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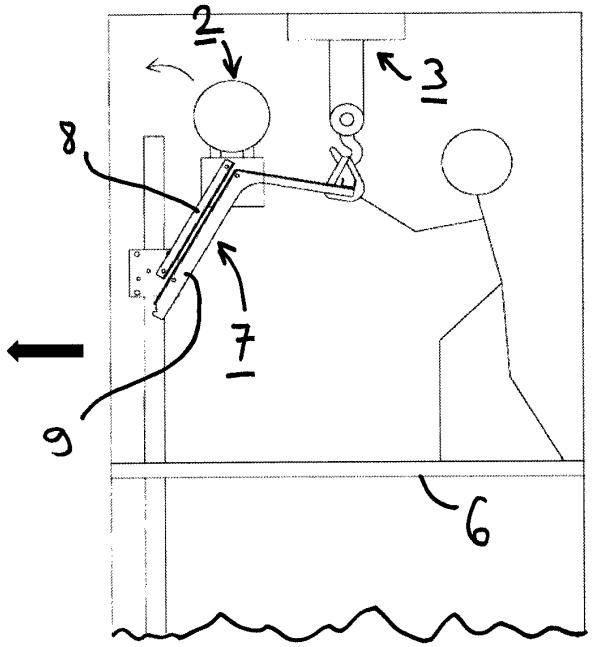
(54) **METHOD OF MOUNTING AN ELEVATOR DRIVE**

(57) The invention relates to a method for mounting an elevator drive (2) in the range of the shaft head of an elevator shaft (1), the method comprising a first step in which the elevator drive (2) is lifted by means of a lifting device (3) into the range of the shaft head lying below its intended mounting position, **characterized in that** in a second step the elevator drive (2) is mounted on a pivoting mounting arm (7) which can pivot about a fixed range that is located in a distance below the intended mounting position on the elevator guide rails (4) on which the elevator drive (2) is to be mounted and is further lifted in a third step in such a way that it moves on a path predetermined by the mounting arm (7) and its fixed area into its intended mounting position in the area of the upper end of the elevator guide rails (4), the weight of the elevator drive (2), when it reaches its mounting position, being essentially supported by the mounting arm (7) which is then preferably located vertically below the motor contour.

FIG. 4



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Description

[0001] The invention relates to a method for mounting an elevator drive in the range of the shaft head of an elevator shaft in the manner of the generic term of claim 1 and an assembly used for the corresponding mounting in the manner of the generic term of claim 7 and a mounting arm for said assembly in the manner of the generic term of claim 12.

TECHNICAL BACKGROUND

[0002] Modern elevator systems are preferably realized as "machine roomless elevator" (MRL) systems. This means that no additional machine room in the shaft head is necessary. This machine room is on the one hand costly and on the other hand takes up most of the space above or next to the shaft, which can be used for other purposes.

[0003] When installing the elevator drive, it has accordingly proved to be a good idea to install this elevator drive alone in the shaft head, preferably above and/or on the elevator guide rails of the elevator system. In order to waste as little space as possible in the shaft (vertically and horizontally), this elevator drive is installed as close as possible to the shaft head ceiling.

[0004] For the installation of the elevator drive, a lifting device is usually used, which is fastened - preferably temporarily - in the shaft head. Due to the dead weight of the lifting device and also due to its positioning, usually in the middle of the shaft, it is not possible to lift the elevator drive to the desired position by means of the lifting device alone, directly below the shaft head ceiling, above the elevator guide rails.

[0005] In order to solve this problem, procedures and devices have been proposed, but they are usually cumbersome or expensive to use.

PRIOR ART

[0006] The patent US 7,624,848 B2 proposes a mounting device that can be mounted directly on the elevator car, which can be moved along the elevator guide rails. For this purpose a foot is fixed on the roof of the car or its cabin. Through this foot an axle passes, on which a supporting beam is pivotably mounted. On this support beam there is a load carrier on which the elevator drive can be fixed in order to bring it to its desired position. The roof of the elevator car thus acts as a platform for the installation work.

[0007] First the load carrier must be loaded with the elevator drive. For this purpose a lifting device is used, which is attached to the shaft head ceiling. With this lifting device the elevator drive is lifted onto the load carrier and fixed there. It must be ensured that the support beam has already been deflected upwards from its horizontal position - at least so far that the load carrier is not so inclined that the loaded elevator drive slips off.

[0008] Rotation limiters on the support beam also limit the rotational movement of the support beam.

[0009] This loading process of the load carrier should preferably be carried out while the car is in its lowest position in the shaft. This allows the car to rest on buffers at the bottom of the shaft without additional support by a lifting device.

[0010] Then the identical lifting device is decoupled from the elevator drive and connected to an eye hook of the car. This allows the car to be raised and lowered. Finally, the car is pulled to a height at which the load carrier and thus the elevator drive stand above the base plate when the support beam is set vertically. The car is then lowered by means of the lifting device until the elevator drive itself rests completely on the base plate and can be fixed. The load carrier and thus the entire mounting device can then be pulled by moving the car further down.

[0011] This mounting device can therefore only be used if a movable platform is available, regardless of whether it is a temporary mounting platform or the roof of the already installed cabin or the elevator car. This means a considerable additional expenditure. In addition, the same lifting gear must be used to lift the elevator drive onto the load carrier and to lift the clearly heavy, complete elevator car. This means that a more powerful lifting device is required than is actually necessary for loading the load carrier. In addition, once the elevator drive has been fixed, the lifting device only holds the weight of the elevator car and the weight of the elevator drive is only absorbed by the rotation limiters of the mounting aid. This generally results in a somewhat cumbersome and partly unsafe installation.

PROBLEM UNDERLYING THE INVENTION

[0012] In view of this, the purpose of the invention is to specify means by which an elevator drive can be easily and safely mounted in the head area of an elevator shaft.

INVENTIVE SOLUTION

[0013] According to the invention, this problem is solved with the features of the main claim directed to the process.

[0014] For this purpose, a special procedure is proposed for the installation of an elevator drive in the range of the shaft head of an elevator shaft. The procedure includes a first step in which the elevator drive is lifted by a lifting device to a part of the shaft head below its intended installation position.

[0015] The solution according to the invention is characterized by the fact that in a second step the elevator drive is attached to a pivoting mounting arm. The mounting arm facilitates the installation of the elevator drive. For this purpose, it rotates around a fixed area (alternatively called "range") that is below the intended installation position on the elevator guide rails on which the el-

evator drive is to be installed, and which is preferably different from the roof of the elevator car.

[0016] In a third step, the elevator drive is then raised even further so that it moves along a path determined by the mounting arm and its fixed area to its intended mounting position in the area of the upper end of the elevator guide rails. The rising within this third step is in numerous cases accomplished purely or partially manually, since the pivoting mounting arm is a big ease for manual lifting. In other cases it could be, too, supported by the lifting device or hoist.

[0017] In this case, the weight of the elevator drive is completely or essentially absorbed by the mounting arm, which is then preferably located vertically below the motor contour, at least 80% of the weight of the elevator drive when it reaches its mounting position.

[0018] Even the preparatory assembly of the mounting arm is much easier than before. Because the fixed area that the mounting arm needs for its function is determined to the rails, there is no need to first get an elevator car running.

[0019] A decisive advantage of the procedure according to the invention is still that it is much easier for the technician(s) to lift the elevator drive the last piece into its intended mounting position. This applies especially to cases where the intended installation position is too close to the shaft head ceiling to be able to lift the hook load and thus the elevator drive directly into the installation position.

[0020] In the first phase of further lifting of the elevator drive, in which the mounting arm cannot yet absorb a significant portion of the weight force of the elevator drive, support of the lifting device is preferably still available.

[0021] Subsequently, the more the mounting arm is erected as the elevator drive is lifted, the greater the proportion of the elevator drive's weight is absorbed by the mounting arm. This makes installation easier, especially in the vicinity of the shaft head ceiling, where the heavy elevator drive is particularly difficult to handle. When the installation position is reached, the weight of the elevator drive is completely or essentially absorbed by the mounting arm, which is then preferably positioned vertically below the motor contour.

[0022] Overall, this considerably simplifies the handling of the elevator drive in the vicinity of the shaft head ceiling.

[0023] Preference is also given to increasing occupational safety. This is because the elevator drive attached to the mounting arm cannot fall into the shaft, at least not if the attachment of the elevator drive to the mounting arm and/or the lifting device is not released until after the elevator drive has been bolted or fixed in its intended mounting position, as is usually the case.

[0024] The mounting arm, which is mounted and guided in a defined manner on the fixed area, defines a path that can be traversed by further raising the elevator drive. The uppermost point of this track is thus located in the area of the upper end of the elevator guide rails. It **usually** represents the intended installation position.

