

DRIVE SYSTEM FOR DRIVING AND FOR GUIDING A WALL ELEMENT FOR A ROOM PARTITION SYSTEM

Description

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The present invention relates to a drive system for driving and for guiding a wall element, in particular for a room partitioning wall system, with a carriage unit, which is guided to be longitudinally movable in a guiding rail, wherein the carriage unit has a roller carriage, and a drive unit.

Drive systems for driving and for guiding a wall element for room partitioning wall systems are well known. The drive systems have carriage units with respective drives such that the carriage units are autonomously displaceable in the guiding rail. For this purpose, carriage units are known in different configurations, which mostly have a roller carriage located within the guiding rail, wherein a drive unit is affixed to said carriage, in which unit at least the drive motor, and optionally a gear system, are accommodated.

If a ceiling track is not mounted straight, if the ceilings are not horizontal or when traveling over branches, when displacing the wall elements, an oscillating motion is introduced into the system consisting of roller carriage – suspension – wall element, which results in a bending load

on the suspension system. The roller carriages are therefore unilaterally loaded and they travel with only one roller side in the ceiling track. The unilateral load may result in canting of the roller carriage, respectively of the guide in the ceiling track, which leads to malfunctioning of the entire sliding wall. The unilateral load may likewise result in increased load on the guiding rollers, whereby, in the extreme case, the drive forces are exceeded and the system comes to a stop when traveling. However, when the roller carriage cants, it may happen that one roller lifts off and thus no torque is transferred, which again results in malfunctioning of the system.

A drive system for driving and for guiding a wall element for a room partitioning wall system is disclosed in EP 0 959 219 A2. A carriage unit is provided therein which is accommodated to be longitudinally movable in the guiding rail via rollers, wherein the rollers are driven via a drive unit. Guiding rollers are provided to allow for guiding the carriage unit within the guiding rail and in particular in branchings of several guiding rails, wherein said guiding rollers are guided on the upper side of the roller carriage of the carriage unit in pre-established guiding paths within the guiding rail. If the roller rail is mounted oblique, the carrying bolts are loaded by an additional bending force and the guiding rollers need to transfer an extreme surface pressure, which might exceed the driving forces.

From the document DE 199 32 891 A1, a drive system of a carriage unit for a room partitioning wall system is known, which has several guiding rollers and requires further guiding devices within the guiding rail which cooperate with the guiding rollers. During an oscillating movement of the sliding wall caused by a non-horizontal ceiling track, this roller carriage does not cant in the slot of the roller rail; however, the load on the guiding rollers becomes so high that the drive forces may not be sufficient any more and, while being displaced, the sliding wall stops.

Therefore, it is the object of the present invention to provide a drive system for driving and for guiding a wall element for a room partitioning wall system which allows to compensate for lateral forces, generated for example by an oscillating movement.

This problem is solved based on a drive system with a carriage unit which is guided to be longitudinally movable in a guiding rail according to the generic part of claim 1, in conjunction with the characterizing features. Advantageous further developments of the invention are indicated in the dependent claims.

The invention includes the technical teaching that a pivotable arrangement of the wall element at the carriage unit excludes malfunction, which might occur on account of

possible canting of the roller carriage in the guiding rail or on account of a too large mechanical load on the guiding rollers. Mounting the guiding rail at the ceiling is therefore less complicated, because it is possible to work with more important tolerances. Likewise, installing the guiding rails at inherently oblique ceiling structures becomes easier, because the compensating sub-structures can be foregone. The pivoting capacity of the wall element in relation to the carriage unit ensures that, at any time, both rollers rest in the guiding rail and absorb constant portions of the wall element weight. The non-positive connection is thereby guaranteed in any operational situation.

In a preferred embodiment, the wall element is suspended at or in the roller carriage via an articulation such that the wall element is free to laterally oscillate to a certain degree, without having any consequences for the drive system in the guiding rail. In this case, the centre of rotation should be located as close as possible to the roller carriage shaft, in order to avoid canting of the carriage.

