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(54) DRIVE FOR FOLDING CHAIRS ON TELESCOPIC SEATING AND TELESCOPIC SEATING COMPRISING SUCH A DRIVE

(57) The invention refers to a drive for folding chairs on telescopic seating and telescopic seating comprising such a drive. The drive comprises a fluid cylinder, a tow bar connected with a piston rod of the fluid cylinder, at least two drive mechanisms, each of them comprising: a housing (6), a main axle (8) mounted within the housing (6) by means of a borehole (18), a switch leg (9) fastened on the main axle (8), at least one torsion spring (12) arranged around the main axle (8) and connected with the housing (6) and with the switch leg (9), an auxiliary axle (13) and a scissors mechanism. The borehole (18) has a first recess engaging, in the operating position of the switch leg, a second recess formed on the main axle (8). The switch leg (9) and/or the housing (6) of the drive mechanism is provided with at least one tab that, in the operating position of the switch leg (9), can engage a groove formed in the housing (6) of the drive mechanism and/or the switch leg (9).

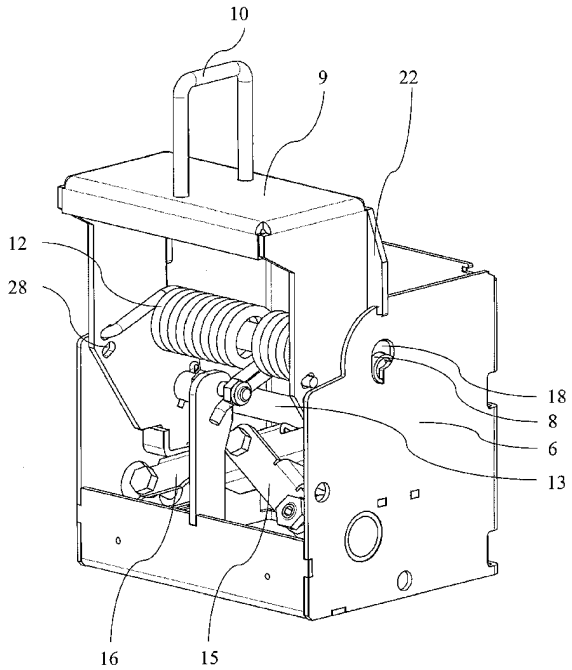

Figure 2

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Description

Field of Invention

[0001] The invention refers to a drive for folding chairs or railings on telescopic seating and to telescopic seating provided with chairs for spectators or railings and comprising such a drive.

Prior Art

[0002] Telescopic seating is a device for spectators that, when in an extracted position, offers safe conditions for spectators to access the seats, while in a retracted position offers the largest space possible intended for other purposes, in which the presence of spectators is not anticipated. Telescopic seating is equipped with foldable chairs which, while the telescopic seating is in a retracted state, are folded in the limited space between adjacent decks of the telescopic seating. The chairs for telescopic seating are usually provided with a mechanism for an automated lifting of the seat when a spectator leaves the chair to increase access paths for filling and emptying of seating. The chairs are usually fastened to a hinged base either individually or in groups of several chairs. The chairs can be folded onto the deck either manually or in an automated way. Manual folding is physically strenuous and time consuming.

[0003] Patent applications US 4557080 and US 4155202 disclose automatic folding of chairs onto a deck, wherein a motorised movement of the decks is used for the drive of the chairs. The advantage of solutions of this type is that no extra drives need to be mounted. A drawback is that the chairs of the upper row do not get folded. A further drawback becomes obvious in a huge number of rows; the seating becomes unstable due to the huge height and cannot be additionally loaded by a transversal force as the seating may overturn.

[0004] Patent application US 4294048 discloses telescopic seating with an extra drive used only for lifting and folding of chairs. The chairs are fastened directly onto the output shaft of the electric drive reduction gear. As torsional deformation of the shaft is experienced with long rows of chairs, each end-position chair is provided with a lock, such that even the more distant chairs are fixed for use. The locks are driven from the same reduction gear, which complicates the construction.

[0005] A drawback of electric drives is the fact that, in the event of drive failure, the mechanical connection with the reduction gear needs to be interrupted to allow for manual positioning of a chair to a desired position, fixing it there and using it until the drive is repaired. Seating with many seats is also provided with a plurality of installed drives which cannot function simultaneously due to a too huge electricity consumption but need to function sequentially row by row. This means a more complicated operation of individual electric motors: an electric motor turns on when the previous row has reached its end position and the electric motor of the previous row has turned off. A huge number of switches and relays diminishes the overall reliability of the system. If the folding part of a chair cannot reach its end position due to a failure or obstacle, the order of setting the chairs is interrupted, the drive may get overheated and fail. Yet another drawback of the electric drive is that in the event of damaged electrical cables electricity may reach the structure of the seating which is dangerous for the seating manager and the spectators.

[0006] Patent application US 4850159 discloses a collapsible seating system with automatically folding seats. A seat is mounted on a beam pivotally secured to a base anchored to the platform. The system is provided with a pneumatic bellows which is inflated and raises a seat. The system has a lock that locks the seat in the upright position to permit deenergization of the bellows. Reinflation of the bellows disengages the lock and the seat collapses into a folded position under the influence of the force of gravity. The system requires at least one compressed air source and at least one system manager. A drawback is experienced if the compressed air supply fails. A seat or a group of seats can be manually lifted to an operating position, in which they get locked, however, the lock cannot be manually released to lower the seats because they are not connected by a common shaft. Another drawback of the system is that the bellows must generate huge forces to collapse the seats from the folded position to the operating position. This means that huge amounts of compressed air need to be provided. In huge seating, very powerful compressors must be used or a very long time is required to set the seating into the operating position.

