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Comacchio et al.(10) **Pub. No.: US 2017/0145792 A1**(43) **Pub. Date: May 25, 2017**(54) **FALL PREVENTION SAFETY DEVICE FOR
HEAD-CARRYING CARRIAGES OF
DRILLING MACHINES****Publication Classification**(51) **Int. Cl.****E21B 41/00** (2006.01)**E21B 19/02** (2006.01)**E21B 15/00** (2006.01)**E21B 19/00** (2006.01)(52) **U.S. Cl.**CPC **E21B 41/0021** (2013.01); **E21B 19/008**(2013.01); **E21B 19/02** (2013.01); **E21B 15/00**

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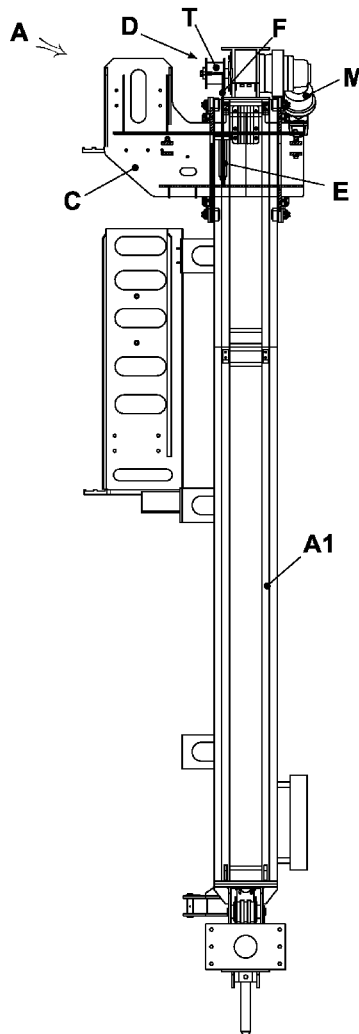
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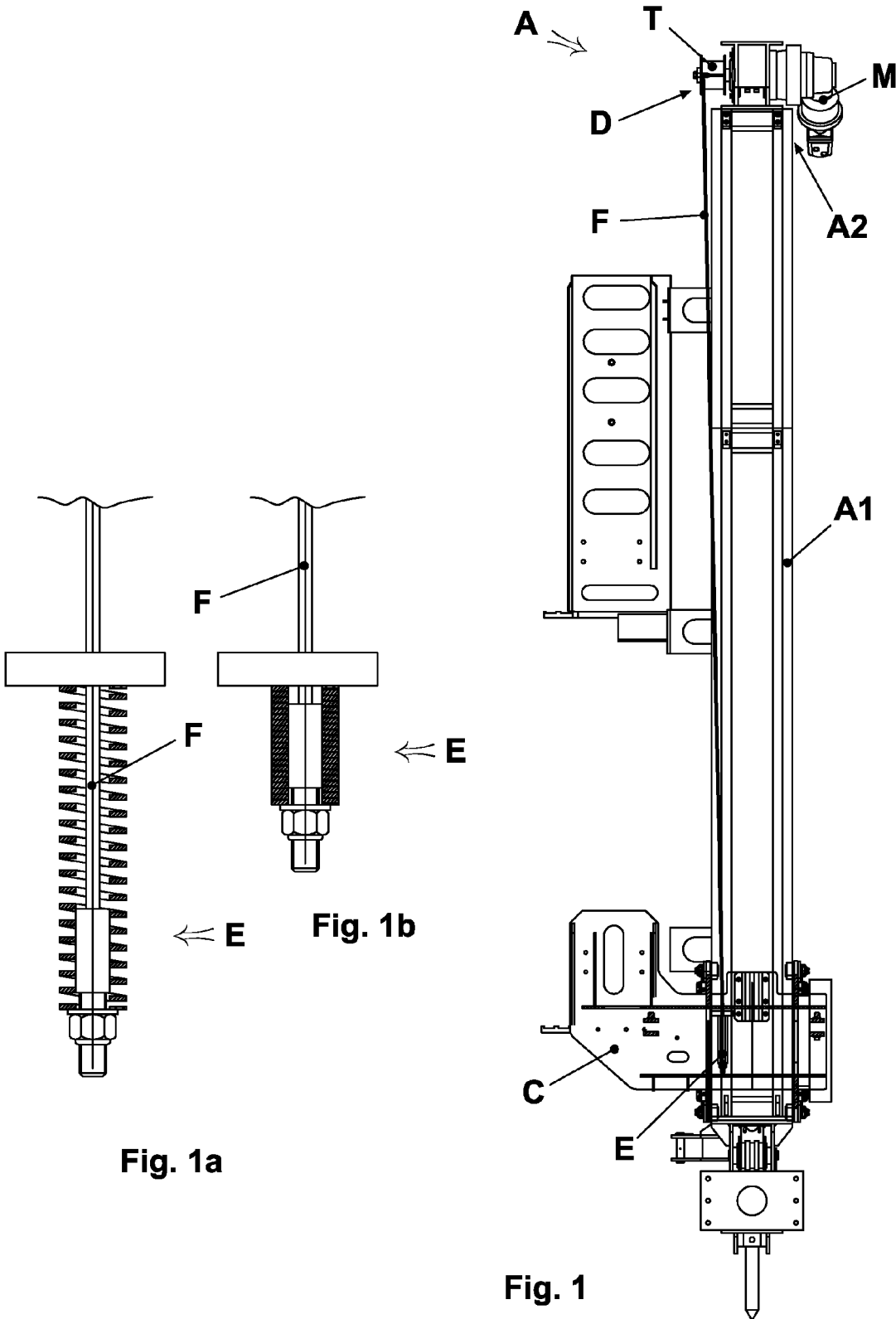
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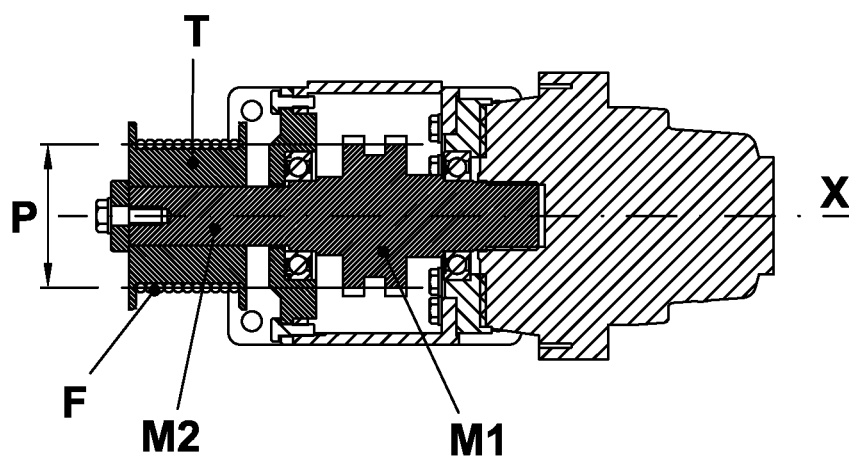
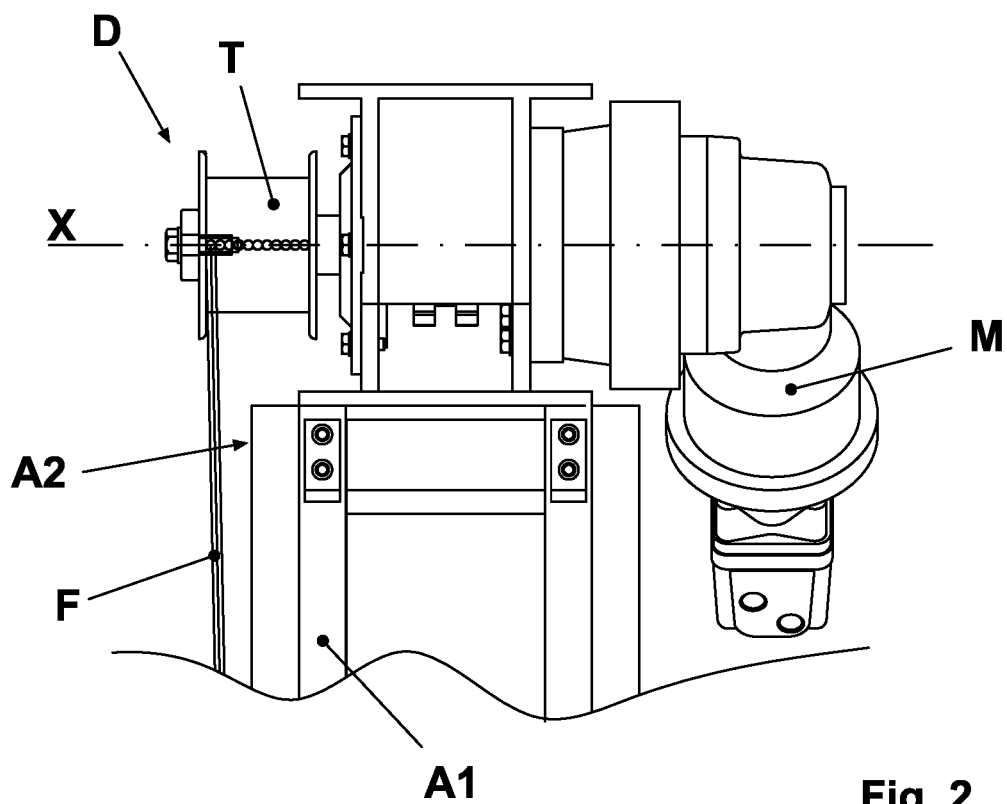
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ABSTRACT

