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(54) **A LIFTING DEVICE FOR THE CONTROLLED VERTICAL TRANSFER OF OBJECTS**

VORRICHTUNG ZUR VERTIKALEN HEBESTEuerung VON GEGENSTÄNDEN

DISPOSITIF ELEVATEUR POUR DEPLACER DES OBJETS VERTICALEMENT DE FACON
CONTROLEE

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EP-A- 0 493 297 **DE-A- 3 913 321**
US-A- 5 105 349

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Description

[0001] The present invention relates to a lifting device for the controlled vertical movement of objects, especially such objects, to which is conveyed an electric current through a line, such as chandeliers, comprising a relatively longitudinal support provided with longitudinal guiding means and a carriage guided by said longitudinal guiding means (2), movable in the longitudinal direction of the support.

[0002] In assembly halls, like churches, theatres etc. there is often a need for a vertical movement of objects, well controlled, that is to say so that the objects may be set accurately vertically and so that they are not caused to perform any turning movement during or after the vertical movement. There may be chandeliers, pictures, set-pieces etc. The chandeliers may have electric lights and candles, which are common in churches, which means, that they must be available for replacing electric lights and more often for replacing candles. If there are no suitable lifting devices, and the objects must be made available with the aid of a ladder or the like, there is much work to be done.

[0003] Among known devices of the art mentioned introductorily, there is EP- A- 0 493 297. There is described a rail- guided system for moving apparatus such as a loudspeaker. It comprises a raillike stationary holder to be fixed to the roof and a movable carrier including a driving motor for moving the carrier along the holder and an apparatus actuating unit for moving the apparatus relative to the carrier: There are electrical means to supply electricity to said unit. This system is rather complicated and is intended exclusively for moving units in a horizontal plane, not for a controlled vertical movement of objects.

[0004] Thus there is a need for a simple and reliable lifting device of the art mentioned introductorily, which is constructed in a not too complicated way, and the object of the present invention is to provide such a lifting device.

[0005] According to the invention such a device is characterised in that there is provided a threaded, preferably trapezoidally-threaded driving shaft journaled in the ends of the support which shaft is driven by a motor via a worm gear unit, said driving shaft cooperating with a nut fastened to said carriage, there being provided a perpendicular shaft in the support carrying a 1:st gear ring and a chain relatively heavy and stable to turning, running over said gear ring, the chain being driven by said carriage to change its position in relationship to the support as the position of the carriage is changed in relationship to the support by the driving shaft, the chain intended for carrying in a 1:st end said object.

[0006] Different embodiments are possible within the scope of the invention. The driving shaft may be driven in any of the ends of the support. The support is intended

to be mounted primarily horizontally or substantially horizontally in an attic or on attic beams, so that the chain can run downwardly via said gear ring through an opening in the roof, in which a chandelier or other object is hanging.

[0007] In one advantageous embodiment of the invention, the lifting device is arranged in such a way, that said shaft, provided perpendicularly in the support, also carries a 1:st pulley, over which there is an electric wire running, the same also being driven by said carriage to change its position in relationship to the support (1) as the position of the carriage in relationship to the support (1) is changed by the driving shaft (3), the end of the wire (16) being connected in a 1:st end to said object. The other end of the wire is connected, possibly via a connecting means, to the electric mains.

[0008] Per se, the chain may be fixed directly to the carriage, which also is true for the other end of the wire, if any, which in that case had to be connected to a movable wire, which in turn had to be connected to the electric mains. More available possible vertical movement length is gained, however, at a given length of the support, if the chain, and the electric wire, if any, are fixed to the support, preferably in the vicinity of said shaft, provided perpendicularly in the support, and the carriage is provided with a perpendicular shaft, which carries a 2:nd gear ring with a 2:nd pulley over which the chain resp. the wire are running before the contact with said 1:st gear ring and 1:st pulley.

[0009] The lifting device according to the invention may, in an advantageous embodiment be provided with a limit switch, which increases the safety in utilizing the lifting device and furthermore facilitates the vertical setting at a certain height of the actual object. Per se the limit switches may be arranged themselves to be movable along the support, at each side of the carriage, but in one suitable embodiment of the lifting device according to the invention, a 1:st limit switch for the electric voltage to said electric motor is provided in the support at its end, turned from the perpendicular shaft, the 1:st limit switch being acted upon by said carriage, whilst the 2:nd limit switch is provided in the support in the vicinity of the perpendicular shaft, the 2:nd limit switch being acted upon by a position indicator, provided with a nut means, embracing said driving shaft, guided in the longitudinal direction of the support by guiding means, possibly said guiding means.