Technical Problem

[0007] The technical problem is how to conceive a simple drive for folding chairs or railings on telescopic seating and telescopic seating that provides for safe operation of the drive and offers a possibility of using the seating even in the event of a power supply failure, and how to provide a functional drive that does not require huge powers.

Solution to the Technical Problem

[0008] The technical problem is solved by a drive for driving a carrier beam with chairs from a folded position into an operating position and vice versa, comprising:

- a fluid cylinder,
- a tow bar connected with one end with the piston rod of the fluid cylinder,
- at least two drive mechanisms arranged along the axle of the tow bar at a mutual distance, each of them comprising:
- a housing with a cover,
- a main axle mounted within the housing by means

of a borehole,

- a switch leg fixed on the main axle and provided with a clamp, with which the carrier beam with chairs is fastenable,
- at least one torsion spring arranged around the main axle and connected with one end with the housing and with the other end with the switch leg,
- an auxiliary axle arranged within the switch leg in parallel to the main axle, yet at a distance from it, and
- a scissors mechanism comprising short and long forks, wherein the long fork is connected with one end with the tow bar and connected with the other end with the auxiliary axle, and the short fork is connected with one end in a Cardan-shaft manner with the housing through a ring rotatable around the axis of the tow bar and with the other end with the long fork such that the distance between the connection of the long fork with the tow bar and the mutual connection of both forks equals the distance between the connection of the short fork with the ring and the mutual connection of both forks.

[0009] The borehole in the housing of the drive mechanism for receiving the main axle on each side of the main axle has an additional first recess extending downwards between the front edge of the borehole and the centre of the borehole. In the area where the main axle is connected with the housing, the main axle which is preferably formed as a tube is provided with another recess that comprises at least 1/4 to 1/3 of the circumference of the axle. The main axle is fastened in the switch leg such that the second recess engages the first recess when the switch leg is in the operating position. The first and the second recess are shaped in a way to prevent lowering of the main axle while the switch leg is lifted to the operating position, although the forces transferred from the scissors mechanism force it to this position. Only when the final operating position of the switch leg has been achieved, the first and the second recess engage each other.

[0010] The switch leg or the housing of the drive mechanism is provided with at least one tab that, in the operating position of the switch leg, engages a groove formed in the housing of the drive mechanism or the switch leg. It goes without saying that the grooves and tabs can be formed in a variety of ways described in the following.

The housing may further be equipped with a stop and the switch leg may be equipped with a projection that prevents the switch leg from swivelling beyond the operating position.

[0011] When the switch leg is in the folded position, the piston rod is extracted from the fluid cylinder, the scissors mechanism attracts the auxiliary axle and causes the switch leg to rotate around the main axle. The switch leg rotates until it reaches the operating position, in which the second recess on the main axle engages the first recess in the housing, wherein the switch leg descends with respect to the housing and at least one tab formed on the switch leg engages with the at least one groove formed on the housing. The switch leg is thus locked in the operating position although the fluid cylinder is disengaged.

[0012] When the switch leg is in the operating position, the piston rod retracts into the fluid cylinder, the scissors mechanism pushes the auxiliary axle and disengages the second recess on the main axle from the first recess in the housing and disengages at least one tab from the groove. The switch leg is thus unlocked and can start returning from the operating position to the folded position.

[0013] The invention further refers to telescopic seating comprising at least one above-indicated drive for driving a carrier beam with chairs from a folded position into an operating position and vice versa, a drive for moving the seating rows and at least one carrier beam with chairs.

[0014] The advantage of the drive of the invention over known solutions is its simple construction that does not require huge installed powers for its operation. In the event of a defect of the drive or in the event of power outage, the chairs can be set up or folded manually without a use of any tools. A further advantage of the drive of the invention becomes obvious when the seating is used only partly extracted, when several rows remain folded because there is no need for full seating. In such case, a selective control by rows which are actually extracted is needed in motor drives, while all drives are activated in the drive with a fluid cylinder. The chairs in the folded rows hit against the upper row and come to a standstill without getting damaged because the force is relatively small, when the system is vented, they return to the desk.

Figure 1: Drive for driving a carrier beam drive with chairs from in an operating position of a switch leg
Figure 2: Drive mechanism in an operating position of a switch leg
Figure 3: Fluid cylinder with a scissors mechanism and a tow bar
Figure 4: Fluid cylinder and a switch leg with belonging transmission
Figure 5: Housing of the drive mechanism and the switch leg in a locked position
Figure 6a: First recess in the housing engaged with a second recess on a main axle
Figure 6b: First recess in the housing disengaged from a second recess on a main axle
Figure 7: Housing of the drive mechanism and the switch leg in a folded position
Figure 8: Drive with the carrier beam with the chairs in the operating position
Figure 9: Drive with the carrier beam with the chairs in the folded position

[0015] The invention is described in more detail hereinbelow.

[0016] The technical problem is solved by a drive 1 for driving a carrier beam with chairs or a railing from a folded position into an operating position and vice versa, comprising:

- a fluid cylinder 2,
- a tow bar 3 connected with one end with the piston rod 4 of the fluid cylinder,
- at least two drive mechanisms 5 arranged along the axle of the tow bar 3 at a mutual distance, each of them comprising:

    - a housing 6 with a cover 7,
    - a main axle 8 mounted within the housing 6 by means of a borehole 18,
    - a switch leg 9 fixed on the main axle 8 and provided with a clamp 10, with which the carrier beam 11 with chairs is fastenable,
    - at least one torsion spring 12 arranged around the main axle 8 and connected with one end with the housing 6 and with the other end with the switch leg 9,
    - an auxiliary axle 13 arranged within the switch leg 9 in parallel to the main axle 8, yet at a distance from it, and
    - a scissors mechanism 14 comprising short 15 and long forks 16, wherein the long fork 16 is connected with one end with the tow bar 3 and connected with the other end with the auxiliary axle 13, and the short fork 15 is connected with one end in a Cardan-shaft manner with the housing 6 through a ring 17 rotatable around the axis of the tow bar 3 and with the other end with the long fork 16 such that the distance between the connection of the long fork 16 with the tow bar 3 and the mutual connection of both forks 15,16 equals the distance between the connection of the short fork 15 with the ring 17 and the mutual connection of both forks 15, 16.

