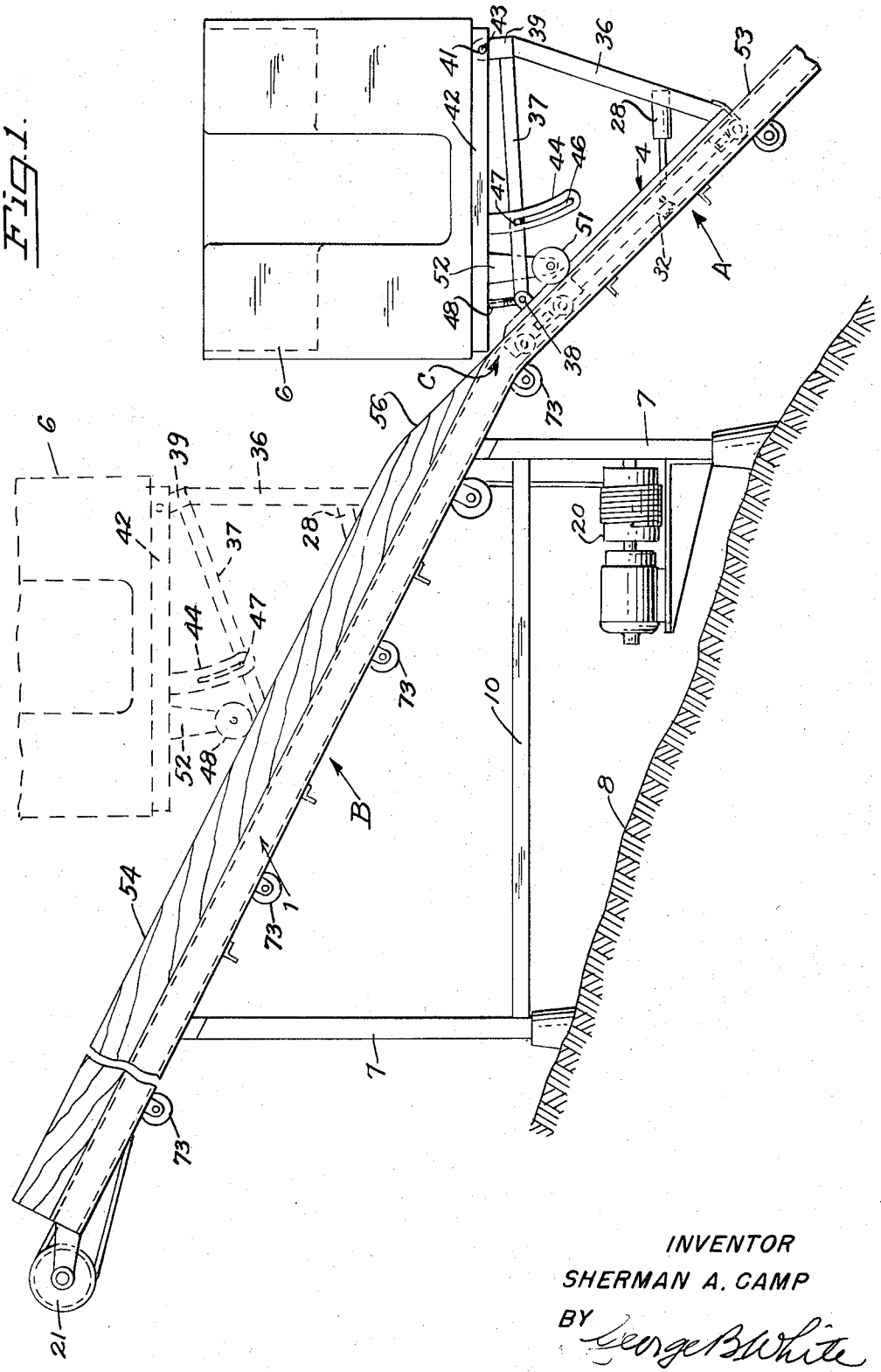
April 4, 1967 S. A. CAMP 3,312,307

HILL CLIMBING ELEVATOR

Filed Nov. 12, 1964 4 Sheets-Sheet 1

Fig. 1.