As a sheet metal support is disposed between the wall element and the articulation in the roller carriage, the drive system can be modularly configured in that for example the motor and a gearing stage are disposed at the sheet metal support, so that only the roller carriage runs in the guiding rail. In a preferred embodiment, the drive unit is disposed in

this case underneath the roller carriage. This allows for easy maintenance, because neither the wall element nor the guiding rail need to be uninstalled for exchanging the motor and the gear system.

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By disposing a guiding device between the roller carriage and the drive unit, the slot, existing in the guiding rail, is utilized in a very space-saving manner. Thereby, the overall system becomes less expensive, because no
10 running surfaces for guiding rollers are required within the guiding rail.

Advantageously, the guiding device has at least one, and preferably two guiding rollers, which, for the purpose of
15 guiding the carriage unit, roll on guiding surfaces which laterally adjoin the guiding device. If the guiding device has two guiding rollers, the roller carriage is guided in the longitudinal direction of the guiding rail. If the guiding rail has a curvature or if the carriage unit passes through a
20 branching, the roller carriage is able to follow the path of the guiding rail, because it is guided by the two guiding rollers. The guiding rollers roll on the guiding surfaces, which are configured at the guiding rail and located in the lower area. The guiding rail forms a box-shaped hollow
25 profile with a C-shaped cross-section and consequently with an opening on the underside, through which the guiding device extends. The carriage unit is rotatably

disposed at the wall element, wherein the wall element may be guided by two carriage units in the guiding rail, one of said carriage units being driven. The second carriage unit simply serves for the purpose of guiding the wall
5 element within the guiding rail without having a driving function. Therefore, the carriage units are rotatably disposed at the wall element such that the roller carriage can follow the curved path of the guiding rail. If the carriage unit passes a turnout, means cooperating with the guiding
10 device are required such that the displacement direction of the carriage unit corresponds to the desired direction. At the location of the turnout, the guiding rails may have flap elements for this purpose, which, like a rail turnout, pre-determine the direction for the carriage unit to follow.

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Another very space-saving improvement is achieved if the guiding rollers are rotatably disposed on the bolts, which connect the sheet metal support to the articulation. In a preferred embodiment, two guiding rollers, disposed
20 vertically one above the other, are mounted to each bolt. This arrangement prevents canting within the slot of the guiding rail, because the bolts do not only rotate about the articulation during a lateral deflection of the wall element, but they also bent, because a portion of the guiding rollers
25 bears against the guiding surface. Disposing two independent guiding rollers one above the other optimizes the running properties, if, in the event of canting, the

guiding rollers move in opposite directions of rotation, if the guiding rollers bear against different guiding surfaces.

The articulation may be disposed directly in or at the roller carriage or be supported within an insert, as it is already
5 known for example with friction bearings or ball-and-socket joints.

The guiding rail is affixed to the ceiling of a room, wherein
10 the drive motor extends in vertical direction underneath the guiding rail and, together with an electrical unit, is accommodated in a sheet metal support. The vertical direction of extension of the drive motor corresponds to the arrangement of the axis of rotation of the motor shaft such
15 that the latter is located within the guiding rail and vertical to the direction of movement of the roller carriage. The drive motor essentially has a cylindrically shaped basic structure, around which the sheet metal support extends. However, the sheet metal support is configured to be bent
20 in a U-shape and provided with a U-opening which is disposed to be vertically and downward oriented. In addition to the drive motor, in the U-shaped sheet metal support, furthermore an electrical unit is disposed adjacent to the drive motor and is affixed to the sheet metal support.

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For driving the roller carriage, different gearing concepts may be provided, in order to drive the roller carriage, which

is disposed above the guiding device, by means of the drive motor, which is disposed underneath the guiding device.

- 5 A possible gearing concept between the drive motor and the roller carriage comprises a cylindrical gear system, wherein the drive motor is laterally offset with regard to the drive shaft. The proper drive motor may be attached to the housing of the cylindrical gear system, wherein the
10 cylindrical gear system and the drive motor may likewise form one mechanical unit.