A fall prevention safety device for the head-carrying carriage of drilling machines, includes a safety cable constrained between the carriage (C) and a rotating drum suitable for winding the safety cable. The drum rotates according to the translation of the head-carrying carriage in such a way as to maintain the safety cable constantly tight, so that when the drive chain is no longer tight, the safety cable holds the carriage and prevents it from falling down.







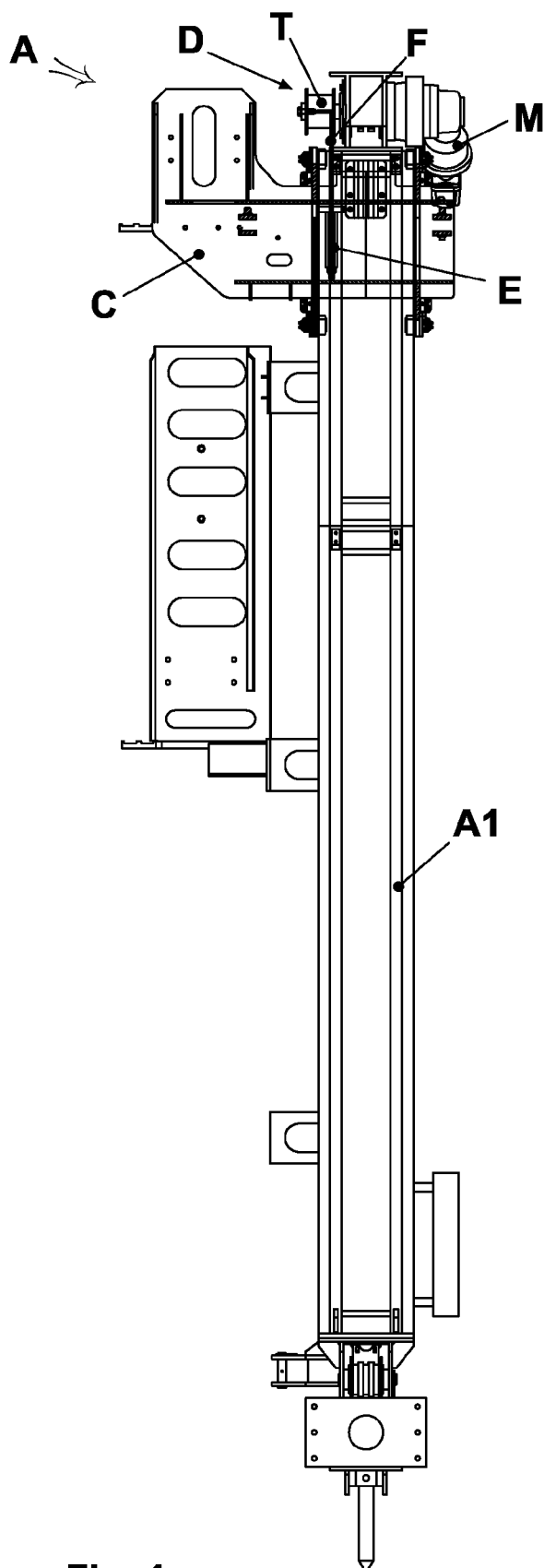


Fig. 4

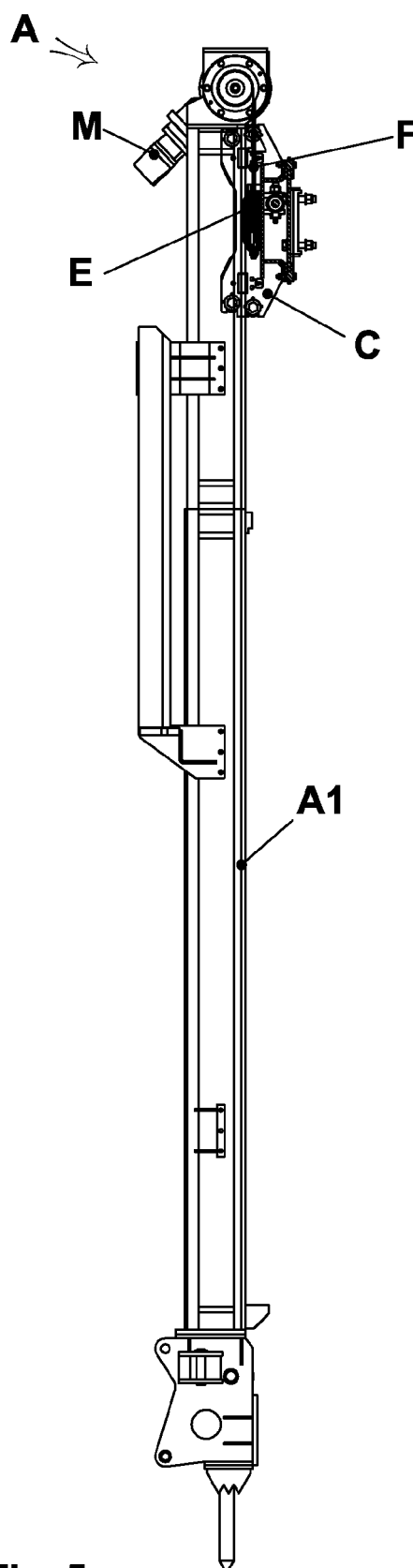


Fig. 5

FALL PREVENTION SAFETY DEVICE FOR HEAD-CARRYING CARRIAGES OF DRILLING MACHINES

[0001] The present patent concerns drilling machines and in particular it concerns a new fall prevention safety device for head-carrying carriages of drilling machines. Drilling machines are known that are suited to drill vertical or inclined holes into the ground.

[0002] Said machines are provided with a drilling head that, through a driving system located under the head, drives the drilling column together with the related tools.

[0003] The drilling head is mounted on a carriage that slides on a guide-rail.

[0004] A driving chain or cable is generally connected above and below the head-carrying carriage and rotates on pulleys located at the ends of the guide-rail. Said driving cable is closed as a ring around the guide-rail, the pulleys and the head-carrying carriage and is set moving by a special driving unit positioned on top or on the back of said guide-rail and provided with a drive pinion whose rotation determines the translation of the head-carrying carriage.

[0005] The sliding movement of said driving chain or cable causes the carriage and the drilling head to slide along the guide-rail and consequently causes the drilling head to lower in order to perforate the ground, or to raise in order to extract the drilling column.

[0006] The carriage and the drilling head are generally supported only by said driving chain or cable.

[0007] If said driving chain or cable should break or detach, the carriage and the drilling head fall along the guide-rail, thus damaging the equipment and with great risks for anyone present along the path of the falling carriage or in proximity to the same.

[0008] In the known drilling machines, the coupling device that connects the driving chain or cable to the carriage represents a relatively critical point as it is constituted by several elements that, if worn out or tampered with, may cause the driving chain or cable to become disconnected from the carriage itself.

