Oct. 16, 1962 J. WYSSEN 3,058,601

TRANSPORATION SYSTEM

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Fig. 1

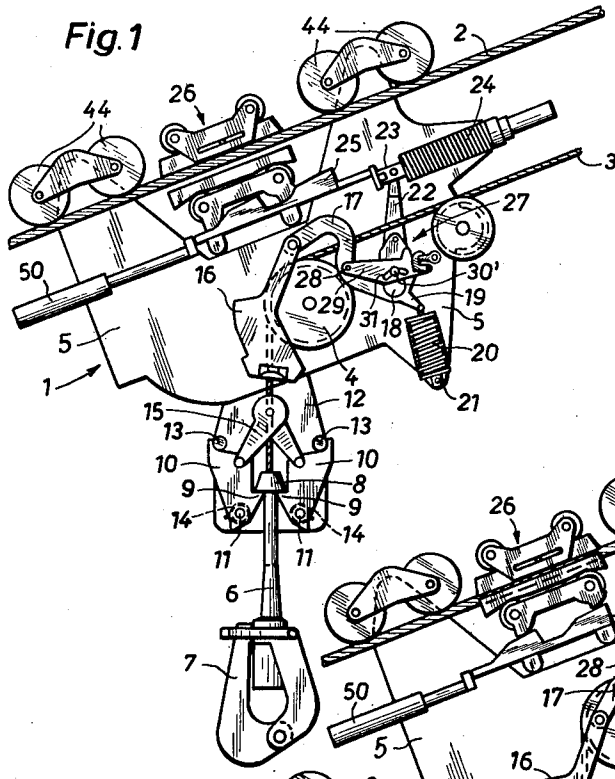


Fig. 2

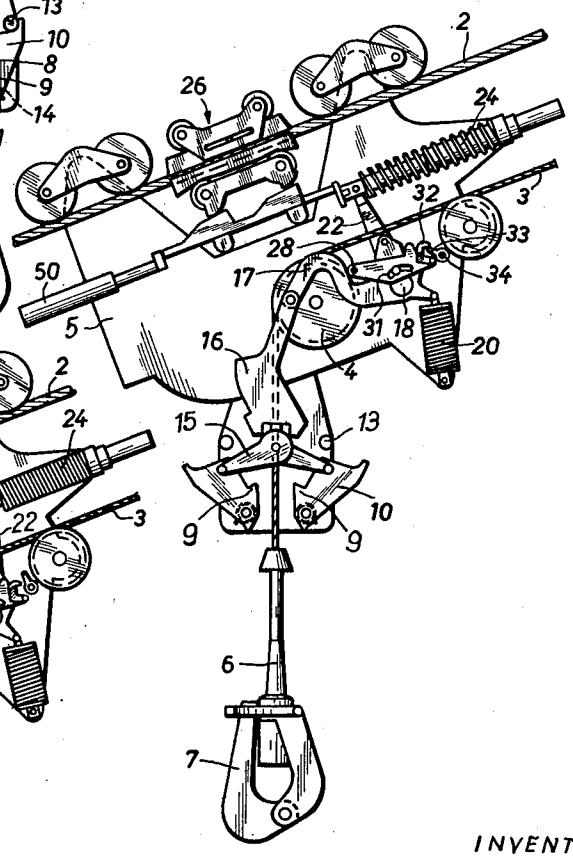
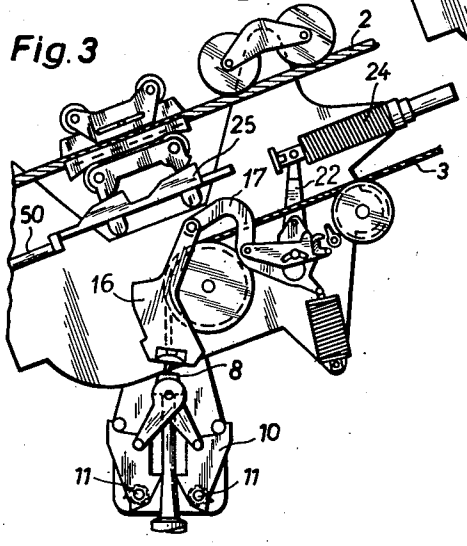


