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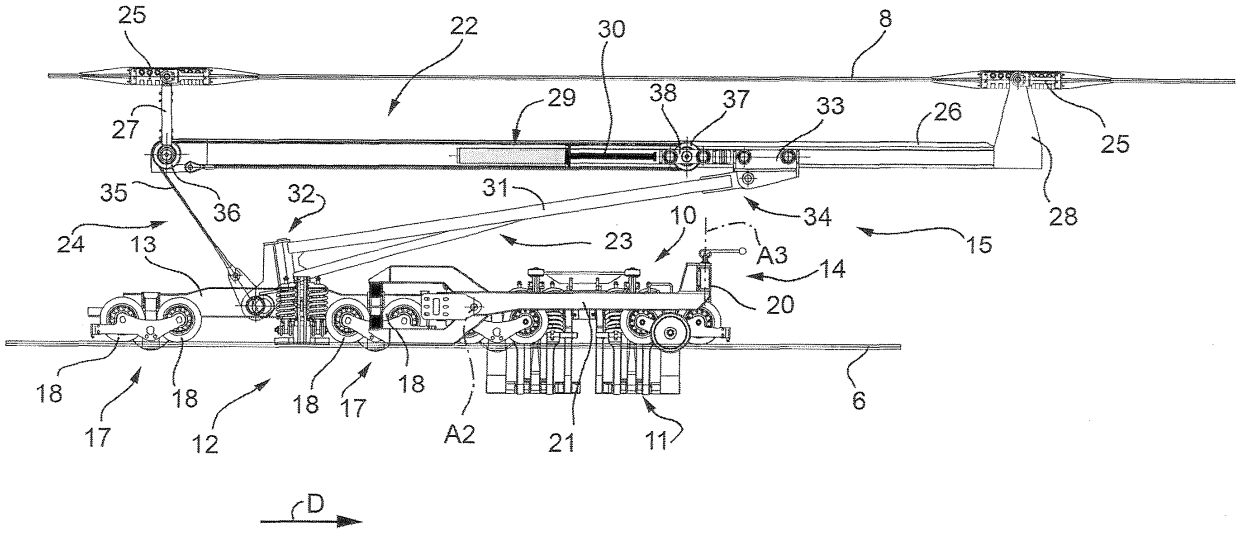
(54) **Rescue trolley for recovering and transporting transportation units of a cable transportation system**

(57) A rescue trolley (12), for recovering and transporting transportation units (9) of a cable transportation system (1) having at least one supporting cable (6) and a rescue pull cable (8), has a frame (13) guided along a given path (P) by the supporting cable (6); an anchoring device (14) for engaging a transportation unit (9); and a connecting device (15) for connecting the frame (13) to the rescue pull cable (8), and which has a first connecting assembly (22) fixed to the rescue pull cable (8), a second connecting assembly (23) hinged to the frame (13) and engaging the first connecting assembly (23) in sliding manner, and a third connecting assembly (24) secured to the frame (13) and engaging the first connecting assembly (22) in sliding manner; the rescue pull cable (8) drawing the rescue trolley (12) selectively by means of the first and second connecting assembly (22, 23) or the first and third connecting assembly (22, 24), depending on the pull direction of the rescue pull cable (8) and the slope of the supporting cable (6).

FIG. 4



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Description

[0001] The present invention relates to a rescue trolley for recovering and transporting transportation units of a cable transportation system.

[0002] More specifically, the present invention relates to a rescue trolley for recovering and transporting transportation units of a cable transportation system comprising at least one supporting cable and a rescue pull cable; the rescue trolley comprising a frame guided along a given path by the supporting cable, an anchoring device for engaging a transportation unit, and a connecting device for connecting the frame to the rescue pull cable.

[0003] Known rescue trolleys of the type described above have the drawback of being unable to move the rescue unit in both pull directions of the rescue pull cable, mainly on account of known rescue trolleys being equipped with a substantially one-way connecting device.

[0004] Another drawback of known rescue trolleys is their inability to negotiate oppositely-inclined path portions. These are located at the idler trains supporting the supporting cable by means of pylons between the top and bottom stations, and, as is known, result from the sag in the supporting cable forming oppositely-sloping portions, i.e. sloping in the opposite direction to the overall slope between the top and bottom stations.

[0005] Being designed to operate along a given path portion with a given slope, and to effect recovery in a given direction, known connecting devices are unable to operate in both directions or to negotiate changes in slope, i.e. opposite slopes.

[0006] Moreover, changes in slope also produce shock capable of further stressing the mechanical parts of the rescue trolley and transportation unit.

[0007] It is an object of the present invention to provide a rescue trolley for recovering and transporting transportation units of a cable transportation system, designed to eliminate the drawbacks of the known art.

[0008] According to the present invention, there is provided a rescue trolley for recovering and transporting transportation units of a cable transportation system comprising at least one supporting cable and a rescue pull cable; the rescue trolley comprising a frame guided along a given path by the supporting cable, an anchoring device for engaging a transportation unit, and a connecting device for connecting the frame to the rescue pull cable; the rescue trolley being characterized in that the connecting device comprises a first connecting assembly fixed to the rescue pull cable; a second connecting assembly hinged to the frame and connected to the first connecting assembly; and a third connecting assembly secured to the frame and connected to the first connecting assembly; said rescue pull cable drawing the rescue trolley selectively by means of the first and second connecting assembly or the first and third connecting assembly, depending on the moving direction of the rescue pull cable and the slope of the supporting cable.