- Advantageously, the cylindrical gear system represents a first gearing stage between the drive motor and the roller
15 carriage, wherein an angular gear system is disposed between the drive shaft and the roller carriage shaft in order to form a second gearing stage. The angular gear system allows for a limited pivoting capacity within the teeth geometry, if the centre of rotation is located close to
20 the pitch circle plane. The angular gear system may be configured as crown toothing, as bevel gear toothing, or as another toothing, in order to transmit the rotational movement of the vertically extending drive shaft to the horizontally extending roller carriage shaft, which is
25 disposed transversely to the displacement direction of the roller carriage within the guiding rail. Rollers are supported on the outside of the roller carriage shaft, at least one of

said rollers being driven by the drive motor. Furthermore, the roller carriage may have a roller carriage shaft with two rollers, wherein one of the rollers is driven on one side of the roller carriage and the second roller, disposed on the opposite side, is supported to be freely moving. Two embodiments of the roller carriage are thus illustrated, wherein a first embodiment has two rollers on one roller carriage shaft, only one of said rollers being driven. The roller located on the opposite side is freely rotatable in this case. The second embodiment of the roller carriage has two roller carriage shafts, which respectively accommodate two rollers. In this case, two rollers on one side of the roller carriage are driven, whereas the other two rollers, located on the opposite side, are supported to be freely moving. This configuration prevents the roller carriage from following a straight-line motion, if the guiding rail is curved. On account of unilaterally driven rollers, the roller carriage is able to follow a curvature in the guiding rail without the roller carriage experiencing any jamming or canting in the guiding rail. As an alternative, all four rollers may be driven, wherein the roller carriage shaft has a differential in order to compensate for the difference of rotation speed of a roller located on the inside of a curvature, compared to a roller located on the outside.

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Another improvement is achieved in that a pivotable coupling is disposed between the electric motor and the

angular gear. The coupling may be configured as a universal rotary joint, which allows for pivoting the wall element including the drive unit, which is disposed at the sheet metal support, in relation to the roller carriage by for example $\pm 5^\circ$ towards the perpendicular line. As described in the embodiment, the configuration of the coupling by means of coupling shaft, upper coupling part and lower coupling part likewise allows for axial length compensation. As an alternative, a flexible shaft may be inserted between the drive unit and the angular gear.

In the present case, a drive system with a carriage unit is provided which, based on its basic structure consisting of a roller carriage, guiding device and drive unit, allows for a plurality of embodiments. In particular several gearing types should be mentioned for transmitting the driving force of the drive motor to the roller carriage shaft.

If, as an angular gear, a bevel gear toothing is provided between the drive shaft and the roller carriage shaft, the drive shaft may also drive two roller carriage shafts, in that one bevel wheel on the drive shaft drives a bevel wheel on a roller carriage shaft and the second roller carriage shaft is driven by an interconnected intermediate shaft.

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Hereinafter, further measures enhancing the invention will be illustrated in detail in conjunction with the description of

one preferred embodiment of the invention based on the Figures, in which:

5 Figure 1: shows an embodiment of an inventive drive system for driving and for guiding a wall element by means of an inventive carriage unit;

Figure 2: shows a sectional view of the carriage unit through the guiding unit;

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Figure 3: shows a sectional view of the carriage unit through the driving train.

Figure 1 shows an embodiment of a drive system 1
15 according to the present invention. The drive system 1 serves for driving and for guiding a wall element, which is in particular utilized in room partitioning wall systems and is not illustrated in detail in the Figure. The wall element may be mounted to a carriage unit 2, wherein the carriage unit 2
20 is guided to be longitudinally movable within a guiding rail 3. According to the present invention, the carriage unit 2 is subdivided into a roller carriage 4, which is located in the box-shaped hollow space of the guiding rail 3. For driving the roller carriage 4, a drive unit 5, which comprises at
25 least one drive motor 13, is provided underneath the guiding rail 3. A guiding device 6 is disposed between the roller carriage 4 and the drive unit 5. Consequently, the

guiding device 6 extends between the roller carriage 4 and the drive unit 5, wherein the mechanical connection between the roller carriage 4 and the drive unit 5 is simultaneously formed by the guiding device 6.