[0017] The torsion spring 12 is pre-stressed to compensate for the weight of the carrier beam 11 with chairs when the latter is arranged on the drive, wherewith the lifting of the switch leg 9 from the folded position into the operating position is facilitated.

[0018] The connection of the tow bar 3 and the piston rod 4 of the fluid cylinder may be formed by means of a thread and a counter nut.

[0019] The borehole 18 in the housing 6 of the drive mechanism for receiving the main axle 8 on each side of the main axle has an additional first recess 19 extending downwards between the front edge of the borehole and the centre of the borehole 18. In the area where the main axle is connected with the housing, the main axle 8 which is preferably formed as a tube is provided with another recess 20 that comprises at least 1/4 to 1/3 of the circumference of the main axle 8. The main axle 8 is fastened in the switch leg 9 such that the second recess 20 engages the first recess 19 when the switch leg is in the operating position. The first and the second recess are shaped in a way to prevent lowering of the main axle 8 while the switch leg 9 is lifted to the operating position, although the forces transferred from the scissors mechanism 14 force it to this position. Only when the final operating position of the switch leg 9 has been achieved, the first 19 and the second recess 20 engage each other.

[0020] The switch leg 9 and/or the housing 6 of the drive mechanism is provided with at least one tab 21, 22 that, in the operating position of the switch leg 9, can engage a groove 23, 24 formed in the housing 6 of the drive mechanism or the switch leg 9, respectively. It goes without saying that the grooves and tabs can be formed in a variety of ways. One embodiment discloses a first groove 24 formed in the upper edge of a side of the housing 6 of the drive mechanism and a first tab 22 formed on the edge of the switch leg 9 in the shape of a projection. A second embodiment discloses a second groove 23 formed in an attachment 25 in the interior of the housing 6 of the drive mechanism and a second tab 21 formed on the lower edge of a side of the switch leg 9 when the latter is in the operating position. There is preferably a plurality of tab and groove pairs. The pairs of tabs and the pairs of grooves are further preferably arranged along the main axle 8 at a mutual distance such that the loads of the main axle during the operation of the drive are smallest possible and that the clearance in the drive is not so expressed.

[0021] The housing 6 may further be equipped with a stop 26 and the switch leg 9 may be equipped with a projection 27 that prevents the switch leg 9 from swivelling beyond the operating position.

[0022] The switch leg 9 may be provided with a plurality of holes 28 arranged radially around the main axle 8 and engaging with one end of the torsion spring 12. By switching between various holes 28, the pre-stressing of the torsion spring 12 can be adjusted. The torsion spring is preferably mounted into the housing 6 and the switch leg 9 such that the ends of the torsion spring 12, while the switch leg is in the operating position, are arranged substantially horizontally, which facilitates the fluid cylinder 2 to lift the main axle 8 from the first recess 19 when lowering the chairs.

[0023] The fluid cylinder 2 can be selected among a pneumatic or a hydraulic cylinder. In case of a hydraulic cylinder, a mechanical clutch is arranged between the hydraulic cylinder and the tow bar.

[0024] The invention further refers to telescopic seating comprising at least one above-indicated drive 1 for driving a carrier beam 11 with chairs 29 or a railing from a folded position into an operating position and vice versa, a drive for moving the seating rows and at least one carrier beam 11 with chairs 29. A seat surface of the chair 29 is preferably pivotally connected with the back rest by way of a pre-stressed spring, such that the seat surface of the chair and the back rest of the chair are parallel to each other both in the folded and the operating positions

of the switch leg. In this case, each spectator unfolds the seat surface of the chair into a horizontal position before sitting on the chair.

[0025] Telescopic seating may further be provided with end switches to control the end positions of the folded chairs and/or railing, which switches alternately exclude the drives of the chairs and/or railings and the drives for extracting the seating in order to prevent collision between a chair or the railing and the desk of the seating. The drive for folding the seating may not turn on if all chairs are not folded on the desk. An end switch is used on each drive of the chairs and/or railing and is preferably arranged on the fluid cylinder. And vice versa, the lifting of the chairs may not turn on if the seating is not fully extracted.

[0026] The power supply line for supplying the fluid cylinders may further be provided with a pressure switch controlling whether the end operating position of the chairs and/or railing has been reached. The control of the working position of the chairs and/or railing is only for information purposes, namely for the user to know that the method of setting the chairs and/or railing has been completed.