[0009] Pulling force is thus transmitted effectively between the frame and rescue pull cable by the second or third connecting assembly, which intervene automatically, depending on the slope of the supporting cables and the pull direction.

[0010] The present invention also relates to a cable transportation system.

[0011] According to the present invention, there is provided a cable transportation system comprising a bottom station; a top station; at least one supporting cable extending between the bottom station and the top station; a pull cable extending between the bottom station and the top station; at least one transportation unit supported by the supporting cable and drawn by the pull cable; a rescue pull cable; and at least one rescue trolley in accordance with the present invention.

[0012] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic side view, with parts removed for clarity, of a cable transportation system equipped with a rescue trolley in accordance with the present invention;

Figure 2 shows a partly sectioned view in perspective, with parts removed for clarity, of the rescue trolley according to the present invention;

Figures 3 to 6 show side views, with parts removed for clarity, of the Figure 2 rescue trolley in different operating positions.

[0013] Number 1 in Figure 1 indicates as a whole a cable transportation system comprising a bottom station 2; a stop station 3; two intermediate idler trains 4 supported by respective pylons 5; two supporting cables 6 (only one shown in Figure 1); a pull cable 7; a rescue pull cable 8; and a transportation unit 9 comprising a trolley 10, which is supported by supporting cables 6 and drawn, in use, by pull cable 7, to which trolley 10 is connected by a clamp 11.

[0014] Cable transportation system 1 comprises a rescue trolley 12 which, in the event of a breakdown of cable transportation system 1, provides for recovering and transporting transportation unit 9 to bottom station 2 or top station 3.

[0015] Figure 1 shows only one rescue trolley 12, it being understood, however, that the system may comprise a number of rescue trolleys parked respectively in the vicinity of bottom station 2 and top station 2, and even at any intermediate locations.

[0016] With reference to Figure 2, rescue trolley 12 rests on supporting cables 6, is connected to rescue pull cable 8, and comprises a frame 13 guided by supporting cables 6; an anchoring device 14 for engaging a transportation unit 9 (not shown in Figure 2); a connecting device 15 for connecting frame 13 to rescue pull cable 8; and a rescue personnel platform 16 fitted to frame 13 to rotate about an axis A1 and so remain horizontal re-

gardless of the tilt of frame 13.

[0017] In the example shown, frame 13 supports in rotary manner four assemblies 17 (only two shown in Figure 2), each of which comprises two rollers 18 connected by a rocker arm and engaging one of supporting cables 6.

[0018] Anchoring device 14 comprises a tow hook 19 integral with frame 13; and a tow hook 20 hinged to frame 13 about an axis A2 by an arm 21, and hinged to arm 21 about an axis A3.

[0019] By means of tow hooks 19 and 20, frame 13 of rescue trolley 12 is connectable to trolley 10 of transportation unit 9 along two opposite sides.

[0020] Connecting device 15 comprises a first connecting assembly 22 fixed to rescue pulley cable 8; a second connecting assembly 23 hinged to frame 13 and engaging first connecting assembly 22 in sliding manner; and a third connecting assembly 24 secured to frame 13 and engaging first connecting assembly 22 in sliding manner. And rescue pull cable 8 draws rescue trolley 12 selectively by means of first and second connecting assemblies 22, 23 or first and third connecting assemblies 22, 24, depending on the pull direction of rescue pull cable 8 and the slope of supporting cables 6. More specifically, first connecting assembly 22 comprises two clamps 25 spaced apart and fixed to rescue pull cable 8; and a longitudinal member 26 supported isostatically between clamps 25 by two arms 27 and 28, and which extends parallel to the portion of rescue pull cable 8 extending between clamps 25.

[0021] With reference to Figures 3 to 5, longitudinal member 26 is hollow and forms a rail fixed inside with a stop which also acts as a damper, and which in the example shown is defined by a fluid cylinder 29, in particular a hydraulic cylinder with a rod 30 maintained in the extended position by a spring not shown in the drawings.

[0022] With reference to Figure 4, second connecting assembly 23 is substantially defined by a rudder comprising an arm 31 connected to frame 13 by an articulated joint 32 defined by a universal joint - in the example shown, a Cardan joint; and a sliding member 33 engaged inside and sliding along longitudinal member 26. Arm 31 and sliding member 33 are connected by an articulated joint 34.

[0023] Third connecting assembly 24 comprises a flexible elongated member 35 - in the example shown, a cable; two pulleys 36, 37; and a sliding member 38 fitted to the free end of rod 30 and in sliding manner to longitudinal member 26.

[0024] Cylinder 29, as stated, is housed inside longitudinal member 26, and divides longitudinal member 26 into two parts. And both sliding members 33, 38 are located on the same side of cylinder 29: in the example shown, sliding member 38 is located between cylinder 29 and sliding member 33.