Fig. 3



INVENTOR
JAKOB WYSSEN

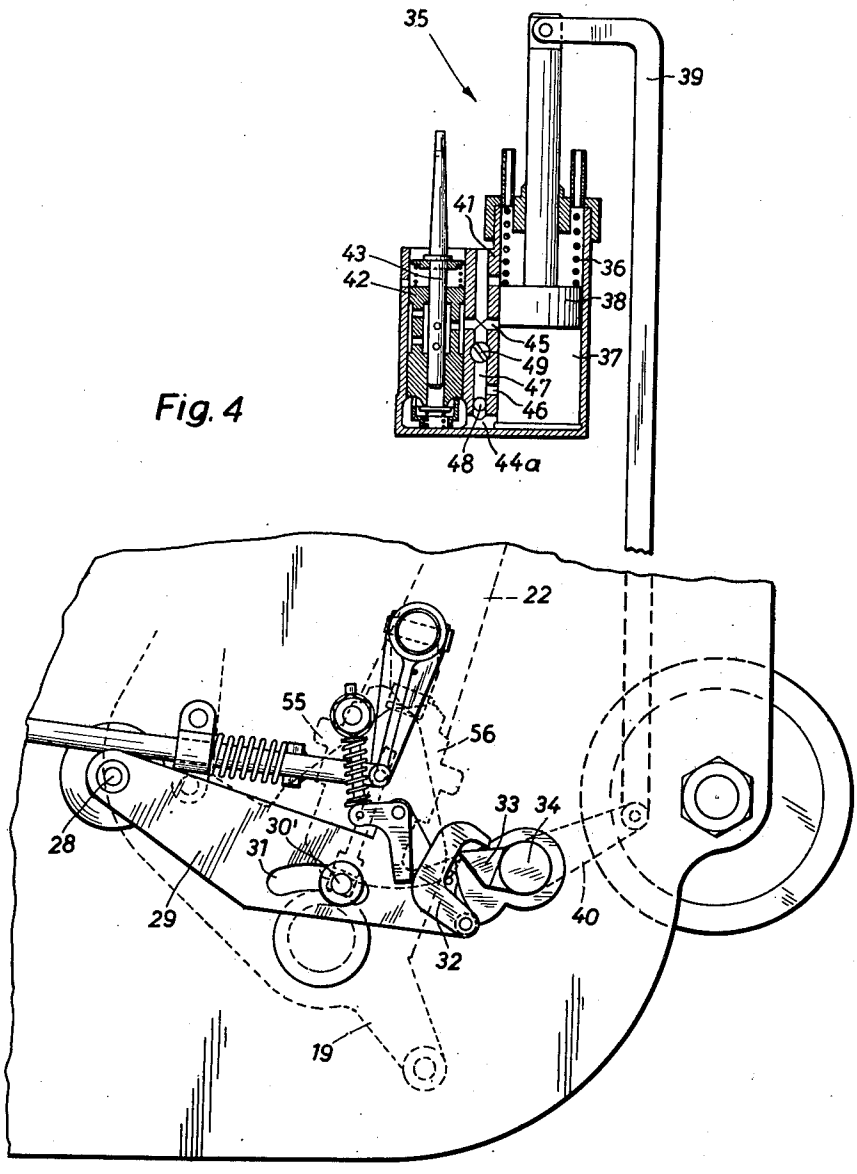
By Wenderoth, Lind & Ponack
ATTORNEYS

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TRANSPORATION SYSTEM

