June 30, 1970 R. E. MEYER 3,517,775

ELEVATOR

Filed Jan. 17, 1968 4 Sheets-Sheet 1

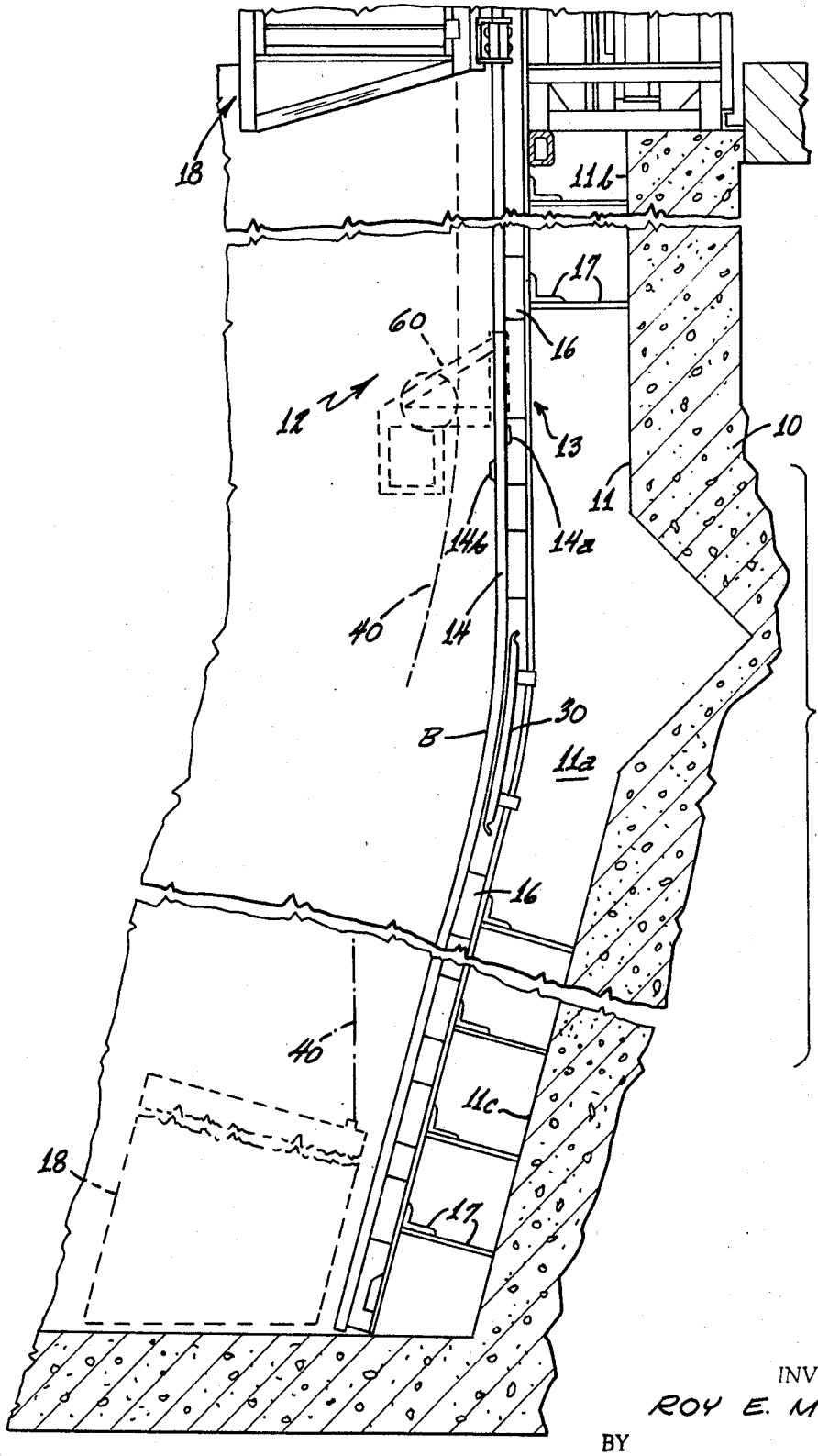