[0025] If the mounting arm has previously been attached to the elevator guide rails with sufficient positional accuracy, this will preferably result in the elevator drive being brought into its mounting position, either alone or essentially alone, by swivelling the mounting arm attached to it upwards, so precisely that it can be fixed there without further alignment work. The latter can be achieved, for example, by aligning the holes on the elevator drive and the rail-mounted counterpart holding it so precisely that the retaining screws can be inserted and tightened.

[0026] If minimal alignment movements are necessary, this is usually harmless.

[0027] Such minimal alignment movements can be seen, for example, by loosening the screw connection of the elevator drive with the mounting arm, which is manufactured for transport purposes, a little bit, then aligning the elevator drive a little bit more precisely and only then being able to insert the said retaining screws. This is not ideal but mostly harmless.

[0028] Here, too, the ingenious, rail-mounted provision of the fixed area helps decisively. In this way, the mounting arm according to the invention can be aligned very easily and with sufficient accuracy - depending on the type of elevator - during the preparatory installation.

[0029] With a mounting arm with a fixed area fixed to the car, on the other hand, it is difficult to first position and fix the car precisely. During the construction phase, when the elevator and its shaft copy are not yet fully assembled and ready for operation, this is almost impossible.

[0030] The said mounting arm is understood to be a pair of two individual bars or a pair of preferably several bars arranged essentially or at least in sections in parallel and hinged at one end. Due to their articulation, they can be pivoted from their loading to their unloading position along a circular or essentially circular path.

[0031] The term "shaft" or "elevator shaft" is mainly characterized by the fact that an elevator can travel in it. In a narrower sense, this term is thus used to describe a conventional shaft in the sense of an essentially closed, square travel tube. In its wider meaning, however, a "shaft" can also have a different shaft cross-section or other distinctive surrounding shaft walls, such as latticework constructions or similar.

[0032] The lifting device in question is usually a general type of hoist, often without special adaptation to an elevator. It is usually only temporary, until the installation work on site is completed. It can therefore be attributed to the assembly tools. It is therefore usually not an additional elevator component that is included in the material costs of the elevator. The term "lifting device" in the sense of the invention preferably includes a rope, belt or chain hoist. It is ideally equipped with a carrying tool. Preferably it has the shape of a load hook, with the main task of lifting the load.

[0033] The "intended mounting position" in the sense

of the invention is preferably located at the upper end of the elevator guide rails. It is usually defined in such a way that the elevator drive is mounted ready for operation at prefabricated mounting holes on the elevator guide rails or mounting parts which are themselves fixed to the elevator guide rails.

[0034] The aforementioned area of the shaft head below its intended installation position is, but not only, an area that is less than 1.5 m below the underside of the shaft head ceiling or the end of the shaft head.

[0035] The "fixed area" in the sense of the invention describes the area in which the mounting arm is fixed - usually rigidly - to the elevator guide rails used as the basis for the exact positioning of the mounting arm during the period of installation. Usually and clearly preferred are the elevator guide rails at whose upper end the intended mounting position of the elevator drive is located. In this respect, however, exceptional cases are also conceivable, for example in the case of backpack elevators, where the car and counterweight guide rails are located in parallel, adjacent planes.

[0036] The mounting arm itself pivots around the fixed area. This fixed area is located directly at the elevator guide rails and is below the intended installation position. Such an immediacy exists if the mounting arm is directly bolted to the corresponding guide rail with the corresponding holes. It is also present if the mounting arm is bolted to a bearing block, which in turn is rigidly connected or bolted to the guide rail by means of a corresponding positive or frictional connection for the duration of the installation.

ANOTHER PROBLEM UNDERLYING THE INVENTION

[0037] Furthermore, it is the task of the invention to provide a system with which an elevator drive can be easily and safely installed in the range of the shaft head.

ANOTHER INVENTIVE SOLUTION

[0038] The solution of the above mentioned problem is achieved by means of an assmebly with which the procedure of the inventive step can be carried out.

[0039] This assembly thus preferably comprises a lifting device, an elevator drive and mounted elevator guide rails, at the top of which the elevator drive is to be mounted. In addition, the assembly contains a mounting arm, which can be swivelled around a fixed area and on which the elevator drive can be guided and swivelled into its mounting position during further swivelling. The solution is characterized by the fact that the fixed area is located below the intended mounting position of the elevator drive in the above defined sense on the elevator guide rails on which the elevator drive is to be mounted.

[0040] The term "assembly" describes a totality of parts by means of which a process in the sense of the invention can be carried out.

[0041] The advantages mentioned in connection with the procedure described at the beginning can also be realized with the help of such an assembly. The definitions of terms given at the beginning of this article apply accordingly.

ANOTHER PROBLEM UNDERLYING THE INVENTION

[0042] Furthermore, it is the task of the invention to provide a device which can fix the elevator drive and also perform a pivoting rotational movement.

ANOTHER INVENTIVE SOLUTION

[0043] The solution to the above problem is provided by a mounting arm, which is used to form an assmebly with which the process of the invention is carried out. A mounting arm preferably consists of a flange, which is preferably designed in the shape of a clamping claw and fixes the mounting arm to the elevator guide rails. In addition, a mounting arm contains at least two single arms that can be swivelled in parallel around a fixed area, which are equipped with a fixture for fixing the elevator drive. The actual mounting of the elevator drive is done in a defined position on the elevator guide rails, which is achieved by pivoting the arms.

[0044] The term "clamping claw" describes a component, preferably a bent sheet metal part, which can be fixed to the elevator guide rails and also provides a receptacle for the preferably two single arms.

OPTIONS FOR IMPROVING THE INVENTION

[0045] There are a number of possibilities for shaping the invention in such a way that its effectiveness or usefulness is further improved.

[0046] It is therefore particularly preferable to use a mounting arm for this procedure, which is designed in such a way that the elevator drive can be mounted in the correct position on the mounting arm and also maintains this correct alignment during pivoting. This ensures that the fixing in the intended mounting position is simplified and no additional tools are required to align the elevator drive.

[0047] Furthermore, it is preferable that the elevator drive is not detached from the lifting device until it has reached its final installation position and ideally only after it has been fixed in this position. This leads to increased safety, since the elevator drive is thus preferably secured against falling by the lifting device in any position not fixed in the intended installation position.

[0048] Preferably, the procedure is such that the lifting device is able to absorb the weight of the elevator drive in a first phase of the swivel movement mainly by the lifting device. This prevents the work of holding and/or deflecting the elevator drive from having to be done manually and/or otherwise than by the existing lifting device.

[0049] In addition, it is particularly preferable if the rope or belt or chain of the lifting device can be pulled at an angle during the procedure when the elevator drive is swung into its mounting position. This ensures that the lifting device will lift the elevator drive to or almost to the last possible swivel position that the lifting device can reach. This facilitates the preferably manual traversing of the remaining swivel path - compared to a mounting arm which is in its swivel movement in a position below. The reason for this is the smaller projected lever arm, which indicates the horizontal distance of the elevator drive from the fixed point of the mounting arm.

[0050] It is also preferred if the rope, belt or chain is also elongated when the elevator drive is pivoted. Here, "elongation" does not refer to elastic elongation, but rather to a deliberate elongation achieved by adding further elements to the rope, belt or chain. In the example of the rope this would mean "unwinding". In this way, it is possible to achieve that the specified trajectory curve can also be traversed beyond the uppermost end position that can be reached with the lifting device without removing the securing connection of the lifting device from the elevator drive or from the mounting arm

[0051] The assmebly according to the invention is preferably designed in such a way that the mounting arm comprises at least two parallel cooperating single arms, each of which in turn consists of two bars. These bars can be hinged to the elevator drive. The articulation is such that the elevator drive can move relative to the mounting arm in such a way that a horizontal orientation of the elevator drive is maintained during the entire pivoting process. This leads to an easier installation in the intended mounting position. This is because the drive is suspended from the lifting device at the time it is attached to the mounting arm. It can therefore be easily and safely aligned during the installation process so that it is exactly in the installation position. If the mounting arm now maintains this alignment even when it is swivelled, the fitter is spared having to carry out the alignment work in a forced position directly under the shaft head ceiling.

[0052] Preferably, the lifting device of the assembly is designed in such a way that it can and must only lift the elevator drive to bring it into the position in which it is attached to the mounting arm. This makes it possible to choose a lifting device for the assembly that is designed purely to transport the elevator drive. Such a lifting device is accordingly small and light. It can therefore be easily mounted and dismounted on the shaft head ceiling and transported from construction site to construction site.