[0009] In this case the head would slide along the guide-rail with consequent damage to the equipment and serious danger for the people standing around.

[0010] Safety devices are known that are suited to be used to lock the head-carrying carriage of drilling machines and comprise wedges interposed between the carriage and the guide-rail, said wedges being constrained to the driving chain or cable, too. Any breakage or detachment of the driving chain or cable releases the wedges that, due to the action of elastic means, move until engaging a corresponding part of the carriage, thus preventing the latter from falling down.

[0011] The use of devices of this type, whose efficiency in preventing the carriage and the head from falling down has been proved, poses the drawback that once they have started operating they cannot be removed and brought back to the position in which they are not in use, unless the carriage driving system has been repaired or recovered.

[0012] In order to overcome the drawbacks described above, a new fall prevention safety device for head-carrying carriages of drilling machines has been designed and produced.

[0013] An object of the new safety device is to prevent the free fall of the carriage and the head in the case where the

driving chain or cable that translates the carriage breaks down or detaches and/or in the case where the coupling device is damaged.

[0014] Another object of the invention is to provide a safety device capable of safeguarding the carriage, the head and the other components of the drilling machine, preventing the free fall of the carriage.

[0015] Another object of the invention is to provide a safety device capable of facilitating the carriage translation movements in case of emergency and during the repair or recovery of the drilling machine in case of breakage of the driving chain or cable of the carriage.

[0016] These and other direct and complementary objects are achieved by the new fall prevention safety device for head-carrying carriages of drilling machines, which among its main parts comprises the following:

[0017] at least one safety cable suited to be directly or indirectly constrained between said head-carrying carriage and at least one rotating drum;

[0018] said at least one rotating drum suited to wind said safety cable and to be positioned in proximity to the driving unit of the head-carrying carriage,

and wherein said drum rotates according to the translation of said head-carrying carriage, in such a way as to maintain said safety cable constantly tight.

[0019] In the preferred solution, said drum is connected to the axis of the drive pinion of the translation motor of the carriage and preferably has the same pitch diameter as the pinion itself, so that the safety cable is substantially wound with the same pitch as the driving cable.

[0020] In this way, the rotation of the drum substantially corresponds to the rotation of the pinion, thus guaranteeing a synchronized movement.

[0021] When the driving cable is no longer tight for any reason, for example due to the breakage of the main driving chain or cable itself or due to faults/anomalies on the coupling device, said safety cable remains tight and holds the head-carrying carriage, thus preventing it from falling down.

[0022] In the preferred solution, said safety cable is furthermore constrained to said head-carrying carriage through at least one elastic means, hereinafter referred to as compensator, which is suited to compensate for any deviations in the drum-pinion synchrony.

[0023] Said compensator is suited to guarantee the pre-tensioning of the safety cable as a consequence of the slackening of the driving chain or cable during the normal operating steps, and furthermore also serves to compensate for variations in the length of the safety cable caused by possible overlapping in the winding of the cable on the drum.

[0024] The characteristics of the new fall prevention safety device for head-carrying carriages of drilling machines will be highlighted in greater detail in the following description with reference to the attached drawings that are enclosed by way of non-limiting example.

[0025] FIG. 1 shows a front view of a drilling mast (A) with guide-rail (A1) and motor (M), carriage (C) in lowered position and fall prevention device (D). FIGS. 1a and 1b show two positions of the elastic compensator (E) for coupling the safety cable (F) of the fall prevention safety device (D) to the carriage (C), respectively with preloaded spring and with completely compressed spring.

[0026] FIG. 2 shows a detail of the safety device (D) applied to the top (A2) of the guide-rail (A1), said device (D) comprising a safety cable (F) and a drum (T) for winding the safety cable (F) itself.

[0027] FIG. 3 shows a sectional view of the detail of the safety device (D) shown in FIG. 2.

[0028] FIGS. 4 and 5 show two views, a side and a front view, of the drilling mast (A) with the carriage (C) in completely raised position.

[0029] The invention is a new fall prevention safety device (D) for carriages (C) of drilling heads translating, for example, on a guide-rail (A1) of a drilling mast (A).