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Fig. 4



INVENTOR
JAKOB WYSSEN

By Kenderoth, Lind & Ponack

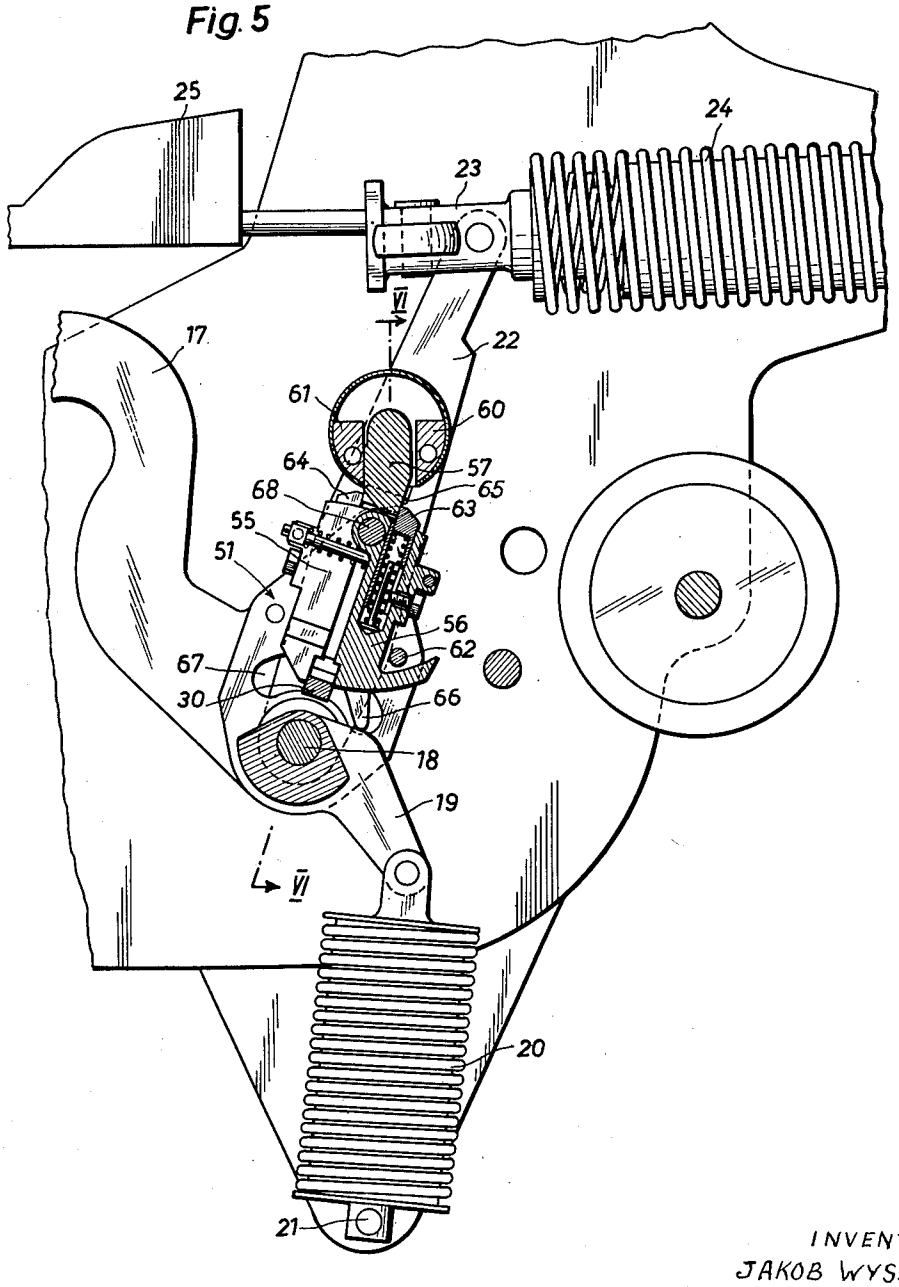
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TRANSPORATION SYSTEM

