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(54) **Device for opening and closing lift door shutters**

Vorrichtung zum Öffnen und Schliessen von Aufzugstürflügeln

Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur

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EP 1 086 923 B1

Description

[0001] The present invention relates to a device for opening and closing lift door shutters.

[0002] The opening and closing operation of the lift door shutters is a critical point in the lift operation. Indeed the devices actuating these functions must be not only reliable and safe, but must also be adapted to allow the whole lift system to operate under precise rules concerning the various operative parameters.

[0003] Lifts are generally provided with central opening doors with two, four or six shutters or side opening doors with one, two or three shutters, while the known opening and closing devices for these shutters consist of rocking arms or belts. Although such devices solve said technical problem, nevertheless they have some drawbacks.

[0004] The rocking arm devices have the advantageous feature of a particular mechanical structure with a motion similar to an electronic control, but are not suitable to actuate shutters with different opening and closing times, as it may be required by operative needs assigning a maximum time between start of deceleration and end of acceleration of the car in transit at a determined floor of the building, as well as a maximum speed of shutter closure to be strictly respected for safety reasons. This happens because the rocking arm devices are designed with a sinusoidal speed cycle that is always equal both in the opening and closing phase.

[0005] The known belt devices are adapted to be operated with different door opening and closing speeds, but are provided with complex linkages to actuate one of the main components of the known devices, hereinafter referred to as retractable coupling, and of the corresponding shutters. Indeed belts are generally provided at their lacing point with a mechanical member which drives through a plurality of linkages said retractable coupling and consequently opening and closing of the shutters.

[0006] This belt device has also problems of maintenance and reliability of the belt, as said belt often works under twist with reduction of its average life.

[0007] Another drawback of the known belt devices consists of the mismatching of the various linkages with consequent plays and a corresponding movement of the shutters with oscillations making the whole device not entirely reliable.

[0008] US 5,246,089 discloses a door drive apparatus with locking mechanism for elevator doors comprising a latch device for coupling floor door shutters during closed and open settings. Actuation system is provided by enclosing a drive motor and a transmission unit commonly used for this class of application, whilst the opening and closing elevator door motion is controlled by a cam-based system such that a smooth starting and braking trend can be performed. Disadvantages of the above-mentioned apparatus are the same discussed in the previous part of the present description. The belt, indeed, is constrained during its motion to a torsion angle at connection

with the clamping element causing repeated maintenance operations due to the consequent fast wear of the same belt. Moreover it is not provided a system to reduce plays between links, such as, for instance, the toggle lever and the clamping element, in order to obtain a noiseless as well as smooth motion.

[0009] The object of the present invention is to remove the above mentioned drawbacks of the state of the art devices.

[0010] This object is achieved by the device for opening and closing lift door shutters according to the present invention which is of simple, safe and reliable construction with moderate costs of installation and maintenance during its operative life.

[0011] In few words the device for opening and closing lift door shutters of the invention comprises support means operatively associated to the car shutters, means for locking and unlocking the latch and coupling the floor shutters, moving means operatively connected to said support means, and at least one belt, where said belt directly drives mechanical means operatively associated with said means for locking and unlocking the latch and coupling the floor shutters so as to allow the simultaneous opening and closing movement of both the car shutters and floor shutters.

[0012] The device for opening and closing lift door shutters according to the invention is characterized by the features recited in Claim 1.

[0013] In the device of the invention the belt is not twisted in operation and its average life is increased because said belt is a toothed belt and said mechanical means comprise a coupling driving sector consisting of a plate provided at one end with a sector gear adapted to mesh with said toothed belt.

[0014] Another advantage consists in obtaining a micrometric regulation of the neutral point of said means for locking and unlocking the latch and coupling the floor shutters because said coupling driving sector has a plurality of inner seats adapted to lodge a chain and means for its micrometric regulation, said micrometric regulation means comprising a rack travelling on a rod while keeping contact with said chain which is connected to said means for locking and unlocking the latch and coupling the floor shutters.

[0015] A further advantage consists of the possibility to close the latch of the floor shutters in a smooth and silent way because the coupling driving sector has a pin on its vertical symmetry axis, said pin being positioned between said toothed sector and the opposite end of said coupling driving sector with a positioning length proportion of about 2:1.