[0030] The carriage (C), for example, is constituted by a metal structure suited to support the drilling head and is suited to slide on said guide-rail (A1).

[0031] Said drilling mast (A), in proximity to or at the level of the top (A2) of said guide-rail (A1), is provided with at least one motor (M) with drive pinion (M1) for winding at least one driving chain or cable, not illustrated in the figures, for the translation of said carriage (C).

[0032] Said driving cable is arranged, for example, according to the usual path around pulleys located over and under the guide-rail (A1), is maintained conveniently tight and is moved by said motor (M).

[0033] The new safety device (D) comprises at least one drum (T) suited to be mounted in proximity to the top (A2) of said guide-rail (A1), preferably arranged so that it is coaxial with the rotation axis (X) of said pinion (M1) of the motor (M) and preferably connected to the same rotor shaft (M2) to which said pinion (M1) is connected.

[0034] The new safety device (D) comprises at least one safety cable (F) suited to be wound around said drum (T), said safety cable (F) being in turn directly or indirectly constrained to said carriage (C) and maintained tight between said drum (T) and said carriage (C).

[0035] According to the invention, the winding diameter (P) of the safety cable (F) on said drum (T) is substantially equal to the pitch diameter of said pinion (M1), as can be observed in FIG. 3, in such a way as to guarantee synchronization in the rotation of the pinion (M1) and the drum (T) and thus also in the sliding movement of the driving cable and the safety cable (F).

[0036] When, due to any reason, the upper driving cable that translates the head-carrying carriage (C) is not tight any longer, said safety cable (F) holds said carriage (C) and prevents it from falling down.

[0037] As shown in FIGS. 1a and 1b, said safety cable (F) is constrained to said carriage (C) through at least one compensator device (E), for example an elastic device.

[0038] Said compensator (E) is particularly effective in the case where said drum (T) and said pinion (M1) rotate in a manner that is not perfectly synchronized or in the case where the safety cable (F) overlaps incorrectly during winding.

[0039] According to the invention, in the case where the driving cable should break, said safety device (D) may be used during the machine repair or recovery operations, in order to translate the carriage (C) at least to a minimum extent, making said drum (T) rotate and causing the winding or unwinding of the safety cable (F) and thus the translation of the carriage (C).

The invention claimed is:

1. A fall prevention safety device (D) for a head-carrying carriage (C) of drilling machines, wherein said carriage (C) translates on at least one guide-rail (A1) of a drilling mast (A), a translation of said head-carrying carriage being controlled by at least one motor unit (M) with at least one driving pinion (M1) of a drive chain, said safety device (D) comprising:

at least one safety cable (F) directly or indirectly constrained between said head-carrying carriage (C) and at least one rotating drum (T);

wherein said at least one rotating drum (T) for winding said safety cable (F) is mounted in proximity to the motor unit (M) of the guide-rail (A1) of the drilling mast (A), and

wherein said drum (T) rotates according to the translation of said head-carrying carriage (C) in such a way as to maintain said safety cable (F) constantly tight, so that when said drive chain is no longer tight said safety cable (F) holds said carriage (C) and prevents said head-carrying carriage from falling down.

2. The fall prevention safety device (D) according to claim 1, wherein said drum (T) is mechanically connected to said motor (M) of a drilling machine.

3. The fall prevention safety device (D) according to claim 2, wherein said drum (T) is mounted coaxial with a rotation axis (X) of said driving pinion (M1).

4. The fall prevention safety device (D) according to claim 3, wherein said drum (T) is connected to a same rotor shaft (M2) as said pinion (M1).

5. The fall prevention safety device (D) according to claim 1, wherein a winding diameter (P) of said safety cable (F) on said drum (T) is substantially equal to a pitch diameter of said pinion (M1).

6. The fall prevention safety device (D) according to claim 1, wherein a said safety cable (F) is constrained to said head-carrying carriage (C) through at least one elastic compensator device (E) that cushions movements of the head-carrying carriage (C) with respect to said safety cable (F).

7. The fall prevention safety device (D) according to claim 1, wherein a motorized rotation of said drum (T) causes said safety cable (F) to be wound or unwound, and consequently causes said head-carrying carriage (C) to translate.

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