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Fig. 5



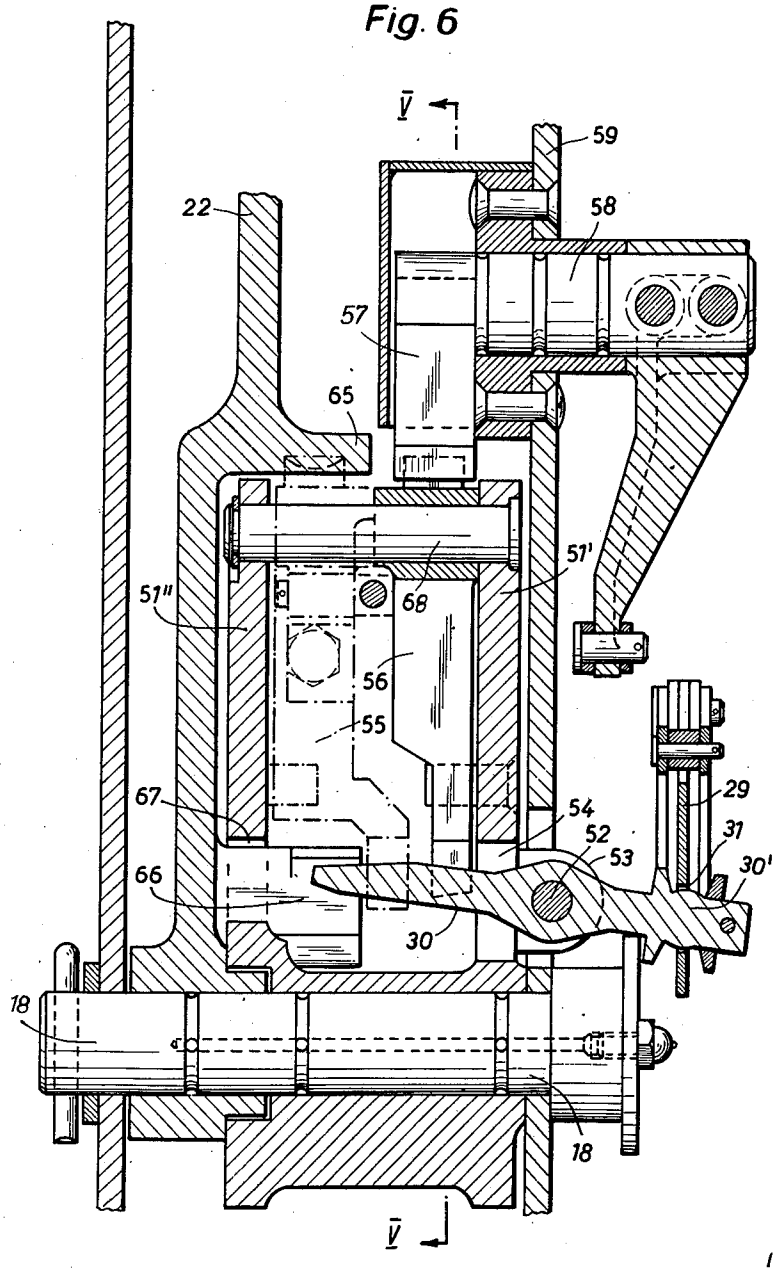
INVENTOR
JAKOB WYSSEN
By Windroth, Lind & Ponack
ATTORNEYS

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TRANSPORATION SYSTEM

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Fig. 6



INVENTOR
JAKOB WYSSEN

By Merderath, Kind & Pouack

ATTORNEYS

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3,058,601

TRANSPORTATION SYSTEM

Jakob Wyssen, Reichenbach, near Frutigen, Bern, Switzerland

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Claims priority, application Switzerland Mar. 9, 1960
7 Claims. (Cl. 212—87)

This invention relates to a transportation system for vertically hauling and conveying loads along a carrier cable by means of a travelling truck which is provided with a holding device, actuated by control means for the purpose of retaining the load hook secured to a single lifting and conveying cable.

The primary object of the invention is the provision of a transportation system of the mentioned type having means for rendering the holding device temporarily inoperative.

Other objects will become apparent from the detailed description of the invention when considered in conjunction with the drawings illustrating a preferred embodiment of the invention, and in which:

FIGURES 1–3 show an uncovered travelling truck in three different operating conditions of the locking means for the holding device.

FIGURE 4 shows the locking means and also a sectional view of a time switch controlling the locking means.

FIGURES 5 and 6, drawn to different scales, show sections through the locking means according to the line V—V of FIGURE 6, and line VI—VI of FIGURE 5, respectively.