FIG. 1

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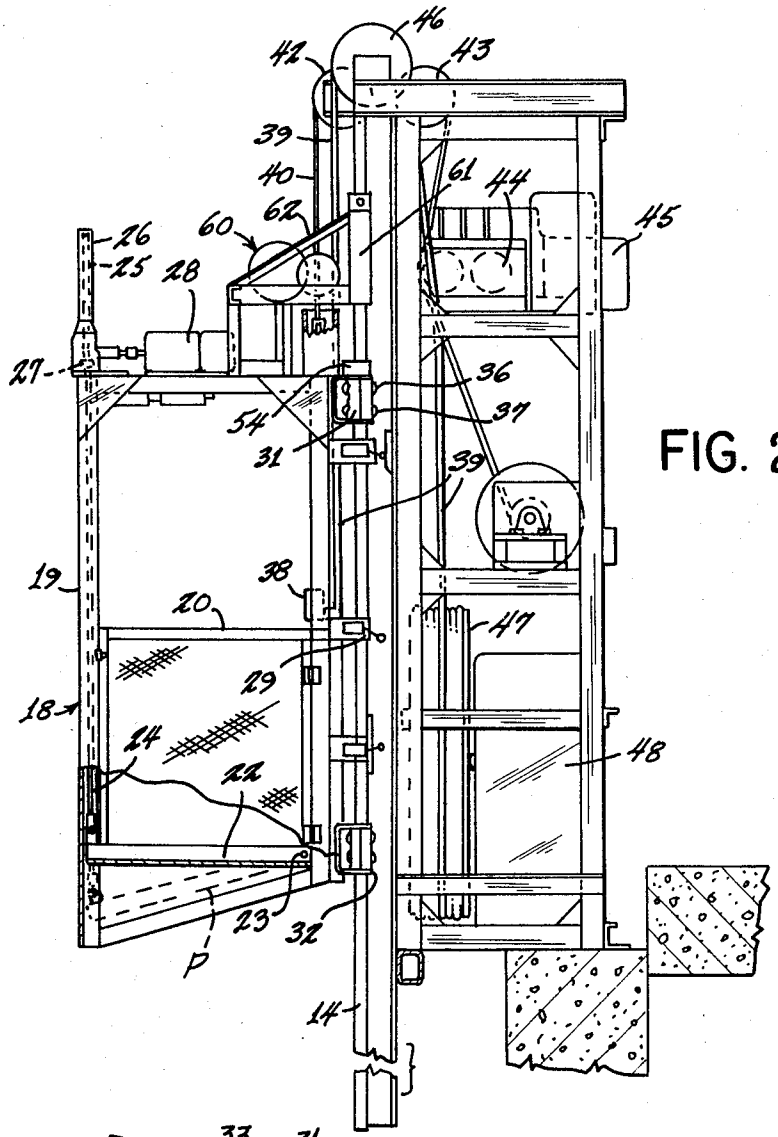

