



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.01.2009 Bulletin 2009/04

(51) Int Cl.:
E05F 5/00 (2006.01) **E05F 1/00** (2006.01)
E05F 1/02 (2006.01)

(21) Application number: **08160499.3**

(22) Date of filing: **16.07.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

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(30) Priority: **18.07.2007 IT PD20070243**

(54) **Braking device particularly for sliding fire doors**

(57) A braking device (10), particularly for fire doors (11) of the type that can slide along a guide (12) and can be closed automatically by means of counterweights,

comprising a magnetic eddy current brake (13), which is adapted to limit the movement speed of the fire door (11), at least during closure, to a speed which is not higher than a predefined speed.

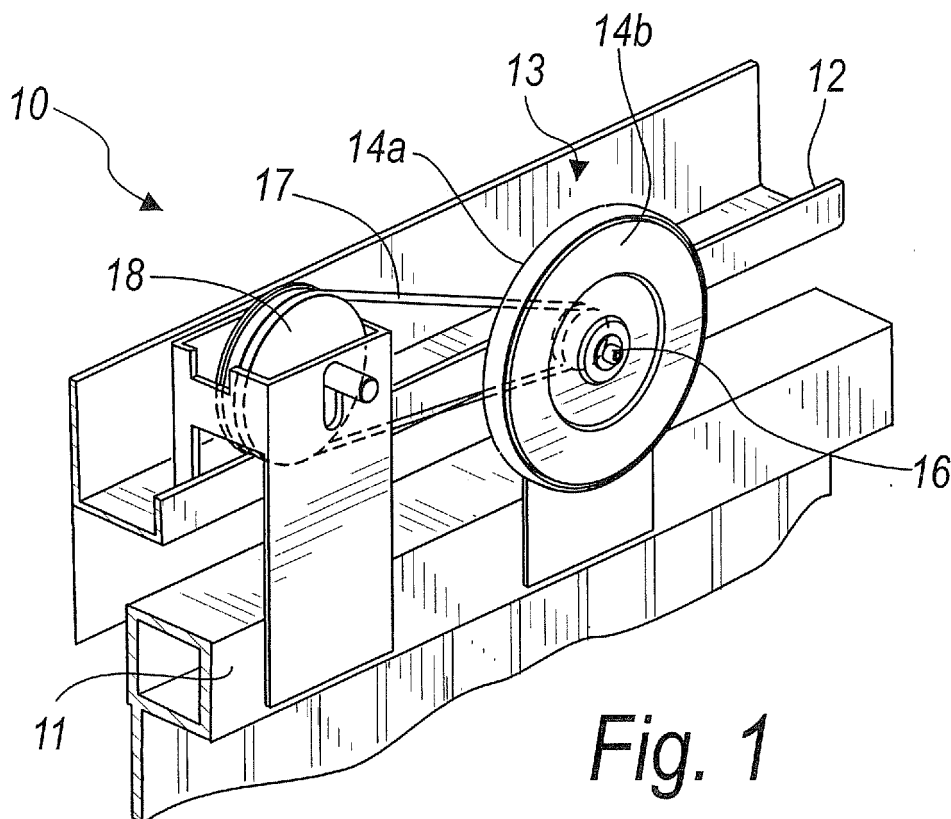


Fig. 1

Description

[0001] The present invention relates to a braking device particularly for sliding fire doors.

[0002] Various types of fire door, with hinged or sliding leaves, are currently known.

[0003] One system for the emergency closure of fire doors which is particularly suitable for sliding doors is the counterweight system.

[0004] This system has counterweights which are connected by means of transmission cables to the sliding leaf of the door.

[0005] When the leaf is open, the counterweights are held raised from the ground, so that when the door needs to be closed, particularly in case of emergency, it is sufficient to release them, so that by gravity they apply to the leaf, by means of the transmission cables, a traction force which is equal to their weight.

[0006] This system has the advantage of not requiring an external power supply in order to be provided and further, by way of its simplicity, is particularly reliable.

[0007] As is known, for safety reasons the closing leaf must not move at an excessive speed; generally, the safety limit speed is not higher than 0.2 m/s.

[0008] It is therefore common to resort to braking devices which are applied to the leaf so as to limit its maximum closing speed.

[0009] Devices of this type generally comprise viscous force brakes, i.e., brakes that apply to the door a braking force which is directly proportional to its speed and in particular is such as to equal the driving force when this speed is equal to the predefined safety speed.