[0025] Pulley 36 is fitted in rotary manner to the end of longitudinal member 26 on the opposite side to sliding members 33, 38, and pulley 37 is fitted in rotary manner to sliding member 38.

[0026] Cable 35 is fixed at one end to frame 13 of rescue trolley 12, and at the other end to longitudinal member 26, close to pulley 36, and is wound about pulleys 36 and 37.

[0027] Cable 35 forms a U about pulley 37, and has two branches substantially parallel to each other and to longitudinal member 26.

[0028] When needed, i.e. in the event of a breakdown of cable transportation system 1 preventing transportation units 9 from being moved, rescue trolley 12 is drawn by rescue pull cable 8 up to the transportation unit 9 closest to bottom station 2 (or top station 3); and the rescue trolley 12 operators on platform 16 connect tow hooks 19 and 20 to trolley 10 of transportation unit 9, and release clamp 11 from pull cable 7.

[0029] Once this is done, transportation unit 9 can be towed by rescue trolley 12 to bottom station 2 or top station 3.

[0030] Figure 3 shows the operating mode by which to tow the transportation unit to top station 3, which means rescue trolley 12 must negotiate a positive slope, i.e. travel uphill in direction D. In which case, first and second connecting assemblies 22, 23 are used to transmit the pulling force between rescue pull cable 8 and frame 13. More specifically, sliding member 33 slides towards and into contact with sliding member 38. The pulling force gradually shortens rod 30 by means of sliding member 33, so that, when starting, any shock produced by sharp movements is damped by cylinder 29. The pulling force is transmitted from rescue pull cable 8 to frame 13 by arm 31 and articulated joints 32, 34.

[0031] In this operating mode, cable 35 is slack and plays no part in transmitting the pulling force.

[0032] Figure 4 shows the operating mode by which to tow the transportation unit along a flat portion of supporting cables 6, and which applies regardless of the travelling direction (to bottom station 2 or top station 3).

[0033] In this case, very little pulling force is transmitted between rescue pull cable 8 and rescue trolley 12, and serves simply to overcome the rolling friction of rescue trolley 12 and transportation unit 9; cylinder 29 expels rod 30; sliding members 33, 38 are positioned contacting each other; and cable 35 is taut. Pulling force, in fact, is mainly transmitted by first and second connecting assemblies 22, 23 when towing towards top station 3 (rightwards in Figure 4), and by first and third connecting assemblies 22, 24 when towing towards bottom station 2 (leftwards in Figure 4).

[0034] Figure 5 shows the operating mode by which to tow the transportation unit to bottom station 2 along an oppositely-sloping portion, i.e. with a positive (uphill) slope, even though towing to bottom station 2 is performed in the opposite direction to direction D.

[0035] In this case, pulling force is transmitted solely by means of first and third connecting assemblies 22, 24; rod 30 is compressed inside cylinder 29 by the taut cable 35; sliding member 33 is located at the end of longitudinal member 26; and frame 13 changes position with respect

to longitudinal member 26: frame 13 is located predominantly under the left half of longitudinal member 26 in Figure 3, and substantially centrally with respect to longitudinal member 26 in Figure 5.

[0036] Rescue trolley 12 is thus able to tow transportation unit 9 in opposite directions and along oppositely-inclined slopes. Supporting cables 6 in the Figure 1 transportation system, in particular, comprise alternating oppositely-inclined portions, which is fairly common, particularly at idler trains 4 (Figure 1). Rescue trolley 12 is able to negotiate oppositely-inclined portions while at the same time damping, by means of cylinder 29, any shock produced by changes in slope.

[0037] Figure 6 shows rescue trolley 12 in a number of operating modes characterized by different distances between supporting cables 6 and rescue pull cable 8. The sag in supporting cables 6 and rescue pull cable 8 between bottom and top stations 2, 3 and intermediate idler trains 4, in fact, make it virtually impossible to keep rescue pull cable 8 at a constant distance from, and more generally in a constant position with respect to, supporting cables 6.

[0038] By virtue of articulated joints 32 and 34, the flexibility of cable 35, and the sliding connection between connecting assembly 22 and connecting assemblies 23, 24, rescue trolley 12 is able to cope with up to a 2200 mm distance between supporting cables 6 and rescue pull cable 8.

Claims

1. A rescue trolley (12) for recovering and transporting transportation units (9) of a cable transportation system (1) comprising at least one supporting cable (6) and a rescue pull cable (8); the rescue trolley (12) comprising a frame (13) guided along a given path (P) by the supporting cable (6), an anchoring device (14) for engaging a transportation unit (9), and a connecting device (15) for connecting the frame (13) to the rescue pull cable (8); the rescue trolley (12) being **characterized in that** the connecting device (15) comprises a first connecting assembly (22) fixed to the rescue pull cable (8); a second connecting assembly (23) hinged to the frame (13) and connected to the first connecting assembly (23); and a third connecting assembly (24) secured to the frame (13) and connected to the first connecting assembly (22); said rescue pull cable (8) drawing the rescue trolley (12) selectively by means of the first and second connecting assembly (22, 23) or the first and third connecting assembly (22, 24), depending on the moving direction of the rescue pull cable (8) and the slope of the supporting cable (6).