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The guiding device 6 has at least one guiding roller 7, which is guided at both, the left side and the right side by means of guiding surfaces 8. These surfaces are configured at the guiding rail 3 and form a sort of a longitudinal slot, which extends in the running direction of the guiding rail 3. The guiding surfaces 8 are formed by the flanks of the longitudinal slot, the guiding roller 7 being able to roll on either the left side or the right side thereof. As a result, a carriage unit 2 is proposed, which has a space-saving and advantageous guiding device 6 utilizing at the same time an existing cross-sectional shape of a guiding rail 3 in that guiding surfaces 8 are affixed thereto.

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On the upper side, the roller carriage 4 has current collectors 11 which are in contact with respective power rails 12. The power rails 12 are accommodated in the top side of the guiding rail 3 via insulators. When the carriage unit 2 is displaced within the guiding rail 3, a permanent current contact and/or signal contact is guaranteed between the carriage unit 2 and the stationarily inserted power rails 12.

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The roller carriage 4 has an upper roller carriage member 4a and a lower roller carriage member 4b, wherein abutment surfaces 30 are provided at the upper roller carriage member 4a in order to limit canting or lifting of the carriage unit 2 within the guiding rail, in that the abutment surface 30 comes to abut against the inner side of the guiding rail.

The roller carriage 4 has one or two roller carriage shafts 21, wherein, according to the illustrated embodiment, two rollers 22 are rotatably accommodated on the roller carriage shaft 21. In this case, one of the two rollers 22 can be driven by a drive motor 13, wherein the drive is realized via a gear, for example a cylindrical gear system 23, and wherein both the drive motor 13 and the gear are accommodated in the drive unit 5.

Essentially, the drive unit 5 consists of a sheet metal support 18, in which the drive motor 13 and a second electrical unit 17 are accommodated. An electrical connection 19, which is affixed to both the roller carriage 4 and the sheet metal support 18 at the carriage unit 2 via attachment points 31, extends between the first electrical unit 16 on the roller carriage 4 and the second electrical unit 17 within the drive unit 5.

In lateral direction, which corresponds to the displacement direction of the carriage unit 2, the sheet metal support 18 is executed with mechanical abutments 32, which form a respective projection in the displacement direction. The
5 sheet metal support 18 is bent in a U-shape with the U-opening being disposed to be vertically oriented to the bottom. A carrying element 27, at which a carrying bolt 28 is rotatably accommodated via a bearing assembly 33, is located in the U-opening of the sheet metal support. The
10 carrying bolt 28 has a hollow bore in order to lead another electrical connection 34 through the carrying bolt 28 such that the connection extends between the drive unit 5 and the wall element, which is accommodated at the carrying bolt 28.

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The drive motor 13 may be disposed concentrically with regard to the drive shaft. At least at one side of the sheet metal support 18, space is thus made available for the second electrical unit 17, which might be configured in the
20 shape of a printed circuit board, to be disposed laterally at a sheet metal support 18 within the drive unit 5. In the event of maintenance work, this circumstance offers the advantage of being able to service the second electrical unit 17, the drive motor 13 and the gear 23, 24 and to
25 exchange them, if required, without having to uninstall the roller carriage 4 which runs in the guiding rail. The second electrical unit 17 serves at least for controlling the drive

motor 13, wherein another electrical connection 34 passes through a cable conduit, which is located within the carrying bolt 28. Thereby another connection can be realized between the carriage unit 2 and a wall element.

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Figure 2 shows a lateral view of the carriage unit 2, wherein at least the roller carriage 4 and the guiding device 6 are illustrated.