[0010] These devices are generally provided by means of an element which can move within a casing which contains a viscous substance, which contrasts the motion of said element with a force which is indeed viscous, i.e., increases with the speed of motion.

[0011] Devices of this type have drawbacks, such as the fact that, as is known, they have a nonzero resisting force even at zero speed, i.e., when the door is motionless.

[0012] Further, they have the drawback that the viscous substance varies its resisting behavior when its temperature varies, and therefore the braking effect is variable as the ambient temperature varies, thus causing the actual closure speed of the door to which they are connected to depend on such ambient temperature.

[0013] The aim of the present invention is to provide a braking device, particularly for fire doors of the sliding type, which applies a braking force of the viscous type and in which such force does not depend on the ambient temperature.

[0014] Within this aim, an object of the invention is to provide a braking device whose force that contrasts the movement of the door is, when the door is motionless, much weaker than the force provided by currently known devices.

[0015] Another object of the invention is to provide a

braking device particularly for sliding fire doors which is structurally simple and easy to use and can be manufactured with low costs.

[0016] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a braking device, particularly for fire doors of the type that can slide along a guide and can be closed automatically by means of counterweights, characterized in that it comprises a magnetic eddy current brake, which is adapted to limit the movement speed of the door, at least during closure, to a speed which is not higher than a predefined speed.

[0017] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment of the braking device according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the braking device according to the invention;

Figure 2 is a partially sectional front elevation view of the braking device according to the invention;

Figure 3 is a partially sectional top plan view of the braking device according to the invention.

[0018] It is noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

[0019] With reference to the figures cited, the reference numeral 10 generally designates a braking device, particularly for fire doors 11 of the type that can slide along a guide 12 and can be closed automatically by means of counterweights, which are not shown in the figure.

[0020] An important feature of the braking device 10 according to the invention is that it comprises a magnetic eddy current brake 13, which is adapted to limit the movement speed of the fire door 11, at least during closure, to a speed which does not exceed a preset speed.

[0021] Advantageously, the magnetic brake 13 comprises two disks 14a and 14b which face each other and are connected in a mutually rotatable manner.

[0022] The first disk 14a of the two disks 14a and 14b is conveniently supported by the fire door 11 and is provided with at least one magnetic element, which preferably comprises multiple permanent magnets 15 which are arranged uniformly along the perimeter of the first disk 14a and face the second disk 14b, which is made of electrically conducting material.

[0023] Advantageously, the second disk 14b is made of paramagnetic material and is provided with a pivot 16 which is coaxial and rigidly coupled thereto and is inserted rotatably and coaxially through the first disk 14a.

[0024] The pivot 16 is conveniently connected, by means of a transmission belt 17, to a wheel 18 which supports the fire door 11, engaging slidably the guide 12, which is associated with the upper cross-member of

the frame of the fire door 11.

[0025] By means of the transmission belt 17, the simultaneous rotation of the second disk 14b with the wheel 18 is achieved conveniently in contrast with the magnetic repulsion force applied to the permanent magnets 15 by the magnetic field generated by the eddy currents induced thereby in the second disk 14b during its relative rotation with respect to the first disk 14a.

[0026] As an alternative, in a fully equivalent embodiment, not shown in the figures, the second disk is advantageously supported by the fire door and the first disk is provided with a pivot which is coaxial and rigidly coupled thereto and is inserted through the second disk so that it can rotate coaxially.

[0027] Even in this embodiment, the pivot is connected conveniently, by means of a transmission belt, to the wheel that supports the door, engaging the guide slidably.

[0028] By means of the transmission belt, the simultaneous rotation of the first disk with the wheel is achieved conveniently in contrast with the magnetic repulsion force applied to the permanent magnets by the magnetic field generated by the eddy currents induced thereby in the second disk during the rotation of the first disk.

[0029] The operation of the braking device according to the invention is as follows.

[0030] When the fire door 11 slides with the wheel 18 coupled to the guide 12, the second disk 14b is turned, actuated by the pivot 16, by the transmission belt 17 which connects it to the wheel 18.

[0031] In this manner, the second disk 14b moves within the magnetic field generated by the permanent magnets 15 which are fixed on the first disk 14a.

[0032] According to Lenz's law, the second disk 14b is therefore affected by eddy currents, which in turn generate a magnetic field which applies to the permanent magnets 15 a force which contrasts their movement with respect to the second disk 14b, i.e., in this case, it brakes the second disk 14b, contrasting its motion in the magnetic field generated by the permanent magnets 15.