[0016] Finally the device according to the invention advantageously avoids the presence of plays and oscillations, allowing that the car shutters are perfectly actuated by the moving means because said coupling driving sector has two holes arranged symmetrically in respect of its vertical symmetry axis, is connected to a plate so as to be able to rock around its vertical axis between two

end positions by means of said pin and there is a lock unit comprising a rod pivoted on said plate, said rod having a protrusion at one end and a frustoconical member at the other end, adapted to be coupled with one of said holes, said lock unit being also provided with a shoulder on a plate fixed to said support means of the device, near one side end of said support means, said shoulder being adapted to cooperate with said protrusion.

[0017] Further advantages, characteristics and details of the device for opening and closing lift door shutters according to the invention, will be made clear by reading the following description, making reference to the accompanying drawings showing a preferred embodiment as an illustrative, non-limiting example.

Fig. 1 is a vertical view of the device for opening and closing lift door shutters of the invention, applied to the car shutters.

Fig. 2 is an enlarged vertical view of some details of the device.

Fig. 3 is an enlarged vertical view of one of the mechanical elements of Fig. 2.

Fig. 4 is a side view of a lock unit for the mechanical element of Fig. 3.

Fig. 5 is a partial front view of the lock unit shown in Fig. 4.

Fig. 6 is a side view of a detail of the lock unit shown in Fig. 4, in its unlocking position.

Fig. 7 is a side view of a detail of the lock unit shown in Fig. 4, in its locking position.

[0018] With reference now to the above listed figures of the drawings, the device 1 for opening and closing lift door shutters, comprises support means on a lift car that will be referred to hereinafter as operator 2.

[0019] Operator 2 generally consists of a frame on which a motor unit 3 is fixed, comprising an electric motor of any known type and not shown in the drawings, associated with a plurality of motion elements allowing to drive a toothed belt 5 which is kept positioned between two gear wheels, the one fixed to the motor unit 3 and the other to a plate arranged at the other longitudinal end of operator 2.

[0020] An electronic control of known type (not shown) is associated to the motor unit 3 for regulating the speed of belt 4 in the stages of opening and closing the door shutters.

[0021] The toothed belt 4 is also coupled to mechanical means fixed on a plate 6 that slides in respect of operator 2, by its fastening to a support 21 movable in respect of operators 2 as it will be better explained hereinafter.

[0022] Said mechanical means generally comprise a coupling driving sector 5 mainly consisting of a plate provided at one end with a toothed sector adapted to be coupled to said belt 4, a plurality of inner seats for containing a chain 7 and means for its micrometric adjustment, two holes 18 symmetrically arranged in respect of its vertical symmetry axis and a rocking pin 23 arranged

on said symmetry axis.

[0023] More particularly said pin 23 is preferably, but not necessarily positioned with a length proportion 2:1 between said toothed sector and the opposite end of the coupling driving sector 5.

[0024] Said adjustment means mainly consist of a rack 13 sliding on a rod 14, the position of said adjustment means being regulated by nuts or equivalent means, said rack 13 being in contact with said chain 7 so as to carry out a micrometric adjustment of the chain, through its movements on the rod 14.

[0025] Said chain 7 is fixed at one end to said coupling driving sector 5 and is connected at the other end to a retractile coupling 8 normally used in the lift construction technique for locking and unlocking the latch of the shutters of the floor doors and for coupling these shutters to the car shutters during the opening and closing operations.

[0026] The retractile coupling 8 is also fixed to a support plate 9 constrained to support 21 to which also plate 6 is constrained, and can slide together with the coupling driving sector 5.

[0027] More particularly, the retractile coupling 8 formed by a couple of sides 10 having at their ends rectilinear lengths bent toward the opposite side. Sides 10 are connected to one another by a couple of motion elements 11, of which one is driven by said chain 7 through a little gear wheel 22, while a return spring 12 is obliquely arranged between said sides 10 approximately at the central zone of the retractile coupling 8. In this way an adjustment of rack 13 is transmitted to said motion elements 11 by the chain 7 so as to obtain a perfect adjustment of the neutral point of said retractile coupling 8.

[0028] The coupling driving sector 5 is pivoted on said plate 6 by said pin 23 so as to be able to swing in respect of its vertical axis. Such a swinging motion brings sector 5 to two positions corresponding to an opening and closing action of the retractile coupling 8 as it will better explained hereinafter.