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Fig. 2

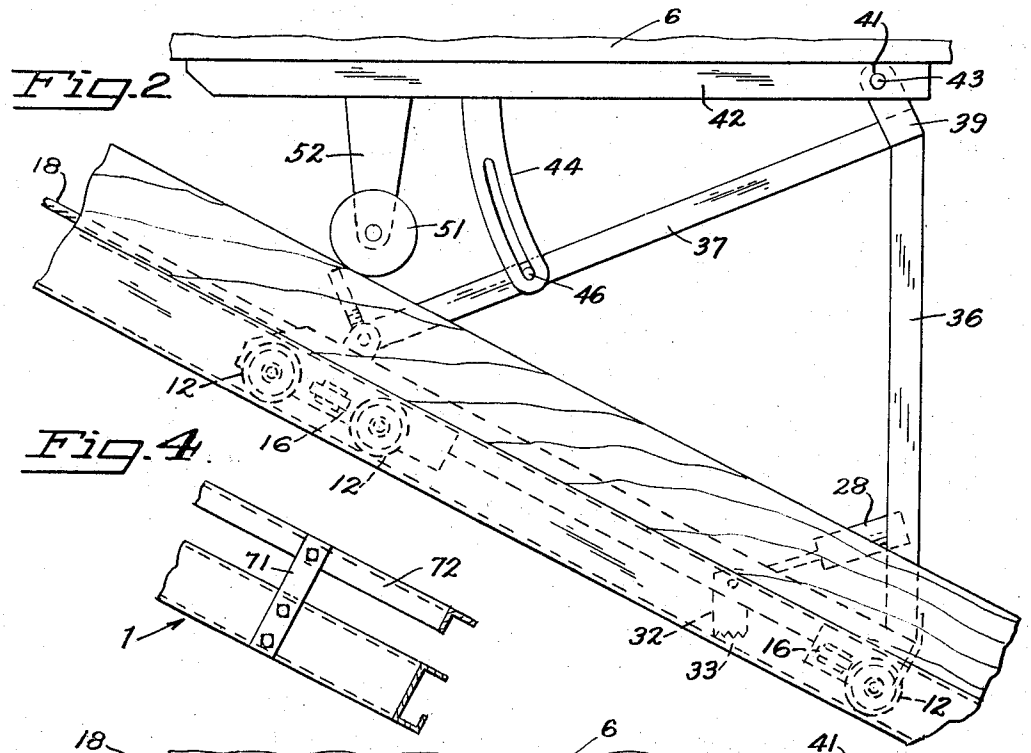


Fig. 4.

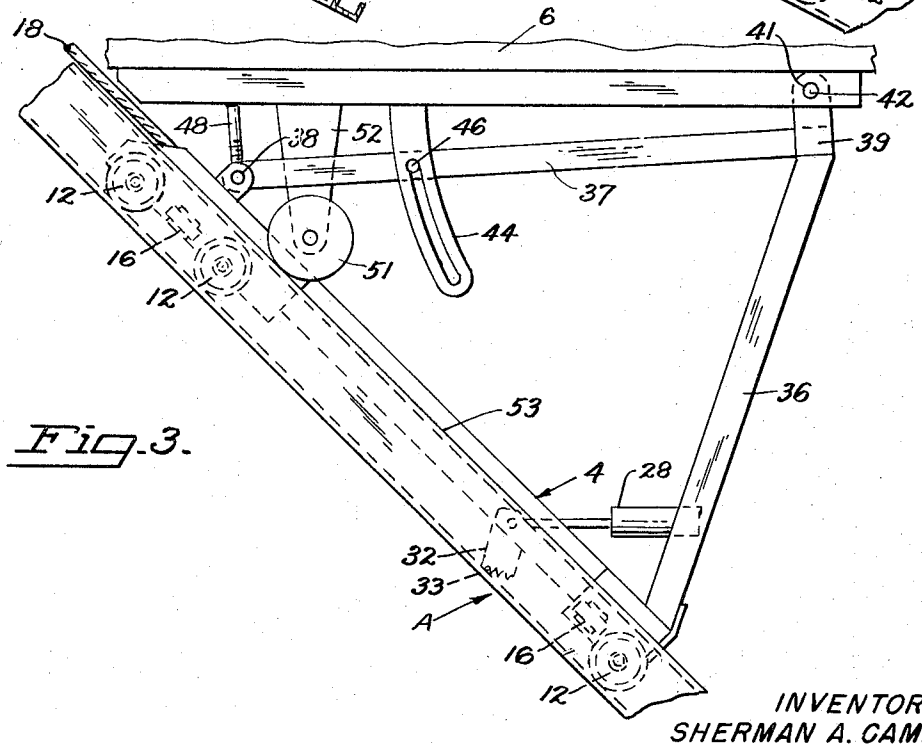


Fig. 3.