2. A rescue trolley as claimed in Claim 1, **characterized in that** the second connecting assembly (23) engages the first connecting assembly (22) in sliding manner; and the third connecting assembly (24) engages the first connecting assembly (22) in sliding manner.

3. A rescue trolley as claimed in Claim 2, **characterized in that** the first connecting assembly (22) comprises a longitudinal member (26) fixed to the rescue pull cable (8) and defining a rail; the second and third connecting assembly (23, 24) respectively comprising a first and second sliding member (33, 38) sliding inside the longitudinal member (26).

4. A rescue trolley as claimed in Claim 3, **characterized in that** the first connecting assembly (22) comprises a stop for limiting travel of said first and second sliding member (33, 38) inside the longitudinal member (26).

5. A rescue trolley as claimed in Claim 4, **characterized in that** said stop comprises a damper.

6. A rescue trolley as claimed in Claim 5, **characterized in that** said damper is a fluid cylinder (29) having a rod (30), and which maintains the rod (30) in an extended position outside the fluid cylinder (29).

7. A rescue trolley as claimed in Claim 6, **characterized in that** the second sliding member (38) is fixed to the rod (30).

8. A rescue trolley as claimed in any one of Claims 3 to 7, **characterized in that** the second connecting assembly (23) comprises an arm (31) connected to the frame (13) by a first articulated joint (32), and to the first sliding member (33) by a second articulated joint (34).

9. A rescue trolley as claimed in Claim 7, **characterized in that** the first articulated joint (32) is defined by a universal joint, in particular a Cardan joint.

10. A rescue trolley as claimed in any one of Claims 3 to 9, **characterized in that** the third connecting assembly (24) comprises a flexible elongated member (35), in particular a cable, secured at a first end to the frame (13), and which draws the second sliding member (38) along the longitudinal member (26).

11. A rescue trolley as claimed in Claim 10, **characterized in that** the third connecting assembly (24) comprises a first and a second pulley (36, 37); the first pulley (36) being fitted in rotary manner to the longitudinal member (26), and the second pulley (37) being fitted in rotary manner to the second sliding member (38); and said flexible elongated member (35) being wound about the first and second pulley (36, 37).

12. A rescue trolley as claimed in Claim 11, **characterized in that** a second end of the flexible elongated member (35) is secured to the longitudinal member (26) and wound in a U about the second pulley (37).

13. A rescue trolley as claimed in any one of the foregoing Claims, **characterized in that** the anchoring device (14) comprises a first and a second tow hook (19, 20) for engaging the transportation unit (9) along opposite sides of the transportation unit (9).

14. A rescue trolley as claimed in Claim 13, **characterized in that** the first and second tow hook (19, 20) tow the transportation unit (9) in respective opposite directions.

15. A cable transportation system comprising a bottom station (2); a top station (3); at least one supporting cable (6) extending between the bottom station (2) and the top station (3); a pull cable (7) extending between the bottom station (2) and the top station (3); at least one transportation unit (9) supported by the supporting cable (6) and drawn by the pull cable (7); a rescue pull cable (8); and at least one rescue trolley (12) as claimed in any one of the foregoing Claims.

16. A cable transportation system as claimed in Claim 15, **characterized by** comprising two supporting cables (6); the rescue trolley (12) resting on both the supporting cables (6).