[0010] The carriage may be guided in different ways in the support by said guiding means, and it is suitable to provide it with steering wheels, cooperating with guiding means provided in the support, in the form of guiding bars on the raised walls of a U- beam.

The invention shall be described in the following, reference being made to the two enclosed figures, of which

figure 1 schematically shows a plan view of a lifting device according to the invention. whilst figure 2 schematically shows a view from the side,

partly as a section, of same lifting device, that is shown in figure 1.

[0011] In figure 1 a longitudinal support in the form of a U- beam is denoted by 1, and on the walls of the U- beam at the inside, there are guiding bars 2, as guiding means. In the ends of the support, there is journaled a trapezoidally threaded driving shaft 3, driven via a gear worm 4 by an electric motor 5. In the support 1 there runs a carriage 6, provided with four steering wheels 7, which are guided by the guiding bars 2. A nut 8 is fixed to the carriage 6, embracing the driving shaft 3, which is made from steel. whilst the nut is made from bronze. In the support, in the vicinity of its end there is provided a perpendicular shaft 9 in the support, carrying a 1:st gear ring 10 and a 1:st pulley 11. In the carriage a second shaft 12 is arranged perpendicularly, carrying a 2:nd gear ring 13 and a 2:nd pulley 14. E relatively heavy chain 15, stable to turning is fastened to the bottom of the support, in the vicinity to said perpendicular shaft, provided in the support. The chain runs over the 2:nd gear ring, turns over and runs over the 1:st gear ring and thereby changes direction 90° if the support is mounted horizontally, and carries in its free end the actual object, which is best shown in figure 2. An electric wire 16 is fixed to the support. longitudinally seen at level with the fixing point of the chain in the support, then runs up over the 2:nd pulley and further to the 1:st pulley, then changes direction 90° and goes down to the object, where the end of the wire is connected to a light source or other current consumer.

[0012] When the driving shaft 3 is brought to rotate in the desired direction by the electric motor 5, via a worm gear 4, which may have a exchange gear reduction of 14:1, the carriage 6 is moved in the desired direction, running smoothly, and the chain 15 resp the wire 16 are extended or reduced a desired stretch. A 1:st limit switch 17 is fixed to the support on the side of the carriage 6, turned to the electric motor 5, and a 2:nd limit switch 18 is fixed to the support on the other side of the carriage. A position indicator, formed like a nut 19 embraces the the driving shaft and is moved with this at the same rate as the carriage 6, as it is prevented from rotating by a tap 20, guided by the guiding bar 2. The nut 19 is suitably formed so that it can be opened, so that it can be moved along the driving shaft 3 to a desired breaking position. An extra nut 21 runs freely on the driving shaft 3 at the carriage 6. In these there is a stop 22. If the fixed nut would break the forced movement of the carriage 6 is stopped by the nut 21 and the stop 22.

Claims

1. A lifting device for the controlled vertical movement of objects, especially such objects, to which is conveyed an electric current through a line, such as chandeliers, comprising

a relatively longitudinal support (1) provided with longitudinal guiding means (2), and a carriage (6) guided by said longitudinal guiding means (2), movable in the longitudinal direction of the support (1) **characterised in that**

there is provided a threaded, preferably trapezoidally- threaded driving shaft (3) journaled in the ends of the support (1), which shaft is driven by a motor (5) via a worm gear unit (4), said driving shaft (3) cooperating with a nut (8) fastened to said carriage, there being provided a perpendicular shaft (9) in the support (1) carrying a 1:st gear ring (10) and a chain (15) relatively heavy and stable to turning, running over said gear ring (10), the chain being driven by said carriage (6) to change its position in relationship to the support (1) as the position of the carriage (6) is changed in relationship to the support (1) by the driving shaft (3), the chain intended for carrying in a 1:st end said object.