[0053] In addition, the assembly is preferably designed so that the lifting device is mounted on the shaft head ceiling or in the area of the shaft head in such a way that its rope or belt or chain for lifting the elevator drive hangs vertically into the shaft next to the elevator guide rails where the elevator drive is to be mounted.

[0054] It is also preferred that this rope or belt or chain hangs down to the bottom of the shaft and maintains its vertical orientation even when the elevator drive is pulled up to the area of the shaft head or mounting arm. This makes it possible to pick up the elevator drive from variable heights and from any floor. Furthermore, the risk of collision of the elevator drive with other components in or on the shaft is reduced.

[0055] The mounting arm of the assembly, as invented, is preferably designed to include two parallel bars per single arm, each of which has a different pivot point at the flange.

[0056] As a result, the bars hinder each other, namely in such a way that both an upper and a lower stop is formed during the swivel movement of the mounting arm. The pivot points of the bars are offset to each other in such a way that a connecting line of the center axes of the two pivot points preferably has a 40° to 50° angle to the horizontal. It should be noted, however, that the center of rotation of the upper bar is closer to the nearest shaft wall than the center of rotation of the lower bar. In addition, it is preferable that both bars touch each other in two positions of the total swivel movement in such a way that a further swivel movement in one direction is stopped.

[0057] In the sense of the invention, a "stop" means a blocking of the further pivoting movement on the given path curve in one direction.

[0058] This results in a considerable gain in security: Even if handled carelessly, the mounting arm cannot fold down any further and thus unintentionally move away from the position in which the elevator drive still hanging on the lifting device is to be attached to the mounting arm. Conversely, the mounting arm must be designed in such a way that it runs up against a stop in the area or immediately upon reaching the intended mounting position. This can make it easier to find the exact mounting position quickly.

[0059] If the pivot points of the bars are cleverly shifted relative to each other, slightly deviating from the 45° line, then it is possible to follow the path specified by the mounting arm - preferably up to 10° - beyond the highest point. In some cases, this can make alignment easier, especially where greater tolerances are to be expected on site - for example, when renovating old buildings.

[0060] Furthermore, it is preferred that the mounting arm according to the invention has a protruding lifting aid in which the lifting device can be fixed. It is preferred that this lifting aid is located at the lower of the preferably two parallel bars of the single arm. The lifting aid preferably protrudes downwards at an angle so that a vertically mounted lifting device can be fixed to the lifting aid without colliding with the elevator drive. Thus it is possible to use a lifting device that can only lift vertically. In addition, the upper end position reached by the lifting device is closer to the intended installation position, which further shortens the manual swivel travel.

[0061] Ideally, the mostly beam-like drive bracket is designed so that its length is greater than the maximum distance between the elevator rails on or to which the elevator drive is to be mounted as intended. The drive

bracket then protrudes in horizontal direction, laterally, left and right, in each case by a certain amount over the outer sides of the elevator guide rails.

[0062] This is preferably accompanied by the fact that the mounting arm is designed so that the two single arms have a horizontal distance to the elevator guide rails. This is preferably achieved by an appropriate design of the two flanges of the mounting arm. This horizontal distance is preferably that from the outside of the elevator guide rails (the side on which the flanges rest) to the outside, i.e. to the surface facing the elevator guide rails. This means that there is still a distance between the outside of the elevator guide rails and the mounting arm even if at least the corresponding sections of the mounting arm run parallel to the elevator guide rails from the fixed area to the top end of the elevator guide rails.

[0063] The fact that the flanges should rest on the elevator guide rails on the one hand and have a horizontal spacing on the other hand, is preferably achieved by a cranked design, preferably as a bent sheet metal part, thus forming a U-profile with fixing lugs.

[0064] It should be noted that due to the design of the flanges, the respective end plate at the horizontal ends of the drive bracket has the preferably identical horizontal distance from the elevator guide rails as the flanges.

[0065] However, since these end plates are also preferably screwed to the elevator guide rails, a cranked design - preferably as a bent plate - is also favored for the end plates. One flat surface of the end plates lies against the elevator guide rails, while the other, preferably parallel flat surface is at a distance from the elevator guide rails.

[0066] These measures help to ensure that there is a horizontal installation clearance between the surface of the end plate, which rests on the elevator guide rail and is screwed there, and the respective single arms. This free space can preferably be used for threading and tightening the nuts of the corresponding fixing screws. Therefore, this horizontal distance between the mounting plate and the mounting arm is preferably at least two, preferably at least three nut thicknesses.

[0067] In general, this additional mounting space is thus preferably achieved by a suitable interaction of the flanges of the mounting arm and the end plates of the drive bracket. The horizontal spacing thus achieved makes it easier to install the elevator drive in its intended installation position.

[0068] Further advantageous design possibilities, modes of action and advantages of the invention result from the following description of the preferred examples of the invention using the figures.

LIST OF FIGURES

[0069]

Fig. 1 shows a schematic illustration of the installation of an elevator drive in the shaft head area of an elevator shaft using only a lifting device and an operator.

Fig. 2 to Fig. 5 show a side view of an elevator shaft and a schematic representation of the steps to be taken to assemble an elevator drive in the shaft head area using the mounting method and the corresponding assembly according to the invention.

Fig. 6 to Fig. 9 show the individual positions of the mounting arm during the mounting steps in a spatial view and with detailed illustrations of the exemplary individual parts of the assembly (without lifting device).

Fig. 10 shows the arrangement of the exemplary bars of a single arm of the mounting arm and their path during a swivel process from the lower to the upper stop.

Fig. 11 to Fig. 14 show a side view of an elevator shaft showing a schematic diagram of the steps to be taken to install an elevator drive in the shaft head area using the installation method and the corresponding assembly as in Fig. 2 to Fig. 5, but with a different variant of the mounting arm.

Fig. 15 to Fig. 18 show in a spatial view and with detailed illustration of the exemplary individual parts of the assembly (without lifting device) the individual positions that the mounting arm assumes when passing through the mounting steps, analogous to Fig. 6 to Fig. 9, but with a different variant of the mounting arm.

PREFERRED EMBODIMENTS

[0070] First, Fig. 1 shows the side view of an elevator shaft 1, in which the installation of an elevator drive 2 is only carried out by means of a lifting device 3 and a schematically shown worker. At the same time, Fig. 1 visualizes the typical problem: The end of the elevator guide rails, on which the elevator drive 2 is to be mounted, is so close below the shaft head ceiling that the elevator drive 2 cannot be lifted into its intended mounting position by means of the lifting device 3 alone.

[0071] The worker must therefore manually move the elevator drive to the end of the elevator guide rails 4 (shown by arrow) to be able to attach it there to a connecting part 5 at the upper end of the elevator guide rails. This is the intended installation position (represented by dotted elevator drive). Often the worker is not only confronted with the problem of having to manually lift the elevator drive the last part into its mounting position. Relatively often he even has the additional problem that he has to align the elevator drive in a forced position just below the shaft head ceiling in order to cover all mounting holes so that he can screw the elevator drive tight.

[0072] Fig. 2 to Fig. 5 show in the same schematic side view the excavation of the upper part of the elevator shaft 1 and the individual steps of the procedure for mounting the elevator drive and the corresponding positions of the mounting arm 7.

[0073] Fig. 6 to Fig. 9 show the individual positions of the mounting arm during the mounting steps in a spatial view and with detailed illustration of the exemplary individual parts of the assembly (without lifting device and without illustration of the shaft) analogous to Fig. 2 to Fig. 5.

[0074] The respective sequence of the process steps is marked with thick, black arrows between the individual figures.

[0075] First, Fig. 2 and, analogously, Fig. 6 illustrate the preparations that were made in the course of the procedure according to the invention.

[0076] After the installation of one rail track of the elevator guide rails 4 (for car and counterweight), on which the elevator drive is to be mounted, the first thing to be done is to erect its temporary working platform 6 in the affected area of the shaft 1 or the shaft head. In individual cases, the car roof can be used alternatively. Due to the effort and expense involved, however, this will remain the exception rather than the rule.

[0077] It can be advantageous if at this stage of the procedure the second elevator guide rail, i. e. the second rail track for the counterweight or the car (depending on where the elevator drive is to be mounted) has not yet been installed. This can be particularly useful in narrow shafts. Then it is possible to work in the shaft 1 with as little obstruction as possible and, in particular, the elevator drive can then be raised largely freely.

[0078] Then, the mounting arm 7 is mounted to the elevator guide rails 4.

[0079] Before going into the details it has to be explained that the mounting arm 7 is an assembly group. Here it is assembled from two single arms 13. Each single arm 13 consists of an upper bars 8 and a lower bar 9. The said single arms 13 are interconnected to each other by means of a - normally horizontal - cross member which is also called single arm connection 14. It is not shown by Fig. 2. That way the two single 12 arms consisting of an upper and a lower bar 8, 9 each, form the mounting arm 7 together with the cross member.