FIG. 1

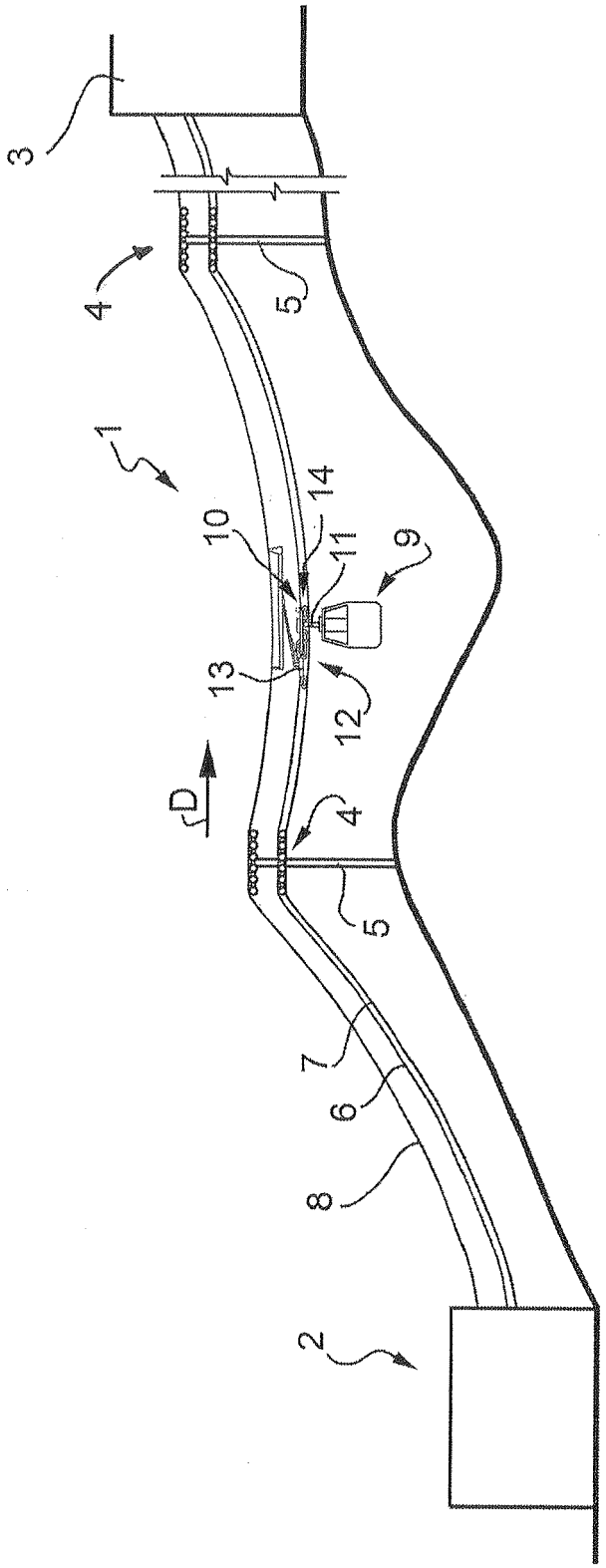

FIG. 2

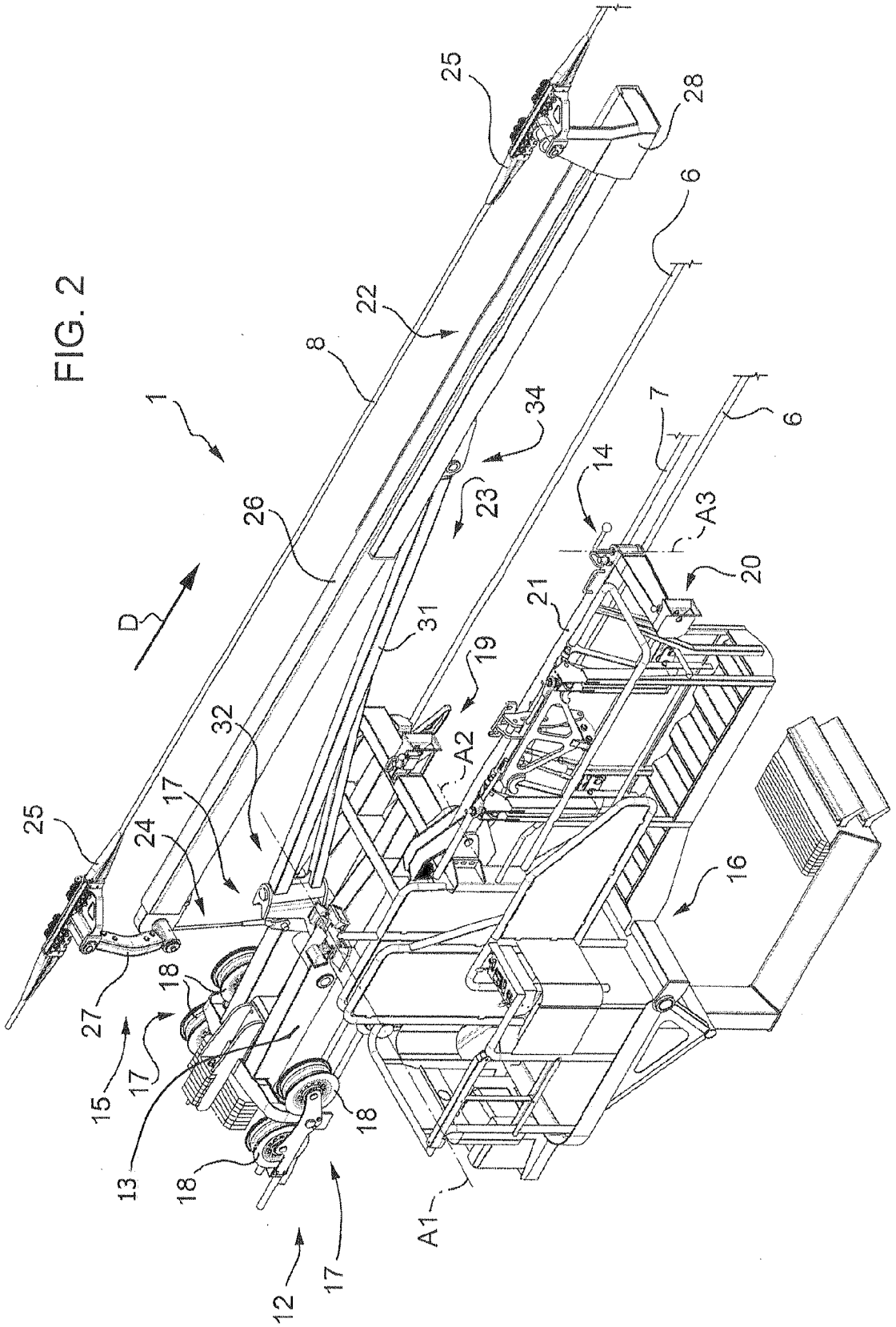
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FIG. 3