[0029] A lock unit for said sector 5 is assembled on plate 6 at the side opposite to the coupling driving sector 5. More particularly said lock unit comprises a rod 15 constituted by a plurality of rectilinear segments connected to one another, said rod 15 being pivoted near its central part so as to swing in respect of plate 6 in direction of sector 5 and in the opposite direction.

[0030] At the end of the lock unit which is arranged upwards when assembled there is a protrusion 17 e.g. consisting of a bolt and nut group, while at the opposite end there is a frustoconical member adapted to cooperate with one of the holes 18 made in sector 5.

[0031] A shoulder 19 being part of said lock unit but mounted on a plate fixed to operator 2 near one of its side ends, can cooperate with the protrusion 17, when the motion of plate 6 through belt 4 will bring these two elements 19 and 17 in mutual contact.

[0032] Car shutters 20 are placed below the plate 9 on supports 21 sliding in respect of operator 2, one support

being fixed to the group plate 6-plate 9 while the other support is connected to the first support by motion elements of known type, so that the car shutters 20 are connected to the motion of belt 4.

[0033] The door shutters of each floor (not shown) are provided with a latch adapted to be actuated by the retractable coupling 8 to allow the locking or unlocking action of said shutters and their motion driven by the contemporaneous movement of the car shutters 20.

[0034] The operation of device 1 is carried out according to the controls given to the lift in the following manner.

[0035] From a starting condition of closed shutters, the electronic control actuates the motor and the motion is transmitted to the toothed belt 4 connected thereto. Belt 4 drives the coupling driving sector 5 causing it to oscillate so as to actuate through chain 7 the retractile coupling 8 which grasps the latch of the floor door shutters, unlocks the latch and couples the floor shutters to the car shutters 20 constrained by the supports 21 to belt 4 as hereinbefore described. At the same time the inclined position of sector 5 due to said oscillation, is constrained by the engagement of the frustoconical member 16 with hole 18 of said sector 5, because the movement of belt 4 caused the protrusion 17 to descend shoulder 19 and the consequent locking movement of said frustoconical member 17. In this way plays that could be existing are removed and the shutter do not oscillate mutually being perfectly controlled by the electronic control.

[0036] In the closing stage the electronic control actuates in the opposite way the toothed belt 4 through the electric motor, starting with closure of the car shutters 20 and floor shutters that were mutually constrained in view of the action of the retractile coupling 8. At a very short distance from the end of the closure stroke, as an average 1 cm, protrusion 17 starts to ascend shoulder 19 and consequently the frustoconical member 16 does no more stop oscillation of sector 5 that swings in the opposite direction to its original position acting on the retractable coupling 8 disengaging the floor shutters by releasing their latch which returns to the closing position.

[0037] In this connection it is to be noted that the particular position of pin 23 of the coupling driving sector 5 causes it to oscillate so as to allow to reduce the closure speed of the retractable coupling 8 to half of the translation speed of the toothed belt 4, so as to close the latch of the floor shutters in a smooth and noiseless way.

[0038] At the end of the closure stage the lift is totally disengaged from the floor shutters and is ready to move to another floor, where the opening stage will start again.

[0039] Clearly many modifications, adaptations, integrations, variations, additions and substitutions may be resorted to the foregoing embodiment described as an illustrative and non-limiting example, without departing however from the scope of the present invention as defined in the appended claims.