[0080] In preferred cases the drive bracket 11 form an additional cross member for connecting the two single arms 13.

[0081] Preferably, the elevator guide rails 4 are used for this purpose, which should support the elevator drive 2 in its intended installation position. As shown in Fig. 2, the mounting arm 7 is firmly connected to a pair of elevator guide rails 4 by means of its flanges 10. For this purpose, the flanges 10 may consist of or form a pair or more claw. The claws are clamped or screwed together so that they clamp an elevator guide rail 4 between them. The respective flange 10 is thus immovably connected to the elevator guide rail 4 for the installation period.

[0082] In many cases, the mounting arm 7 according to the invention is mounted directly below or above a rail bracket 21 anchored to the shaft wall and the elevator guide rails 4, see for example Fig. 6 or Fig. 7. This increases stability. Often this is accompanied by an improvement in the accuracy with which the elevator drive 2 reaches its intended installation position at the first attempt. The mounting arm 7 is not only mounted directly under or above a rail bracket, but in any case preferred if the distance of its flanges 10 to the rail bracket 21 is less than 30 cm.

[0083] In contrast to a car suspended from a more or less elastic suspension rope, smaller vertical movements are also prevented. In addition, high positional accuracy is also achieved in the horizontal direction. This is another difference to a car. Its horizontal positioning can vary slightly by a few millimeters back and forth from one trip to the next, depending on how it currently runs along the elevator guide rails.

[0084] The preparatory steps also include mounting the lifting device 3 in the area of the shaft head or on the shaft head ceiling, as also shown in Fig. 2.

[0085] Relatively often it will also be advantageous to mount the elevator drive 2 in its delivery position, in the bottom of the shaft or even before it is brought into the shaft 1 on the drive bracket 11.

[0086] Then the elevator drive 2, if necessary together with the drive bracket 11, must be moved from its delivery position, which is usually in the bottom of the shaft, but occasionally also in front of the elevator door on any floor, to a position in which it can be fixed to the mounting arm 7.

[0087] For this purpose, it is attached to the lifting device 3, normally to the loading hook 12. Sometimes a lifting gear not shown as a figure is used for this purpose, which ensures that the elevator drive, possibly together with the drive bracket 11, is suspended from the hook from the front in such a way that it is in a position which at least essentially corresponds to the later assembly position.

[0088] If the elevator drive 2 is not already at the bottom of the shaft and is picked up by the lifting device 3, it is now maneuvered into the shaft with the help of lifting device 3.

[0089] Then the elevator drive 2 is lifted upwards the shaft 1 until it reaches the position shown in Fig. 3 and Fig. 7. In this position, the elevator drive 2 is connected to the mounting arm 7 correctly aligned.

[0090] It is particularly preferable not to connect the elevator drive 2 directly to the mounting arm 7, but rather by means of the drive bracket 11, which will then often be designed as a support tube or elongated support profile for this purpose.

[0091] Ideally, it can serve as a cross beam that rigidly connects the left and right-hand bars of the mounting arm 7 after the elevator drive 2 has been fastened for the further mounting process, if necessary in addition to the already existing but possibly less torsionally rigid single arm connection 14 - which ideally forms a handle on

which the installer can lift the mounting arm 7 upwards. As an option, the single arm connection 14 can also be designed and constructed in such a way that the lifting device can be attached in a supporting manner, for example with a rope or belt sling 22 (see Fig. 3 and Fig. 4).

[0092] A lifting device 3 is used for this purpose, which is preferably installed in the area of the shaft head, ideally on or directly below the shaft ceiling. In addition, it is preferable if the lifting device 3 is only used temporarily for the installation of the elevator drive 2, in order to save space in the shaft 1 as well as costs. The elevator drive 2 can be attached to the lifting device by means of a carrying tool - preferably a loading hook 12 - so that the elevator drive 2 can then be lifted by the lifting device 3. At first, the elevator drive 2 must be lifted to an area below its intended mounting position, but preferably at a height of less than 1.5 m below the uppermost point of the elevator guide rails 4.

[0093] The elevator drive 2 must therefore be fixed to the mounting arm 7 with the preferably already mounted drive bracket 11. Preferably, the mounting arm 7 is only attached to the drive bracket 11 so that the elevator drive 2 remains in position during the entire swiveling process. This facilitates the installation of the elevator drive 2 or the drive bracket 11 in the intended installation position, since the alignment does not have to be done manually. Fig. 3 and analog Fig. 7 thus show the initial state of the procedure before the swiveling process starts.

[0094] Then the mounting arm 7 can be lifted by the lifting device 3 with the elevator drive 2 now indirectly fixed by the fixing of the drive bracket 11. In Fig. 7 it can also be seen that the elevator drive 2 preferably consists of the motor, the drive sheave and the feet.

[0095] Fig. 4 and analog Fig. 8 show the condition after the swivelling process has reached the highest point that can be reached by a purely vertically pulling lifting device 3. An arrow in Fig. 4 indicates which further swivelling movement must still be carried out manually by an operator.

[0096] Here a schematically depicted worker stands on an again schematically depicted working platform 6.

[0097] Fig. 5 and analog Fig. 9 show the last position of the mounting arm 7 in the intended mounting position of the elevator drive 2. For this purpose, the operator performs the manual swivel movement just mentioned. Fig. 5 shows that the lifting device 3 is no longer attached to the mounting arm 7. This is due to the fact that the lifting device 3 is used in the variant shown here and only pulls vertically. However, it is also possible to use a lifting device 3 that can move at an angle. This is shown in Fig. 11 to Fig. 19, which will be explained in more detail later. Furthermore it is possible to for elongate the lifting device in a manner that the lifting device 3 can stay attached to the elevator drive 2 or the drive bracket 11 during the manual swivel movement.

[0098] The top stop of the mounting arm 7 allows the drive bracket 11 to be aligned so that the end plates 15 can be positioned so that the mounting holes there are aligned with the mounting holes of the elevator guide rails 4. Now, preferably screws must be inserted through the mounting holes of the elevator guide rails 4, with the screw head preferably resting on the elevator guide rails 4. Then nuts can be threaded on the other side of the screw and finally screwed tight. For this purpose, the horizontal mounting space between the end plates 15, which partly rest on the elevator guide rails 4, and the mounting arm 7 is suitable.

[0099] Fig. 10 shows the arrangement of the exemplary bars of a single arm 13 of the mounting arm 7 and their path during a swivel process from the lower to the upper stop. First the single arm 13 is in horizontal position, which corresponds to the lower stop. Here the mounting arm 7 cannot perform any further swivel movement downwards. This is indicated by the lower cross. The single arm 13 again consists of the upper bar 8 and the lower bar 9. The lower bar 9 has an additional lifting aid 16, which leads down from the horizontal part of the bar. The two bars each have two individual pivot points 17 and 18. The lower bar also has a latching groove 19, which locks into a pin 20 in this lower stop position and provides additional support for this position. Since the elevator drive 2 with the drive bracket 11 has the largest possible lever arm to the two pivot points in the horizontal position, this position also provides the greatest torque, which can be additionally absorbed by this pin 20. If the swivel movement is performed upwards, the two bars rotate around their pivot points 17 and 18 and the single arm is finally stopped at the upper stop (marked by the upper cross). This upper stop does not have to be the final mounting position of the elevator drive 2 at the same time, because the single arm 13 can also be turned a few degrees above the vertical position of the mounting arm 7 to facilitate mounting.

[0100] Fig. 11 to Fig. 14 and Fig. 15 to Fig. 18 show the position of the assembly for mounting an elevator drive 2 and its position during the steps to be performed completely analogous to Fig. 2 to Fig. 5 and Fig. 6 to Fig. 9, but with a different variant of the mounting arm 7.

[0101] The aforementioned figures show that the mounting arm 7 of this embodiment, too, is an assembly group. Here it is assembled from two single arms 13 again. Each single arm 13 consists of an upper bars 8 and a lower bar 9 being part of the lateral single arms of the mounting arm. The said single arms 13 are interconnected to each other by means of the drive bracket 11 which forms the cross member here. That way the two single arms 13, consisting of an upper and a lower bar 8, 9 each, form the mounting arm 7 together with the dive bracket 11.

[0102] In some preferred cases, as shown here, the drive bracket 11 forms the only interconnection between the single arms 13.

[0103] With this variant, all statements made and advantages that were already explained with the previously described variant apply, apart from the differences that will be explained in more detail below.