FIG. 2

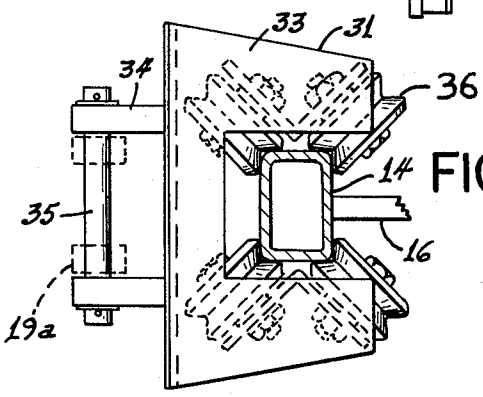

FIG. 3

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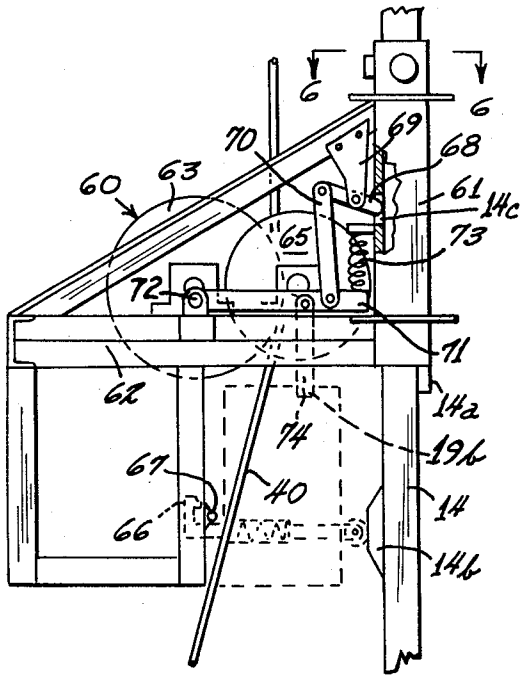