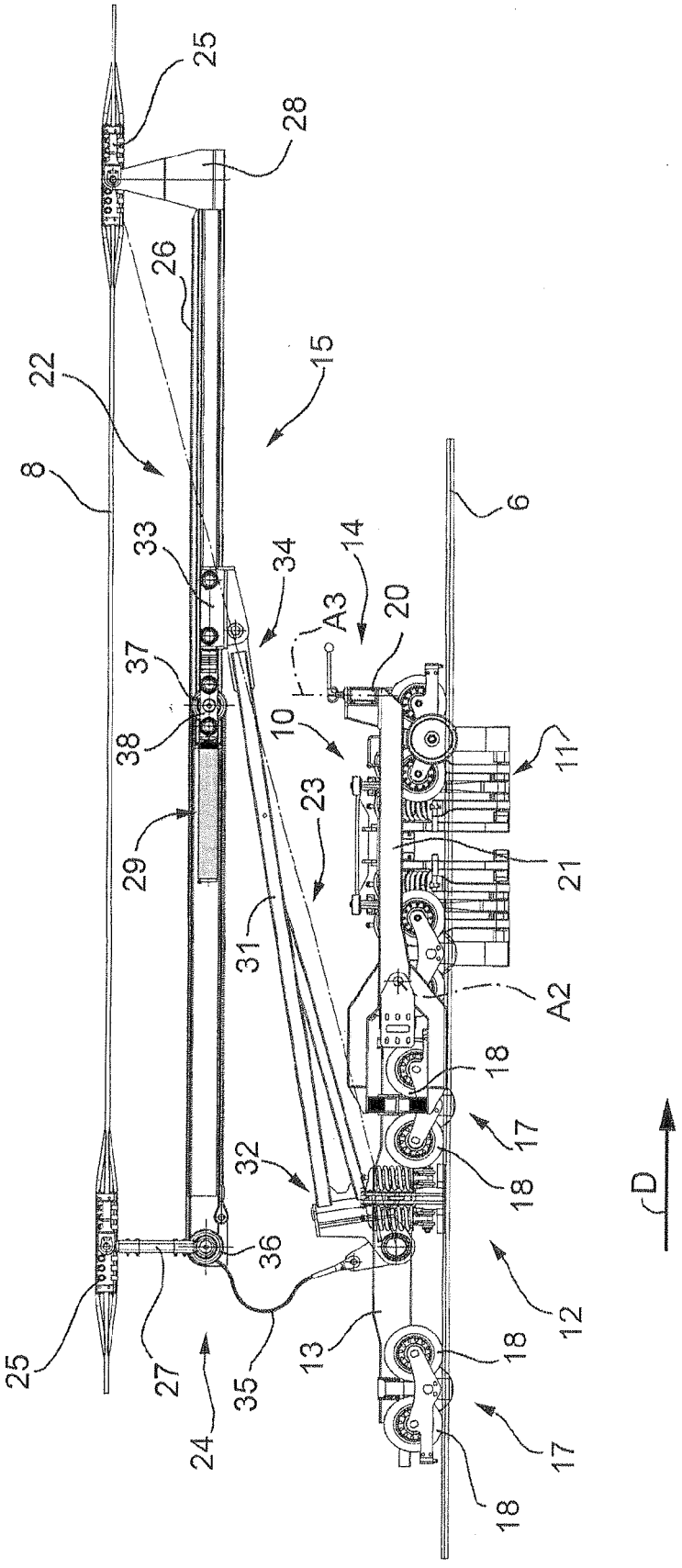
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FIG. 4

