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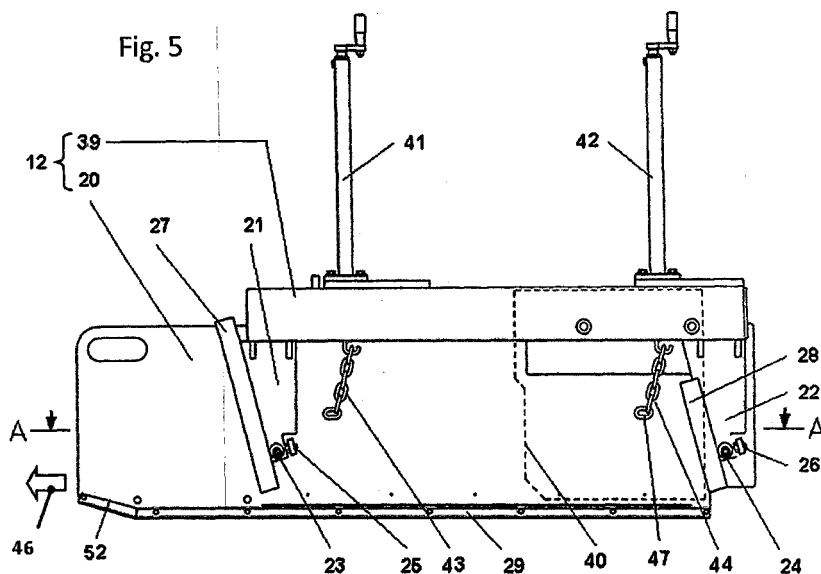
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(54) **End plate for a screed unit of a paver finisher**

(57) Retaining end plate for a screed unit of a paver finisher, of the type comprising a frame applicable to the screed unit sideways with respect to the advancing direction and a vertical section intended to contain and shape the material applied which at the bottom is in contact with the ground and is movable with respect to the frame (39), the movement of the vertical section with respect to the frame being guided by means of first guiding means and second guiding means, the first guiding means being applied on one member selected from the group consisting of frame and vertical section and the second guiding means being applied on the other of these members, in which the first guiding means are inclined on the plane defined by the development of the vertical

section according to an angle greater than ninety-degree with respect to the advancing direction of the paver finisher, the second guiding means being slidable on the first guiding means, the movement of the paver finisher involving a frictional force with respect to the ground whose frictional force represented in correspondence of the point of contact between first guiding means and second guiding means consists of an orthogonal component and a parallel component with respect to the first guiding means with respect to the inclination according to the previously defined angle, the pushing action towards the ground generated by the weight force of said vertical section being increased by this parallel component contributing to the push of said vertical section towards the ground.



Description

Technical field

[0001] The present invention relates to an end plate for a screed unit of a paver finisher according to the characteristics of the pre-characterizing part of claim 1. The present invention also relates to a screed unit of a paver finisher according to the characteristics of the pre-characterizing part of claim 29.

The present invention also relates to a paver finisher according to the characteristics of the pre-characterizing part of claim 30.

Definitions

[0002] During the present description the term "side" refers to a position on the machine placed sideways with respect to the advancing direction of the same machine in working condition, according to the advancing direction of the machine indicated in the figures.

The terms "right" and "left" are defined with respect to the advancing direction of the machine indicated in the figures.

Prior art

[0003] In the present state of the art the paver finisher machines also known in lingo as finishers, pavers, etc. are known.

These machines consist of two main units:

- a self-propelled tractor on wheels or on tracks, generally operated by a Diesel engine;
- a material screed unit, towed by the tractor.

The tractor's Diesel engine operates a series of hydraulic pumps that supply different circuits destined:

- to the machine advancing;
- to the screed material controlled supplying;
- to the screed unit operation and control.

[0004] When a screed width greater than the base unit width is required, some extensions are applied at the end of the same unit until the required width is reached. Said extensions are generally available with different widths and they can be applied in more sectors until the limit established by the unit maker is reached.

In general, therefore, the screed unit includes a central section having fixed length, connected by means of two towing arms to the tractor towing points.

The central section generally consists of two sub-sections hinged to one another at the centre to obtain different screed transverse sections.

In the case of an extensible screed unit, it comprises a right side section and a left side section.

The right side section and the left side section each have a width equal to about the half of the central section and are generally hydraulically extensible to obtain variable screed widths.

5 In the case of a screed unit with fixed width there is only the central section.

Both in case of an extensible screed unit and in case of a screed unit with fixed width, in correspondence of each of the right and left ends of the total screed unit a retaining end plate is applied.

10 During the screed, the retaining end plates avoid the material to overflow outside the screed unit width. The end plates, therefore, are necessary to retain the material delivered by the cochleas in front of the unit and to convey the material toward the machine longitudinal axis when the screed width tightens in case of the unit with extensible sectors.

In general the end plates consist of:

- 20 - a fixed part fixed to the screed unit frame;
- a movable part sliding vertically with respect to the fixed part, the sliding happening on vertical guides;
- means for adjusting in height the movable part position with respect to the fixed part position.

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[0005] The adjustment in height of the movable part is carried out according to the screed thickness and must be such as to allow a good contact with the support surface, with sufficient freedom of vertical movement to compensate possible unevenness of the same support surface.

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The base of the movable part of the end plate is generally provided with a slide to limit the pressure on the surface and avoid the end plate from being restrained during its push on the support surface, namely on the ground.

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If the end plate works correctly, the layer of screed material applied by the paver finisher presents vertical edges and a good local pre-compacting, that are important characteristics to carry out in accordance with the best workmanship the possible longitudinal coupling between the material in progress of screed and the material screed sideways in a step that precedes or follows the screed step in progress.

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In the traditional solution the contact between the movable part of the end plate and the support surface generally occurs only due to the own weight of the movable part of the same end plate.

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In some prior art solutions auxiliary devices are utilized to increase the pressure on the ground of the movable part of the end plate, as springs or hydraulic cylinders. Such devices are interposed between the fixed part and the movable part of the end plate.

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The fixed part constitutes the reaction element to the vertical force exerted downwardly by the auxiliary device, which, therefore, exerts a pushing force downward to the movable part with respect to the fixed part of the end plate.

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Problems of the prior art

The sliding of the slide placed below the end plate on the surface causes reaction forces. The reaction forces aim to prevent the vertical movement of the movable part of the end plate because of the frictional increase on the vertical guides and because of the frictional increase between the movable part and the fixed part of the end plates.

[0006] This often involves also an inserting of material between the two parts.

If the vertical movement of the movable part of the end plate is contrasted, the pressure exerted on the support surface only by the weight of the movable part of the end plate may not be sufficient to maintain the contact with the support surface in a correct way.

In such case, some material can so insert and adhere under the slide.

The material tends to lift the movable part of the end plate thus allowing the side exit of part of the material during the screed.

About prior art techniques providing the resort to auxiliary devices to increase the pressure on the ground of the movable part of the end plate first of all it should be noticed that such auxiliary devices involve an additional cost that can also be considerable, above all about auxiliary devices of the type with hydraulic cylinders. Moreover, mainly in case of the solutions providing the resort to hydraulic cylinders circuits and additional devices are inserted in the machine that must be submitted to maintenance and that could be subjected to breakdowns involving the machine stop. Moreover, in the systems providing the resort to hydraulic cylinders, it is necessary to provide also a regulator of the hydraulic pressure supplied to the cylinders and the possibility to raise hydraulically the movable part of the end plate.

The systems of the prior art based on the spring system, though being economic and of simple execution, need a spring pre-loading device.

Moreover the force that is applied depends on the spring deformation and is therefore variable according to the deformation undergone by the spring not only in its pre-loading step, but also following the deformation undergone by the spring because of the unevenness of the support surface and possible infiltration of material under the slide.

Aim of the invention

[0007] The aim of this invention is to supply a screed unit for paver finisher that allows to obtain a most effective action of the movable part of the end plate. Concept of the invention

[0008] The aim is reached with the characteristics of the main claim.

The sub-claims represent advantageous solutions.

Advantageous effects of the invention

[0009] The solution in accordance with the present invention, by the considerable creative contribution whose effect constitutes an immediate and not-negligible tech-

nical progress, presents various advantages.

First of all the solution according to the present invention allows to avoid the resort to additional auxiliary devices to increase the pressure exerted on the support surface by the movable part of the end plate, at the same time ensuring an effective downward pushing action of the movable part of the same end plate. This, besides benefits from the economical point of view also involves a greater reliability of the machine in its whole inasmuch there are less additional elements that could be subjected to breakdowns.

Moreover the solution according to the present invention also allows a fast and prompt adjusting of the reciprocal position in height of the movable part of the end plate with respect to the fixed part of the end plate, according to the desired configuration of the machine and to the screed operating conditions.