According to FIGURES 1–3 the travelling truck designated by **1** can be moved along a carrying cable **2** by means of a single conveying and hoisting rope **3**. The hoisting rope or cable **3** which is wound around the drum of a motor winch, not shown, in a manner known per se extends over a guide roller **4** which is carried between the rear wall **5** of the travelling truck **1** and the front wall thereof, not shown in FIGURES 1 to 3. The shaft **6** of a load hook **7** is secured to the end of the hoisting rope or cable **3**. The end of the shaft **6** connected to the cable **3** is provided with an upwardly tapering head **8**. When the load hook **7** is upwardly drawn towards the travelling truck **1**, the hooks **9** of the two locking levers **10** engage the head **8**, said levers being mounted each on journal pin **11** of a pendulum lever **12** suspended on the travelling truck, so as to be pivotable towards or away from each other like a pair of tongs. The arrangement is made so that the weight of the load hook **7** or of the load suspended on the hook tends to swing the two locking levers **10** towards each other, and to urge these levers against abutments **13**. In this manner the two locking levers **10** form a pair of self-locking tongs **10—10**. Besides, each of the two levers **10** is subjected to the influence of a return spring **14**. The free ends of a toggle lever **15** are linked to the locking levers **10**, the hinge portion of the lever **15** being located in the operative zone of a slider **16** which is guided in the travelling truck **1** in the direction of the vertical hoisting cable section in a manner not illustrated in more detail. The arrangement is such that the slider **16** in moving downwards engages the hinge portion of the toggle lever **15** and subsequently spreads the arms of the lever **15**, whereby the locking tongs **10—10** are opened (FIG. 2).

The top end of the slider **16** is linked to an S-shaped release lever **17** which is pivotally mounted at **18** in the travelling truck **1**. One end of a compression spring pack **20** engages a short extension **19** of this release lever **17**, while the other end of said spring pack is anchored at **21** to the travelling truck **1**.

A lever **22** is pivotally mounted on the journal pin **18**

of the lever **17** the upper end of which lever is linked to a pressure rod **23**. The rod **23** which is guided in the travelling truck for axial movement is subjected to the action of a compression spring **24** which is anchored in the travelling truck and tends to urge the pressure rod again a clamping key **25** of the adjusting device **26** of the travelling truck **1**.

In the position shown of the two levers **17** and **22**, the springs **20** and **24**, respectively, are preloaded. The levers are maintained against the action of these springs by means of a locking device **27**. This locking device comprises a locking pawl which in FIGURES 1–3 is concealed behind an additional lever **29** linked to the lever **17** at **28**. The head **30'** of this locking pawl is only visible in FIGURE 1 and enters into an arcuate recess **31** of the lever **29**, wherein this head is guided. Pivotally mounted on the free end of the lever **29** is a claw **32** which is urged in clockwise direction against an abutment, not shown, and kept in this position by the action of a spring not shown. A cam **33** cooperates with the claw **32** and is itself supported on a camshaft **34** pivotally mounted on the travelling truck **1**. When the cam **33** which engages the claw **32** is turned in clockwise direction, the lever **29** is angularly moved in counter-clockwise direction. The locking pawl already mentioned automatically follows this movement, in order to release the two levers **17**, **22** which had been blocked until then. In releasing the claw **32** by the cam **33**, the lever **29** and thus also the locking pawl returns to the starting position.

The cam **33** is actuated by a time switch designated by **35** in FIGURE 4. In the present case a hydraulic time switch is involved which comprises a reciprocating piston **38** guided in a cylinder **37** and operated by pressure fluid against the action of a spring **36**. The piston rod is connected by a connecting rod **39** to a pivoting arm **40** splined onto the camshaft **34**. The casing **41** of the time switch **35**, which is carried by the travelling truck **1** and contains the cylinder **37**, also accommodates a feed pump **42** the piston **43** of which is connected, in a manner not shown in detail, with one of the wheels **44** of the truck **1** (compare FIGURES 1–3) such that the feed pump **42** is actuated by the travelling motion of the truck **1**. The pump **42** discharges through a duct **44*a*** into the cylinder **37** which is connected to a return duct **47** by means of both an overflow bore **45** and a control bore **46**. The return duct **47** opens into the connecting duct **44*a*** and is provided with a throttle **48** and also an adjustable return valve **49** which control the return flow of the operating fluid from the duct **44*a***, and the bore **46**, respectively.