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HILL CLIMBING ELEVATOR

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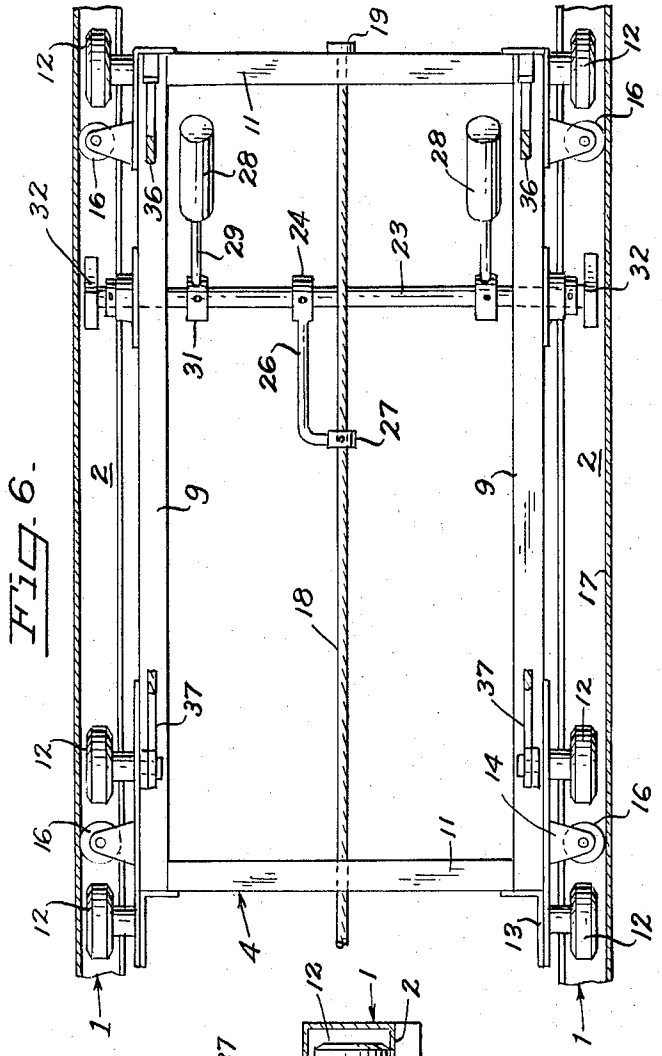


Fig. 6.

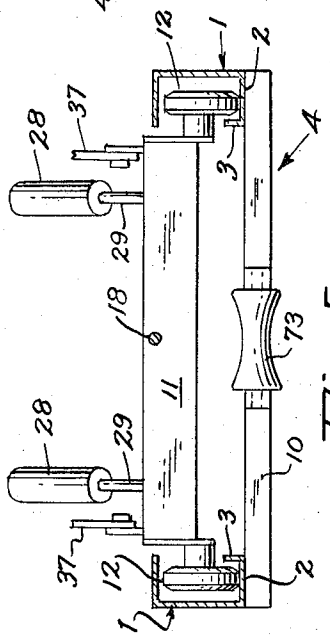


Fig. 5.

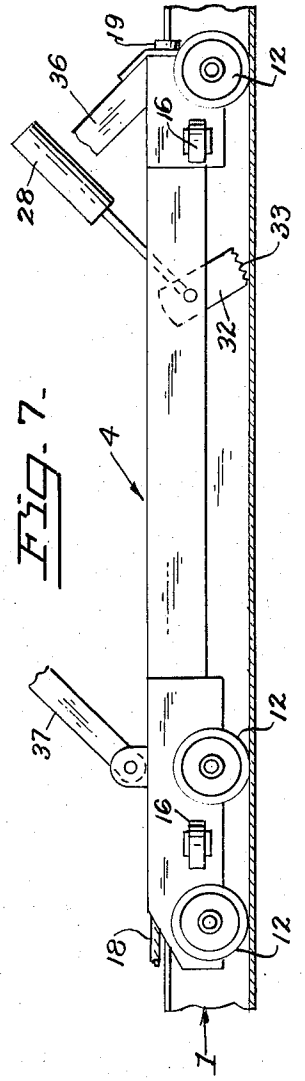


Fig. 7.