The solution according to the present invention, moreover, also allows a fast release of the movable part of the end plate, for example in the case in which carrying out a maintenance intervention is necessary.

Moreover, the solution according to the present invention is also applicable to the existing machines, requiring less modifications to the same ones.

Description of the drawings

[0010] It is in the following described a solution obtainable with reference to the included drawings to be considered as a non-limiting example of the present invention in which:

Fig. 1 shows schematically a wheeled tractor according to a plan view.

Fig. 2 shows schematically a screed unit according to a plan view.

Fig. 3 shows schematically the coupling of the screed unit of Figure 2 with the tractor of Figure 1 according to a plan view.

Fig. 4 shows schematically the generic configuration of a screed unit according to a side view.

Fig. 5 is a side-view of the end plate according to the present invention.

Fig. 6 is a sectional view of the end plate according to the section line A-A of Figure 5.

Fig. 7 is an exploded side view of the end plate of Figure 5.

Fig. 8 is a partial back view of the left sector of the screed unit with the application of the end plate according to the present invention.

Fig. 9 is a side-view of the end plate according to the present invention showing the forces acting on the same.

Fig. 10 is a partial three-dimensional view of the left sector of the screed unit with the application of the end plate according to the present invention.

Fig. 11 is a partial back view of the left sector of the screed unit with the application of the end plate ac-

cording to the present invention showing schematically the retaining action of the screed material applied by the paver finisher.

Fig. 12 is a partial back view of the left sector of the screed unit showing schematically the undesired side outflow of the material when a plate of the prior art remains partially lifted.

Fig. 13 is a side-view of one particular relative to the fastening and to the adjustment of one of the guiding rolls.

Fig. 14 is a back view of one particular relative to the fixing and adjustment of one of the adjusting rolls.

Description of the invention

[0011] The Fig. 1 shows schematically a wheeled tractor (13) and includes:

- a hopper (1) for the collection of the material to be applied: typically bituminous conglomerate, case-hardened aggregate, stabilized inert materials. Such materials are discharged in the collection hopper (1) from specially equipped transport means, typically trucks with overturnable platform, or from auxiliary means, typically front loaders, dumpers and the like.
- Advantageously the collection hopper (1) is provided with overturnable side-walls that, in opening position, allow the easy discharge of the material from the transport means and in closing position allow the tractor (13) to fall within the sizes allowed for its road haulage;
- one or two conveyers-extractors (2) of the material from the collection hopper (1) to the rear part of the tractor (13);
- two towing points (3) of the screed unit (17), opportunely adjustable in height to allow different screed thicknesses;
- a material delivery cochlea (4), generally consisting of two independent sections, with the function to deliver the material evenly on the total width of the screed unit (17);
- an operator seat (5) for driving the means and for controlling all the machine functions;
- steering front wheels (6), if necessary also motive;
- motive rear wheels (7).

Referring to the Fig. 2, the screed unit (17) includes:

- a central section (8) with fixed length.
The central section (8) generally consists of a first sub-section (30) and of a second sub-section (31) hinged to one another at the centre to obtain different screed transverse sections;
- in the case of extensible screed unit (17): a right side section (10) and a left side section (11). The right side (10) and left side (11) sections are each of a width equal to about the half of the central section

(8) and are hydraulically extensible to obtain variable screed widths;

- in the case of screed unit (17) with fixed width there is only the central section (8);
- two retaining end plates (12) of the delivered material.

Other known types of configuration of the screed unit (17) that however do not influence or prejudice in any way the application of the invention, which is applicable to a generic screed unit (17), both extensible and with fixed width are possible.

Referring to the Fig. 3, the paver finisher (45) made up by the coupling between the screed unit (17) and the tractor (13) is shown; the coupling of the screed unit (17) occurs by means of the two towing arms (9) that hook to one another in correspondence of the towing points (3) of the tractor.

The Fig. 4 shows schematically the generic configuration of a screed unit (17).

The screed unit (17) is connected to the towing arms (9) by means a pin (14) and by a fastening system (15), able to change the angle between the arms and the screed unit (17).

According to prior art, the screed unit (17), for having a floating action, is connected by means of articulations (32) only to the two towing points (3) of the tractor.

Its arrangement is determined from the equilibrium of the forces acting on it: towing force, frictional resistance of the material, bearing capacity of the material.

The arrangement of the screed unit (17) in conditions of equilibrium shows an inclination (16) of the bottom plate (33) with respect to the screed surface; this angle, known as connecting angle, determines the capacity of the screed unit (17) to mount on the material during the screed and to confer it a pre-compacting.

[0012] The screed unit (17) is furthermore generally equipped with accessories of known art, as reciprocate motion blades, called tampers (not shown), with vertical action to facilitate the inserting of the material below the bottom plate (33), and vibrators (not shown) to confer a good screed finishing, as well as a heating system (not shown) to avoid the adhering of the material to the bottom plate (33) and to the tamper in the case of screed of hot bituminous conglomerate.

To avoid that the material during the screed outflows beyond the width of the screed unit (17), appropriate retaining end plates (12) are provided.

The end plates (12) are used to retain the material delivered by the cochleas (4) in front of the screed unit (17) and to convey the material toward the longitudinal axis of the machine when the screed width tightens in case of the screed unit (17) with extensible sectors.

As previously observed, when a screed width greater than the base width of the main unit (19) is required, some extension sectors (18) are applied at the ends of the same unit until the required width is reached. Such extension sectors (18) are generally available with different widths

and more extension sectors (18) can be applied one after the other until the limit established by the maker of the screed unit (17) is reached.

[0013] The retaining end plates (12) are applied side-ways of the screed unit (17). In the case of screed unit (17) with fixed width, in which there is only the central section (8), the end plates (12) will be directly applied in correspondence of the respective ends of the central section (8), namely in correspondence of the right end and of the left end of the screed unit (17) in its whole.

In the case of extensible screed unit (17), an end plate (12) will be applied in correspondence of the right end of the screed unit (17), namely in correspondence of the end of the right side section (10) and another end plate (12) will be applied in correspondence of the end of the left side section of the screed unit (17), namely in correspondence of the end of the left side section (11).

In the case in which extension sectors (18) are used at the ends of the screed unit (17) to increase the screed width of the main unit (19), an end plate (12) will be applied in correspondence of the right end of the last of the extension sectors (18) mounted in correspondence of the right side section (10) of the screed unit (17) and another end plate (12) will be applied in correspondence of the left end of the last of the extension sectors (18) mounted in correspondence of the left side section (11).

From what previously observed, it is understood that the present invention will be applicable, in general, independently on the type of screed unit (17) used and, therefore, it will be applicable to screed units (17) with fixed width, to extensible screed units (17), to screed units (17) equipped with extension sectors (18).

[0014] The retaining end plates (12) of the material delivered by the cochlea (4) are generally fixed to the screed unit (17) by means of fastening bolts, but other equivalent fastening means can be used without exiting from the domain of the present invention.

The end plates (12) applied on the right side and on the left side of the paver finisher (45) are symmetrical with respect to the advancing direction (46) of the machine. Therefore the description of the present invention will be limited to the specific case of an end plate (12) mounted on the left side of the screed unit (17), resulting obvious the application of the solution to the case of an end plate (12) mounted on the right side of the screed unit (17). The description related to the operation of the end plate (12) according to the present invention applies to both sides of the screed unit (17). In particular (Figs. 5, 6, 7, 8, 9, 10, 11) the end plate (12) according to the present invention is described relating to the mounting on the left side of the screed unit.

The end plate (12) according to the present invention (Fig. 7) consists of a frame (39) and of a vertical section (20).

[0015] The frame (39) acts as support of the vertical section (20) according to what will be described in the following of the present description.

The frame (39) is fixed (Figs. 8, 10) to the screed unit (17) of the paver finisher (45). It will be obvious that:

- in the case of screed unit (17) with fixed width, the frame (39) will be applied directly in correspondence of the end of the central section (8);
- in the case of extensible screed unit (17), the frame (39) will be applied in correspondence of the end of one of the two right (10) or left (11) side sections;
- in the case in which extension sectors (18) are used, the frame (39) will be applied in correspondence of the external end of the last of the extension sectors (18) mounted on the screed unit (17).

The frame (39) includes (Fig. 7) a first lifting device (41) that is placed on the frame (39) in frontal position with respect to the advancing direction (46) of the machine and a second lifting device (42) that is placed on the frame (39) in rear position with respect to the advancing direction (46) of the machine.

In the shown form of execution (Figs. 5, 6, 7, 8, 9, 10, 11) the first lifting device (41) and the second lifting device (42) are identical and are made by means of a hook (48) placed at the end of a rod controllable in the lowering and lifting by means of rotation means of a handwheel (49). It will be however evident that other forms of execution are possible to carry out this lowering and lifting action of the hook (48), if necessary also by means of electrical control means.