[0033] Since the second disk 14b is connected to the wheel 18, the rolling motion of which on the guide 12 produces the sliding of the fire door 11, such braking force is transmitted by means of the transmission belt 17 to the wheel 18 and therefore contrasts the sliding of the fire door 11.

[0034] Since, as is known, the magnetic force thus generated is proportional to the rotation rate of the second disk 14b in the magnetic field generated by the permanent magnets 15, it is proportional to the speed of the fire door 11, and thus has the characteristic of a viscous force.

[0035] In practice it has been found that the invention achieves the proposed aim and objects by providing a braking device, particularly for sliding fire doors, which applies a braking force of the viscous type, and that such force does not depend on the ambient temperature, since the characteristics of the magnets that generate it sub-

stantially do not depend on such ambient temperature.

[0036] Further, the force that contrasts the movement of the door, generated by the braking device, according to the invention, is substantially zero when the door is stationary or in any case much smaller than the force applied by currently known devices, since it does not depend on frictions that are functional to the braking action.

[0037] The braking action, according to the invention, is in fact not based on mechanical frictions but on electromagnetic forces, leading to the further advantage of avoiding the mechanical wear produced by such frictions.

[0038] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0039] In practice, the materials used, so long as they are compatible with the specific use, as well as the contingent shapes and dimensions, may be any according to requirements and to the state of the art.

[0040] The disclosures in Italian Patent Application No. PD2007A000243 from which this application claims priority are incorporated herein by reference.

[0041] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A braking device (10), particularly for fire doors (11) of the type that can slide along a guide (12) and can be closed automatically by means of counterweights, **characterized in that** it comprises a magnetic eddy current brake (13), which is adapted to limit the movement speed of the fire door (11), at least during closure, to a speed which is not higher than a predefined speed.
2. The braking device (10) according to claim 1, **characterized in that** said magnetic brake (13) comprises two disks (14a, 14b) which face each other and are connected in a mutually rotatable manner, a first disk (14a) of said two disks (14a, 14b) being provided with at least one magnetic element which faces the second disk (14b) of said two disks (14a, 14b), said second disk (14b) being made of electrically conducting material and being connected to a wheel (18) for supporting the fire door (11), which engages slidably said guide (12), for the simultaneous rotation of said second disk (14b) with said wheel (18), in contrast with the magnetic repulsion force applied to said at least one magnetic element by the magnetic field generated by the eddy currents induced thereby

in said second disk (14b) during the relative rotation of said second disk (14b) with respect to said first disk (14a).

3. The braking device (10) according to claim 1, **characterized in that** said magnetic brake (13) comprises two disks (14a, 14b) which face each other and are connected in a mutually rotatable manner, a first disk (14a) of said two disks (14a, 14b) being provided with at least one magnetic element which faces the second disk (14b) of said two disks (14a, 14b), said second disk (14b) being made of electrically conducting material and said first disk (14a) being connected to a wheel (18) for supporting the fire door (11), which engages slidingly said guide (12), for the simultaneous rotation of said first disk (14a) with said wheel (18), in contrast with the magnetic repulsion force applied to said at least one magnetic element by the magnetic field generated by the eddy currents induced thereby in said second disk (14b) during the relative rotation of said first disk (14a) with respect to said second disk (14b).

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4. The braking device (10) according to one or more of the preceding claims, **characterized in that** said at least one magnetic element comprises multiple permanent magnets (15) which are arranged uniformly along the perimeter of said first disk (14a) and face said second disk (14b).

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5. The braking device (10) according to one or more of claims 1, 2 and 4, **characterized in that** said first disk (14a) is supported by the fire door (11), said wheel (18) being connected to said fire door (11) to support it by engaging slidingly said guide (12), which is associated with the upper cross-member of the frame of said fire door (11), said second disk (14b) having a pivot (16) which is coaxial and rigidly coupled thereto and inserted rotatably and coaxially in said first disk (14a), said pivot (16) being connected by means of a transmission belt (17) to said wheel (18), for the simultaneous rotation of said wheel (18) and of said second disk (14b), in contrast with the magnetic repulsion force applied to said permanent magnets (15) by the magnetic field produced by the eddy currents induced by said permanent magnets (15) in said second disk (14b) during its relative rotation with respect to said first disk (14a).