[0104] The only difference to the previous version is the design of the lower bar 9 of the single arms. This is designed in such a way that it is preferably identical to the upper bar 8 of the single arm 13. So this mounting arm 7 has no lifting aid 16 and therefore no single arm connection 14 can be mounted. For this reason, the lifting device 3 is also attached directly to the elevator drive 2 or to the drive bracket 11. In order to be able to start the swivelling process with the help of the lifting device 3, a lifting device is required which can also pull at an angle. This offers the advantage that the lifting device 3 remains attached to the elevator drive 2 or the drive bracket 11 until the elevator drive 2 or the drive bracket 11 is mounted in the intended mounting position. This increases the safety of the manual slewing process, as the mounting arm 7 can still be supported by the lifting device (see Fig. 14).

MISCELLANEOUS

[0105] Again it should be mentioned that the two lateral side arms, with two holes at each end, form a mechanism with four pivots. Fixing brackets are used to connect these arms to the guide rails. Holes on these brackets are the two fixed points of the mechanism. The location of the holes on the bracket and the machine frame allows the arms to move in most cases approximately a quarter circle from horizontal to vertical.

[0106] These pivot positions also keep the machine frame angle constant with ground while the machine frame moving.

[0107] In addition, protection is claimed for an assembly according to claim 7, which is described by the fact that the elevator drive is preferably mounted on a drive bracket - connecting the two single arms - at each of whose vertical ends a cranked end plate is preferably attached, which is adapted to the horizontal cranking of the flange to the extent of its horizontal cranking.

LIST OF REFERENCE SIGNS

[0108]

1 Elevator shaft
2 Elevator drive
3 Lifting device
4 Elevator guide rails
5 Connecting part
6 Working platform
7 Mounting arm
8 Upper bar of a single arm of the mounting arm
9 Lower bar of a single arm of the mounting arm
10 Flange of the mounting arm
11 Drive bracket
12 Loading hook of the lifting device
13 Single arm of the mounting arm
14 Single arm connection or cross member
15 End plate of the drive bracket
16 Lifting aid on lower bar of the single arm
17 Pivot point of the upper bar of the single arm
18 Pivot point of the lower bar of the single arm
19 Latching groove of the lower bar of the single arm
20 Pin to accept the locking groove of the lower bar of the single arm
21 Rail bracket
22 Rope or belt sling

Claims

1. A method for mounting an elevator drive (2) in the range of the shaft head of an elevator shaft (1), the method comprising a first step in which the elevator drive (2) is lifted by means of a lifting device (3) into the range of the shaft head lying below its intended mounting position, **characterized in that** in a second step the elevator drive (2) is mounted on a pivoting mounting arm (7) which is can pivot about a fixed range that is located in a distance below the intended mounting position on the elevator guide rails (4) on which the elevator drive (2) is to be mounted and is further lifted in a third step in such a way that it moves on a path predetermined by the mounting arm (7) and its fixed area into its intended mounting position in the area of the upper end of the elevator guide rails (4), the weight of the elevator drive (2), when it reaches its mounting position, being essentially supported by the mounting arm (7) which is then preferably located vertically below the motor contour.

2. Method for mounting an elevator drive (2) according to claim 1, **characterized in that** a mounting arm (7) is used which is designed in such a way that the elevator drive (2) can be mounted on it in the correct position and then maintains its correct position during pivoting.

3. Method according to one of the preceding claims, **characterized in that** the elevator drive (2) is only released from the lifting device (3) after reaching its final assembly position and ideally only after its fixation in the final mounting position.

4. Method for mounting an elevator drive (2) according to one of the preceding claims, **characterized in that** the weight force of the elevator drive (2) in a first phase of pivoting is predominantly taken up by the lifting device (3) .

5. Method for mounting an elevator drive (2) according to one of the preceding claims, **characterized in that** the rope, belt or chain of the lifting device (3) can be pulled obliquely in the course of the pivoting of the elevator drive (2) into its mounting position.

6. Method of assembling an elevator drive (2) accord-

ing to one of the preceding claims, **characterized in that** the rope, belt or chain are lengthened in the course of the pivoting of the elevator drive (2) to its mounting position.

7. Assembly for mounting an elevator drive (2) in the range of the shaft head, the assembly comprising a lifting device (3) and an elevator drive (2), elevator guide rails (4) mounted in an elevator shaft (1), at the upper end of which the elevator drive (2) is to be mounted, and a mounting arm (7) pivotable about a fixed range, on which the elevator drive (2) can be guided during further lifting and pivoted into its mounting position, **characterized in that** the fixed range is formed below the intended mounting position of the elevator drive (2) on the elevator guide rails (4) on which the elevator drive (2) is to be mounted.

8. Assembly for mounting an elevator drive (2) in the range of the shaft head according to claim 7, **characterized in that** the mounting arm (7) comprises at least two parallel cooperating single arms (13), each of which consists of two bars (8 and 9) which can be pivotally connected to the elevator drive (2) to be pivoted by them into its intended mounting position.

9. Assembly for mounting an elevator drive (2) in the range of the shaft head according to claim 8, **characterized in that** said two bars (8 and 9) are pivotable in such a way that the elevator drive (2) also during pivoting maintains its correct position in which it has been fixed to the mounting arm (7) before pivoting and which it should take in its final mounting position.

10. Assembly according to one of the previous claims, **characterized in that** the lifting device (3) is designed to lift only the elevator drive (2) to bring it to the position where it is fixed to the mounting arm (7).

11. Assembly according to one of the preceding claims, **characterized in that** the lifting device (3) is mounted on the shaft head ceiling or in the area of the shaft head in such a way that its rope or belt or chain for lifting the elevator drive (2) is vertically adjacent to the elevator guide rails (4), on which the elevator drive (2) is to be mounted, hangs down into the shaft (1), preferably up to the area of the shaft bottom and its vertical orientation also when the elevator drive (2) is raised up to the area of the shaft head or the mounting arm (7).

12. Mounting arm (7) for forming an assembly according to one of claims 7 to 11 consisting of a flange (10) preferably in the form of a clamping claw for fixing the mounting arm (7) to the elevator guide rails (4) to which the mounting arm (7) is to be attached, and at least two single arms (13) which can be pivoted in parallel about a fixed point and are equipped with a receptacle adapted to an elevator drive (2) for fixing the latter in a defined position on the elevator guide rails (4) by giving away the mounting arm (7) .

13. Mounting arm (7) for forming an assembly according to claim 12 with preferably two parallel bars (8 and 9) per single arm (13), **characterized in that** their respective offset centres of rotation on the flange (10) lie relative to one another in such a way that the bars (8 and 9) hinder one another in such a way that both an upper and a lower stop are formed during the pivoting movement of the mounting arm (7) .

14. Mounting arm (7) for forming an assembly according to claim 12 with preferably two parallel bars (8 and 9) per single arm (13), **characterized in that** preferably the lower bar (9) of the mounting arm (7) has a projecting lifting aid (16) in which the lifting device can be fixed.

15. Mounting arm (7) for forming an assembly according to claim 12 with preferably two parallel bars (8 and 9) each per single arm (13), **characterized in that** the two single arms (13) are preferably horizontally spaced from the elevator guide rails (4) by a corresponding design of the flanges (10) of the mounting arm (7).