The frame (39) further includes a first arm (21) that is placed on the frame (39) in frontal position with respect to the advancing direction (46) of the machine and a second arm (22) that is placed on the frame (39) in rear position with respect to the advancing direction (46) of the machine.

The two arms (21, 22) are downwardly protruding with respect to the frame (39) and are made by means of plates with an essentially trapezoidal shape with the frontal end (51) inclined according to an angle (b) greater than ninety-degree with respect to the advancing direction (46) of the machine. It will be evident that while in the shown form of execution the arms (21, 22) are made of plates, within the aims of the present invention the arms (21, 22) can also be made by means of metal bars welded or fixed to the frame (39) with an inclination with respect to the same frame corresponding to the angle (b) greater than ninety-degree with respect to the advancing direction (46) of the machine as well as by means of metal bars (39) orthogonally welded or fixed to the frame with respect to the same frame.

On the first arm (21) at least one frontal guiding roll (23) is mounted, whose function will be explained in the following of the present description.

It will be obvious that also a greater amount of frontal guiding rolls (23) could be supplied.

If necessary on the first arm (21) also a frontal adjusting roll (25) can be mounted, whose function will be explained in the following of the present description.

It will be obvious that also a greater amount of frontal adjusting rolls (25) could be supplied.

In similar way, on the second arm (22) is mounted at least one rear guiding roll (24), whose function will be explained in the following of the present description. It will be obvious that also a greater amount of rear guiding rolls (24) could be supplied.

If necessary on the second arm (22) can be mounted also a rear adjusting roll (26), whose function will be explained in the following of the present description.

It will be obvious that also a greater amount of rear adjusting rolls (26) could be supplied.

[0016] In summary, on each of the arms (21, 22) at least one guiding roll (23, 24) is mounted and if necessary at least one adjusting roll (25, 26) can be mounted.

As previously observed, it will be evident that providing even more guiding rolls (23, 24) for each arm (21, 22), for example two guiding rolls (23, 24) for each arm is possible.

In similar way, it will be evident that providing even more adjusting rolls (25, 26) for each arm (21, 22), for example two adjusting rolls (25, 26) for each arm is possible. The frontal guiding roll (23) and the rear guiding roll (24) are spaced (Fig. 10) for a distance (d).

The frame (39) can further comprise a fixed section (40) of the end plate (12) placed in correspondence of the backing zone with the screed unit (17), or with the backing zone of the extension sector (18) or with the backing zone with the corresponding side section (10, 11) of the screed unit (17). In general the fixed section (40) will be placed in correspondence of the side-wall (53) of the screed unit (17). In the case in which there is the fixed section (40), the vertical section (20) will be sliding in the hollow space made up with fixed section (40) and side-wall (53) of the screed unit (17).

The vertical section (20) of the end plate (12) is shaped (figs. 5, 6, 7, 8, 9, 10, 11) as an oblong plate in the advancing direction (46) of the machine and is equipped at the bottom with a slide (29) intended to limit the pressure on the support surface and to avoid that the end plate (12) may be restrained during its push on the support surface, namely on the ground.

In correspondence of the frontal and lower end of the vertical section (20) there is a bevel able to favour the advancing of the end plate (12) in its whole and also intended to avoid that the end plate (12) may be entrained during its push on the support surface, namely on the ground.

Sideways to the vertical section (20) of the end plate (12) a frontal guide (27) and a rear guide (28) are fixed.

The frontal guide (27) and the rear guide (28) are inclined with respect to the direction orthogonal to the advancing direction (46) of the machine.

In the preferred solution of the present invention the frontal guide (27) and the rear guide (28) are reciprocally parallel and are inclined according to an angle (b) greater than ninety-degree with respect to the advancing direction (46) of the machine and are placed at a reciprocal

distance (d) equal to the distance (d) between the frontal guiding roll (23) and the rear guiding roll (24) previously described.

[0017] In different solutions the two guides (27, 28) could also not be perfectly parallel to allow and guide an inclination of the vertical section (20) with respect to the frame (39). As a result, the inclination of one of the guides or of the first guiding means (27, 28) could be equal to or different from with respect to the inclination of the other guides or of other first guiding means (27, 28).

The vertical section (20) of the end plate (12) further includes two coupling means (47) whose function will be described in the following of the present description. Therefore the end plate (12) according to the present invention (Fig. 7) consists of a frame (39) and of a vertical section (20) that are different elements reciprocally coupled so that the vertical section (20) is free to move vertically with respect to the frame (39).

The vertical section (20) is coupled to the frame (39) by means of a first coupling device (43) and a second coupling device (44). The first coupling device (43) is hooked on one side to one of the two fastening means (47) of the vertical section (20) and on the other side to the first lifting device (41) present on the frame (39). In similar way the second coupling device (44) is hooked from side to side of the two fastening means (47) of the vertical section (20) and on the other side to the second lifting device (42) present on the frame (39).

In general, therefore, in the retaining end plate (12) according to the present invention the frame (39) includes lifting devices (41, 42) of the vertical section (20), and the lifting devices (41, 42) include coupling means (48) intended to the coupling of the vertical section (20). The vertical section (20) is thus liftable with respect to the ground and with respect to the frame (39) by means of lifting devices (41, 42).

In the form of execution shown the coupling devices (43, 44) are represented as chains, but it will be evident that other equivalent forms of execution are possible, e.g. generic cables, metallic cables, etc.

[0018] In general the coupling devices will be generic flexible coupling devices, to ensure that the end plate (12) can be lowered until the contact with the ground and successively further release the coupling devices to allow the necessary clearance in the vertical movement of the end plate (12) so that it can adapt to non-homogeneity of the ground on which it slides.

In the case in which the lifting devices (41, 42) include the previously described hook (48), the coupling of the coupling devices (43, 44) can be simply carried out by inserting a slot of these same or a chain ring that makes them up within the hook (48). The hook (48) can also comprise closure means able to prevent that the end of the coupling devices (43, 44) exits from the hook (48) once it has been inserted in the same hook (48).

In similar way also the fastening means (47) of the vertical section (20) can be made in equivalent different ways within the aim of the present invention, for example by

being themselves a hook secured to the vertical section (20) or a slot, a hole or a couple of holes within which a hook present in correspondence of the corresponding end of the coupling devices (43, 44) is secured.

In the coupling step of the vertical section (20) with the frame (39), the frontal guiding roll (23) is in condition of support at the frontal guide (27) and the rear guiding roll (24) is in condition of support at the rear guide (28) and the vertical section (20) is suspended on the frame (39), by the connection of the first coupling device (43) with the corresponding first lifting device (41) and by the connection of the second coupling device (44) with the corresponding second lifting device (42).

In this way the end plate (12) thus consists of the frame (39) fixed to the screed unit (19) and of the vertical section that is suspended on the frame (39) by means of coupling devices (43, 44) and whose height with respect to the support surface, namely with respect to the ground, to can be adjusted by acting on the lifting devices (41, 42). The lifting of the end plate (12) by means of lifting devices (41, 42) favours the machine transportation. Moreover, according to prior art, the whole ensemble of the end plate (12) can be engaged with the screed unit (19) by means of a hinging connection, that allows to rotate rearwards the whole group to bring again the machine width within the limits allowed for its haulage.

During the step of the material screed the vertical section (20) is not supported by the coupling devices (43, 44), but is let free to follow the ground profile, helped in the contact by the particular inclination of the guides (27, 28) in condition of support to the guiding rolls (23, 24).

As previously observed, the sliding of the slide placed at the bottom of the end plate on the surface causes reaction forces. In the end plates of the known art (Fig. 12) the reaction forces tend to prevent the vertical movement of the movable part or vertical section (20) of the end plate (12) because of the increase of the friction on the vertical guides and because of the increase of the friction between the vertical section (20) and the fixed part or frame (39) of the end plates (12). This often involves also a material inserting between vertical section (20) and frame (39) that involves in turn an additional obstacle to the free vertical movement of the vertical section (20) and that may therefore further worsen the situation. If the movement of the vertical section (20) of the end plate (12) is hindered, then the pressure exerted on the support surface, namely on the ground, by the weight of the vertical section (20) of the end plate (12) may not be sufficient to maintain in a correct way the condition of contact with the support surface. In that case, under the slide (29) some material (38) can so insert and adhere. The material (38) tends to further lift the vertical section (20) of the end plate (12) thus allowing the side exit (Fig. 12) of part of the material (38) during the screed.