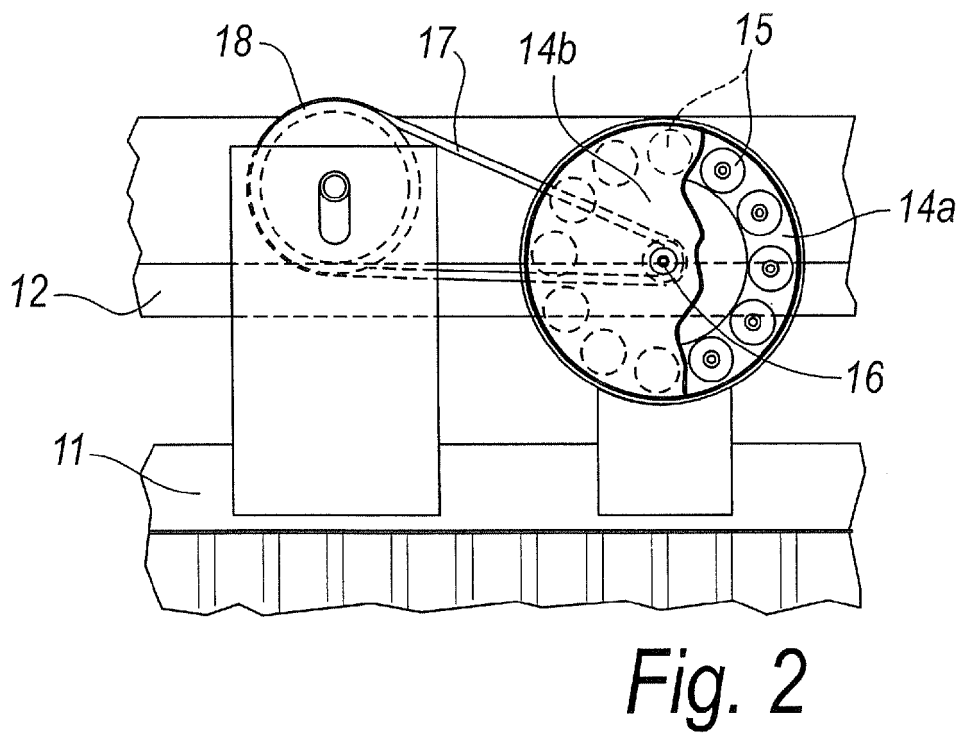
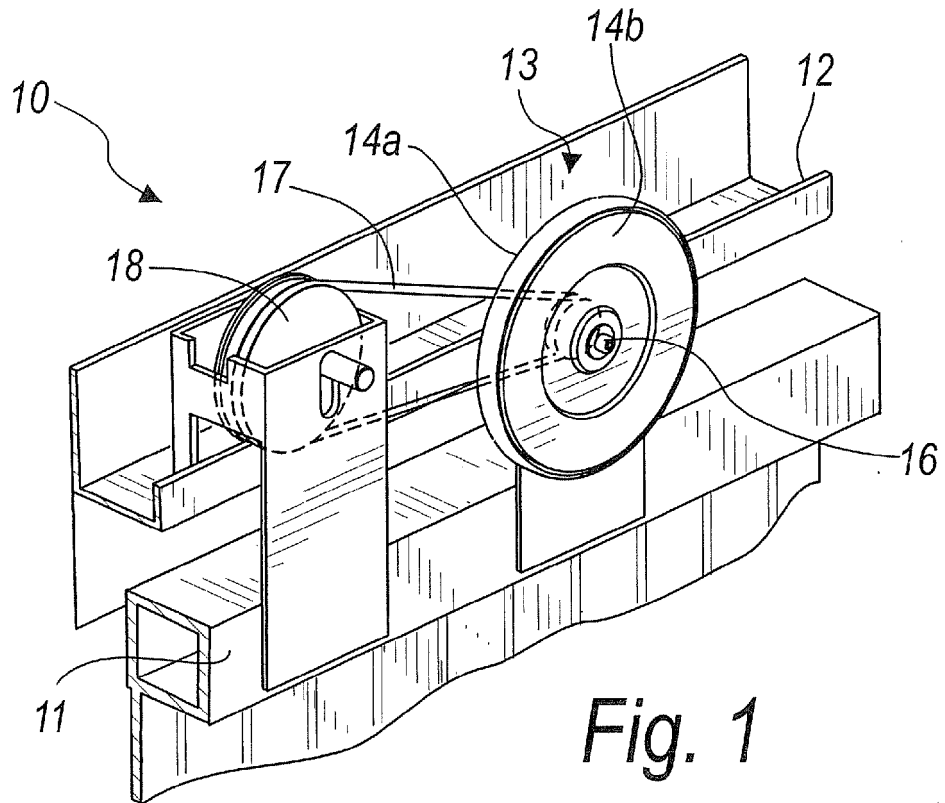
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6. The braking device (10) according to one or more of claims 1, 3 and 4, **characterized in that** said second disk (14b) is supported by the fire door (11), said wheel (18) being connected to said fire door (11) in order to support it by engaging slidingly said guide (12), which is associated with the upper cross-member of the frame of said fire door (11), said first disk (14a) being provided with a pivot (16) which is coaxial and rigidly coupled thereto and inserted rotatably