Claims

1. An opening and closing lift door shutters device comprising support means operatively associated to car shutters (20), locking and unlocking means for a coupling latch (8) and coupling means for the floor door shutters, motion means operatively connected to said support means and to at least a toothed belt (4), said toothed belt (4) directly driving mechanical means operatively associated to said locking and unlocking means for the latch and to said coupling means for the floor door shutters so as to allow the simultaneous opening and closing motion of the car shutters together with the floor shutters, **characterized in that** said mechanical means comprise a coupling driving sector (5) including a plate having a toothed sector at one end adapted to be coupled with said toothed belt (4), a plurality of inner seats containing a chain (7) and means for its micrometric adjustment, two horizontal holes (18) arranged symmetrically in respect of its vertical symmetry axis and a pin (23) on said symmetric axis.
2. The device for opening and closing lift door shutters according to Claim 1, **characterized in that** said coupling driving sector (5) is constrained to a plate (6) by said pin (23) so as to be able to swing in respect of its vertical axis between two end positions.
3. The device for opening and closing lift door shutters according to Claim 2, **characterized in that** said pin (23) is arranged between said toothed sector and the opposite end of said coupling driving sector (5) with a length proportion 2:1.
4. The device for opening and closing lift door shutters according to Claim 2, **characterized in that** said plate (6) is slidably constrained to said support means of the device (1) by connection to a support (21).
5. The device for opening and closing lift door shutters according to Claim 2, **characterized in that** a lock unit is provided, comprising a rod (15) pivoted to said plate (6), having a protrusion (17) at one end and a frustoconical member (16) at the other end, adapted to be coupled to one of said holes (18), said lock unit comprising also a shoulder (19) arranged on a plate constrained to said support means of the device near one of their side ends, an adapted to cooperate with said protrusion (17).
6. The device for opening and closing lift door shutters according to Claim 2, **characterized in that** said means for the micrometric adjustment of chain (7) comprise a rack (13) sliding on a rod (14) while keeping contact with chain (7).

7. The device for opening and closing lift door shutters according to Claim 2, **characterized in that** said means for locking and unlocking the latch and coupling the floor shutters comprise a retractable coupling (8) connected through a plate (9) to said support (21) and through said chain (7) to the coupling driving sector (5).
8. The device for opening and closing lift floor shutters according to Claim 7, **characterized in that** said retractable coupling (8) comprises a couple of sides (10) opposite to one another, having their ends bent towards the opposite side, said sides being connected by a spring (12) and a couple of motion elements (11), to one of said elements one end of said chain (7) being fixed after having been directed by a gear wheel (22).
9. The device for opening and closing lift door shutters according to Claim 1, **characterized in that** said motion means (11) comprise a motor unit (3) operatively associated to electronic control means.

Patentansprüche

1. Eine Vorrichtung zum Öffnen und Schließen von Lifttürflügeln mit Haltemitteln, die operativ Kabinentüren (20) zugeordnet sind, Verriegelungs- und Entriegelungsmitteln für einen Kopplungsriegel (8) und Kopplungsmitteln für die Etagentürflügel, Bewegungsmitteln, die operativ mit den Haltemitteln und wenigstens einem Zahnriemen (4) verbunden sind, wobei der Zahnriemen (4) mechanische Mittel direkt antreibt, die operativ den Verriegelungs- und Entriegelungsmitteln für den Riegel und den Kopplungsmitteln für die Etagentürflügel zugeordnet sind, um die simultane Öffnungs- und Schließbewegung der Kabinentüren zusammen mit den Etagenflügeln zu ermöglichen, **dadurch gekennzeichnet, dass** die mechanischen Mittel einen Kopplungsantriebssektor (5) mit einer Platte, die an einem Ende einen Verzahnungssektor aufweist, der dazu ausgestaltet ist, mit dem Zahnriemen (4) gekoppelt zu werden, eine Vielzahl von inneren Sitzen mit einer Kette (7) und Mitteln zu deren mikrometrischer Einstellung, zwei horizontale Öffnungen (18), die relativ zu ihrer vertikalen Symmetrieachse symmetrisch angeordnet sind, und einen Stift (23) auf der Symmetrieachse aufweisen.
2. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 1, **dadurch gekennzeichnet, dass** der Kopplungsantriebssektor (5) durch den Stift (23) auf einer Platte (6) gehalten wird, so dass er relativ zu seiner vertikalen Achse zwischen zwei Endpositionen schwingen kann.

3. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 2, **dadurch gekennzeichnet, dass** der Stift (23) zwischen dem verzahnten Sektor und dem gegenüberliegenden Ende des Kopplungsantriebssektors (5) mit einer Längenproportion von 2:1 angeordnet ist.
4. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 2, **dadurch gekennzeichnet, dass** die Platte (6) durch Verbindung mit einem Träger (21) gleitend an den Haltemitteln der Vorrichtung (1) gehalten wird.
5. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 2, **dadurch gekennzeichnet, dass** eine Verriegelungseinheit vorgesehen ist, die eine Stange (15) aufweist, welche schwenkbar mit der Platte (6) verbunden ist und einen Vorsprung (17) an einem Ende und ein kegelstumpfförmiges Element (16) an dem anderen Ende aufweist, das mit einer der Öffnungen (18) gekoppelt werden kann, wobei die Verriegelungseinheit außerdem eine Schulter (19) aufweist, die an einer Platte angeordnet ist, welche mit den Haltemitteln der Vorrichtung nahe einem von ihren Seitenenden verbunden ist und dazu ausgestaltet ist mit dem Vorsprung (17) zusammen zu wirken.
6. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 2, **dadurch gekennzeichnet, dass** die Mittel für die mikrometrische Einstellung der Kette (7) eine Zahnstange (13) umfassen, die auf einer Stange (14) gleitet, wobei sie in Kontakt mit der Kette (7) steht.
7. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 2, **dadurch gekennzeichnet, dass** die Mittel zum Verriegeln und Entriegeln des Riegels und Koppeln der Etagentüren eine einziehbare Kupplung (8) umfassen, die über eine Platte (9) mit dem Träger (21) und über die Kette (7) mit dem Kopplungsantriebssektor (5) verbunden ist.
8. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 7, **dadurch gekennzeichnet, dass** die einziehbare Kupplung (8) ein Paar von Seiten (10) aufweist, die einander gegenüberliegen, wobei ihre Enden zu den gegenüberliegenden Seiten gebogen sind, wobei die Seiten über eine Feder (12) und ein Paar von Bewegungselementen (11) mit einem der Elemente verbunden ist, wobei ein Ende der Kette (7) fixiert wird, nachdem es durch ein Zahnrad (22) geführt wurde.
9. Die Vorrichtung zum Öffnen und Schließen von Lifttürflügeln nach Anspruch 1, **dadurch gekennzeichnet, dass** die Bewegungsmittel (11) eine Motoreinheit (3) umfassen, die operativ elektronischen Steu-

ermitteln zugeordnet ist.

Revendications

1. Dispositif pour ouvrir et fermer des vantaux de portes, d'ascenseur comprenant des moyens de support fonctionnellement associés à des vantaux de chariot (20), des moyens de verrouillage et de déverrouillage pour un loquet de verrouillage (8) et des moyens de couplage pour les vantaux de porte de plancher, des moyens de mouvement fonctionnellement reliés auxdits moyens de support et à au moins une courroie dentée (4), ladite courroie dentée (4) entraînant directement des moyens mécaniques fonctionnellement associés auxdits moyens de verrouillage et de déverrouillage pour le loquet et auxdits moyens de couplage pour les vantaux de porte de plancher de manière à permettre le mouvement d'ouverture et de fermeture simultanée des vantaux de chariot ensemble avec les vantaux de plancher, **caractérisé en ce que** lesdits moyens mécaniques comprennent un secteur d'entraînement de couplage (5) incluant une plaque ayant un secteur denté à une extrémité apte à être couplée avec ladite courroie dentée (4), une pluralité de sièges internes contenant une chaîne (7) et des moyens pour son ajustement micrométrique, deux trous horizontaux (18) agencés symétriquement relativement à son axe de symétrie vertical et un axe (23) sur ledit axe de symétrie. 5
2. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 1, **caractérisé en ce que** ledit secteur d'entraînement de couplage (5) est contraint à une plaque (6) par ledit axe (23) pour pouvoir pivoter relativement à son axe vertical entre deux positions finales. 10
3. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 2, **caractérisé en ce que** ledit axe (23) est agencé entre ledit secteur denté et l'extrémité opposée dudit secteur d'entraînement de couplage (5) avec une proportion de longueur 2 :1. 15
4. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 2, **caractérisé en ce que** ladite plaque (6) est contrainte d'une manière coulissante auxdits moyens de support du dispositif (1) par la connexion à un support (21). 20
5. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 2, **caractérisé en ce qu'**une unité de verrouillage est prévue, comprenant une tige (15) pivotée à ladite plaque (6) ayant une saillie (17) à une extrémité et un élément tronconique (16) à l'autre extrémité, apte à être couplé 25
6. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 2, **caractérisé en ce que** lesdits moyens pour l'ajustement micrométrique d'une chaîne (7) comprennent une crémaillère (13) coulissant sur une tige (14) tout en gardant le contact avec la chaîne (7). 30
7. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 2, **caractérisé en ce que** lesdits moyens pour verrouiller et déverrouiller le loquet et pour coupler les vantaux de plancher comprennent un couplage rétractable (8) relié par une plaque (9) audit support (21) et par ladite chaîne (7) au secteur d'entraînement de couplage (5). 35
8. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 7, **caractérisé en ce que** ledit couplage rétractable (8) comprend un couple de côtés (10) opposés l'un à l'autre, ayant leurs extrémités courbées vers le côté opposé, lesdits côtés sont reliés par un ressort (12) et un couple d'éléments de mouvement (11), à l'un desdits éléments, une extrémité de ladite chaîne (7) étant fixée après avoir été dirigée par une roue dentée (22). 40
9. Dispositif pour ouvrir et fermer des vantaux de portes d'ascenseur selon la revendication 1, **caractérisé en ce que** lesdits moyens de mouvement (11) comprennent une unité à moteur (3) fonctionnellement associée aux moyens de commande électroniques. 45