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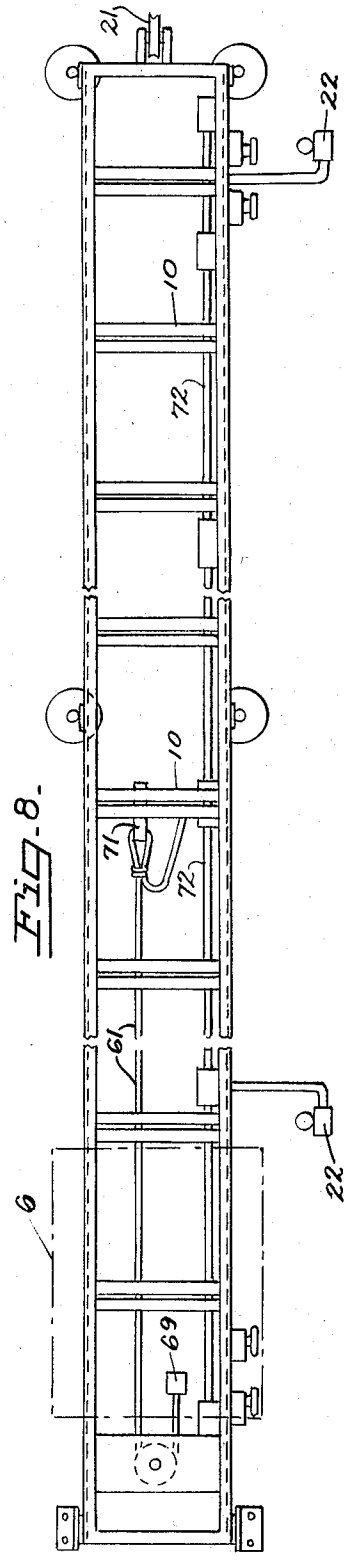


Fig. 8.

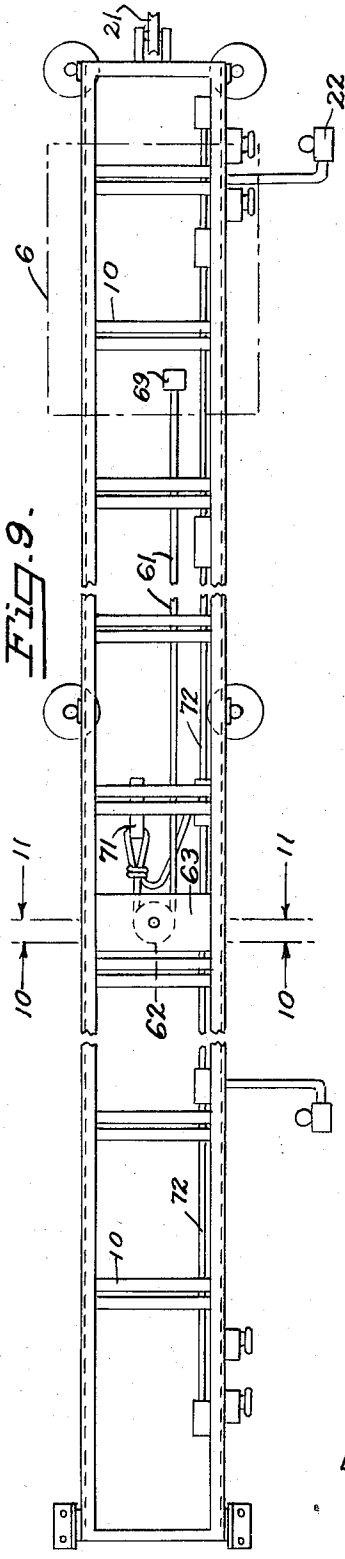


Fig. 9.