FIG. 4

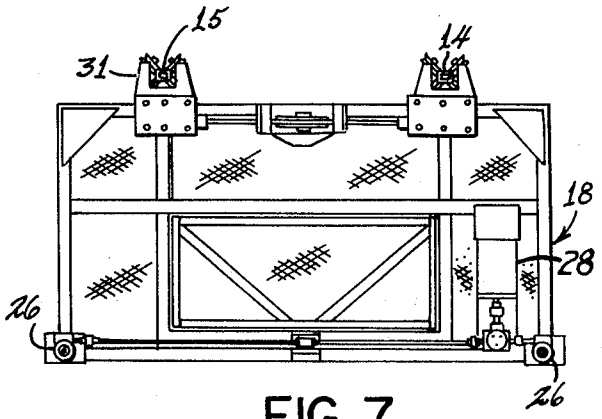

FIG. 7

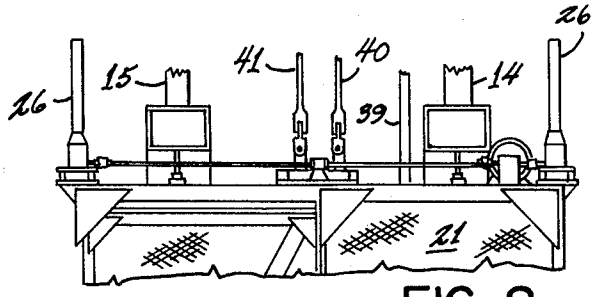

FIG. 8

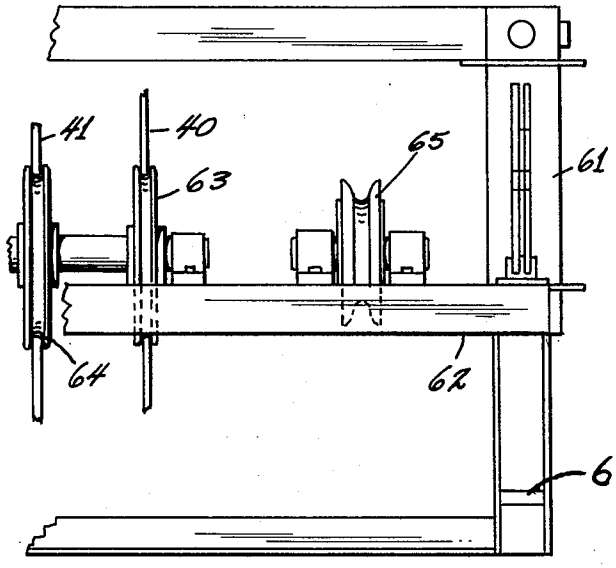

FIG. 5

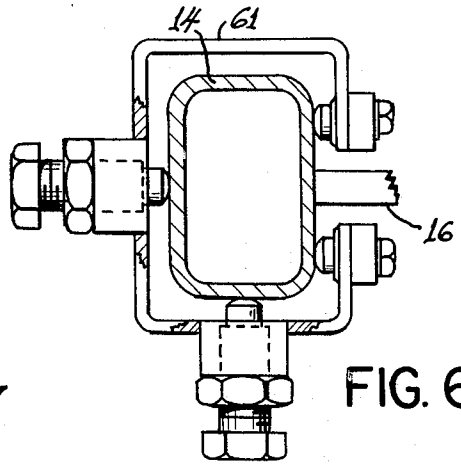

FIG. 6

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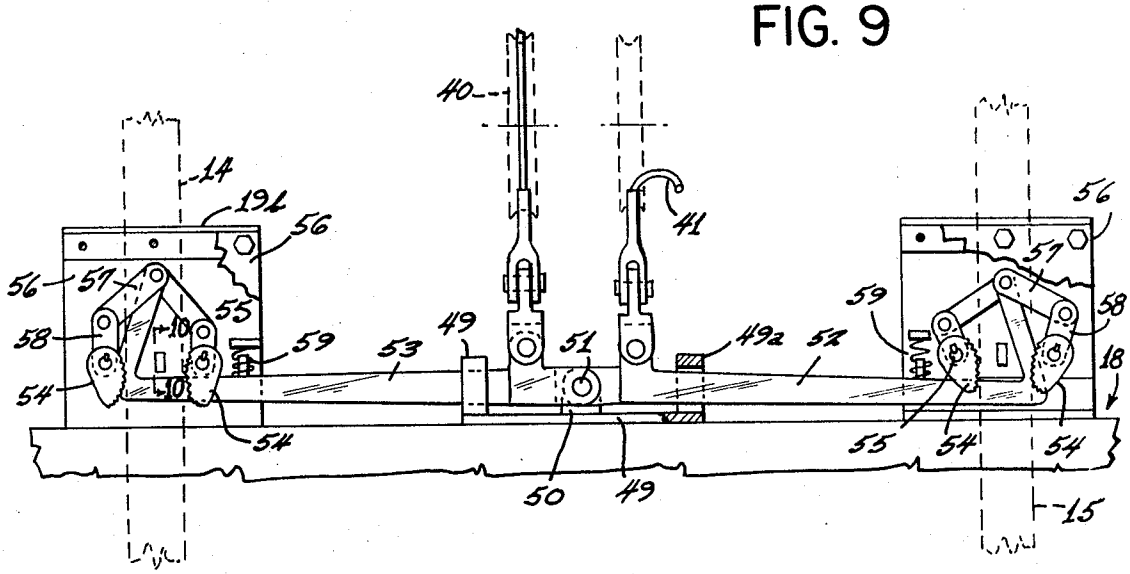
FIG. 9



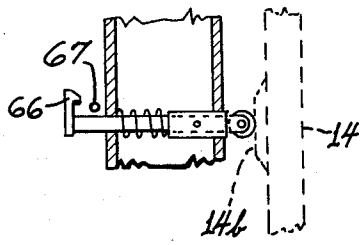


FIG. 10

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United States Patent Office 3,517,775 Patented June 30, 1970

3,517,775

ELEVATOR

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Filed Jan. 17, 1968, Ser. No. 698,549
Int. Cl. B66b 7/04
U.S. Cl. 187—12 12 Claims

ABSTRACT OF THE DISCLOSURE

An elevator traveling along a course with a bend therein and carrying a detachable sheave mounting carriage downwardly to the bend where the carriage and cable guiding sheaves are detached and locked in stationary position to guide the cable to the car in the lower reaches of the course; a tiltable floor in the car and a rail gripping locking mechanism to stop the car in the event either of the support cables is ruptured.