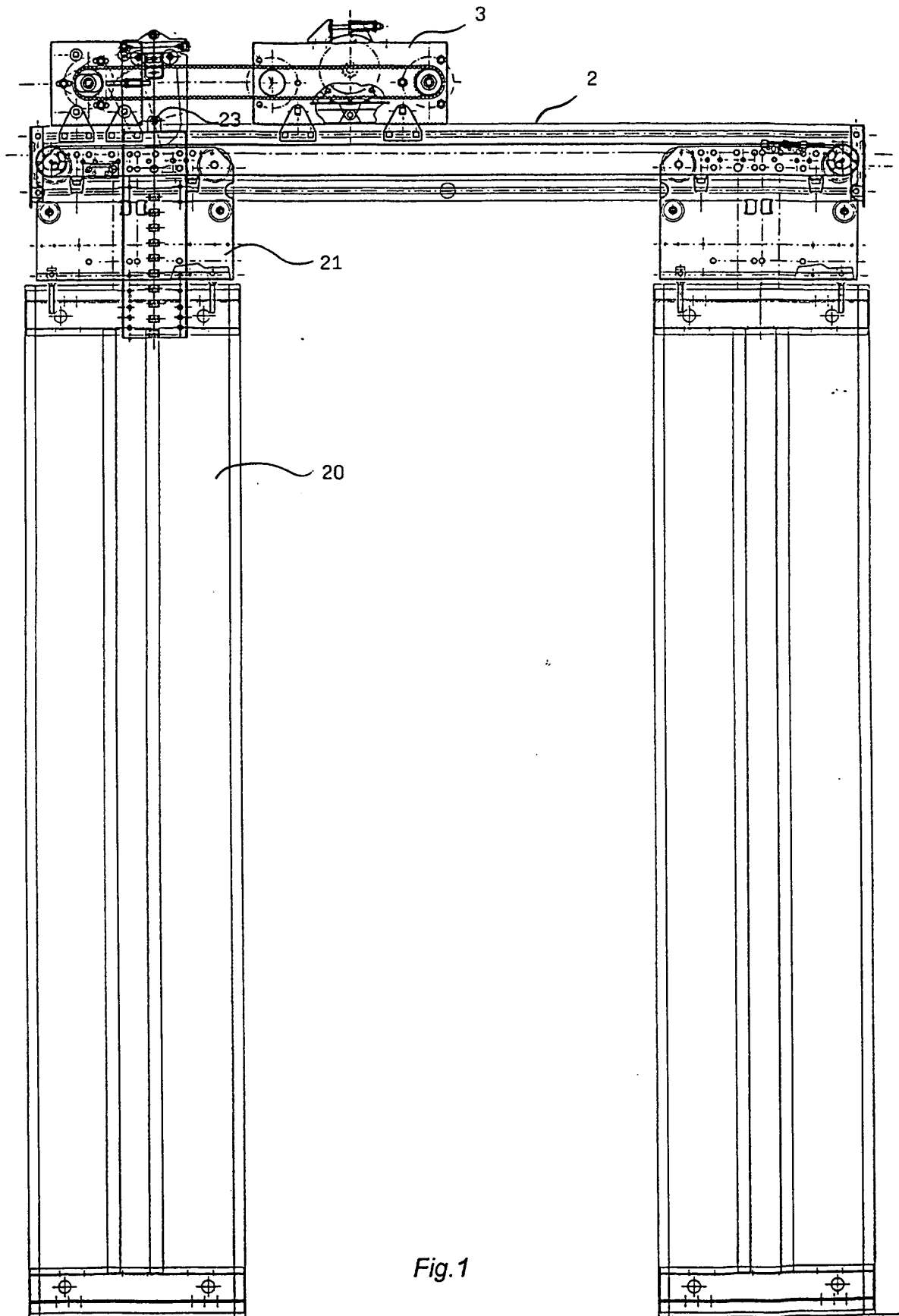