During the travel of the truck **1** along the carrying cable **2** the feed pump **42** is actuated and the piston **38** is raised against the pressure of the spring **36** by the action of the pressure fluid supplied to the cylinder **37** until free passage for the overflow bore **45** is provided. During this raise of the piston the cam **33** is brought into the position illustrated in FIGURE 4 and also in FIGURE 1, temporarily urging the claw **32** back in counter-clockwise direction. The positions of the remaining members which are shown in these two figures and provided each with the same reference letter, conform accordingly. As already mentioned, the two levers **17** and **22** are retained against the power of the pretensioned springs **20** and **24**, respectively. When the travelling truck **1** now stands still somewhere along the carrying cable, thus if the feeding of operating fluid into the cylinder **37** is discontinued, the piston **38** gradually moves downwards in the cylinder **37** by means of the spring **36** whereby the pressure fluid enclosed within said cylinder will be displaced. The cam **33** is then moved in clockwise direction by means of the connecting rod **39** and the pivoting arm **40** and this cam in turn again angularly moves the lever **29** in counter-

clockwise direction. The arrangement is made so that the locking pawl influenced by the lever **29** through its head **30'** releases the locked levers **17** and **22** approximately in the moment in which the control bore **46** is closed by the piston **38**. The released levers **17** and **22** are now turned in counter-clockwise direction by the springs **20** and **24**, respectively. The pressure rod **23** then acts on the wedge **25** of the adjusting device **26** and causes the clamping of the travelling truck on the carrying cable. The slider **16** is downwardly forced by the lever **17** and acts on the articulation of the lever **15**. The lever **15** is spread apart and the tongs **10—10** are opened when the hook is unloaded, but the power of the spring **20** does not suffice to open the prongs against the action of an additional load suspended from the hook **7**. However, after relieving the tongs **10—10** from load by means of the motor winch acting on the hoisting cable **3**, the spring **20** will be able to open the tongs also in the last mentioned case, i.e. the spring can bring the levers **10** into their position indicated in FIGURE 2. Thereafter the load hook can be lowered by means of the motor winch.

Subsequently, when the load hook is raised into the travelling truck **1**, the head **8** engages the bottom end of the slider **16** and moves the latter along, so that the lever **17** is tilted backwards in clockwise direction and the spring **20** is prestressed. The lever **22** is concurrently pivoted by the lever **17** in clockwise direction by means of an engaging device, to be described in more detail later, so that the spring **24** is likewise compressed. The two levers **17** or **22** would then be retained in their inoperative position, shown in FIGURE 1, under the action of the locking pawl referred to several times, provided that the cam **33** has released the claw **32**, i.e. that the lever **29** has returned the locking pawl into its active position. Such a condition is shown in FIGURE 3 where the head **8** still makes contact with the slider **16**. The reset springs **11** are now able to return the lever **10** to its abutting position and thus to close the tongs **10—10**, so that the empty or the loaded hook **7** is locked in the travelling truck **1** when the hoisting cable **3** will be loosened.

In actual practice it has been found that the load hook, in the moment of its release, effects vertical oscillatory movements mainly caused by oscillations of the carrying cable or the hoisting cable, which movements cause the raising of the slider **16** until the lever **17** is locked, so that the hook **6**, **7** is retained in the travelling truck **1** by the prongs **10—10** which in the meantime have been closed. The load hook could then be released only after renewed storing of switching energy in the switch **35**.

However, in the described structure the release of the load hook takes place simultaneously with the closure of the bore **46**, whereby the piston **38** can still effect a residual stroke, while displacing the pressure fluid through the throttle **48**. The cam **33** now acts upon the claw **32** during the entire duration of this residual stroke and releases this claw only when the piston **38** arrives in the lower dead-center position. The lever **29** therefore remains raised during a certain time, particularly during the duration of the residual stroke, and the locking pawl and consequently the entire locking device will be ineffective. When the load hook rebounds, the slider can still be raised but the lever **17** is no longer retained when it arrives in its initial position and can swing back under the action of the spring **20** and open the tongs **10—10**. The load hook, when rebounding, thus is not engaged in the travelling truck and sufficient time is available to lower the load hook already at the first attempt. At the end of the residual stroke of the piston **38**, usually after approximately 1 to 1½ minutes, the claw **32** is released and the upwardly pulled load hook can then be locked in the travelling truck **1**.