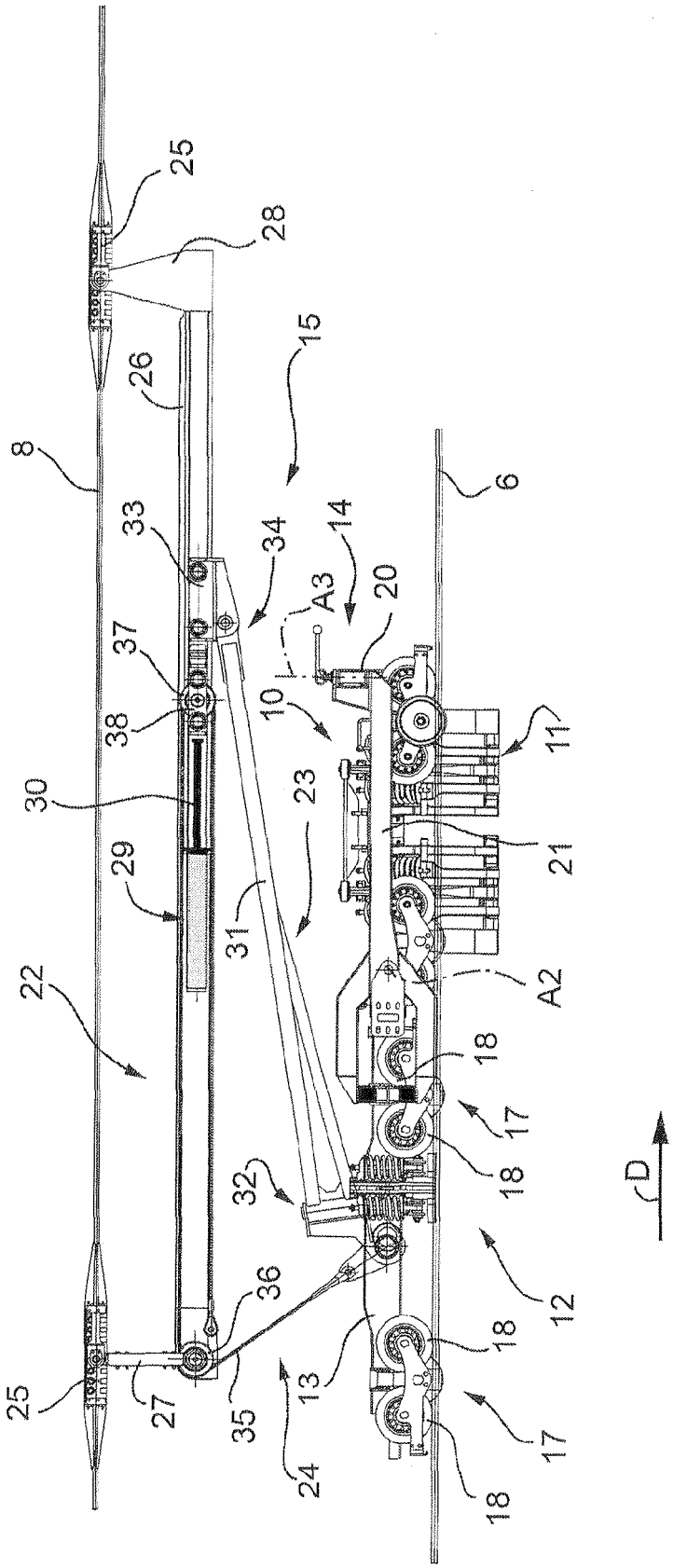
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FIG. 5