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and coaxially in said second disk (14b), said pivot (16) being connected by means of a transmission belt (17) to said wheel (18) for the simultaneous rotation of said wheel (18) and of said first disk (14a), in contrast with the magnetic repulsion force applied to said permanent magnets (15) by the magnetic field generated by the eddy currents induced in said second disk (14b) during the rotation of said first disk (14a).

7. The braking device (10) according to one or more of the preceding claims, **characterized in that** said second disk (14b) is made of paramagnetic and electrically conducting material.



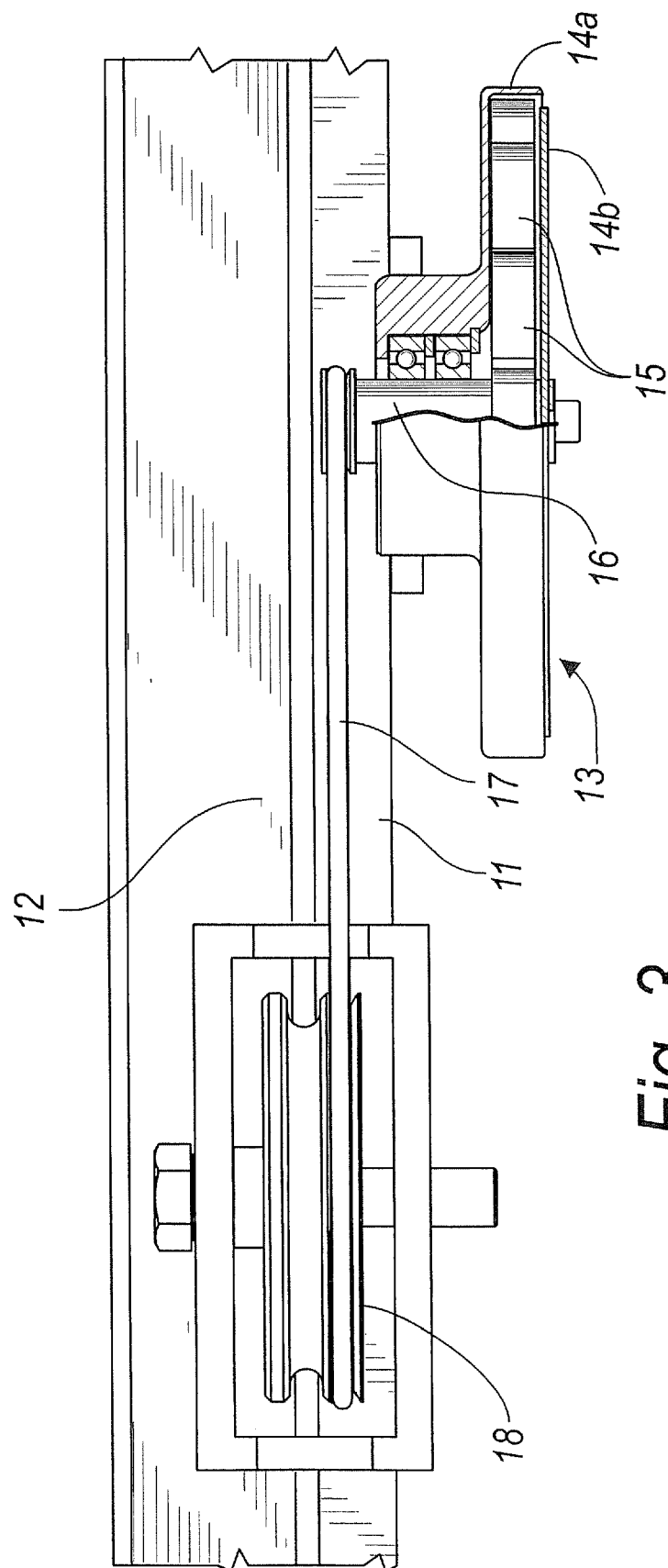


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 08 16 0499

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Place of search Munich		Date of completion of the search 13 November 2008	Examiner Di Renzo, Raffaele
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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