2. A lifting device according to claim 1, **characterized in that** said shaft (9), provided perpendicularly in the support (1) also carries a 1:st pulley over which there is an electric wire (16) running, the same also being driven by said carriage (6) to change its position in relationship to the support (1) as the position of the carriage in relationship to the support (1) is changed by the driving shaft (3), the end of the wire (16) being connected in a 1:st end to said object.
3. A lifting device according to claim 2, **characterized in that** the chain (15) and the wire (16) are fixed to the support (1), preferably near said shaft (9), provided perpendicularly to the support (1) and that the carriage (6) is provided with a perpendicular shaft (12), which carries a 2:nd gear ring (13) with a 2:nd pulley over which the chain (15) resp. the wire (16) are provided to run before the contact with said 1:st gear ring (10) and the 1:st pulley (11).
4. A lifting device according to any of claims 1 to 3, **characterized by** a 1:st limit switch (17) for the electric voltage to the electric motor (5), provided in the support (1) in its end turned from the shaft (9), provided perpendicularly, the 1:st limit switch being acted upon by said carriage (6), and a 2:nd limit switch provided in the support (1) in the vicinity of the shaft (9), provided perpendicularly, the 2:nd limit switch (18) being acted upon by a position indicator (19), provided with a nut means (19), embracing said driving shaft (3) guided in the longitudinal direction of the support by guiding means, possibly said guiding means (2).

5. A lifting device according to any of claims 1 to 4, **characterized in that** said carriage (6) is provided with steering wheel (7), cooperating with guiding means in the support (1) in the form of guiding bars (2) on the raised walls of a U-beam.

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Patentansprüche

1. Hebevorrichtung zur gesteuerten vertikalen Bewegung von Objekten, insbesondere solchen Objekten, denen über eine Leitung ein elektrischer Strom zugeführt wird, wie zum Beispiel Kronleuchtern, mit:

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einem relativ longitudinalen Träger (1), der mit longitudinalen Führungsmitteln (2) versehen ist, und einem durch die longitudinalen Führungsmittel (2) geführten Schlitten (6), der in Längsrichtung des Trägers (1) beweglich ist,

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dadurch gekennzeichnet, dass

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eine mit einem Gewinde, vorzugsweise einem Trapezoid-Gewinde versehene Antriebswelle (3) vorgesehen ist, die an den Enden des Trägers (1) drehbar gelagert ist, wobei die Welle durch einen Motor (5) über eine Schrauben-Getriebeeinheit (4) angetrieben wird und die Antriebswelle (3) mit einer an dem Schlitten befestigten Mutter (8) zusammenwirkt, eine senkrechte Welle (9) in dem Träger (1) vorgesehen ist, die einen ersten Getriebering (10) treibt und eine Kette (15), die relativ schwer ist und sich beständig drehen kann, über den Getriebering (10) läuft, wobei die Kette durch den Schlitten (6) angetrieben wird, um ihre Position in Bezug auf den Träger (1) zu ändern, wenn die Position des Schlittens (6) in Bezug auf den Träger (1) durch die Antriebswelle (3) geändert wird, und wobei die Kette zum Tragen des Objektes an einem ersten Ende vorgesehen ist.

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2. Hebevorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die senkrecht in dem Träger (1) angeordnete Welle (9) auch eine erste Riemenscheibe trägt, über die eine elektrische Leitung (16) läuft, die ebenfalls durch den Schlitten (6) angetrieben wird, um ihre Position in Bezug auf den Träger (1) zu ändern, wenn die Position des Schlittens in Bezug auf den Träger (1) durch die Antriebswelle (3) geändert wird, wobei das Ende der Leitung (16) mit einem ersten Ende mit dem Objekt verbunden ist.

3. Hebevorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** die Kette (15) und die Leitung (16) an dem Träger (1) vorzugsweise in der Nähe der senkrecht zu dem Träger (1) angeordneten Welle (9) befestigt sind und dass der Schlitten

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(6) mit einer senkrechten Welle (12) versehen ist, die einen zweiten Getriebering (13) mit einer zweiten Riemenscheiben trägt, die dazu vorgesehen sind, dass darüber die Kette (15) beziehungsweise die Leitung (16) laufen, bevor diese den ersten Getriebering (10) und die erste Riemenscheibe (11) berühren.