- 10 The suspension of the sliding wall at the roller carriage is realized via bolts 51, which are disposed to be pivotable in the roller carriage 4. For this purpose, the bolt 51 has an articulation 52 at one end, which is executed as a sphere in this embodiment. The bolt 51 may be integrally connected
- 15 to the articulation 52, which allows for an inexpensive manufacturing as a turned part. However, the bolt 51 with the articulation 52 may consist of several separate components, whereby an optimized material configuration is possible. The articulation 52 may be supported directly in
- 20 the lower roller carriage member 4b or in a separate insert 50 within the lower roller carriage member 4b. Again material pairings can be thus optimized with regard to wear behavior. At the other end, the bolt 51 has attachment means for an attachment element 53, in order to be able to
- 25 attach the sheet metal support 18 or another reception for the sliding wall. The sliding wall is thus suspended from the bolt 51 and can be pivoted with the bolt 51 at the

articulation 52. The support of the bolt 51 in the roller carriage may be realized in this case, in that, in addition to the pivotable attachment of the wall element, likewise length compensation is possible. Delimiting the pivoting angle is realized by configuring, respectively by selecting
5 the diameter of the bore 57, through which the bolt 51 extends into the roller carriage 4. Concerning the length, the bolt 51 is configured in that it can receive one or more guiding rollers 7. In the embodiments of Figures 1 to 3, two
10 guiding rollers 7 are illustrated on each bolt 51, which fact, when pivoting the sliding wall, contributes to minor canting within the guiding rail 3.

In order to support the guiding rollers 7, non-illustrated distance sleeves may be provided which act as a bearing.
15 The guiding rollers 7 are separated from each other by means of buffer discs such as to allow for rotating in opposite directions.

20 Furthermore, the bolts 51 serve for a spring-loaded reception of a current collector 11. This collector is supported by means of two guiding pins 14, which are respectively accommodated in an associated bolt 51. The guiding pins 14 are loaded by means of spring elements 15
25 such as to be able to press the current collectors 11 against the power rail 12, which is located above the current collectors 11. On account of the double-stepped

bores in the articulation 52, the guiding pins 14 and the spring elements 15 are separately accommodated whereby the construction height of the current collectors 11 is reduced.

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The sectional view of Figure 3 reveals the driving train, which extends between the drive motor 13 and the roller carriage shaft 21. The drive motor 13 is disposed at a cylindrical gear system 23 from which a drive shaft extends
10 vertically upwards into the roller carriage 4. An angular gear system 24 in the shape of a beveled toothing or crown toothing is configured at the drive shaft and the roller carriage shaft 21, such as to entrain the roller carriage shaft 21 and consequently the rollers 22 in a rotational
15 movement by operating the drive motor 13. The drive shaft is rotatably supported in the lower roller carriage member 4b by means of a bearing 35. When laterally pivoting the sliding wall about the articulations 52, the transmission of forces by means of the angular gear 24 may continue to
20 occur within a limited pivoting angle, because the gear compensates for angle errors in the meshing pignons. However, this is only possible with small pivoting angles.

For compensating larger pivoting angles, a pivotable
25 coupling may be disposed between the cylindrical gear 23 and the angular gear 24 system. This coupling may consist of a coupling shaft 56, a lower coupling member 55 and an

upper coupling member 54. In this case, the lower coupling member 55 is connected to the cylindrical gear 23. The upper coupling member 54 engages in the angular gear 24 and is supported in a bearing 35 in the intermediate web 9.

5 Both coupling members 54, 55 are connected by means of the coupling shaft 56, which is disposed within a distance sleeve 36. The coupling may be configured as an angle-compliant coupling, such as a tooth coupling or as a universal coupling for example. Combining the articulated

10 suspension of the sliding wall with the pivotable coupling allows the sliding wall to be pivotable, such as to compensate for any inaccuracy during installation of the running rail or any inaccuracy because of oblique ceiling structures.

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The invention in its configuration is not limited to the above presented preferred embodiment. On the contrary, a number of variants is conceivable, which make use of the presented solution, even with basically different types of

20 embodiments.