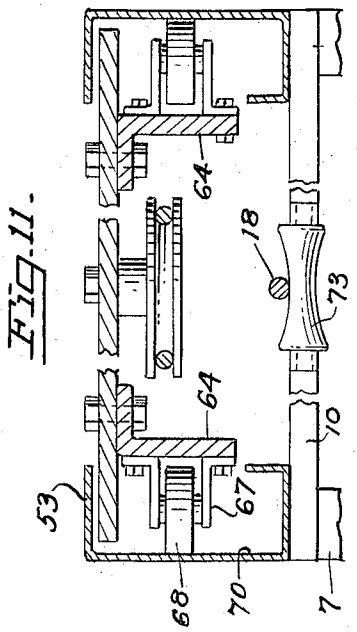


Fig. 11.

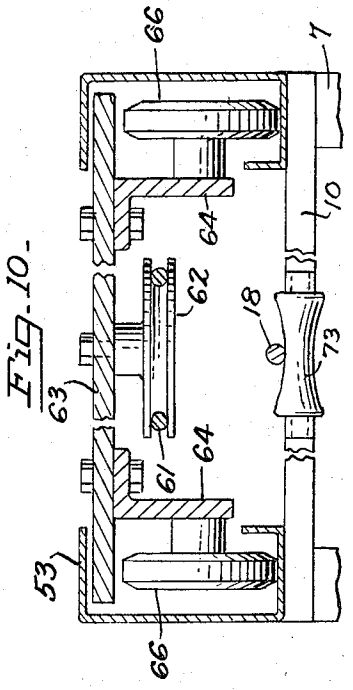


Fig. 10.

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HILL CLIMBING ELEVATOR

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Filed Nov. 12, 1964, Ser. No. 410,359
3 Claims. (Cl. 187—10)

This invention relates to a hill climbing elevator.

In connection with hill climbing elevators, wherein the track is not in a straight line but is bent or curved at differing angles for instance, so that the lower end of the track is steeper than the upper portion of the track, vexing problems arise essentially in connection with the positive guiding of the carriage and also the righting of the carriage in vertical position so as to maintain the floor of the cab of the carriage horizontal during travel over all portions of the track; further problems arise in connection with the guiding of the electric cable so as to confine the relative movement of the electric cable to the steeper portions of the track.

The features of the herein invention include the provision of a carriage and means for supporting it and guiding it on the rails of the track in such a manner that the carriage is held in vertical position on the steeper portion of the track and then it is readjusted when it enters on the other portion of the track at a different angle than the steeper track, thereby to be held in vertical attitude at all times.

Another object of the invention is to provide an under-carriage on which the elevator cab is pivoted, providing adjusting and guiding means to turn the cab on the carriage into vertical position irrespective of the angle of incline of the rails, the said adjusting means co-acting with the respective rails so as to compensate for the difference between the angles of incline of the steeper lower portion and the upper portion of the tracks.

Another object of the invention is to provide differential means to maintain the electric cable leading to the elevator cab taut at all times, yet limit its travel within the lower, steeper portion of the track.

Other objects of the invention are the positive guiding of the undercarriage in the tracks against vertical and horizontal displacement, and positive engagement of the under-carriage in the respective attitudes of the cab.

I am aware that some changes may be made in the general arrangements and combinations of the several devices and parts, as well as in the details of the construction thereof without departing from the scope of the present invention as set forth in the following specification, and as defined in the following claims; hence I do not limit my invention to the exact arrangements and combinations of the said device and parts as described in the said specification, nor do I confine myself to the exact details of the construction of the said parts as illustrated in the accompanying drawings.

With the foregoing and other objects in view, which will be made manifest in the following detailed description, reference is had to the accompanying drawings for the illustrative embodiment of the invention, wherein:

FIG. 1 is a diagrammatic side view of the hill climbing elevator.

FIG. 2 is a fragmental side view of the under-carriage and the floor of the cab on the upper portion of the track.

FIG. 3 is a fragmental side view of the under-carriage and the floor of the cab on the lower or steeper portion of the track.

FIG. 4 is a fragmental view showing a modified form of the guide on the top of the upper portion of the track.

FIG. 5 is a fragmental front view of the under-carriage.

FIG. 6 is a fragmental top plan view of the under-carriage.

FIG. 7 is a fragmental side view of the carriage, the track being shown in section.

FIG. 8 is a fragmental plan view of the track showing the location of the cable dolly.

FIG. 9 is a plan view of the track showing the electric cable dolly in its upper or raised position.