BRIEF SUMMARY OF INVENTION

This invention is to accommodate elevator installation in structures where it is not possible or practical to make an elevator shaft which is prefectly straight from end to end. For instance, in a hydroelectric power station, the dam may have a height of several hundred feet, possibly 600 feet or more, and it is necessary to provide for travel from the top of the dam to the bottom of the dam, but it is not always possible to design the shaft in the dam to be linear or straight up and down.

The present invention provides for the installation of an elevator in a shaft which has one or more bends therein and wherein the track along which the elevator follows, has a bend corresponding to the bend in the shaft. The present invention provides a carriage to move with the elevator car downwardly to the bend in the shaft, whereupon the carriage is detached from the elevator car and secured to the track in the shaft and sheaves on the carriage serve to guide the car supporting cables around the bend in the shaft and direct the cables linearly from the bend downwardly to the car. It should be understood that more than one bend in the elevator shaft may be accommodated by providing more than one releasable carriage on the elevator car.

The present invention also contemplates tilting the floor in the elevator car at the bend in the shaft and in the track so that persons in the elevator car may continue to stand on a horizontal floor regardless of the direction of the elevator shaft. A braking mechanism locks to the rails of the track immediately adjacent the wheels of the elevator car so that the rail gripping clamps of the brake maintain a proper relationship to the rail, even while the bend in the track is being negotiated. If either of the dual car supporting cables has a slack or ruptures, the car will be locked in rigid relation to the track to immobilize the car until the cable situation has been corrected.

BRIEF DESCRIPTION OF DRAWING

FIG. 1 is a section view taken on a vertical plane through a generally upright, but bent shaft which is to accommodate an elevator, with substantial portions of the length of the shaft being broken away in order to emphasize important details, and certain of the apparatus shown in dotted lines in its various positions.

FIG. 2 is a side elevation view of the elevator car and cable support and track mechanism at the top of the shaft.

FIG. 3 is an enlarged detail top plan view of one of the clusters of mounting and guide wheels.

FIG. 4 is an enlarged side elevation view of the detachable cable guiding carriage, and illlustrated separated from the car.

FIG. 5 is an enlarged detail elevation view of the carriage as viewed from the left side of FIG. 4.

FIG. 6 is a greatly enlarged detail section view taken approximately at 6—6 in FIG. 4.

FIG. 7 is a top plan view of the elevator car with the removable carriage detached.

FIG. 8 is a detail elevation view of the rear upper portion of the elevator car.

FIG. 9 is an enlarged detail elevation view of the front upper portion of the car and the rail gripping brake mechanism.

FIG. 10 is an enlarged detail section view taken approximately at 10—10 in FIG. 9 and eliminating background mechanism for clarity of detail.

DETAILED DESCRIPTION

One form of the invention is shown in the drawings and is described herein. The structure **10** has a shaft **11** downwardly therethrough which may be multi-purpose shaft with numerous power conducting cables (not shown) at one side of the shaft and the elevator structure, indicated in general by numeral **12** at the opposite side of the shaft. The structure **10** may be a dam having a height of almost 600 feet, and the elevator shaft **11** will have a corresponding length or depth.

The shaft **11** has a bend in it at approximately **11***a*, such that the upper portion **11***b* of the shaft which is oriented substantially vertically, will be at an oblique angle with respect to the lower portion **11***c* of the shaft which is at an angle of approximately 15 degrees with the vertical.