FIG. 1

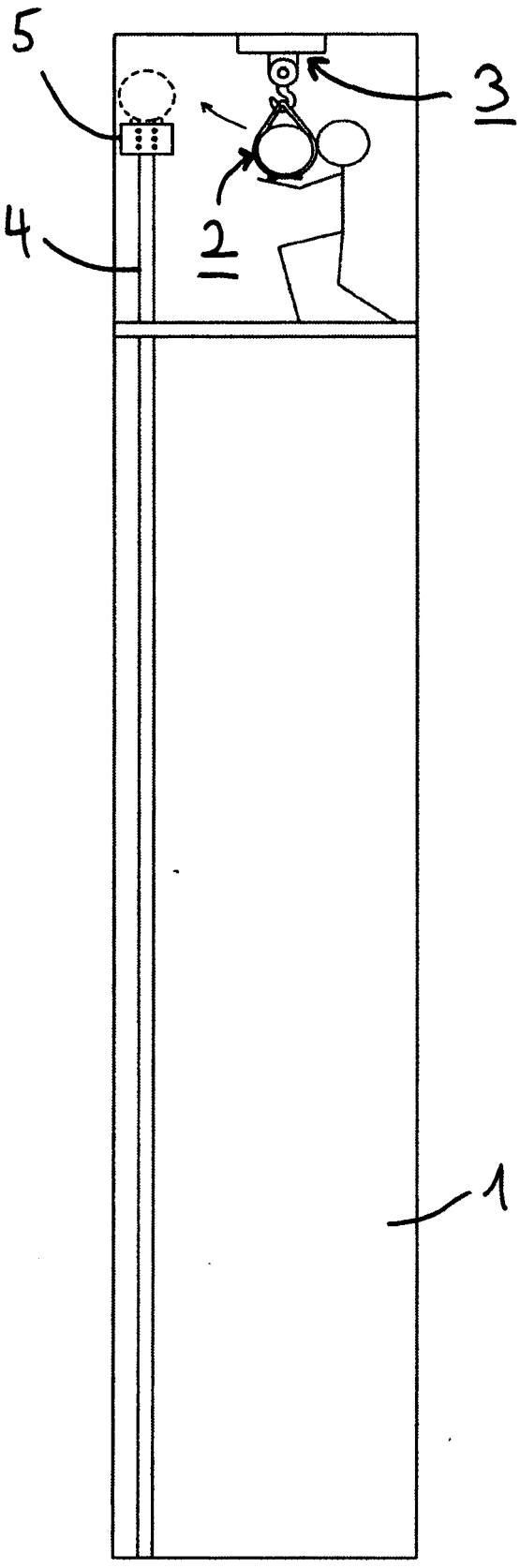


FIG. 2

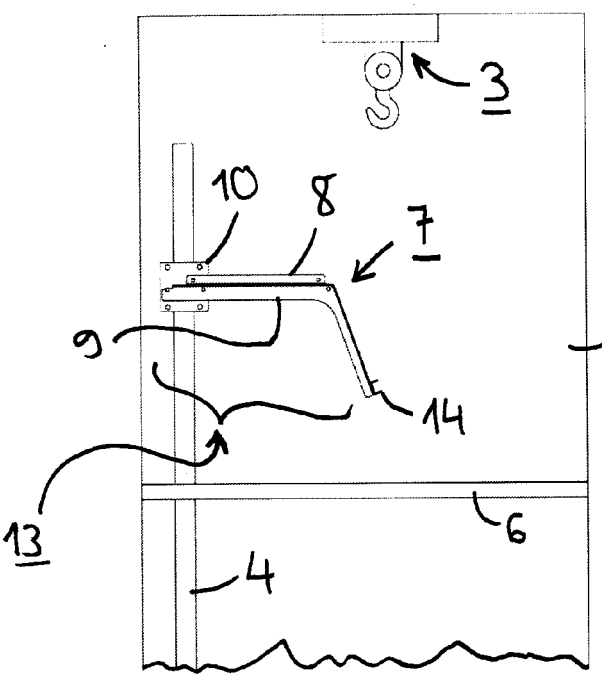


FIG. 3

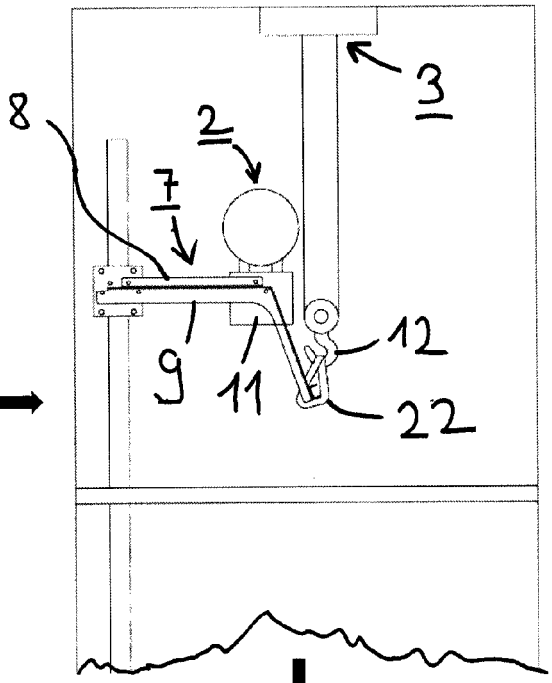


FIG. 5

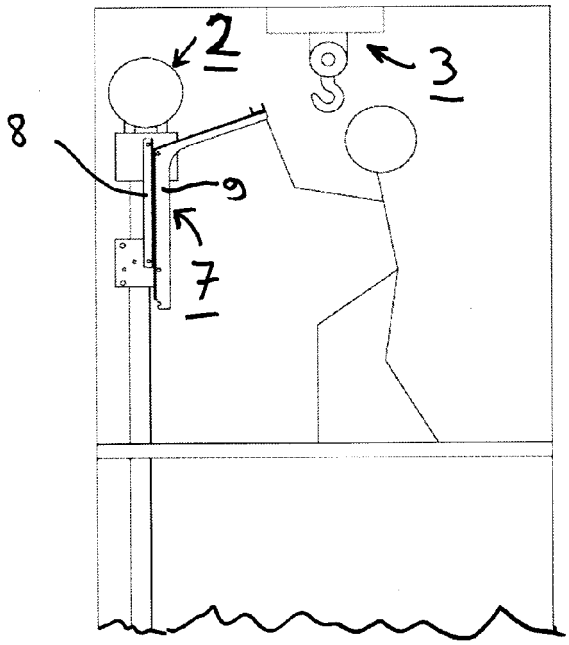


FIG. 4

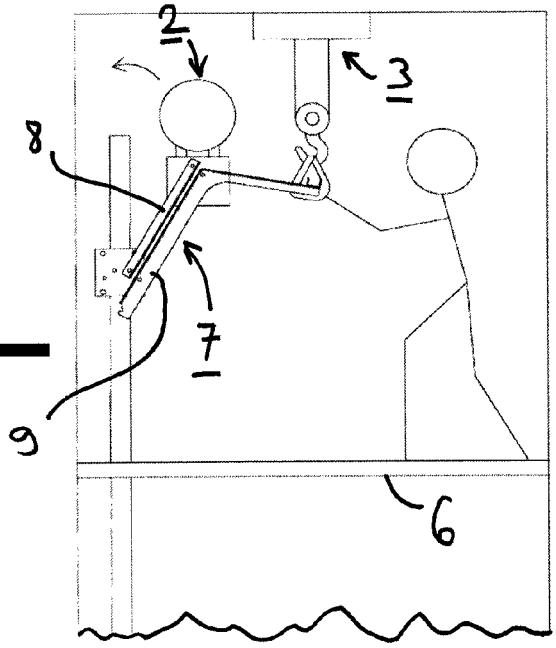


FIG. 6

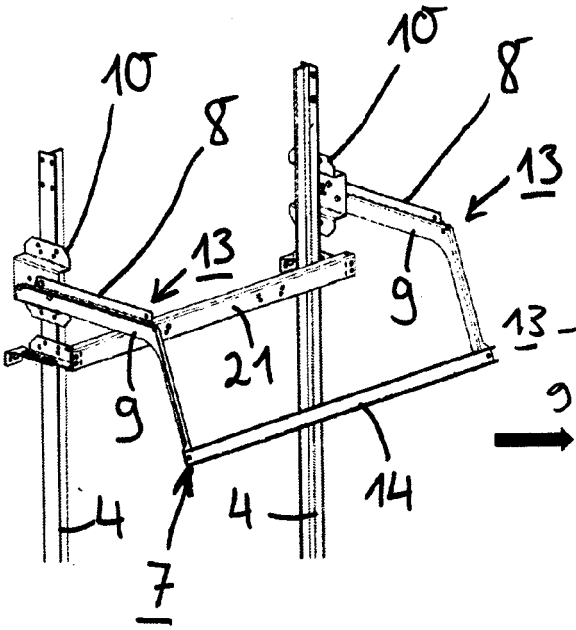


FIG. 7

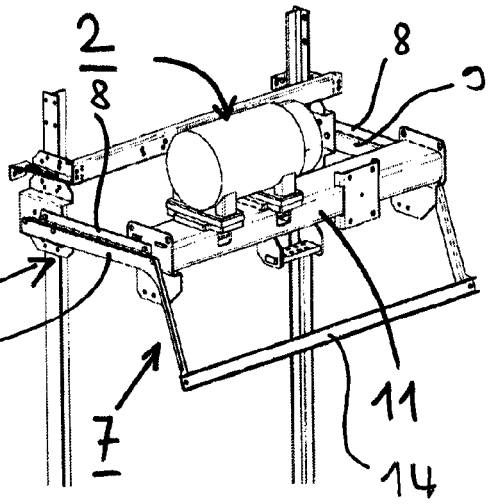


FIG. 9

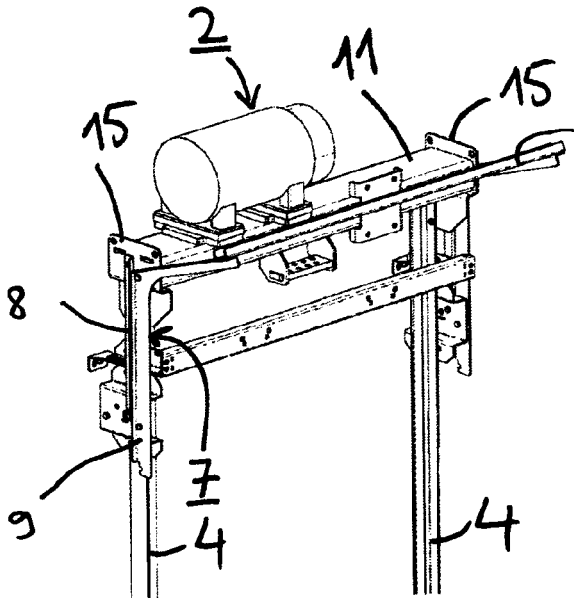


FIG. 8

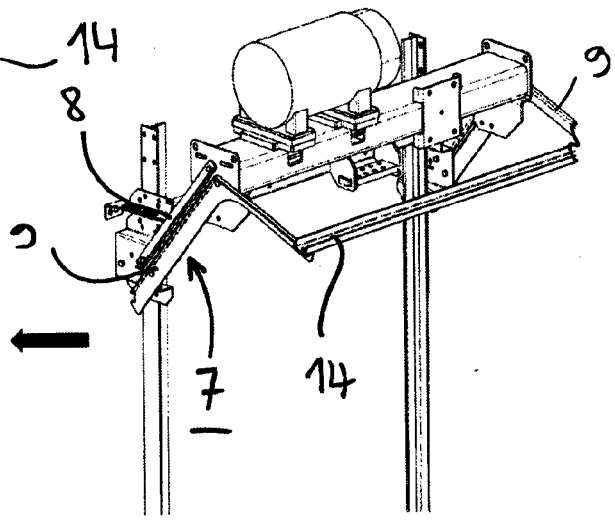


FIG. 10

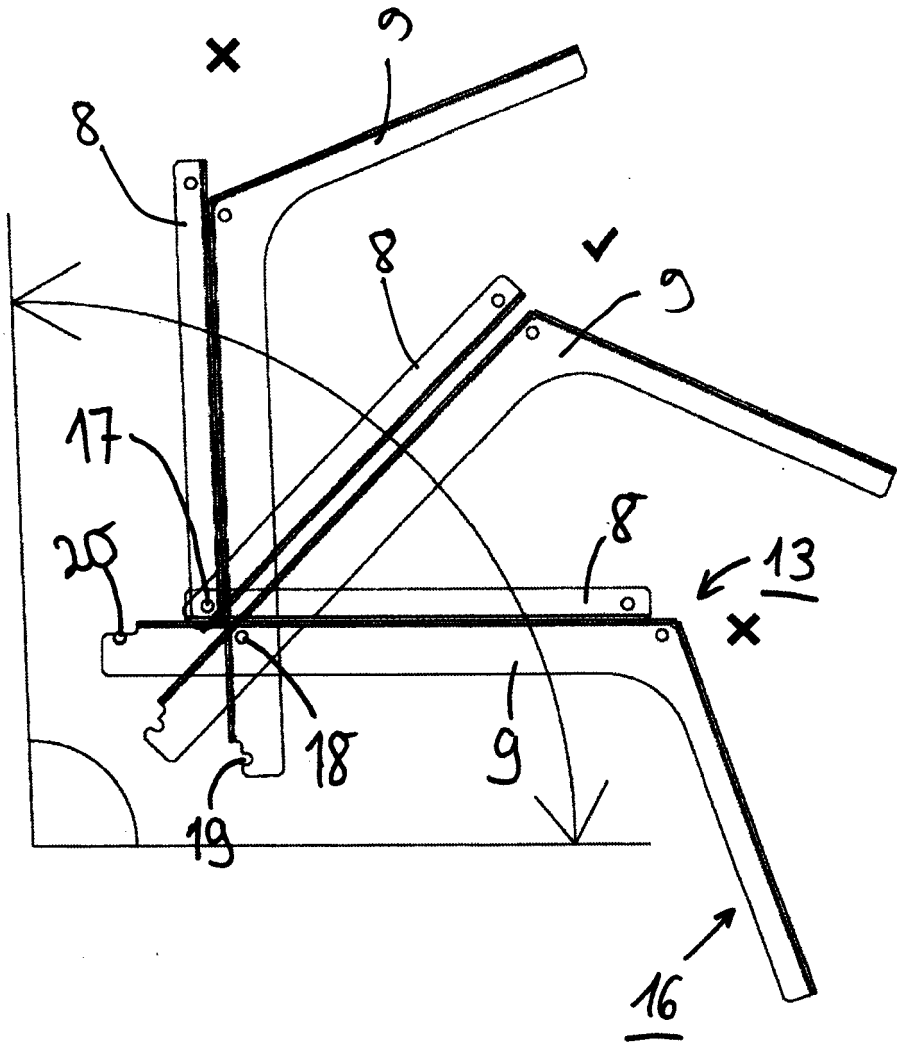


FIG. 11

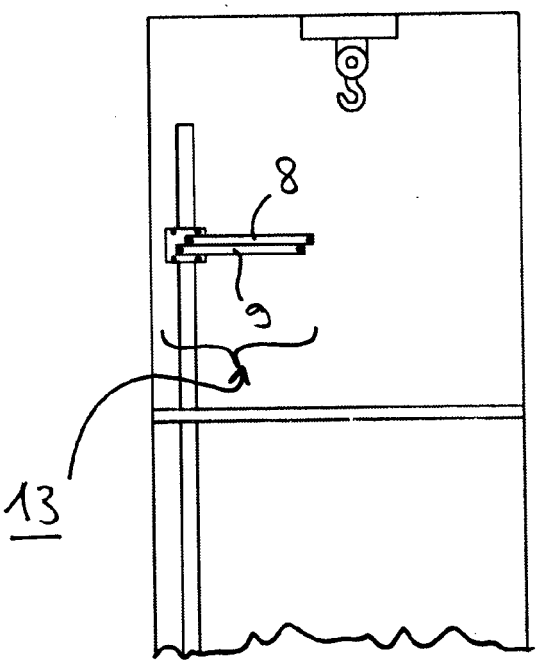


FIG. 12

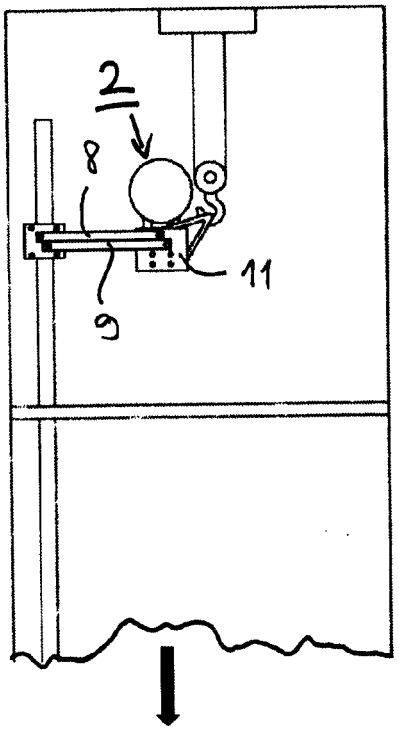


FIG. 14

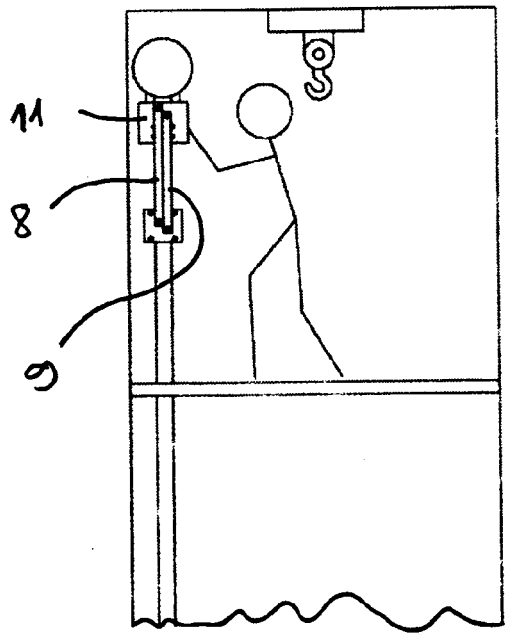


FIG. 13

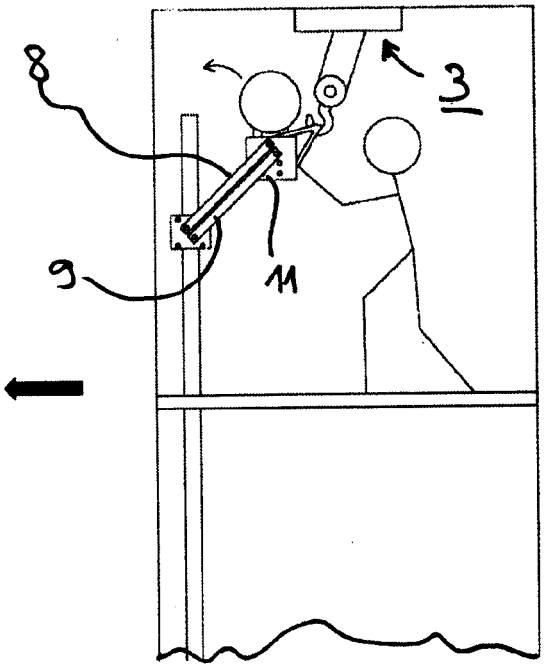


FIG. 15

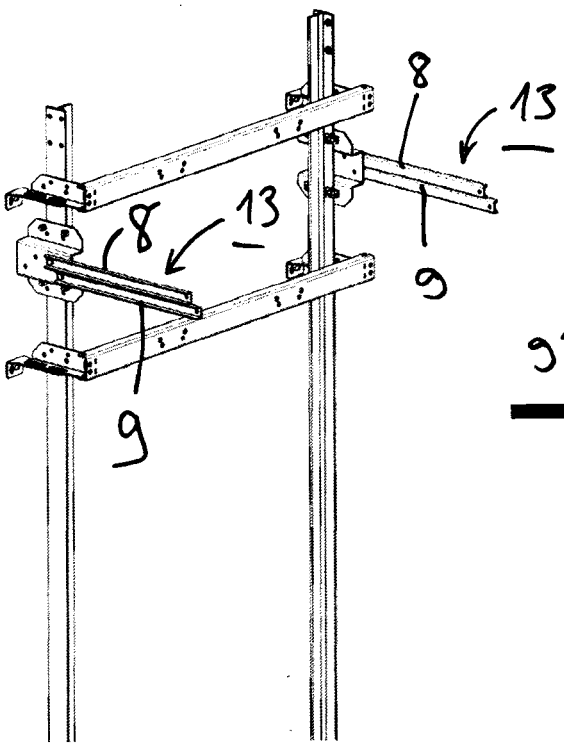


FIG. 16

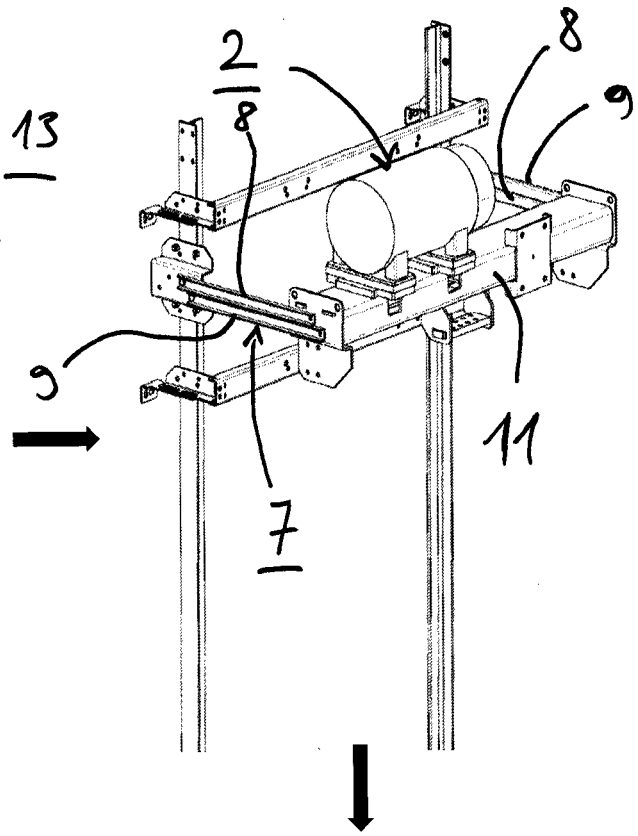


FIG. 18

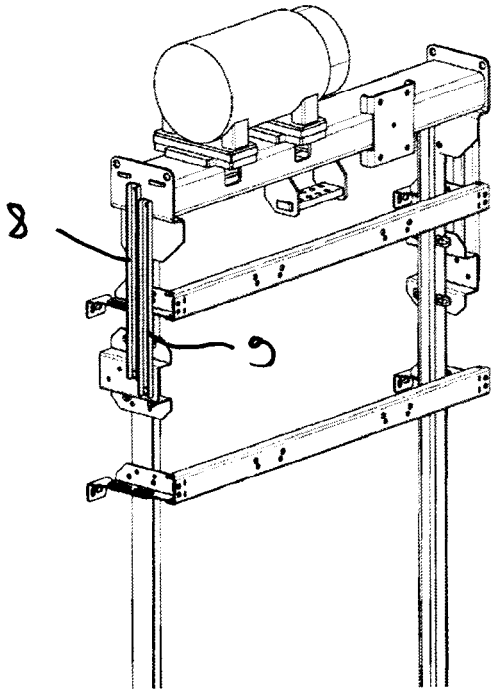
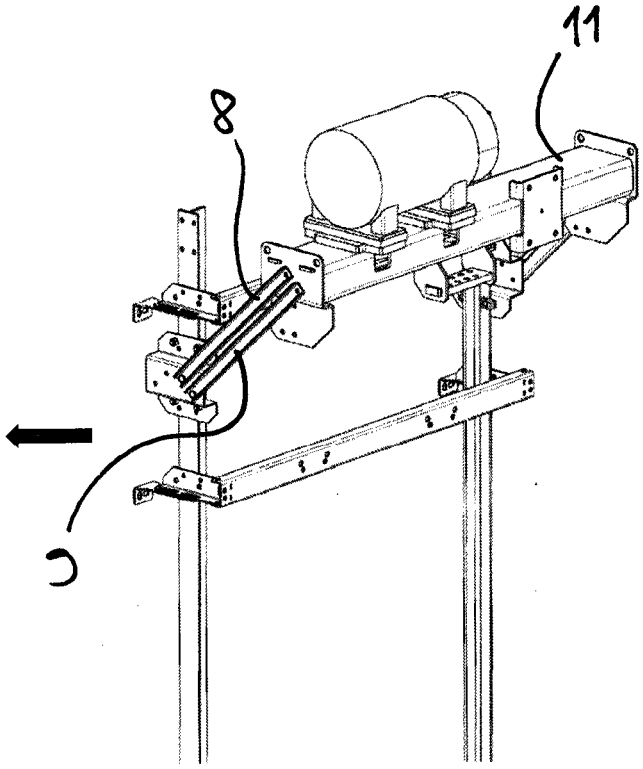


FIG. 17