FIG. 10 is a cross-sectional view of the dolly on the track, the section being taken on lines **10—10** of FIG. 9.

FIG. 11 is a sectional view of the dolly on the track, this section being taken on lines **11—11** of FIG. 9.

The hill climbing elevator climbs on a track consisting of rails **1**. Each rail **1** is a channel of substantially U shape cross section as shown in FIGS. 5, 10 and 11. The lower horizontal flange **2** of each rail **1** is bent upwardly to form a wheel confining flange **3**.

The track formed by the parallel rails **1** in the herein illustration is divided into two parts inclined at different angles. The lower portion A is inclined at a steeper angle as needed on certain hill contours. The upper portion B of the track is inclined at a lesser angle to the perpendicular than the lower or steeper portion A.

The rails **1** are so arranged that their open sides face each other so as to accommodate an under-carriage **4** for the support of the cab **6** of the elevator. The rails **1** are supported on suitable posts **7** or other suitable frame structure spaced above the ground **8**, such as spreaders and transverse supports **10**.

The under-carriage **4** has a substantially rectangular frame with longitudinal sides **9** and cross members or ends **11**. This frame rides on wheels **12** supported on suitable brackets **13** secured on the longitudinal sides **9** of the frame so that the wheels **12** ride on the lower horizontal flanges **2** in the channel of the respective rails **1**. The frame is within the space between the rails **1**.

On the upper end of each longitudinal side **9** of the frame is mounted a pair of wheels **12** spaced from one another on each side of the frame riding in the respective rails **1** to facilitate the guiding of the under-carriage **4** at the area where the angle of incline of the track changes.

Between each pair of wheels **12** and also adjacent each single wheel **12** at the lower end, is a horizontal bearing bracket **14** in which is journalled a horizontal wheel **16**. The horizontal wheels **16** ride on the vertical sides **17** of the rails **1**, thereby to inhibit lateral or transverse play of the under-carriage between the rails **1**.

In the operation of such hill climbing elevators, a steel hoist cable **18** is used which extends through the ends **11** of the carriage frame and is suitably secured at **19** to the lower end **11** of the under-carriage frame so as to bear the weight of the elevator. This cable **18** is played around a sheave **21** at top of the track, and then at about the middle of the length of the track it is played around other suitable pulleys or sheaves and guided to a power compartment below the track, wherein it is wound around a hoist drum **20**. This drum is driven by the usual power mechanism and controlled by suitable electric circuits from the various landings of the elevator as well as from the elevator cab. Such a controlled circuit to the electric motor for operating the drum is shown, for instance, in Fig. 14 of Patent No. 2,841,093 issued to Sherman A. Camp on July 1, 1958. It is preferable as shown in said previous patent to have a low voltage control circuit to control the high voltage circuit of the electric motor which drives the drum for winding and unwinding cable **18**. The manipulating switches **22** for this control circuit are shown in FIGS. 8 and 9 as they would appear at about the upper and lower landings.

The under-carriage also has an emergency brake device shown in FIGS. 5, 6 and 7. A transverse shaft **23** is suitably journalled in the sides **9** of the under-carriage frame. A hub **24** of a lever **26** is fixed to the shaft **23**. A guide

sleeve 27 on the lever 26 slidably guides the cable 18. A pair of counter-weights 28 with counter-weight arms 29 have their hubs 31 fixed on the shaft 23 at such angle that the weights normally urge the lever 26 upwardly. On each end of the shaft 23 within the respective rails 1 is a brake claw 32, the serrated end 33 of which extends to the bottom flange 2 of the adjacent rail 1. The cable 18 is normally under tension supporting the weight of the carriage and the cab, hence it holds the sleeve 27 and lever 26 in an initial position so as to hold brake claw 32 out of contact with the bottom flange 2 of the rails 1. If for any reason a failure occurs and the cable 18 slackens, then the counter-weights 28 are permitted to rock the shaft 23 so as to turn the serrated ends 33 into contact with the rail bottoms 2. As the brake claw 32 is firmly jammed against the track bottoms 2, the carriage and the cab are held fast and cannot fall down the incline. As repair is made and the cable 18 is again pulled tight to suspend the carriage, the sleeve 27 is forced downwardly or in a clockwise direction viewing FIG. 7, thereby lifting the counter weights 28 upwardly and turning the brake claws 32 away from the track bottoms 2 and thus releasing the emergency brake.