A track structure, indicated in general by numeral **13** is affixed in the shaft **11** and the track structure includes a pair of rigid rails **14** and **15** extending in spaced parallel relation with each other throughout the entire length of the shaft **11** and at one side thereof. As seen in FIG. 3, the rails **14** and **15** are of a rectangular tubular construction and are mounted on bracket plates **16** which are affixed to rigid supporting structure **17** which is embedded in the structure **10** at the side of the shaft **11**. The rails **14** and **15** are related to each other with a substantial degree of precision so that they will accurately guide the elevator car **18** which travels therealong. The elevator car **18** has a rigid framework **19** and a hinged door **20** providing access into the interior of the car, and peripheral screening which substantially encloses the sides and top of the car. The car **18** also has a tiltable floor **22** which is hinged at **23** to the framework **19** of the car so as to be tiltable between the full line position and the dotted line position P shown in FIG. 2. The outer edge of the floor **22** is supported by operating rods **24** which extend upwardly and connect to operating screws **25** confined in the tubular housings **26** at the top of the car. Each of the housings encloses a rotary nut **27** driven by suitable gearing from an electric motor **28**. The motor **28** is controlled by an operating switch **29** which is closed when the feeler thereof engages the stationary cam **30** mounted at the side of the track **14** adjacent the bend B in each of the tracks **14** and **15**. Suitable limit switches are provided for stopping the movement of the floor **22** at the desired limits of its swinging. As seen, the floor **22** is in horizontal position along the upright portion **11***b* of the shaft, and when the elevator car moves downwardly past the bend B in the tracks, the floor is tilted downwardly so as to remain in substantially horizontal position for the comfort and convenience and safety of the persons riding in the car.

The car **18** is guided along the rails **14** and **15** by upper and lower clusters **31** and **32** of wheels respectively disposed adjacent the top and bottom of the car. The clusters **31** and **32** of guide wheels are all substantially identical

and are illustrated in FIG. 3. Each of these clusters has a frame **33** which is provided with a pair of mounting ears **34** for pivotal mounting on a shaft **35** supported by mounting ears **19***a* which are rigid with and an integral part of the frame **19** of the car. Each of the frames or brackets **33** is capable of swinging to a limited degree about a horizontal axis relative to the car **18**.

The cluster **31** includes upper and lower tiers of grooved wheels **36** and **37** which are identical to each other, and are oriented on stationary axes so as to engage and nest with the angular corners of the rails **14** and **15**.

Because of the pivotal mountings provided by shaft **35** of the clusters **31** and **32** of guide wheels, the car **18** may pass along the bend B in the tracks **14** and **15** without binding and while continuing to be adequately supported and guided by the rails.

The elevator car **18** has a suitable control panel **38** therein which is connected to a power cable **39** extending upwardly from the car. The operator of the elevator may thereby control the upward and downward movement of the elevator and may communicate with persons at the top or bottom of the shaft, and the power cable **39** also supplies operating power for the motor **28** and the other lights and interlocks of various sorts for the operating mechanism of the elevator.

Extending upwardly parallel to the control and power cable **39**, are a pair of car support cables **40** and **41**. The car support cables **40** and **41** extend upwardly through the shaft **11** and over a pair of sheaves **42** and **43** and to a winching mechanism **44** operated by an electric motor **45** with a built-in braking mechanism and reversing control. Through the operation of a motor **45**, the elevator car **18** is moved upwardly and downwardly in the shaft **11**. The power cable **39** passes upwardly and over a guide sheave **46** and downwardly to a cable drum **47** operated by a suitable motor operated control mechanism **48** to keep the power cable **39** relatively tight in the shaft **11** without taking any substantial strain in regard to the support of the car. As the car moves upwardly and downwardly, the power cable **39** is correspondingly reeled in or payed out from the drum **47**.

In FIG. 9 is illustrated the attachment of the cables **40** and **41** to the car **18**, and the rail clamping brake mechanism to immobilize the car in the event that one of the cables is broken. In FIG. 9, the condition is illustrated wherein the cable **41** has ruptured so that operation of the apparatus may be understood.