As soon as the clamping of the travelling truck on the carrying cable is released in the manner already described and the truck is moved, the pump **42** discharges pressure fluid into the cylinder **37**, whereby the switching energy of the spring **36** is again stored and the cam is turned back in counter-clockwise direction into its initial position.

Making the locking device for the load hook inoperative, besides for the time period immediately following the release of the hook, it will be necessary to render it inoperative also in case the clamping device of the travelling truck **1** on the carrying cable cannot be loosened concurrently with the raising of the load hook, for example due to a mechanical defect. It has been previously pointed out that in raising the load hook, the lever **17** is turned back in clockwise direction and the lever **22** is moved along with it. The clamping wedge **25** is then relieved (compare FIGURE 3), so that a releasing device **50** (compare FIGURES 1–3) provided for this purpose, will be able in the given moment to move the wedge **25** backwards in the direction towards the pressure rod **23** and to release the clamped travelling truck on the carrying cable. When the lever **22** for any reason is not moved by the lever **17** or not locked in the position shown in FIGURE 3, the release of the clamping arrangement of the travelling truck **1** on the carrying cable naturally is rendered impossible. When just in such an event the hook **7** which may carry a load would be retained in the prongs **10—10**, the removal of this defect would encounter additional difficulties and above all the release of the locked condition of the load hook would require a direct interference on the travelling truck. It will be understood that the carrying truck **1** blocked high up on the carrying cable **2** is not easily accessible.

Quite different is the case when the load hook, upon failure of release of the travelling truck, is not locked in the tongs **10**, i.e. remains freely movable. It will then easily be possible to pull a repair man upwards on the load hook until the travelling truck, in order to remove the defect in the clamping device. For this purpose the provisions described in detail are made in order to bring the locking pawl **30** into its inoperative position when disengagement of the clamped travelling truck fails to operate, and to avoid the locking of the load hook in the travelling truck. Reference is now made also to FIGURES 5 and 6, in addition to the FIGURES 1–4. The designation of similar parts, with the same reference numbers, has, of course, been maintained in these figures. As may easily be seen in FIGURES 5 and 6, the S-shaped lever **17**, which is supported by the journal pin **18**, comprises, in addition to the arm **19**, a further double-armed lever arm **51** which is particularly shown in FIGURE 6 and the arms of which are designated by **51'** and **51''**, respectively. On the front arm **51'**, situated at the right hand side in FIGURE 6, the locking pawl **30** is mounted on a pin **52** which is supported in eyes **53** of the arm **51'**. The locking pawl **30** of which the head **30'** engages the recess **31** of the lever **29** extends with its other end through an opening **54** of the arm **51'** towards the arm **51''**. In the operative position of the pawl **30** as shown, the free end thereof engages between the ends of two tilting levers **55** and **56** which both are pivotally mounted on a pin **68** extending between the arms **51'** and **51''**. The engaging action of the pawl **30**, however, prevents the lever **55** from pivoting in counter-clockwise direction and the lever **56** from pivoting in clockwise direction. The top end of the lever **56** acts upon a cam **57** mounted on a shaft **58** which is rotatably carried by the front wall **59** of the travelling truck **1**, said cam being angularly movable between two abutments **60** and **61** provided on this wall of the travelling truck **1**.

In the position shown of the lever **17**, the force of the spring **20** acts by means of the lever **56** and the cam **57** on the abutment **61**. However, as soon as the locking pawl **30** is brought out of engagement with the bottom end of the lever **56**, the latter is able to turn in clockwise direction, so that the lever **17** is released and angularly moved by the power of the spring **20**. This is, for example, the case when the locking pawl **30** is brought into its ineffective position by the time switch

35 and is maintained in this position. The lever 17 thus cannot be supported on the cam 57 or on the abutment 61 when the locking pawl 30 occupies this ineffective position. However, as soon as the locking pawl 30 is released and returns to its operative position, the lever 56 is blocked on the lever arm 51, particularly between the pawl 30 and an abutment 62, and the backwardly pivoted lever 17 will now be supported on the abutment 61. The top end of the lever 56 is formed by a sliding bolt 63 mounted in the lever 56 so as to be resiliently yielding therein, in order that the lever can pass underneath the cam 57 when the lever 17 is swung back.