Claims

1. A drive (1) for driving a carrier beam (11) with chairs or a railing from a folded position into an operating position and vice versa, comprising:

   - a fluid cylinder (2),
   - a tow bar (3) connected with one end with the piston rod (4) of the fluid cylinder,
   - at least two drive mechanisms (5) arranged along the axle of the tow bar (3) at a mutual distance, each of them comprising:

     - a housing (6) with a cover (7),
     - a main axle (8) mounted within the housing (6) by means of a borehole (18),
     - a switch leg (9) fixed on the main axle (8) and provided with a clamp (10), with which the carrier beam (11) with chairs is fastenable,
     - at least one torsion spring (12) arranged around the main axle (8) and connected with one end with the housing (6) and with the other end with the switch leg (9),
     - an auxiliary axle (13) arranged within the switch leg (9) in parallel to the main axle (8), yet at a distance from it, and
     - a scissors mechanism (14) comprising short (15) and long forks (16), wherein the long fork (16) is connected with one end with the tow bar (3) and connected with the other end with the auxiliary axle (13), and the short fork (15) is connected with one end in a Cardan-shaft manner with the housing (6) by means of a ring (17) rotatable around the axis of the tow bar (3) and with the other end with the long fork (16) such that the distance between the connection of the long fork (16) with the tow bar (3) and the mutual connection of both forks (15, 16) equals the distance between the connection of the short fork (15) with the ring (17) and the mutual connection of both forks (15, 16).

2. Drive (1) according to claim 1, **characterized in that** the borehole (18) in the housing (6) of the drive mechanism for receiving the main axle (8) is provided on each side of the main axle with an additional first recess (19) extending downwards between the front edge of the borehole and the centre of the borehole (18) and that the main axle (8) which is preferably formed as a tube is provided in the area, in which the main axle is connected with the housing, with another recess (20) that comprises at least 1/4 to 1/3 of the circumference of the main axle (8).

3. Drive (1) according to any of preceding claims, **characterized in that** the switch leg (9) and/or the housing (6) of the drive mechanism is provided with at least one tab (21, 22) that, in the operating position of the switch leg (9), can engage a groove (23, 24) formed in the housing (6) of the drive mechanism and/or the switch leg (9).

4. Drive (1) according to claim 3, **characterized in that** the tabs (21, 22) and the grooves (23, 24) are formed in pairs, wherein the pairs of tabs and the pairs of grooves are arranged along the main axle (8) at a distance from each other.

5. Drive (1) according to any of preceding claims, **characterized in that** the housing (6) is equipped with a stop (26) and the switch leg (9) is equipped with a projection (27) to prevent the switch leg (9) from swivelling beyond the operating position.

6. Drive (1) according to any of preceding claims, **characterized in that** the connection of the tow bar (3) and the piston rod (4) of the fluid cylinder is formed by means of a thread and a counter nut.

7. Drive (1) according to any of preceding claims, **characterized in that** the torsion spring (12) is prestressed to facilitate lifting of the switch leg (9) from the folded position to the operating position.

8. Drive (1) according to any of preceding claims, **characterized in that** the switch leg (9) is provided with a plurality of holes (28) arranged radially around the main axle (8) and engaging one end of the torsion spring (12), such that switching between various

holes (28) allows adjustment of the pre-stressing of the torsion spring (12).

9. Drive (1) according to any of preceding claims, **characterized in that** the torsion spring (12) is mounted into the housing (6) and the switch leg (9) such that the ends of the torsion spring (12), while the switch leg is in the operating position, are arranged substantially horizontally.

10. Drive (1) according to any of preceding claims, **characterized in that** the fluid cylinder (2) is selected between a pneumatic or a hydraulic cylinder.

11. Telescopic seating comprising at least one drive (1) according to any of preceding claims, a drive for moving the seating rows and at least one carrier beam (11) with chairs (29) and/or a railing.

12. Telescopic seating according to claim 11, **characterized in that** a seat surface of the chair (29) is pivotally connected with a back rest of the chair by way of a pre-stressed spring.

13. Telescopic seating according to claim 11 or 12, **characterized in that** it is further provided with end switches to control the end positions of the chairs and/or railing, which switches mutually exclude the drives of the chairs and/or railings and the drives for extracting the seating.