A mounting plate **49** is affixed to the frame **19** of the car, and in upstanding ears **50**, a pivot pin **51** is secured for mounting a pair of cantilever arms **52** and **53** for limited rocking pivotal movement about the horizontal axis of the pivot pin **51**. The horizontally extending cantilever arms extend in opposite directions from the pivot pin **51** toward the respective rails **14** and **15**. A pair of elongate rail clamping brake dogs **54** are mounted adjacent each of the rails **14** and **15**, and on shafts **55** which are journaled in suitable bearings in upright rigid mounting plates **56**, also affixed to the frame **19** of the car. The outer ends of the cantilever arms **52** and **53** are pivoted to links **57** so as to swing the operating arms **58** of the brake dogs **54** and thereby cause the brake dogs **54** to lock against the rails **14** and **15** when the end of the corresponding cantilever arm is moved downwardly. The cantilever arms **52** and **53** are urged downwardly continuously by springs **59**, and are urged upwardly by the action of the cables **40** and **41** pulling upwardly against the weight of the car which is supported from the pin **51**. Upward movement of the cantilever arms **52** is restrained by stops or brackets **49***a* which are rigid with the base plate **49**.

In FIG. 9, the cable **41** is assumed to have ruptured, and it will be seen that the the cantilever arm **52** has been urged and moved downwardly by the spring **59** and the brake dogs **54** have been swung inwardly by action of the spring **59** into a clamping and braking relationship with

respect to the rail **15**, thereby immobilizing the car **18** until the cable **41** is repaired and the cantilever arm **52** is again swung upwardly to its normal position.

In order to adequately guide the car support cables **40** and **41**, and the power cable **39**, as the car moves in the lower reaches of the shaft **11** and below the bend B in the track **13**, a removable or detachable cable guiding carriage, indicated in general by numeral **60** is releasably attached to the top of the car and is independently slidably mounted on the rails **14** and **15** by a pair of mounting sleeves **61**. The carriage **60** has a frame structure **62** affixed to the mounting sleeves **61**, and a pair of sheaves **63** and **64** are journaled on the frame of the carriage and adjacent the car supporting cables **40** and **41** to continuously engage and guide these support cables. An additional sheave **65** is journaled on the frame **62** of the carriage to guide the power cable **39**.

The tracks **14** and **15** have rigid stops **14***a* affixed thereto adjacent the bend B in the track for engaging the lower ends of the sleeves **61** and preventing further downward movement of the carriage in the shaft **11**. The carriage **60** is normally latched to the car **18** by a hook **66** which is spring pressed against a stop bar **67** welded on the carriage frame. The hook **66** is moved away from the stop **67** by a cam **14***b* so as to release the carriage from the car as the carriage engages the stops **14***a*.

The carriage **60** is also provided with locking mechanism preventing any upward movement of the carriage along the track after the car **18** moves downwardly away from the carriage. The locking mechanism comprises a locking bar **68** swingably mounted on a bracket **69** rigid with the carriage frame **62** and swingable into a slot **14***c* in the track **14**. The locking bar **68** is retained in the slot **14***c* by a link **70** at a crossbar **71** pivoted to the carriage frame at **72** and continuously urged downwardly by the spring **73**. A feeler **74** affixed to the crossbar **71** will engage the top **19***b* of the car when the car moves upwardly against the carriage to lift the cross-bar **71** and swing the lock bar **68** out of the track, to thereby permit the carriage **60** to move upwardly again. A similar lock bar and operating linkage is provided adjacent the rail **15** which also has a locking slot similar to **14***c* formed therein.

In operation, it will therefore be understood that as the person in the elevator car moves the car downwardly in the shaft **11**, the cables **40**, **41** and **39** are payed out and the car **18** and carriage **60** move downwardly toward the bend B. When the car **18** reaches the bend B in the track, several things occur nearly simultaneously. The operating switch **29** engages the operating cam **30** so as to operate motor **28** and tilt the floor **22** to the dotted position P. The car is unlatched from the carriage **60** which engages the stops **14***a* on the track and the car **18** pulls downwardly away from the carriage, whereupon the bar **68** swings into the slot in the track and prevents any upward movement of the carriage **60**. As the car **18** travels downwardly beyond the bend B in the track **13**, the cables **39**, **40** and **41** are guided around the bend by the sheaves **65**, **63** and **64**, respectively, so that the cables are maintained in approximately the same relationship to the track as in the upper portion of the shaft.