[0019] Before using the machine, the vertical section (20) is manually lowered by means of lifting devices (41, 42) that support the vertical section (20) by means of coupling devices (43, 44). In the form of execution shown,

the acting on the handwheels (49) causes the lowering of the hooks (48) to which the chains (43, 44) are fastened. The lowering of the vertical section (20) continues till when occurs the contact of the slide (29) with the support surface or ground. In this limit condition the vertical section (20) is still at least partially supported by the coupling devices (43, 44) and the weight of the same vertical section (20) could not carry out its function intended to maintain the contact of the slide (29) with the support surface or ground. Acting again on the lifting devices (41, 42) an additional release of the coupling devices (43, 44) is caused. In this way the vertical section (20) results no more supported by the coupling devices (43, 44) and the weight of the same vertical section (20) can carry out its function intended to maintain the contact of the slide (29) with the support surface or ground. Moreover in this way it is possible for the vertical section (20) to go down further in case of unevenness of the surface, e.g. a hollow. As previously observed, the good contact with the support surface allows (Fig. 11) the retaining of the material (38) transported by the cochleas (4) toward the end of the screed unit (19) and the correct shaping of the transverse section of the material (38) being worked. Considering the action of the acting forces (Fig. 9) it is obtained that the push of the vertical section (20) on the support surface or ground according to the advancing direction of (46) the machine generates frictional forces (34) having an essentially parallel but opposite direction with respect to the advancing direction of (46) the machine. Due to the shown shape, the frictional forces (34) are represented as frictional forces (35) acting on the guides. The frictional forces (35) operate in correspondence of the point of contact between the guiding rolls (23, 24) and the respective guides (27, 28).

[0020] Introducing (Fig. 9) a reference Cartesian system (50) with axis of abscissas (x) parallel to the guide (27, 28) and oriented in the direction towards the support surface or ground and axis of the ordinates (y) orthogonal to the axis of the abscissas (x) and oriented in the direction toward the rear of the end plate (12) with respect to the advancing direction (46) of the machine, with the centre of the reference system coinciding with the point of contact between the guiding rolls (23, 24) and the respective guides (27, 28), it is obtained that the represented frictional forces (35) can be vectorially decomposed in:

- first component (36) of the represented frictional force (35), that is the component of the frictional force (35) represented along the axis of the abscissas (x);
- second component (37) of the represented frictional force (35), which is the component of the frictional force (35) represented along the axis of the ordinates (y).

By applying the known trigonometric formulas it results that:

- the first component (36) has module equal to the

module of the represented frictional force (35) multiplied by the cosine of (180 - degrees "b"), where "b" is the value in degrees of the previously defined angle (b) according to which the guides (27, 28) are inclined with respect to the advancing direction (46) of the machine.

The first component (36) has a direction similar to the axis of the abscissas (x) referring to the previously defined reference system (50);

- the second component (37) has module equal to the module of the represented frictional force (35) multiplied by the sine of (180 - degrees "b"), where "b" is the value in degrees of the previously defined angle (b) according to which the guides (27, 28) are inclined with respect to the advancing direction of (46) the machine.

The second component (37) has direction similar to the axis of the ordinates (y) relating to previously defined reference system (50).

The result is, therefore, that the first component (36) of the represented frictional force (35) is parallel to the inclined guides (27, 28), and tends to push the vertical section (20) downwardly.

The second component (37) of the represented frictional force (35) is orthogonal to the inclined guides (27, 28), and tends to maintain the contact between the same guides (27, 28) and the guiding rolls (23, 24).

The effect on the vertical section (20) is equivalent to an increase in weight of the same and is independent on the vertical position of the vertical section (20) with respect to the frame (39).

The function of the previously described adjusting rolls (25, 26) is to counteract the side-thrust of the material and adjust the clearance between the frame (39) and the vertical section (20), further facilitating a good displacing of the latter.

It will be evident that the same function may be carried out also by means different from the adjusting rolls shown, as, for example, some shims with a corresponding sliding surface.

In general, therefore the retaining end plate (12) according to the present invention can comprise adjusting means (25, 26), that in the preferred form of execution of the present invention are the adjusting rolls shown. The adjusting means (25, 26) are intended to the adjusting of the reciprocal position of the frame (39) and of the vertical section (20) according to a direction orthogonal with respect to the plane defined by the development of the same vertical section (20), namely they are intended to the adjusting of the reciprocal distance between frame (39) and vertical section (20). The adjusting means (25, 26) can be indifferently applied on the frame (39) or on the vertical section (20) and, therefore, in general, will be applied on one member selected from the group consisting of frame (39) and vertical section (20). In general the

adjusting means (25, 26) will have to be slidable on the other member selected from the group consisting of frame (39) and vertical section (20) with respect to the member on which they are mounted or may provide appropriate backing elements intended to facilitate their sliding.

Advantageously, for the heating screed of bituminous materials, the base of the movable plate can be heated to reduce the scale risks of the material that would bring to a consequent reduction of the functional effectiveness of the same end plate (12).

[0021] In an alternative solution (not shown) functionally equivalent from the point of view of the distribution of the forces, the arrangement of the guides (27, 28) and of the guiding rolls (23, 24) on frame (39) and on vertical section (20) can be inverted. In practice, in this case the arms (21, 22) will be shaped as guides, while the guiding rolls will be used to replace the guides (27, 28) present on the vertical section (20). The distribution and the effect of the forces on frame (39) and vertical section (20) will be equivalent to what described referring to the shown solution.

In general, therefore, the generic configuration of the end plate (12) according to the present invention is applicable to a generic end plate (12) of the type comprising a frame (39) and a vertical section (20) in which the frame (39) is applicable to the screed unit (17) sideways with respect to the advancing direction (46) of the paver finisher (45) and in which the vertical section (20) is intended to contain and to shape the screed material (38) applied by the screed unit (17). The vertical section (20) is at the bottom in contact with the ground and is movable with respect to the frame (39).

[0022] According to the present invention the movement of the vertical section (20) with respect to the frame (39) is guided by means of first guiding means (27, 28), that in the form of execution shown are guides shaped as oblong plates including a sliding surface, and second guiding means (23, 24) that in the form of execution shown are guiding rolls slidable on the sliding surface of the first guiding means (27, 28). The first guiding means (27, 28) will be applied on one member selected from the group consisting of frame (39) and vertical section (20) and the second guiding means (23, 24) will be applied on the other member selected from the group consisting of said frame (39) and said vertical section (20) with respect to the member on which there are the first guiding means (27, 28). According to the present invention the first guiding means (27, 28) are inclined on the plane defined by the development of the vertical section (20) according to an angle (b) greater than ninety-degree with respect to the advancing direction (46) of the paver finisher (45) and the second guiding means (23, 24) are slidable on the first guiding means (27, 28). In this way, the movement of the paver finisher (45) according to the advancing direction (46) involves a frictional force (34) with respect to the ground of the vertical section (20) and the frictional force (35) carried in correspondence of the

point of contact between first guiding means (27, 28) and second guiding means (23, 24) consists of an orthogonal component (37) and a parallel component (36) with respect to the first guiding means (27, 28) with respect to the inclination according to the angle (b), the pushing action towards the ground generated by the weight force of the vertical section (20) being increased by the parallel component (36) contributing to the push of the vertical section (20) towards the ground. As previously observed, the first guiding means (27, 28) can be applied on the frame (39) with the corresponding second guiding means (23, 24) applied on the vertical section (20), or the first guiding means (27, 28) can be applied on the vertical section (20) with the corresponding second guiding means (23, 24) applied on the frame (39), while the adjusting means can be indifferently applied on frame (39) or on vertical section (20) independently on the positioning of first guiding means (27, 28) and second guiding means (23, 24).

In the preferred solution of the present invention, the end plate (12) includes two first guiding means (27, 28), of which a first frontal guiding means (27) and a first rear guiding means (28), and corresponding two second guiding means (23, 24), of which a second frontal guiding means (23) and a second rear guiding means (24), but, as previously observed, also a greater number of first guiding means and corresponding second guiding means (23, 24), e.g. first guiding means with respect to first frontal guiding means (27) and first rear guiding means (28), and intermediate corresponding second guiding means intermediate with respect to second frontal guiding means (23) and second rear guiding means (24) may possibly be provided.

[0023] Though the configuration described relatively to the present invention makes reference to the case in which the end plate (12) is maintained in contact with the ground by means of the action exerted by the weight of the vertical section (20) of the same end plate (12), the present invention can be advantageously also applied to the prior art techniques using auxiliary devices (not shown) to increase the pressure on the ground of the movable part or vertical section (20) of the end plate (12), as springs or hydraulic cylinders. Such devices are interposed between the frame (39) or fixed part and the vertical section (20) or movable part of the end plate (12). The frame (39) or fixed part constitutes the reaction element to the vertical force exerted downwardly by the auxiliary device, which, therefore, exerts a pushing force downwardly of the vertical section (20) or movable part with respect to the frame (39) or fixed part of the end plate (12). In fact the solution according to the present invention would bring important benefits also to such solutions, because the pushing action downwardly described referring to the present invention would sum to the pushing action exerted by the auxiliary members, which, for example, could be sized differently keeping in consideration such additional force obtaining benefits both from the operational and from the economical point

of view. It should be noted moreover that the present invention is advantageously applicable also to the existing machines, requiring a reduced number of modifications to these same, being sufficient:

- applying the guides (27, 28) on the vertical section (20);
- applying the arms (21, 22) on the frame (39);
- obtaining or fixing on the vertical section (20) the fastening means (47);
- applying the lifting devices (41, 42) on the frame (39).