List of reference numerals

	1	drive system
	2	carriage unit
5	3	guiding rail
	4	roller carriage
	4a	upper roller carriage member
	4b	lower roller carriage member
	5	drive unit
10	6	guiding device
	7	guiding roller
	8	guiding surface
	9	intermediate web
	11	current collector
15	12	power rail
	13	drive motor
	14	guiding pin
	15	spring element
	16	first electrical unit
20	17	second electrical unit
	18	sheet metal support
	19	electrical connection
	21	roller carriage shaft
	22	roller
25	23	cylindrical gear system
	24	angular gear system
	27	carrying element

	28	carrying bolt
	30	abutment surface
	31	attachment point
	32	mechanical abutment
5	33	bearing arrangement
	34	electrical connection
	35	bearing
	36	distance sleeve
	50	insert
10	51	bolt
	52	articulation
	53	attachment element
	54	upper coupling member
	55	lower coupling member
15	56	coupling shaft
	57	bore

Patent claims

1. A drive system (1) for driving and for guiding a wall element, in particular for a room partitioning wall system, with a carriage unit (2), which is guided to be longitudinally movable in a guiding rail (3), wherein the carriage unit (2) has a roller carriage (4) and a drive unit (5), characterized in that the wall element is pivotably supported at the carriage unit (2).

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2. A drive system (1) according to claim 1, characterized in that at least one articulation (52) is disposed at or in the roller carriage (4) for the pivotable attachment of the wall element.

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3. A drive system (1) according to claim 2, characterized in that the wall element is directly or indirectly attached to a sheet metal support (18), wherein the sheet metal support (18) is connected to the articulation (52).

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4. A drive system (1) according to claim 1, characterized in that the drive unit (5) is disposed below the roller carriage (4).

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5. A drive system (1) according to claim 4, characterized in that the roller carriage (4) has at least one roller carriage shaft (21), wherein an angular gear system (24) is disposed between the roller carriage shaft (21) and the drive unit (5).
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6. A drive system (1) according to claim 4, characterized in that a guiding device (7), which guides the carriage unit (2) within the guiding rail (3), is disposed between the roller carriage (4) and the drive unit (5).
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7. A drive system (1) according to claim 6, characterized in that the guiding device (6) has at least one and preferably two guiding rollers (7), which, for guiding the carriage unit (2), roll on guiding surfaces (8) which laterally adjoin the guiding device (6).
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8. A drive system (1) according to claim 7, characterized in that the guiding rollers (7) are rotatably disposed on bolts (51) which connect the sheet metal support (18) to the articulation (52).
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9. A drive system (1) according to claim 8, characterized in that at least two guiding rollers (7) are disposed on each bolt (51).
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10. A drive system (1) according to claim 2, characterized in that the articulation (52) is supported in an insert (50), which is disposed at or in the roller carriage (4).
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11. A drive system (1) according to claim 5, characterized in that the output shaft of the drive unit (5) is pivotally in engagement with the angular gear system (24).
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12. A drive system (1) according to claim 11, characterized in that a pivotable coupling (54, 55, 56) is disposed between the output shaft of the drive unit (5) and the angular gear system (24).
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13. A drive system (1) according to any of the aforementioned claims, characterized in that the guiding rail (3) is affixed to the ceiling of a room and in that the drive motor (13) extends in vertical direction underneath the guiding rail (3).
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14. A drive system (1) according to claim 3, characterized in that the sheet metal support (18) is configured in a U-shape and is disposed with the U-opening being oriented vertically downwards, wherein a cylindrical gear system (23) is disposed in the sheet metal support (18).
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15. A drive system (1) according to claim 14, characterized in that the drive motor (13) is disposed laterally offset within the sheet metal support (18), wherein the drive motor (13) is mechanically connected to the cylindrical gear system (23).
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16. A drive system (1) according to any of the preceding claims, characterized in that the roller carriage (4) has a roller carriage shaft (21) with two rollers (22), wherein one of the rollers (22) is driven on one side of the roller carriage (4) and the second roller (22), disposed on the opposite side, is supported to be freely moving.
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17. A drive system (1) according to any of the preceding claims, characterized in that the roller carriage (4) has two roller carriage shafts (21) with respectively two rollers (22), wherein two of the rollers (22) are driven on one side of the roller carriage (4) and the two rollers (22), disposed on the opposite side, are supported to be freely moving.
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