4. Hebevorrichtung nach einem der Ansprüche 1 bis 3, **gekennzeichnet durch** einen ersten Begrenzungsschalter (17) für die an dem elektrischen Motor (5) anliegende elektrische Spannung, der in dem Träger (1) an seinem **durch** die Welle (9) gedrehten Ende senkrecht vorgesehen ist, wobei der Schlitten (6) auf den ersten Begrenzungsschalter einwirkt, sowie einen zweiten Begrenzungsschalter, der in dem Träger (1) in der Nähe der Welle (9) senkrecht vorgesehen ist, wobei ein Positionsindikator (19) auf den zweiten Begrenzungsschalter (18) einwirkt, der mit einer Mutter (19) versehen ist, die die Antriebswelle (3) umfasst und in Längsrichtung des Trägers mit Führungsmitteln, insbesondere den Führungsmitteln (2) geführt wird.

5. Hebevorrichtung nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der Schlitten (6) mit Steuerrädern (7) versehen ist, die mit Führungsmitteln in dem Träger (1) in Form von Führungstangen (2) an den hochgezogenen Wänden eines U-förmigen Trägers zusammenwirken.

Revendications

1. Dispositif de levage pour le déplacement vertical commandé d'objets, spécialement des objets vers lesquels un courant électrique est transporté par l'intermédiaire d'une ligne, tels que des chandeliers, comportant un support relativement longitudinal (1) pourvu de moyens de guidage longitudinaux (2), et un chariot (6) guidé par lesdits moyens de guidage longitudinaux (2), mobile dans la direction longitudinale du support (1),

caractérisé en ce que

un arbre d'entraînement fileté, de préférence à filetage trapézoïdal (3) qui tourillonne dans les extrémités du support (1) est prévu, lequel arbre est entraîné par un moteur (5) par l'intermédiaire d'une unité à vis sans fin (4), ledit arbre d'entraînement (3) coopérant avec un écrou (8) fixé sur ledit chariot, un arbre perpendiculaire (9) dans le support (1) portant une première couronne dentée (10) et une chaîne (15) relativement lourde et stable afin de tourner, en s'étendant sur ladite couronne dentée (10), est prévu, la chaîne étant en-

traînée par ledit chariot (6) afin de modifier sa position par rapport au support (1) lorsque la position du chariot (6) est modifiée par rapport au support (1) par l'arbre d'entraînement (3), la chaîne étant prévue pour porter à une première extrémité ledit objet. 5

2. Dispositif de levage selon la revendication 1, **caractérisé en ce que** ledit arbre (9), prévu perpendiculairement dans le support (1), porte également une première poulie sur laquelle s'étend un fil électrique (16), celui-ci étant également entraîné par ledit chariot (6) afin de modifier sa position par rapport au support (1) lorsque la position du chariot (6) par rapport au support (1) est modifiée par l'arbre d'entraînement (3), l'extrémité du fil (16) étant reliée à une première extrémité dudit objet. 10 15
3. Dispositif de levage selon la revendication 2, **caractérisé en ce que** la chaîne (15) et le fil (16) sont fixés sur le support (1), de préférence près dudit arbre (9), prévu perpendiculairement au support (1), et **en ce que** le chariot (6) est pourvu d'un arbre perpendiculaire (12), qui porte une deuxième couronne dentée (13) avec une deuxième poulie sur lesquelles la chaîne (15) et le fil (16) respectivement sont prévus pour s'étendre avant le contact avec ladite première couronne dentée (10) et la première poulie (11). 20 25 30
4. Dispositif de levage selon l'une quelconque des revendications 1 à 3, **caractérisé par** un premier contact de fin de course (17) pour la tension électrique vers le moteur électrique (5), prévu sur le support (1) dans son extrémité tournée par rapport à l'arbre (9), prévu perpendiculairement, le premier contact de fin de course étant actionné par ledit chariot (6), et un deuxième contact de fin de course prévu dans le support (1) au voisinage de l'arbre (9), prévu perpendiculairement, le deuxième contact de fin de course (18) étant actionné par un indicateur de position (19), pourvu de moyens à écrou (19), entourant ledit arbre d'entraînement (3) guidé dans la direction longitudinale du support par des moyens de guidage, éventuellement lesdits moyens de guidage (2). 35 40 45
5. Dispositif de levage selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** ledit chariot (6) est pourvu d'une roue (7), qui coopère avec des moyens de guidage dans le support (1) sous la forme de barres de guidage (2) sur les parois relevées d'une poutre en U. 50 55