Such elements can be prearranged for the mounting so that the application of the same is simple and fast to allow the fitting to the existing machines.

The present invention also relates to a screed unit (17) of a paver finisher (45), in which the screed unit (17) can be a screed unit with fixed width, a screed unit comprising a right side section (10) and a left side section (11) extensible sideways with respect to a main unit (19), a unit extensible by the application of at least one extension sector (18). The screed unit according to the present invention will be structured for fixing a retaining end plate (12) according to the present invention and will include a retaining end plate (12) according to the present invention in correspondence of at least one of the side-walls (53) of the same screed unit (17).

[0024] Finally the present invention also relates to a paver finisher (45) of the type comprising a self-propelled tractor (13) on wheels or on tracks (6, 7) and a screed unit (17) towed by the tractor (13), in which the screed unit (17) can be a screed unit with fixed width, a screed unit comprising a right side section (10) and left side section (11) extensible sideways with respect to a main unit (19), a screed unit extensible by means of application of at least one extension sector (18). The paver finisher (45) will include in correspondence of at least one of the side-walls (53) of the screed unit (17) a retaining end plate (12) according to the present invention and the screed unit (17) of the paver finisher (45) will be structured for fixing a retaining end plate (12) according to the present invention. Referring to the figures 13 and 14, that are respectively a side-view of one particular relative to the fixing and to the adjustment of one of the guiding rolls and a back-sight of one particular relative to the fixing and to the adjustment of one of the adjusting rolls:

- the fixing system of the frontal guiding roll (23) of the plate (12) is obtained by means of an eccentric first pin (54). The clearance is adjustable intervening on the eccentric pin (54), by means of which the position of the frontal guiding roll (23) is adjusted with respect to the corresponding frontal guide (27);
- the fixing system of the frontal adjusting roll (25) of the end plate (12) is obtained by means of a second eccentric pin (55). The clearance is adjustable intervening on the eccentric pin (55), by means of the which the position of the frontal adjusting roll (25) is

adjusted with respect to the corresponding vertical section (20), the adjustment of the clearance/position of the frontal adjusting roll (25) and correspondingly of the rear adjusting roll (26) corresponding to an adjustment of the reciprocal distance between the end plate (12) and the vertical section (20).

Though in describing the adjustment of the guiding and adjusting rolls reference has been made to the corresponding frontal rolls, the same fixing and adjustment system is also used for the corresponding guiding and adjusting rear rolls.

The description of the present invention has been made with reference to figures enclosed in a preferred form of execution of the same, but it is evident that many possible alterations, modifications and variants will be immediately clear to those skilled in the art of the sector in view of the previous description. So, it should be stressed that the invention is not limited by the previous description, but contains all alterations, modifications and variants in accordance with the appended claims.

Used nomenclature

[0025] With reference to the identification numbers reported in the enclosed figures, it has been used the following nomenclature:

1. Hopper
2. Extractor-conveyor
3. Towing point
4. Cochlea
5. Operator seat
6. Front wheels
7. Rear wheels
8. Central section
9. Towing arm
10. Right-side section
11. Left-side section
12. End plate
13. Tractor
14. Pin
15. Fixing system
16. Inclination of the bottom plate with respect to the ground
17. Screed unit
18. Extension sector
19. Main unit
20. Vertical section
21. First arm or frontal arm
22. Second arm or rear arm
23. Frontal guiding roll or second frontal guiding means
24. Rear guiding roll or second rear guiding means
25. Frontal adjusting roll or frontal adjusting means
26. Rear adjusting roll or rear adjusting means
27. Frontal guide or first frontal guiding means
28. Rear guide or first rear guiding means

29. Slide
30. First sub-section
31. Second sub-section
32. Articulation
33. Bottom plate
34. Frictional force
35. Frictional force represented on the guide
36. First component of the represented frictional force or orthogonal component
37. Second component of the represented frictional force or parallel component
38. Material
39. Frame
40. Fixed section
41. First lifting device
42. Second lifting device
43. First coupling device
44. Second coupling device
45. Paver finisher
46. Advancing direction of the machine
47. Fastening means
48. Hook
49. Handwheel
50. Reference system
51. Frontal end
52. Bevel
53. Side-wall of the screed unit
54. First eccentric pin
55. Second eccentric pin
- b. Angle
- d. Distance

Claims

1. Retaining end plate (12) for a screed unit (17) of a paver finisher (45), said end plate being of the type comprising a frame (39) and a vertical section (20), said frame (39) being applicable to said screed unit (17) sideways with respect to the advancing direction (46) of said paver finisher (45), said vertical section (20) being intended to contain and shape the material (38) applied by said screed unit (17), said vertical section (20) being at the bottom in contact with the ground and being movable with respect to said frame (39), the movement of said vertical section (20) with respect to said frame (39) being guided by means of first guiding means (27, 28) and second guiding means (23, 24), said first guiding means (27, 28) being applied on one element selected from the group consisting of said frame (39) and said vertical section (20) and said second guiding means (23, 24) being applied on the other element selected from the group consisting of said frame (39) and said vertical section (20) with respect to the element on which said first guiding means (27, 28) are present, **characterised in that** said first guiding means (27, 28) are inclined on the plane defined by the development

of said vertical section (20) at an angle (b) greater than ninety-degree with respect to the advancing direction (46) of said paver finisher (45), said second guiding means (23, 24) being slidable on said first guiding means (27, 28), the movement of said paver finisher (45) according to said advancing direction (46) causing a frictional force (34) with respect to the ground of said vertical section (20), the friction force (35) acting in correspondence of the contact point between said first guiding means (27, 28) and said second guiding means (23, 24) consisting of an orthogonal component (37) and a parallel component (36) with respect to said first guiding means (27, 28) with respect to said inclination at said angle (b), the pushing action towards the ground generated by the weight force of said vertical section (20) being increased by said parallel component (36) which contributes to the push of said vertical section (20) toward the ground.

2. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** it includes adjusting means (25, 26) intended to adjust the reciprocal position of said frame (39) and said vertical section (20) according to a direction which is an orthogonal direction with respect to the plane defined by the development of said vertical section (20), namely intended to adjust the reciprocal distance between said frame (39) and said vertical section (20), said adjusting means (25, 26) being applied on one element selected from the group consisting of said frame (39) and said vertical section (20), said adjusting means (25, 26) being slidable on the other element selected from the group consisting of said frame (39) and said vertical section (20) with respect to the element on which they are mounted, said adjusting means (25, 26) opposing the side-pressure applied by the applied material (38) and being intended for the adjustment of the clearance between said frame (39) and said vertical section (20).
3. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said adjusting means (25, 26) are at least one adjusting roll (25, 26), said adjusting roll (25, 26) being orthogonally displaceable in different positions according to one direction which is an orthogonal direction with respect to the plane defined by the development of said vertical section (20), the different orthogonal displacements of said adjusting roll (25, 26) corresponding to different reciprocal distances between said frame (39) and said vertical section (20).
4. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 3 **characterised in that** said first guiding

means (27, 28) are at least one guide shaped as an oblong guiding plate comprising a sliding surface intended to guide said second guiding means (23, 24), said second guiding means (23, 24) being slidable on said sliding surface of said guide (27, 28).

5. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 4 **characterised in that** said second guiding means (23, 24) are at least one guiding roll (23, 24) guided by said first guiding means (27, 28), said at least one guiding roll (23, 24) being slidable on said first guiding means (27, 28).
6. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said at least one guiding roll (23, 24) is fixed by means of a corresponding arm (21, 22).
7. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said arm (21, 22) includes two of said guiding rolls (23, 24).
8. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the claims 5 to 7 **characterised in that** said at least one guiding roll (23, 24) is fixed by means of a first eccentric pin (54), said first eccentric pin (54) being intended for the adjustment of the clearance/position of said at least one guiding roll (23, 24) with respect to the corresponding guide (27, 28).
9. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 6 to 8 and according to claim 3 **characterised in that** said arm (21, 22) includes said at least one adjusting roll (25, 26).
10. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said at least one adjusting roll (25, 26) is fixed by means of a second eccentric pin (55), said second eccentric pin (55) being intended for the adjustment of the clearance/position of said at least one adjusting roll (25, 26) with respect to said vertical section (20), said adjustment of the clearance/position of said at least one adjusting roll (25, 26) corresponding to an adjustment of the reciprocal distance between said plate (12) and said vertical section (20).
11. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 6 to 10 **characterised in that** said arm (21, 22) is obtained by means of plates with an essentially trapezoidal shape with the frontal end (51) inclined

at said angle (b) which is greater than ninety-degree with respect to the advancing direction (46) of said paver finisher (45).

12. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 11 **characterised in that** said first guiding means (27, 28) are applied on said frame (39) and said second guiding means (23, 24) are applied on said vertical section (20). 5
13. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim and according to claim 2 **characterised in that** said adjusting means (25, 26) are applied on said vertical section (20). 10
14. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 11 **characterised in that** said first guiding means (27, 28) are applied on said vertical section (20) and said second guiding means (23, 24) are applied on said frame (39). 15
15. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim and according to claim 2 **characterised in that** said adjusting means (25, 26) are applied on said frame (39). 20
16. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 15 **characterised in that** it includes at least two of said first guiding means (27, 28) of which at least one first frontal guiding means (27) and at least one first rear guiding means (28), and at least two corresponding second guiding means (23, 24) of which at least one second frontal guiding means (23) and at least one second rear guiding means (24), each of said guiding means (27, 28) being inclined on the plane defined by the development of said vertical section (20) at an angle (b) greater than ninety-degree with respect to the advancing direction (46) of said paver finisher (45), the inclination of at least one of said first guiding means (27, 28) being different with respect to the inclination of the other said first guiding means (27, 28). 25
17. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 15 **characterised in that** it includes at least two of said first guiding means (27, 28) of which at least one first frontal guiding means (27) and at least one first rear guiding means (28), and at least two corresponding second guiding means (23, 24) of which at least one second frontal guiding means (23) and at least one second rear guiding means (24), each of said guiding means (27, 28) being in- 30

clined on the plane defined by the development of said vertical section (20) at an angle (b) greater than ninety-degree with respect to the advancing direction (46) of said paver finisher (45), the inclination of each of said first guiding means (27, 28) being equal to the inclination of the other said first guiding means (27, 28).

18. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 17 **characterised in that** said paver finisher (45) includes a fixed section (40) located at the side-wall (53) of said screed unit (17), said fixed section (40) being fixed on said frame (39), said vertical section (20) being slidable in the space formed by said fixed section (40) and from said side-wall (53) of said screed unit (17). 35
19. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 18 **characterised in that** said frame (39) includes lifting devices (41, 42) of said vertical section (20), said lifting devices (41, 42) including coupling means (48) intended to hook said vertical section (20), said vertical section (20) being liftable with respect to the ground and with respect to said frame (39) by means of said lifting devices (41, 42). 40
20. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said lifting devices (41, 42) are a rod which is controllable in the lowering and lifting actions by means of rotation means of a hand-wheel (49), at the lower end of said controllable rod said coupling means (48) being present. 45
21. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said coupling means (48) is a hook. 50
22. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 19 to 21 **characterised in that** it includes flexible coupling devices (43, 44), said flexible coupling devices (43, 44) being secured at an end to said vertical section (20) by means of fastening means (47), said flexible coupling devices (43, 44) being secured at the other end to said lifting devices (41, 42) by means of said coupling means (48). 55
23. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said flexible coupling devices (43, 44) are chains.
24. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to claim 22 **character-**

ised in that said flexible coupling devices (43, 44) are belts.

25. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 24 **characterised in that** said vertical section (20) includes at the bottom, at the contact surface with the ground, a slide (29) limiting the pressure applied on the ground. 5
26. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 25 **characterised in that** said vertical section (20) includes a heating device which heats said contact surface with the ground. 10
27. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 26 **characterised in that** said frame (39) comprises at least one auxiliary device interposed between said frame (39) and said vertical section (20) of said end plate (12), said frame (39) constituting the reaction element to the vertical force which is applied downwardly by said auxiliary device, said auxiliary device applying a downwardly pushing force to said vertical section (20) with respect to said frame (39), the pushing action towards the ground generated by the weight force of said vertical section (20) being increased by said parallel component (36) which contributes to the pushing action of said vertical section (20) towards the ground and by said downwardly pushing force applied by said auxiliary device. 20 25 30
28. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to the previous claim **characterised in that** said auxiliary device is a spring. 35
29. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to claim 27 **characterised in that** said auxiliary device is a hydraulic cylinder. 40
30. Retaining end plate (12) for a screed unit (17) of a paver finisher (45) according to any of the previous claims 1 to 28 **characterised in that** said end plate (12) is fixed to said screed unit (17) by means of a hinging connection, said hinging connection being intended to the rear folding of said end plate (12). 45 50
31. Screed unit (17) of a paver finisher (45), said screed unit (17) being of the type selected from the group consisting of fixed width screed unit, screed unit comprising a right end section (10) and a left end section (11) which are extensible sideways with respect to a main screed (19), screed unit which is extensible by means of application of at least one 55

extension sector (18), **characterised in that** said screed unit (17) is structured for fixing a retaining end plate (12) according to any of the previous claims 1 to 30, said screed unit (17) comprising said retaining end plate (12) in correspondence with at least one of said side-walls (53) of said screed unit (17).

32. Paver finisher (45) of the type comprising a self-propelled tractor (13) on wheels or tracks (6, 7) and a screed unit (17) towed by said tractor (13), said screed unit (17) being of the type selected from the group consisting of fixed width screed unit, screed unit comprising a right end section (10) and a left end section (11) which are extensible sideways with respect to a main screed (19), screed unit which is extensible by means of application of at least one extension sector (18), **characterised in that** said screed unit (17) is structured for fixing a retaining end plate (12) according to any of the previous claims 1 to 30, said screed unit (17) comprising said retaining end plate (12) in correspondence with at least one of said side-walls (53) of said screed unit (17).