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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 22 16 0822

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2007 210703 A (TOSHIBA ELEVATOR CO LTD) 23 August 2007 (2007-08-23)	7,10,11	INV. B66B19/00
A	* figure 8 * * paragraphs [0007], [0008] *	1-6,8,9	
X,D	US 7 624 848 B2 (INVENTIO AG [CH]) 1 December 2009 (2009-12-01)	7,10,11	
A	* abstract; figures 1-8 * * column 1, line 61 - column 2, line 61 *	1-6,8,9	
X	JP 2012 201497 A (TOSHIBA ELEVATOR CO LTD) 22 October 2012 (2012-10-22)	7,10,11	
A	* abstract; figures 5-10 *	1-6,8,9	

TECHNICAL FIELDS SEARCHED (IPC)

B66B

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
The Hague	23 November 2022	Bleys, Philip

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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INCOMPLETE SEARCH
SHEET C

Application Number
EP 22 16 0822

Claim(s) completely searchable:
1-11

Claim(s) not searched:
12-15

Reason for the limitation of the search:

Claims 7 and 12 are drafted as separate independent claims of the same category (Rule 62a EPC) and claim 12 fails to comply with Article 84 EPC to such an extent that it is impossible to carry out a meaningful search for claim 12 and its dependent claims 13-15 (Rule 63 EPC).
The search has been restricted to the subject-matter indicated by the applicant in the letter of 05.10.2022 filed in reply to the invitation pursuant to Rule 62a(1) and Rule 63(1) EPC.
The search report is issued with respect to claims 1-11.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 16 0822

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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23-11-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 7624848 B2	01-12-2009	CA 2506380 A1	07-11-2005
		JP 2005320164 A	17-11-2005
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JP 2012201497 A	22-10-2012	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7624848 B2 **[0006]**