The lever 55 is basically formed in the same manner as the lever 56 and is also provided with a sliding bolt 64 guided on the top end of the lever so as to be resiliently yielding thereon. This bolt 64 provides an abutment for a driving cam 65 which is formed on the lever 22 and particularly visible in FIGURE 6, and thus offers an abutment for the lever 22, so that the force of the spring 24 is supported by means of the lever 22 and the lever 55 which is blocked by the locking pawl 30 and also by the cam 65; thus the spring force finally bears on the abutment 61 by the intermediary of the lever 56. It will be understood that, when the locking pawl 30 releases the lower end of the lever 55, the lever 22 is also released, and may be pivoted independently under the influence of the spring 24. On the other hand, it is also clear that, when the lever 17 swings back, the lever 22 is also taken along as soon as the locking pawl 30 arrives again in its operative position and prevents the lever 55 from pivoting about the axis 57.

The lower end portion of the lever 22 carries a cam 66 which extends through a recess 67 of the arm 51" into the lever 51 and into the path of the free end of the locking pawl 30. During a relative movement between the two levers 17 and 22, in which the last named lever will arrive behind the lever 17, the bottom side of the cam 66 would engage the free end of the locking pawl 30, force the latter downwardly and thus bring the pawl 30 into its inoperative position. Such a relative position of the two levers 17 and 22 may, for example, occur in the case already mentioned, where the last mentioned lever, during raising the load hook and retracting the lever 17, is not taken along owing to a mechanical defect occurring, for example, on the lever 55. Since in this case the locking pawl 30 passes to its ineffective position, the lever 17 consequently cannot be locked and the load hook thus will not be retained at all in the travelling truck 1.

I claim:

1. A transportation system for vertically hauling loads and conveying them along a carrier cable, comprising a travelling truck adapted to move along said cable, a single conveying cable for vertical hoisting of the load and moving said travelling truck along the carrier cable, a load hook depending from said conveying cable, holding means for said load hook carried by said truck, control means on the truck for locking and releasing the load hook in and from said holding means, and timer means coupled to said holding means and having time delay means incorporated therein for temporarily rendering the holding means inoperative.

2. A transportation system for vertically hauling loads and conveying them along a carrier cable, comprising a travelling truck adapted to move along said cable, a single conveying cable for vertical hoisting of the load and moving said travelling truck along the carrier cable, a load hook depending from said conveying cable, holding means for said load hook carried by said truck, control means on the truck for locking and releasing the load hook in and from said holding means, and a time switch operatively connected with said control means for rendering the control means inoperative to lock said holding means for a predetermined period of time.

3. A transportation system for vertically hauling loads and conveying them along a carrier cable, comprising a travelling truck adapted to move along said cable, means for clamping the travelling truck to said carrier cable, a single conveying cable for vertical hoisting of the load and moving said travelling truck along the carrier cable, a load hook depending from said conveying cable, holding means for said load hook carried by said truck, control means on the truck for locking and releasing the load hook in and from said holding means, and a time switch operatively connected with said control means and movable responsive to stopping of the travelling truck to at least two positions, in the first position for releasing said load hook and clamping the truck to said carrier cable, and in the second position, after release of the load hook, for temporarily rendering said holding means inoperative.

4. A transportation system according to claim 3 and comprising disengaging means responsive to the operating positions of said clamping means and operatively connected with the control means of said holding means for rendering the holding means inoperative when the travelling truck is clamped to the carrying cable.

5. A transportation system according to claim 4, in which a two-positional control member is provided which in each of its two positions adjusts the operative or inoperative condition of said holding means and which is coupled to and subjected to the action of both the time switch and said disengaging means.

6. A transportation system according to claim 5, further comprising a bolt operable by said clamping means upon clamping of the travelling truck for locking said control member in its position initiating the inoperative condition of the holding means.

7. A transportation system according to claim 6, further comprising a cam moved into the switching path of the control member by said clamping means for locking said control member when the travelling truck is clamped.

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