The under-carriage also includes converging braces 36 and 37. Brace 36 is fixed to the lower end of the longitudinal frame member 9. The other brace 37 is fixed to a lug 38 near the upper end of the adjacent side 9 of the carriage frame. At the apex or corner 39 formed by the converging braces 36 and 37 is a bearing 41 to which is pivotally secured a floor frame 42 of the cab 6.

The pivot 43 is at each corner at the lower end of the cab floor frame 42. From each side of the floor frame 42 extends an arcuate guide 44 which has an arcuate slot 46. The slot 46 rides on a limit pin 47 extended from the adjacent brace 37 for limiting the swinging of the cab floor about its pivots 43 away from the rails 1. An adjustable spacer abutment 48 extends from each side 19 adjacent to the lug 38 to a pre-adjusted position to abut the cab floor frame 42 in a position wherein the cab floor will be horizontal and the cab 6 will extend vertically on the lower or steeper portion A of the track.

As the carriage is pulled up and around the bend C of the tracks the angular position of the sides 9 of the under-carriage changes from the steeper angle of the lower portion A to the lesser incline of the upper portion B. This change of the angle of the under-carriage in the rails 1 would tilt the cab from its vertical position toward the upper end of the track. In order to prevent such tilting and to maintain the cab in a vertically riding position with its floor frame 42 horizontal, a guide roller 51 is supported on a downwardly extended bracket 52 on each side of the floor frame 42. The length of the bracket 52 and the diameter of the guide roller 51 is such that when the elevator is riding on the steeper portion A of the track, the wheel 51 rides on the top wall 53 of the rails 1. As the elevator carriage turns around the bend C the cab 6 must be swung around its pivot correspondingly to the change of the angular position or incline of the under-carriage frame from the steeper incline to the lesser incline of the track. In order to compensate for this change of the angular attitude of the under-carriage, there is a lift rail or guide 54 super-imposed on the top flange 53 of each rail 1 in the upper track portion B. The lower end of the lift rail 54 is curved and converges gradually into an entrance slope 56 for gradually compensating for the changing of the angularity or incline of the under-carriage as it turns around the bend C. The height of the lift rail 54 is determined by the difference of incline between the steeper lower portion A and the upper portion B of the track.

The guide rollers 51 ride on the lift rails 54 and turn the cab floor frame 42 around its pivot 43 from the full line position to the broken line position in FIG. 1.

It is important, particularly when the track changes incline, as in the herein illustration, that the electric control cable 61 be kept taut yet follow the cab 6 in its travel from one end of the track to the other. This was difficult to accomplish especially when the cable 61 is anchored at about the middle of the track near the bend C while the cab 6 travels a considerable distance upwardly from the bend C. For the solution of this problem and for a differential slack, the electric cable 61 is played around a pulley 62 journalled on a dolly plate 63, which dolly plate 63 is provided with suitable bearing brackets 64 on each side to support wheels 66 riding within the channels of rails 1. There are also horizontal bearing brackets 67 extending laterally outwardly from the vertical brackets 64 to accommodate horizontal wheels 68 which ride on the inside of the vertical walls 70 of the rails 1 to prevent lateral play of the dolly. The electric cable 61 has its lower end played around the pulley 62 and then suitably secured to the cab 6 and connected to the control box 69 in the cab for controlling the stopping and starting of the elevator by the passengers in the cab 6. The upper end of the electric cable 61 is anchored on a suitable bracket 71 near the bend C and then extends through suitable conduits 72 along one of the rails 1 and it is connected to the platform or landing control switches 22 as well as to suitable relay switches to control the higher voltage circuit of the electric motor which latter operates the cable drum.

By reason of the differential motion accomplished by the cable dolly as the cab 6 travels upwardly, the dolly lags behind so that when the cab 6 reaches the top landing as shown in FIG. 9, the dolly with the pulley 62 is at about the bend C and thereby the relative motion of the dolly is limited to the steeper portion B of the track. This prevents entanglement of the electrically controlled cable which must remain connected to the cab at all times.