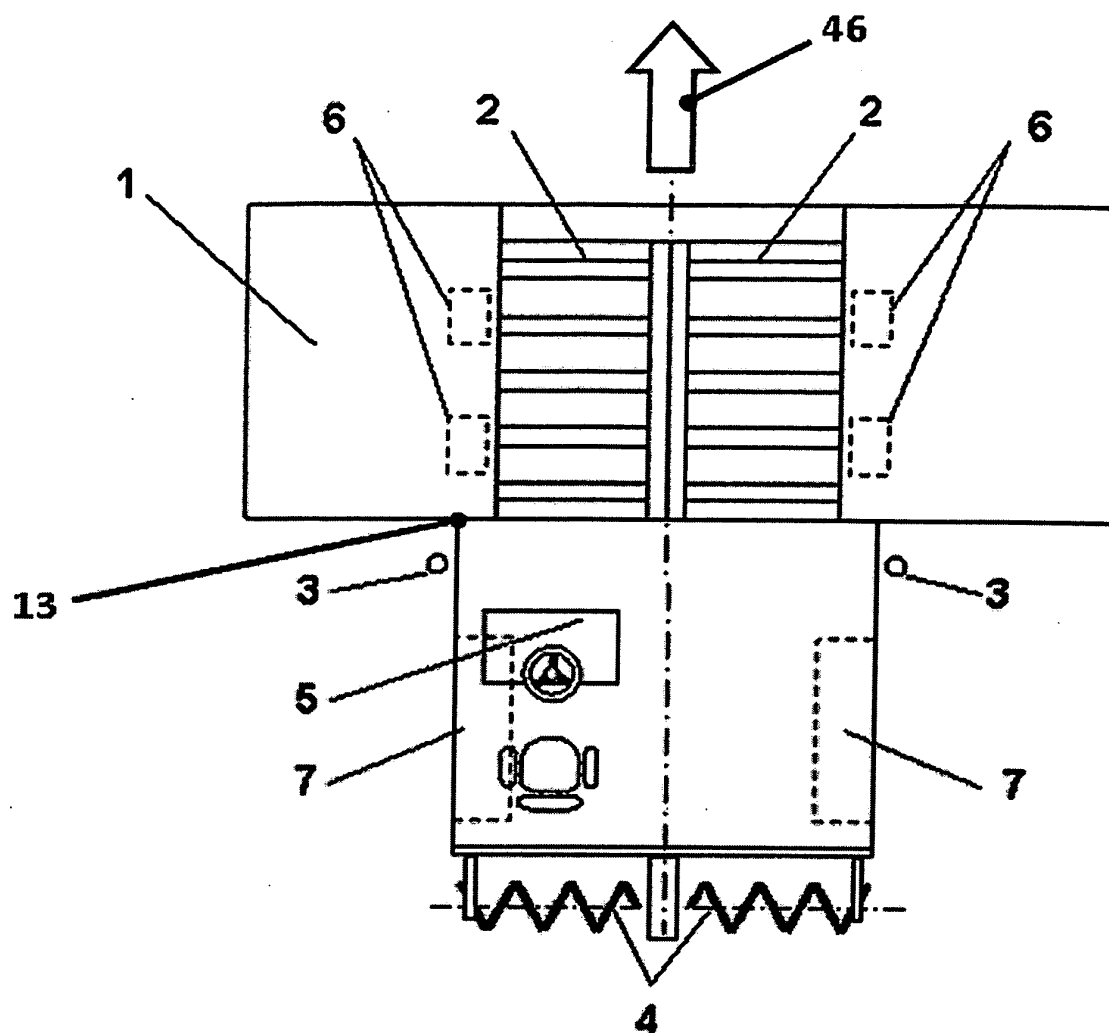


Fig. 1

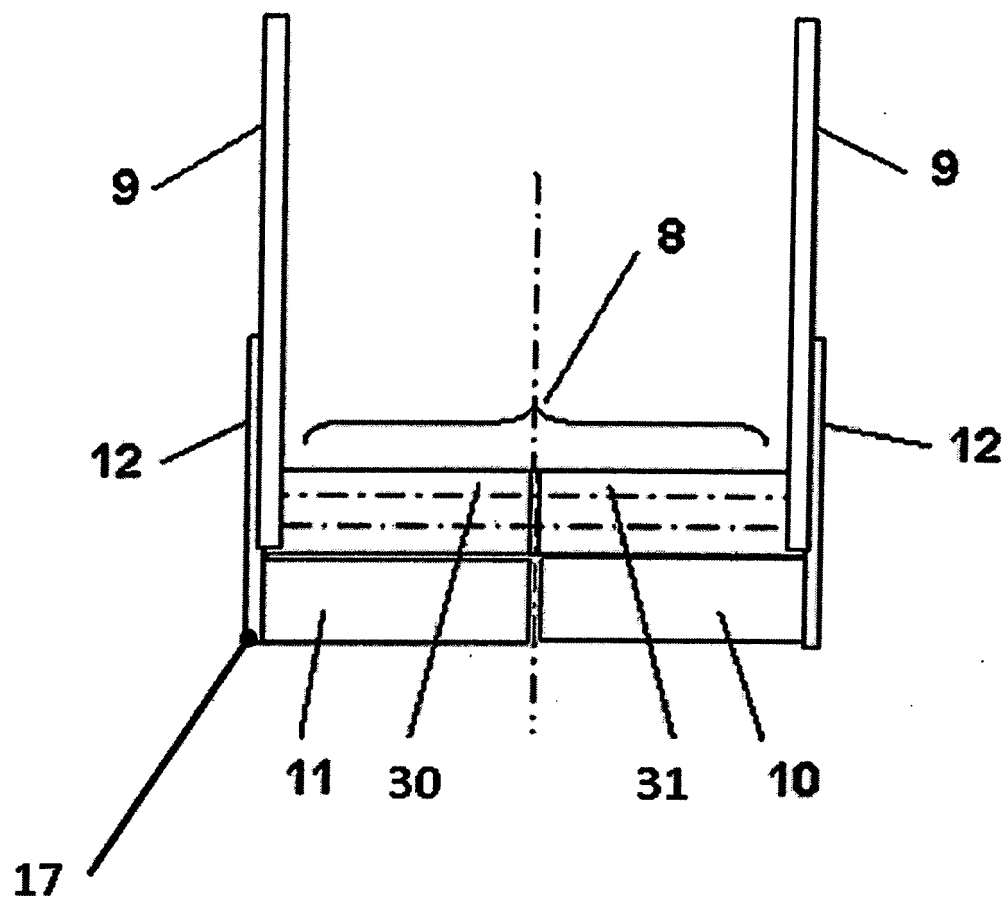


Fig. 2

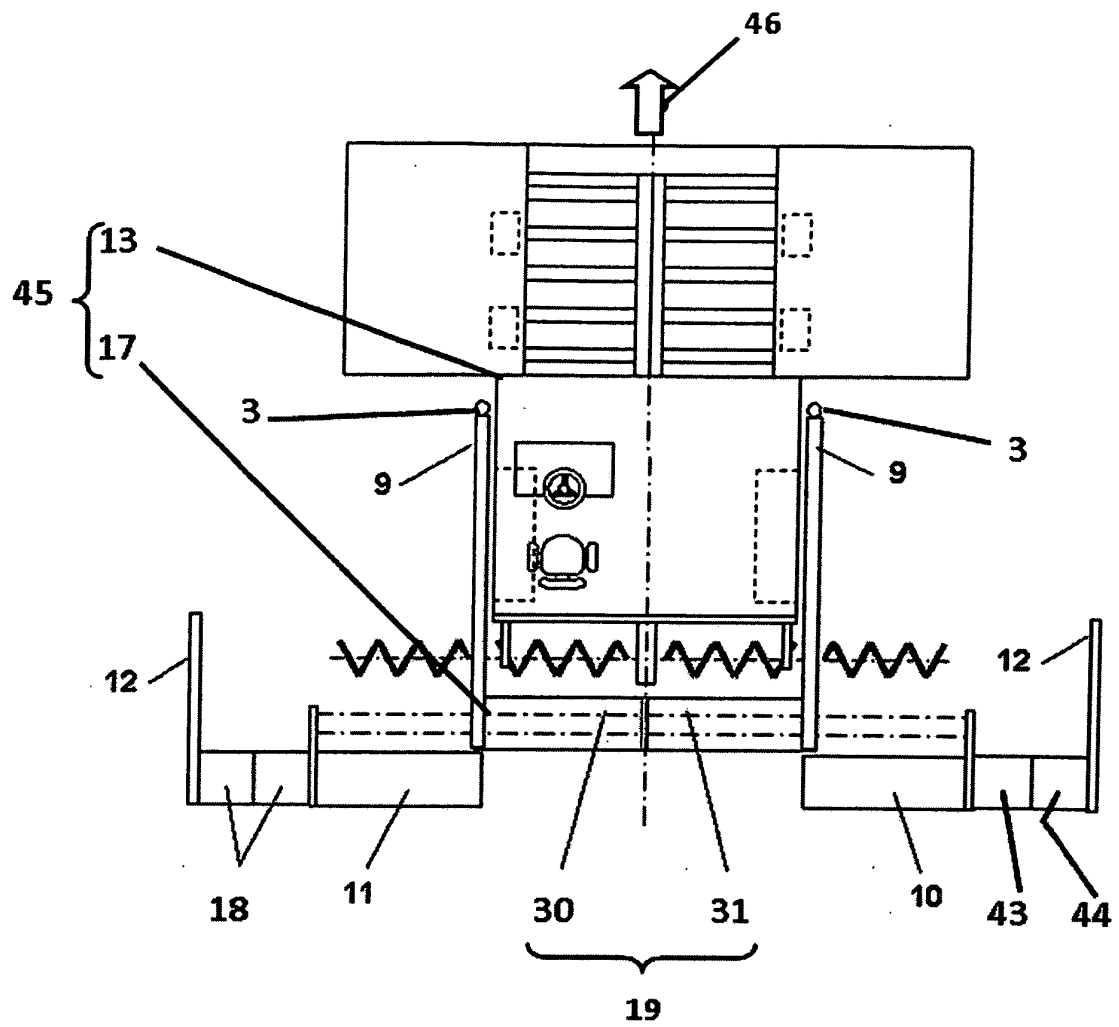


Fig. 3

