r and r_1 as shown by the drawing. R and R_1 are relatively large and r and r_1 relatively small with respect to the dimensions of the core. Of course the curvilinear arcs are not necessarily exactly circular. The plane of symmetry XY of every core is radial, i. e. passes through the axis of shaft **7**.

One interesting advantage of such a shape of the cores is that while ensuring a high magnetic flux it facilitates the circulation of air along the path illustrated by arrow F (and also along paths illustrated by arrows *f* owing to the provision of holes **38** in rotor discs **1** and **2**). Side plates **39** carried by radial arms **3** and **4** serve to guide the air streams toward the outer periphery of the rotor. These plates **39** extend nearly as far as the outer periphery of discs **1** and **2**. A supplementary advantage of said plates **39** is that they protect radial arms **3** and **4** against stones as might be thrown thereon by the vehicle wheels.

Another advantage of cores shaped as shown by Fig. 3 is that they have a rounded surface without ridges or flat areas whereby the wires forming windings **18** can be wound directly thereon (preferably with the interposition of an asbestos lining **40**). There is no risk of the wire

being cut either during its winding or when the device is in service. Windings 18 are held laterally by plates 41 with insulating rings 42 interposed between said plates and the windings.

Shaft 7 is mounted in sleeve 43 by means of two opposed thrust bearings 50*a*, 50*b* each interposed between a shoulder of shaft 7 and a tightening screw-threaded ring 51*a*, 51*b* engaged in one end of sleeve 43. These rings may be provided with packing means for lubricating oil.

The portion of shaft 7 between its shoulders is relatively little heated, whereby it can be mounted between thrust bearings. The shaft portions that are heated are those which carry radial arms 3 and 4. But as the device is symmetrical, the air gaps *e* on either side of the armature remain equal to each other.

In the modifications of Figs. 4 and 5, the armature discs 1 and 2 are slidable axially, being urged away from each other by resilient means and their displacements toward each other being limited by suitable abutments.

For instance, as shown on the left hand side of Fig. 4 (the arrangement being the same on the other side since the device is symmetrical) hub 5 is mounted by means of splines on the end of shaft 7 so that it can slide along said shaft between two limit positions. The inner limit position is determined by abutment with a sleeve 52 bearing against ring 51*a* and the outer limit position is determined by abutment with the inner edge of coupling member 53 fixed to the shaft by a nut 54. Resilient rings 55*a*, 55*b* are provided, to reduce shocks of hub 5 against its abutments. A spring 56 is interposed between hub 5 and sleeve 52 so as to urge the hub outwardly. This spring 56 is housed inside hub 5, in the construction of Fig. 4 (in the construction of Fig. 5, spring 56 is on the outside of hub 5).

The same result could be obtained, in the construction of Fig. 1, by making arms 3 and 4 sufficiently resilient and fixing hubs 5 and 6 longitudinally on shaft 7.

With such an arrangement, when the braking device is not in operation and no current is flowing through windings 18, the rotor discs are held by springs 56 away from the inductor whereby any risk of friction between the fixed and rotating parts is eliminated. On the contrary when current is being passed through windings 18 the armature discs 1 and 2 are pulled toward the inductor portion, and air gap *e* becomes very small which achieves a high electromagnetic efficiency.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. A Foucault current braking apparatus which comprises, in combination, a frame, a shaft to be braked, two armature discs parallel to each other mounted on said shaft for rotation together therewith, a fixed inductor located between said discs including a plurality of electro-magnets each constituted essentially by a core and a winding, said cores being of substantially cylindrical shape with their generatrices parallel to said shaft, two discs fixed to said frame and parallel to each other, each provided with a circular row of holes, at least the ends of said cores extending through said holes, means for fixing said cores with respect to said inductor discs, a central sleeve carried by said last mentioned discs, and bearings for said shaft carried in said sleeve.

2. A Foucault current braking apparatus which comprises, in combination, a frame, a shaft to be braked journalled in said frame, two armature discs parallel to each other mounted on said shaft for rotation together therewith, and an inductor fixed to said frame and located between said discs, said inductor including two annular discs coaxial with said shaft, said shaft being freely rotatable with respect to said last mentioned discs, said discs being located between said armature discs and being provided each with at least one annular row of holes extending about the axis of said shaft, each hole in one of said inductor discs being in line with one hole in the other inductor disc respectively, a plurality of cores of a magnetic metal, said cores being of substantially cylindrical shapes with their generatrices parallel to said shaft axis, each of said cores having its ends slidably engaged in two holes of said two inductor discs respectively which are in line with each other, abutment ments carried by said cores to cooperate with the edges of said holes, so that said cores limit to a minimum the distance between said two inductor discs, means interposed between said two inductor discs for applying thereto a force tending to bring them closer to each other, so that said cores are tightly held between said two inductor discs by said last mentioned means, electro-magnet windings around said cores respectively, and means for fixing said two inductor discs to said frame.

3. A Foucault current braking apparatus which comprises, in combination, a frame, a shaft to be braked journalled in said frame, two armature discs parallel to each other mounted on said shaft for rotation together therewith, and an inductor fixed to said frame and located between said discs, said inductor including two annular discs coaxial with said shaft, said shaft being freely rotatable with respect to said last mentioned discs, said discs being located between said armature discs and being provided each with at least one annular row of holes extending about the axis of said shaft, each hole in one of said inductor discs being in line with one hole in the other inductor disc respectively, a plurality of cores of a magnetic metal, said cores being of substantially cylindrical shapes with their generatrices parallel to said shaft axis, each of said cores having its ends slidably engaged in two holes of said two inductor discs respectively which are in line with each other, said core ends and the edges of said holes forming cooperating abutments so that said cores limit to a minimum the distance between said two inductor discs, means interposed between said two inductor discs for applying thereto a force tending to bring them closer to each other, so that said cores are tightly held between said two inductor discs by said last mentioned means, electro-magnet windings around said cores respectively, and means for fixing said two inductor discs to said frame.

4. A braking apparatus according to claim 3 in which each of said cores has in cross section the shape of an isosceles triangle with curvilinear sides and rounded apexes, one axis of symmetry of said triangle intersecting the axis of said shaft and the apex located on said triangle axis being turned toward said shaft.

5. A braking apparatus according to claim 1 in which said bearings are rolling bearings provided at the ends of said central sleeve, said sleeve and said bearings limiting a space around a portion of said shaft, with a lubricating oil in said space.

References Cited in the file of this patent

UNITED STATES PATENTS

596,272	Libby	Dec. 28, 1897
2,230,878	Bohli	Feb. 4, 1941
2,493,607	Wendelburg	Jan. 3, 1950
2,700,343	Pezzillo	Jan. 25, 1955
2,724,067	Herrick	Nov. 15, 1955

FOREIGN PATENTS

591,091	Great Britain	Aug. 6, 1947
646,853	Great Britain	Nov. 29, 1950
816,070	France	Apr. 19, 1937
1,005,416	France	Dec. 19, 1951