As previously described, in the event that either of the cables becomes slightly slack or ruptures, the car will be immobilized by the brake dogs **54** locking against one of the rails **14** or **15**. It will be noted that the brake dogs **54** are disposed immediately adjacent and above the upper cluster **31** of guide wheels and the relationship of the brake dogs to the rails is continuously maintained.

Of course, it will be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

1. An elevator adapted to travel a generally upright course with a bend therein,

comprising a track extending continuously along the course and having a bend corresponding to the bend in the course, the track being substantially upright at locations above and below the bend,

a car to move along the course, the car having wheels in continuous engagement with the track to be guided therealong, a support cable suspending the car on the track,

cable supporting and operating means lifting and lowering the cable and car,

a detachable carriage demountably carried on the car and having a cable guiding sheave,

and means detaching the carriage from the car and supporting the carriage independently of the car adjacent the bend in the track to locate the sheave for guiding the cable downwardly from the bend to the car.

2. The elevator according to claim **1** wherein the car has a tiltable floor, and means tilting the floor to maintain the floor substantially horizontal regardless of the direction of the track means.

3. The elevator according to claim **2** and including upright screws attached to the floor in the car and moving one side of the floor upwardly and downwardly.

4. The elevator according to claim **1** wherein the wheels are arranged in a pair of wheel clusters respectively adjacent the top and bottom of the car and engaging and bearing against the track in multiple directions for moving therealong, one of the wheel clusters having pivotal connection to the car for rocking about an axis transverse to said track means.

5. The elevator according to claim **4** wherein said tiltable cluster of wheels has an upper tier and a lower tier of wheels on axes rigid with respect to each other.

6. The elevator according to claim **1** wherein the carriage has follower means independent of the car and slidably engaging the track and maintaining the carriage in predetermined orientation with respect to the track and car.

7. The elevator according to claim **6** wherein said follower means include a pair of split sleeves sliding along the track in close fitting relation and maintaining the carriage and the track in predetermined orientation with respect to each other.

8. The elevator according to claim **1** and said last-mentioned means including a cam on the track adjacent the bend, sensing means engaging the cam and effecting unlatching of the carriage from the car and locking of the carriage to the track.

9. The elevator according to claim **1** and including a stop on the track to engage and support the carriage against downward movement adjacent the bend, and also including a car-engaging feeler on the carriage and effecting locking of the carriage against upward movement in response to movement of the car downwardly away from the carriage.

10. An elevator comprising a car,

a support cable for suspending the car,

cable supporting and operating means lifting and lowering the cable and car,

track means guiding the car and including a rigid rail along which the car travels,

a pair of clamps rotatable on the car to trip the rail,

an elongate horizontal cantilever arm with an inner end connected to the car and an outer end connected with a linkage to said clamps for operating the clamps, the inner end of the cantilever arm being connected to said cable and supporting the car,

and spring means bearing against the arm to prevent deflection of the outer end of the arm under the weight of the car suspended from the cable, and said spring means also moving the arm against slack or rupture of the cable to operate the clamps and grip the rail to immobilize the car.

11. The elevator according to claim **10** and including a second pair of rail gripping clamps on the car, a second cantilever arm and linkage to said second pair of clamps for operating the same, and a second car supporting cable and spring means to oppositely deflect the arm for ordinarily maintaining said clamps inoperative, and causing the clamps to grip the rail in response to a rupture of or slack in the cable.

12. The elevator according to claim **10** wherein said track means has a bend therein to effect a change in direction of the course of the car as it travels upwardly and downwardly, the car having upper and lower clusters of wheels respectively adjacent the top and bottom of the car for following the track, and said clamps being disposed closely adjacent one of said clusters of wheels to maintain a proper closely spaced relation with the rail.

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187—27, 87, 95