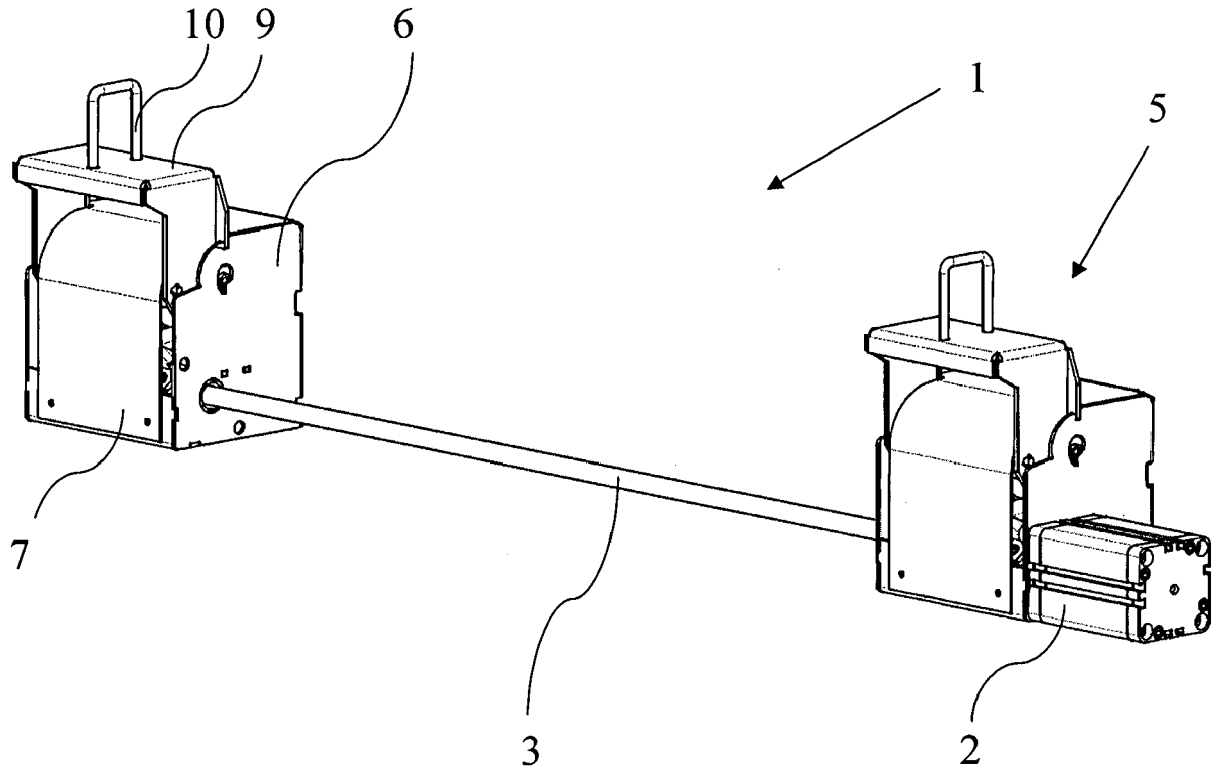

Figure 1

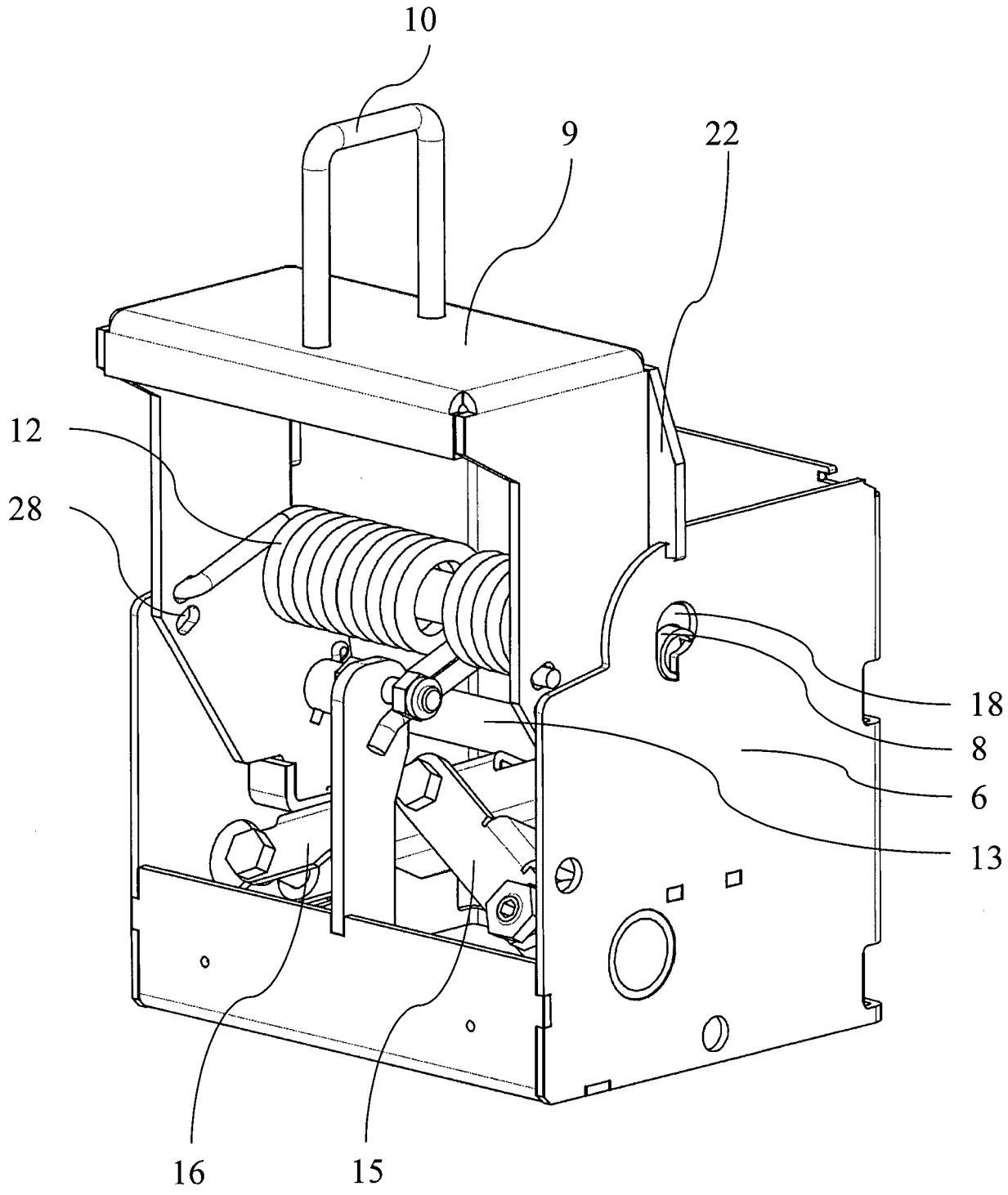

Figure 2

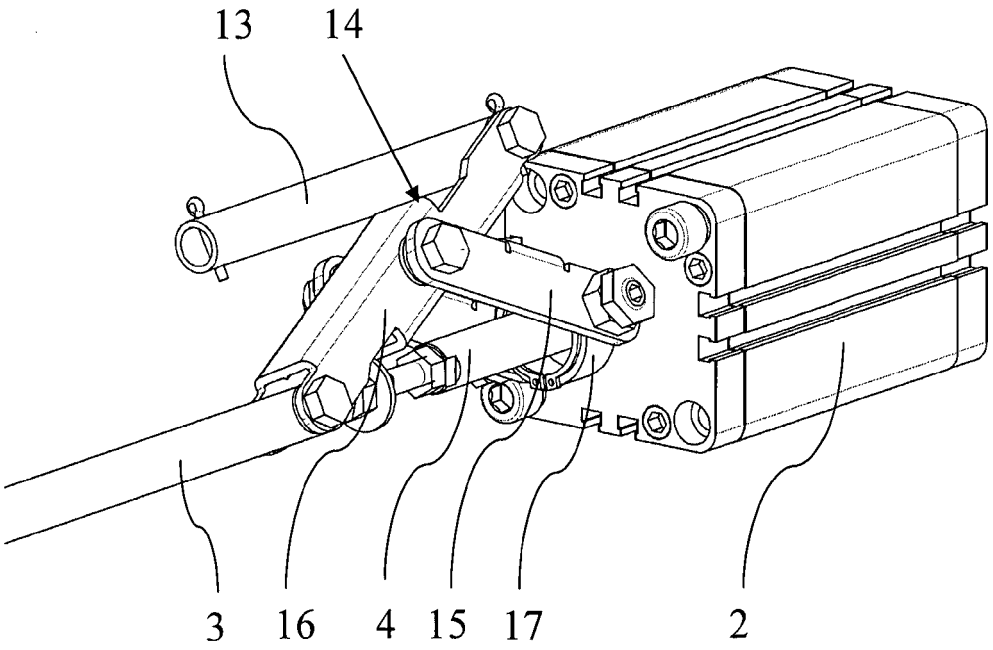

Figure 3

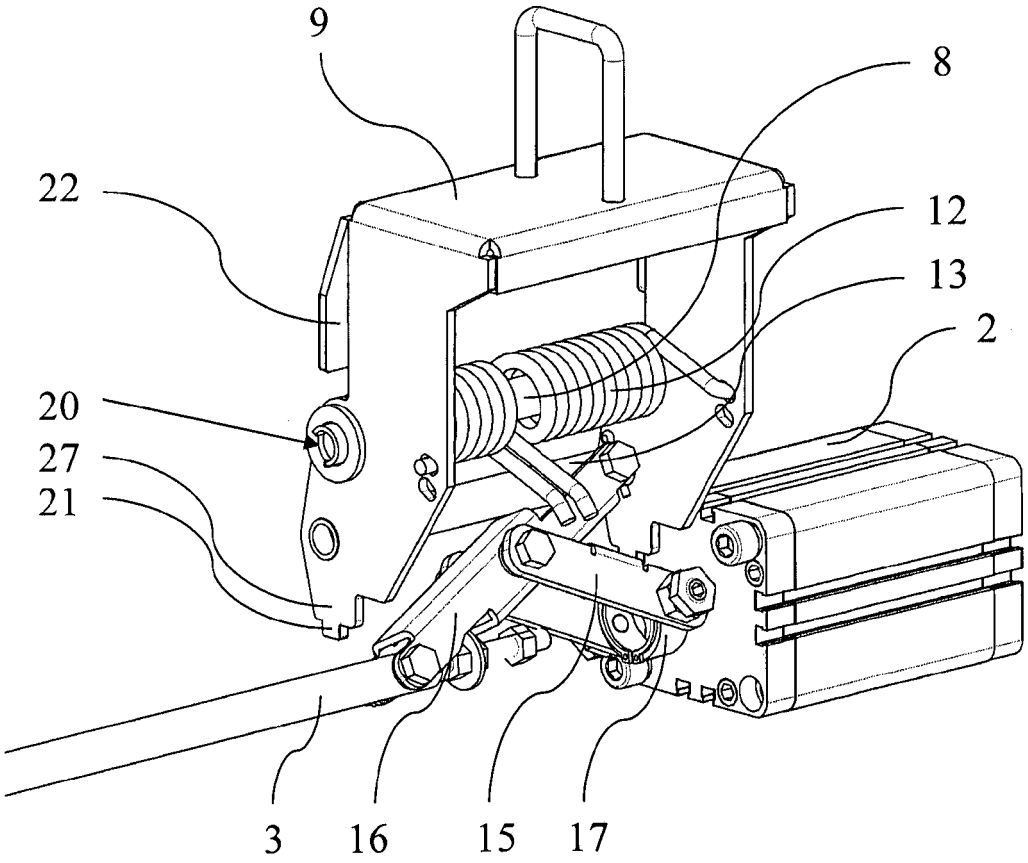

Figure 4

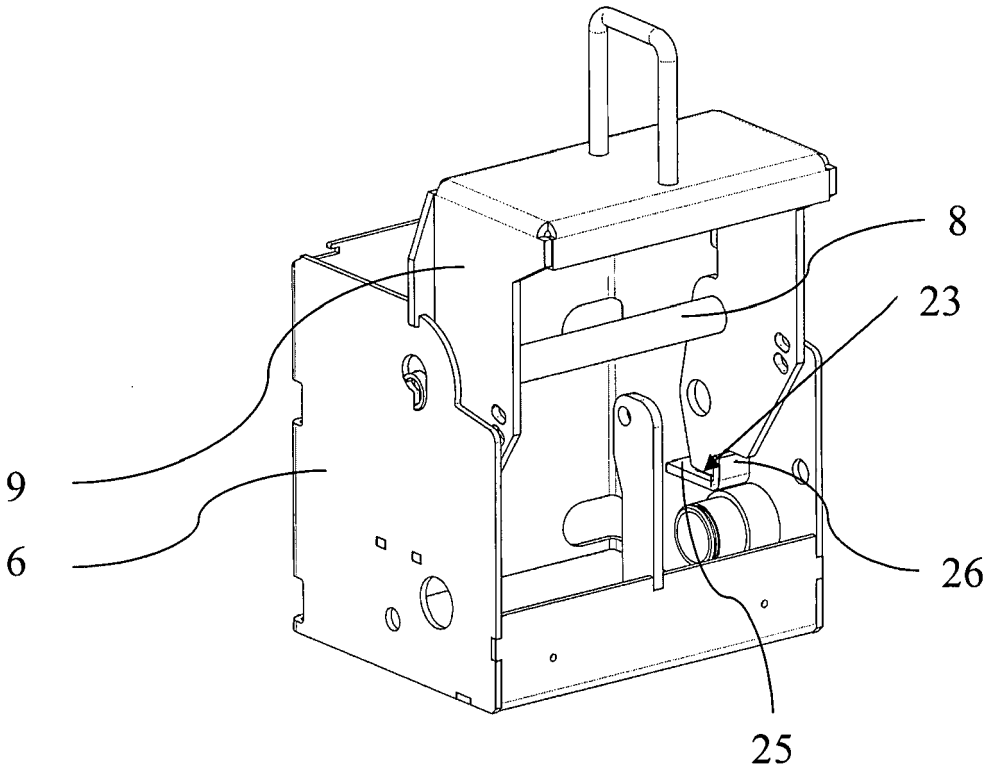

Figure 5

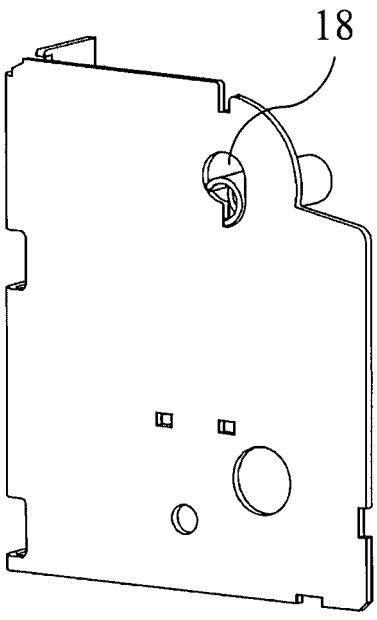

Figure 6a

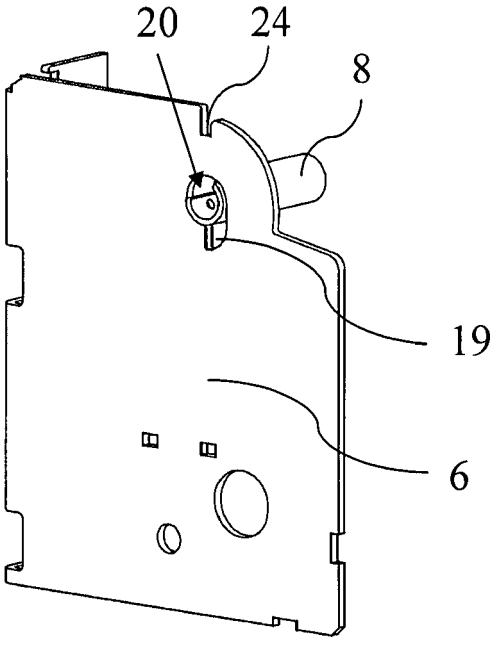

Figure 6b