In the form shown in FIG. 2 the lift rail 54 is formed by a strip of wood suitably bolted, or otherwise fixed, to the top flanges 53 of the rails 1 in the upper portion B of the track. In the form shown in FIG. 4, spaced bracket bars 71 are bolted to the outer walls of the rails 1 and extend upwardly to a desired height. Lift rails in the form of angle irons 72 are bolted or welded to the bracket bars 71 in inverted position so that a flange of the angle irons 72 forms the guiding surface on which the lift roller 51 rides.

In operation the person on the landing manipulates the adjacent switch 22 so as to actuate the electric motor to turn the drum 20 for pulling the elevator carriage and cab to the respective landing. Then the occupants of the elevator cab 6 operate the control switch 69 in the cab 6 again to suitably actuate the drum 24 for pulling up or lowering the elevator as desired. As the carriage turns around the bend C in either direction, the difference in the angle of incline of the respective portions of the track is compensated for by the changing of the engagement of the lift wheel 51 from the top flange 53 of each rail 1 to the lift guides 54 and 56 as the carriage and the cab are pulled upward, and vice versa when the carriage and the cab move down. The low voltage circuit electric cable 61 is prevented from entanglement by moving around the sheave 62 and shifting the cable dolly accordingly as heretofore described. In the event of excessive slacking of the hoist cable 18, by reason of failure of any kind, the emergency brake claws 32 are actuated as heretofore described and lock the carriage and the elevator. During normal slack of the cable 18, especially while the elevator is on the lower track portion A, the hoist cable rides on suitable guide rollers 73 mounted on certain of the cross members or spreaders 10, thereby to prevent excessive wear of the hoist cable 18.

I claim:

1. In a hill climbing elevator,

(a) a pair of spaced rails of generally channelled cross-section facing one another to form an inclined track,

(b) means to support said rails to hold said track on a predetermined incline,
(c) a carriage frame between the rails,
(d) wheels on the opposite sides of said carriage frame confined and riding inside the respective channels of said rails,
(e) a hoist line connected to said carriage frame,
(f) power means for said hoist line for pulling up or lowering said carriage on said inclined track,
(g) support elements extended from said carriage frame adjacent each rail to above the level of said track,
(h) a floor frame and an elevated cab on the floor frame, an end of said floor frame being pivoted on said support elements, the free end of said floor frame gravitating toward said track about the pivot of said pivoted end,
(i) coacting means on said floor frame and on said support element to limit the pivoting of said floor frame away from said track,
(j) adjustable abutment means projecting from said support elements toward the free end of said floor frame for abutting said floor frame in a generally horizontally attitude of said floor frame relatively to said inclined track thereby to maintain the cab on said floor frame in a generally perpendicular attitude.
(k) the incline of one portion of said track being steeper than the incline of another portion of said track,
(l) rolling supports spaced from said pivoted end toward said free end of said floor frame and extending toward the top of the respective rails of said track to space said floor frame from said rails at a predetermined distance for holding the cab in said perpendicular attitude,
(m) compensating guides spaced above the rails of one of said portions for engagement by said rolling supports, the height of said rolling supports relatively to the spacing of said compensating guides above said rails being such that said rolling supports engage and ride upon said compensating guides thereby to turn said floor frame about said pivotal end in proportion to the difference of incline between said portions of said track for maintaining said floor frame in a horizontal attitude and said cab on said floor frame in a vertical attitude.

2. In a hill climbing elevator defined in claim 1,
(n) said rolling supports being near the free end of said floor frame and said limiting means being between said rolling supports and the pivoted end of said floor frame.

3. In a hill climbing elevator,
(a) a pair of spaced rails of generally channel cross-section facing one another to form a track,
(b) a carriage for the elevator between said rails,
(c) wheels on each side of said carriage riding in the respective channels of the respective rail,
(d) wheels extended laterally from said frame bearing laterally against the respective rails to inhibit transverse play of said carriage between said rails,
(e) means to adjustably support an elevator cab on said carriage,
(f) means to hoist said carriage with the cab thereon on said rail,
(g) an electrical cable between the rails,
(h) one end of said cable being anchored between said rails at a point spaced from the ends of said track,
(i) a cable dolly between said rails and riding in the respective rails,
(j) a sheave journalled on said dolly, the other end of said cable being played around said sheave and connected to said cab to ride with said cab whereby the said electrical cable is kept taut in a portion of said track spaced from the upper portion of the track.

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