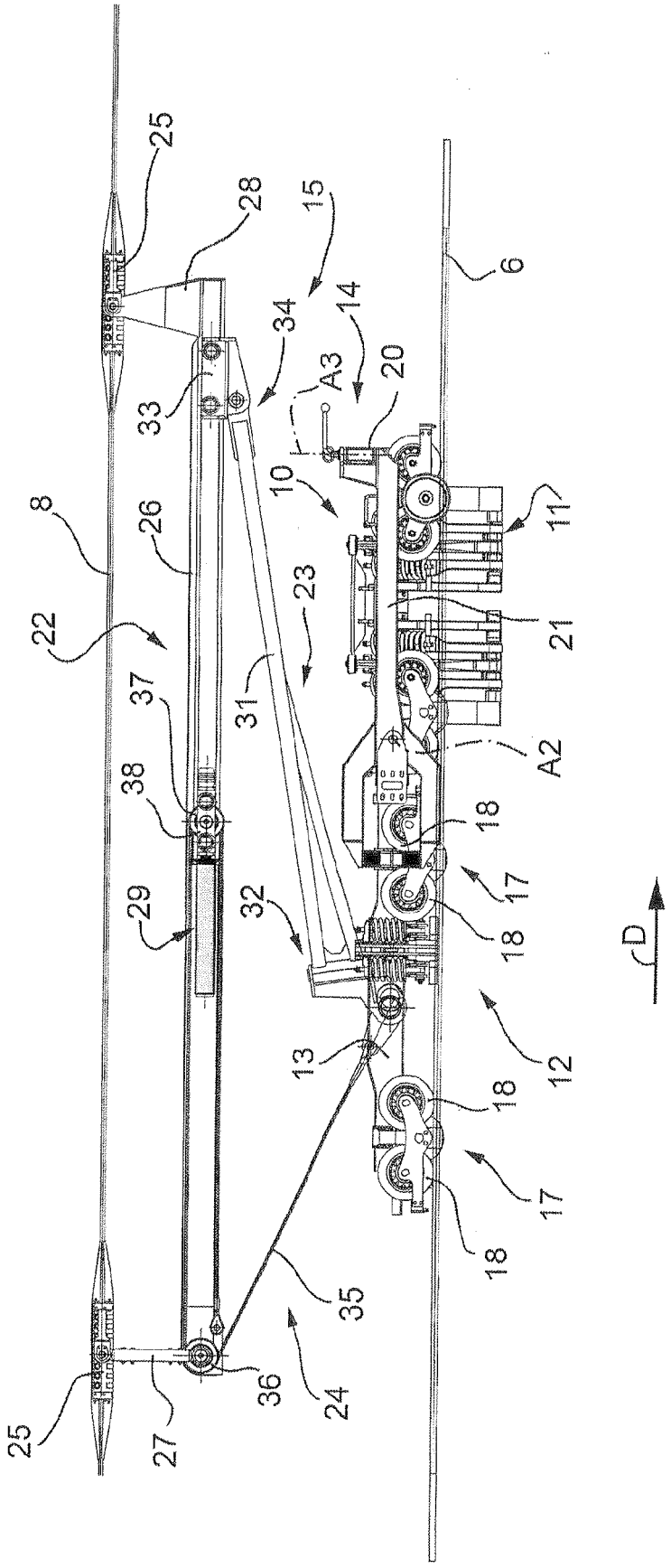
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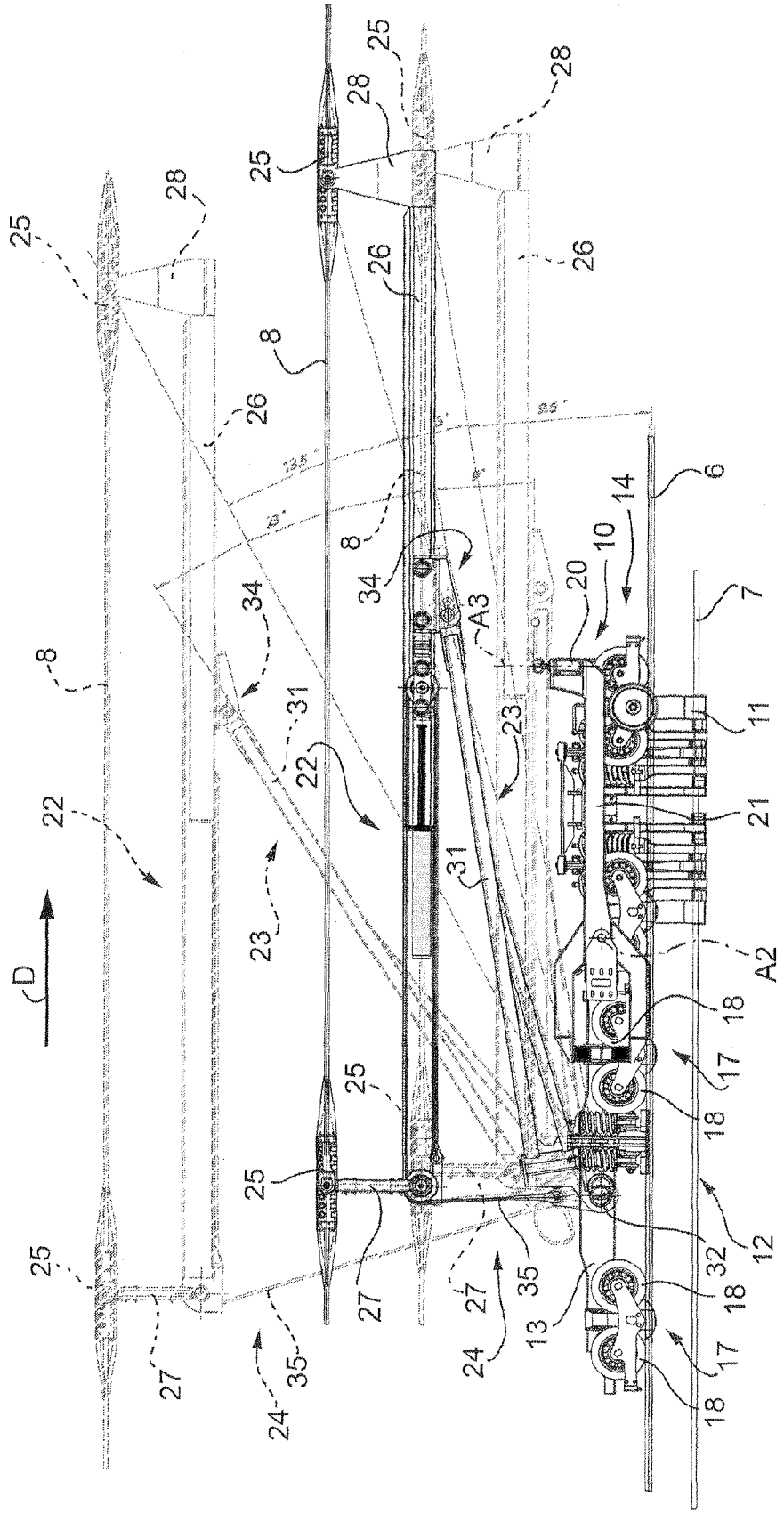
FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 2870

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 265 354 A (CREISSELS DENIS SA [FR]) 27 April 1988 (1988-04-27) * column 3, line 4 - column 4, line 26; figures 1-8 *	1,15	INV. B61B12/00
A	CH 689 115 A5 (GARAVENTA & STAEDELI AG [CH]) 15 October 1998 (1998-10-15) * column 2, line 12 - line 55; figures 1,2 *	1,15	
A	DE 889 166 C (WALLMANNSBERGER GEORG DR-ING) 7 September 1953 (1953-09-07) * the whole document *	1,15	

TECHNICAL FIELDS SEARCHED (IPC)

B61B
A62B
E01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 November 2008	Chlosta, Peter

CATEGORY OF CITED DOCUMENTS

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12-11-2008

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CH 689115 A5	15-10-1998	NONE	
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