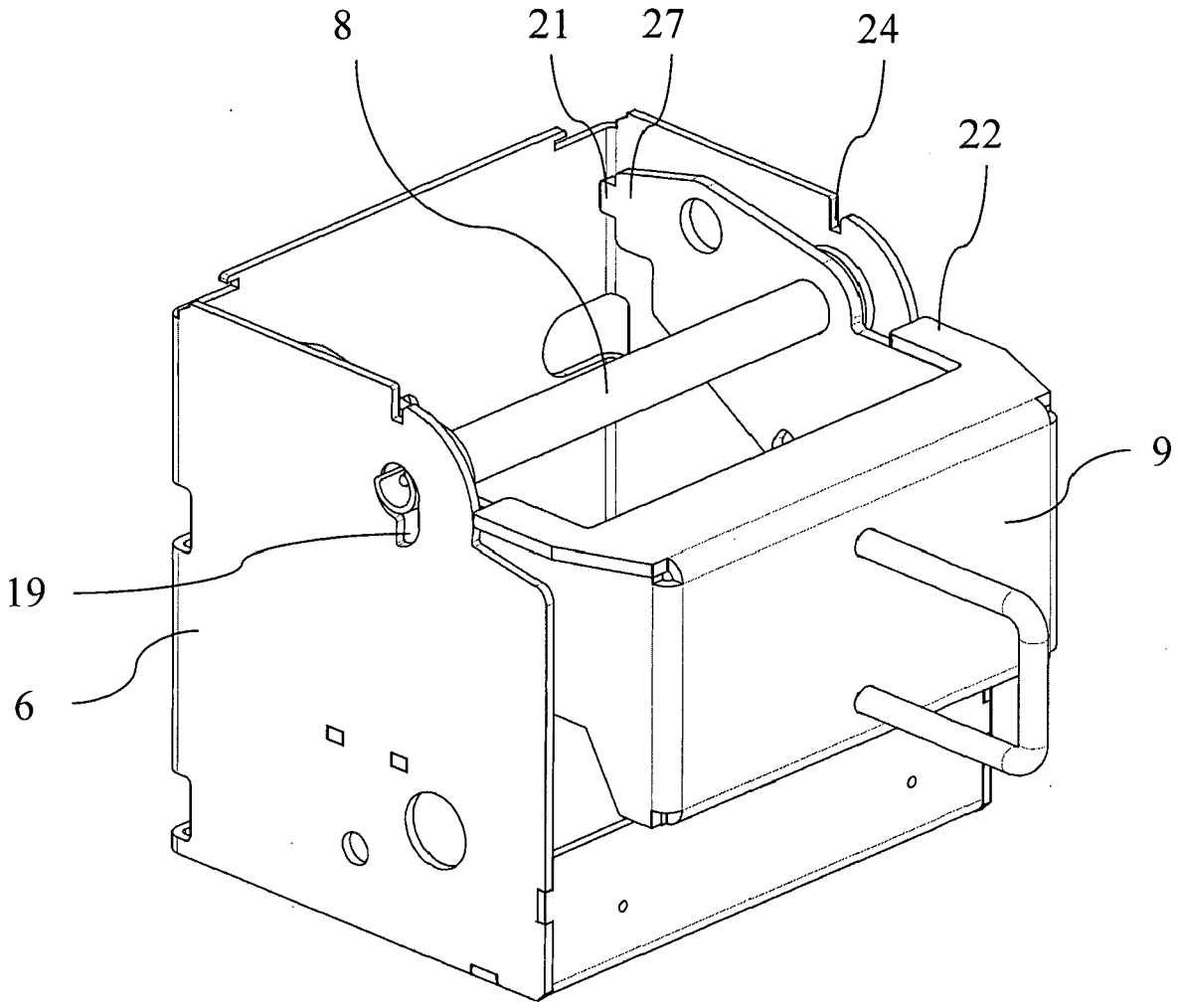

Figure 7

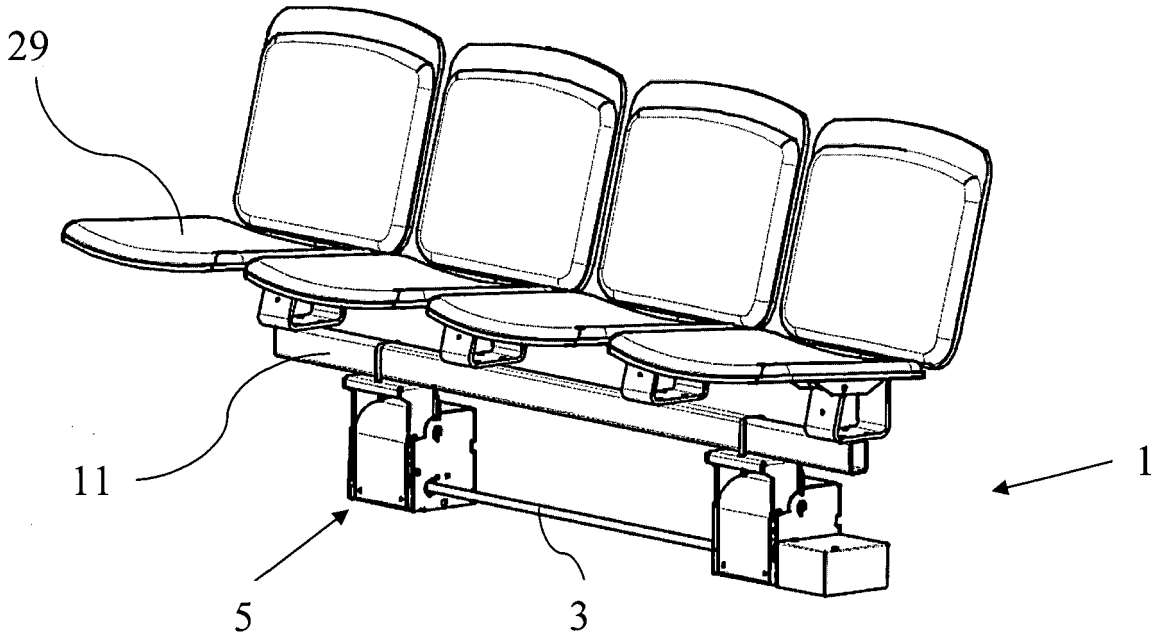

Figure 8

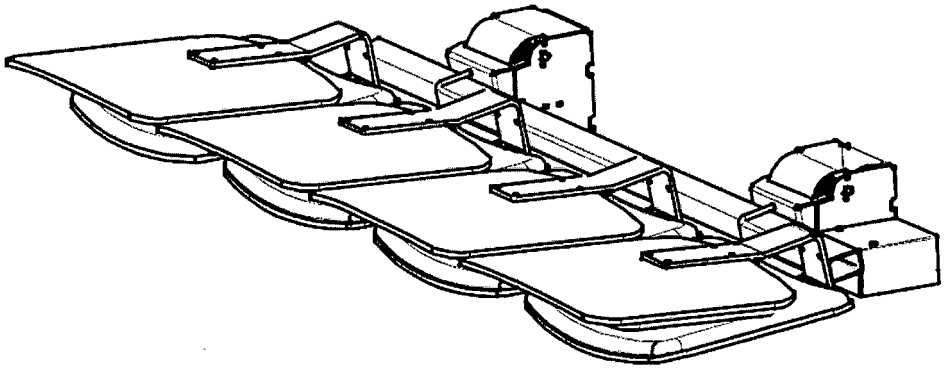

Figure 9

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EUROPEAN SEARCH REPORT

Application Number
EP 18 00 0950

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 4 294 048 A (SUTTER DAVID L) 13 October 1981 (1981-10-13) * column 3, line 40 - column 7, line 44; figures 1-11 * -----	1-13	INV. A47C1/126 E04H3/12

TECHNICAL FIELDS SEARCHED (IPC)

A47C
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 March 2019	Lehe, Jörn

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 00 0950

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11-03-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4294048 A	13-10-1981	CA 1148459 A	21-06-1983
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EPO FORM P0459

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

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Patent documents cited in the description

- US 4557080 A **[0003]**
- US 4155202 A **[0003]**
- US 4294048 A **[0004]**
- US 4850159 A **[0006]**