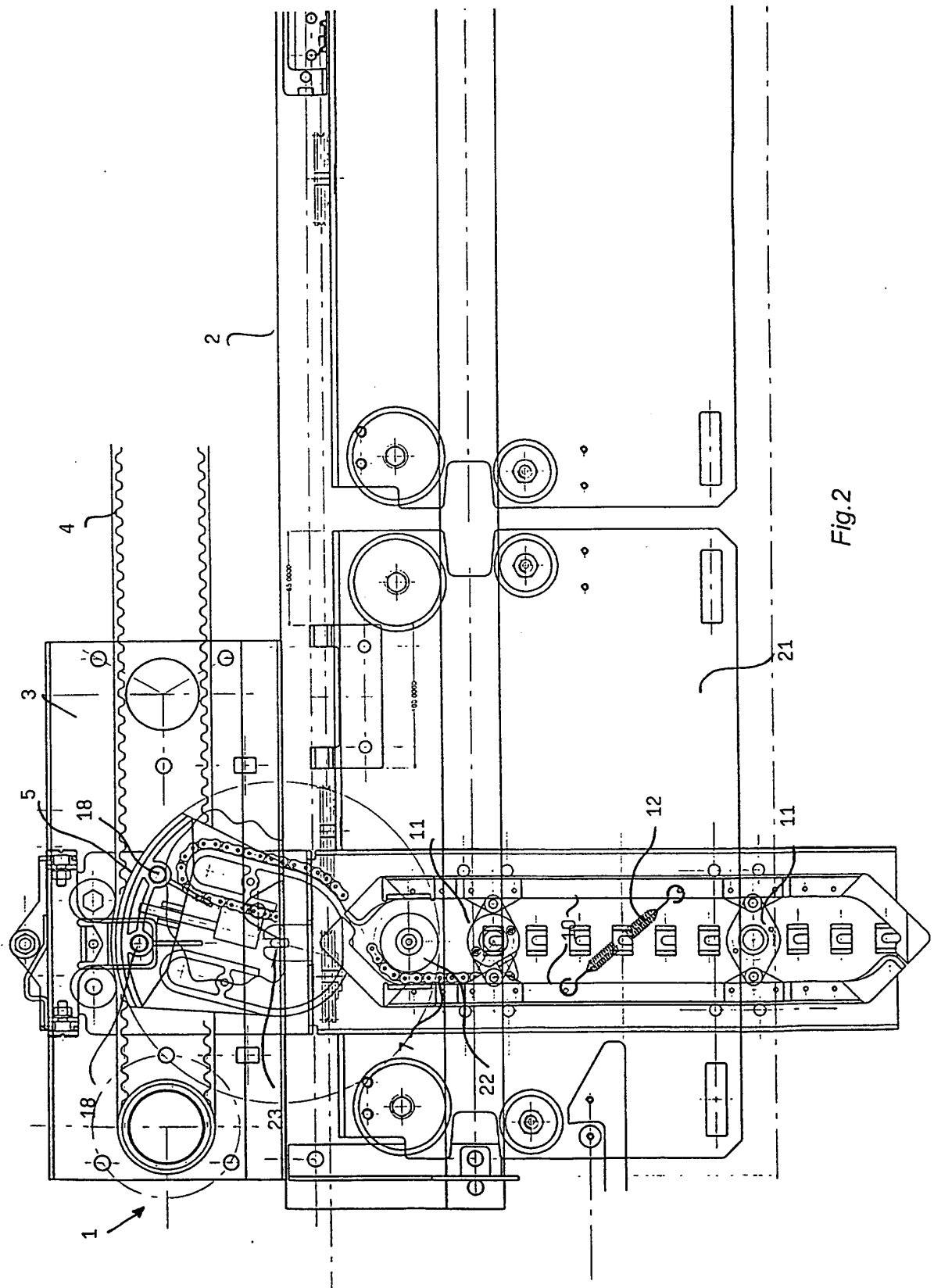


Fig.1



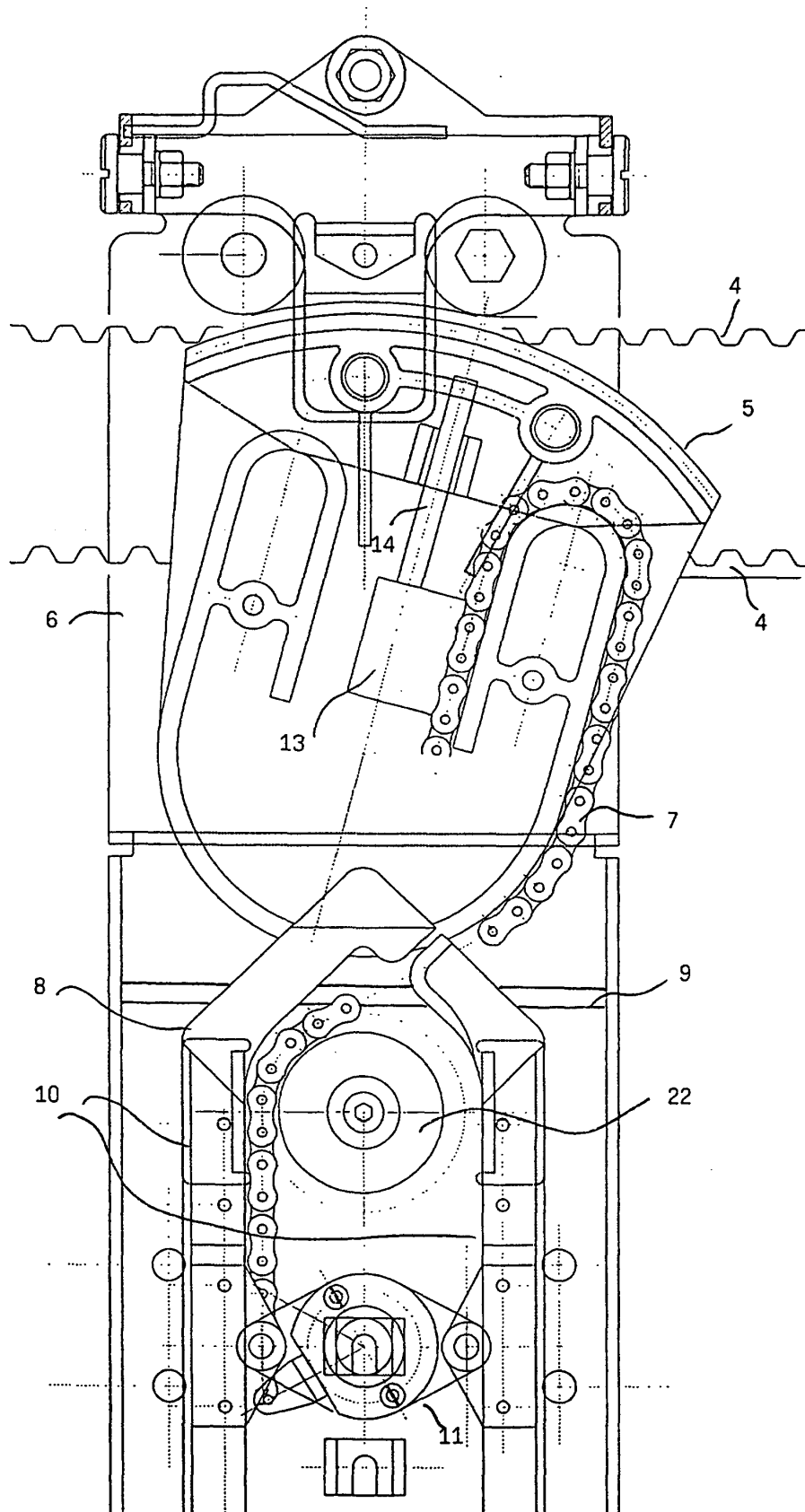


Fig.3