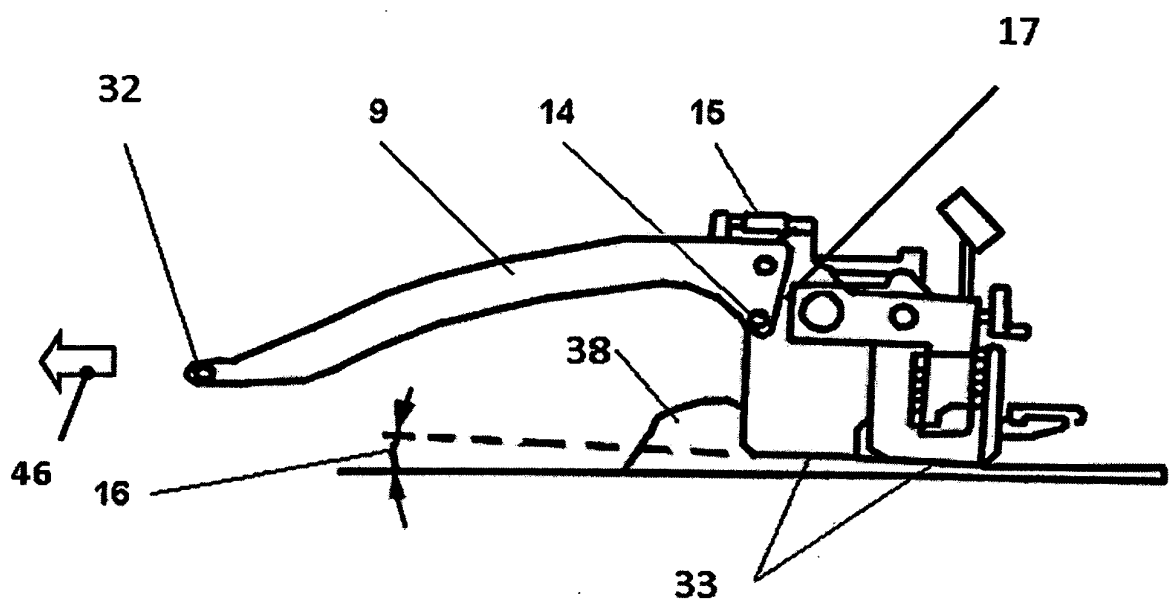
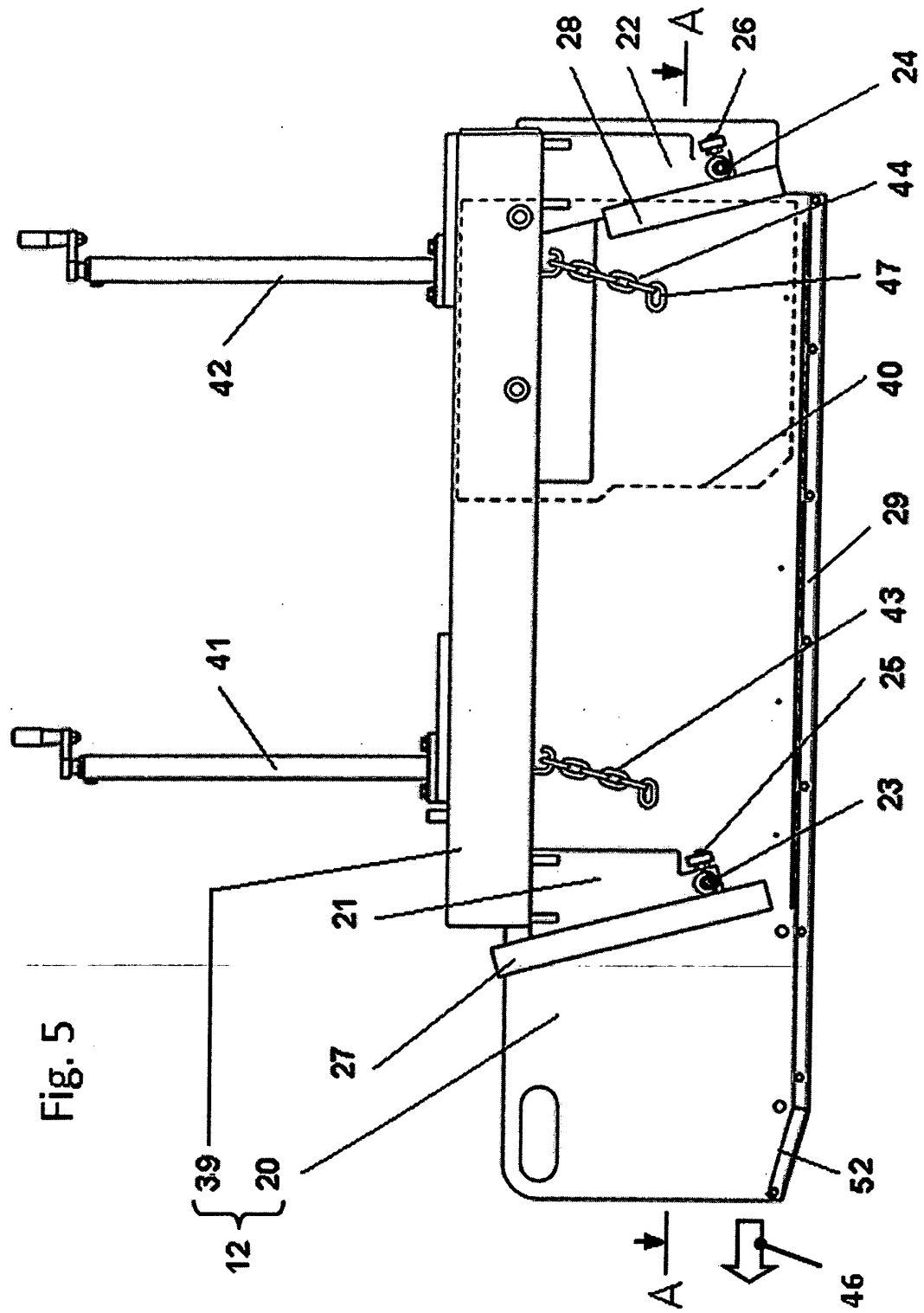
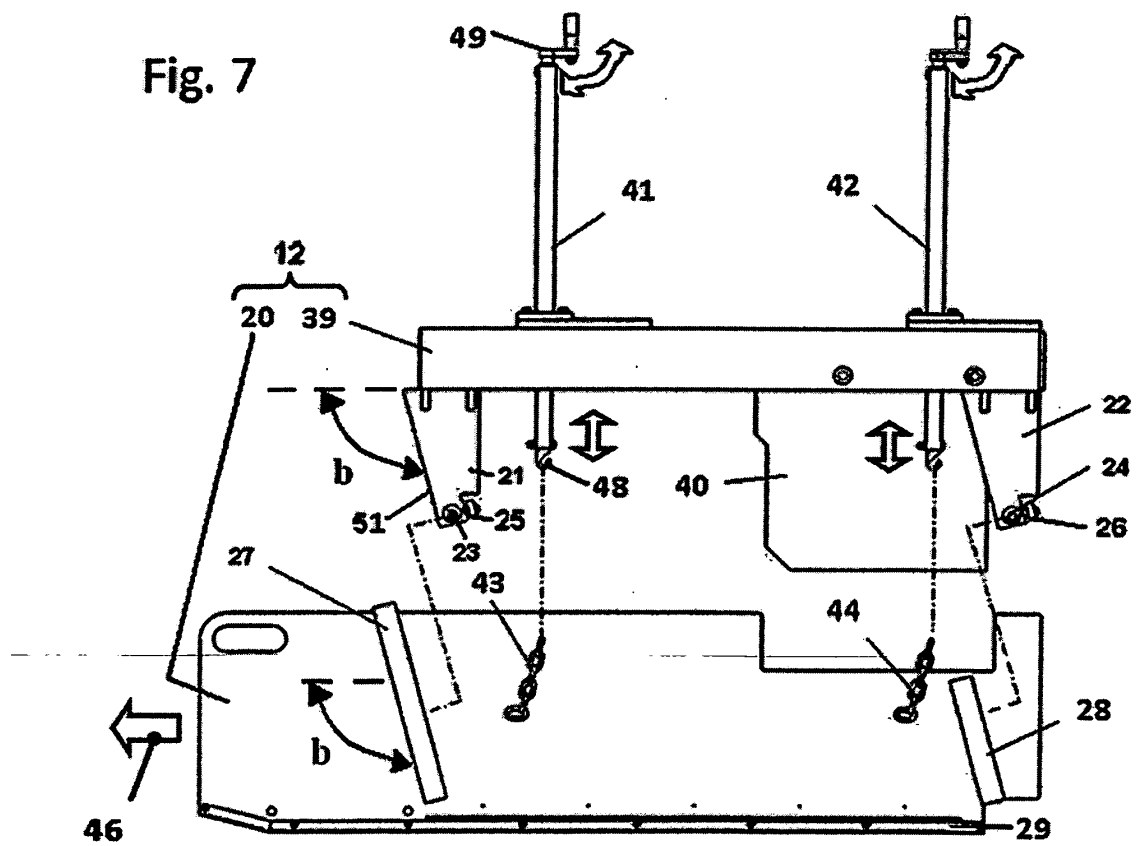
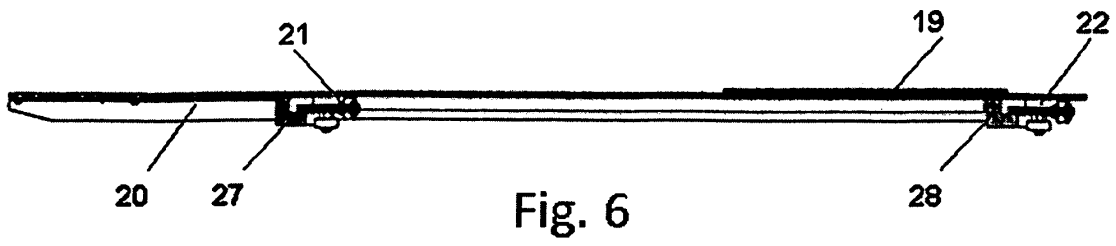


Fig. 4





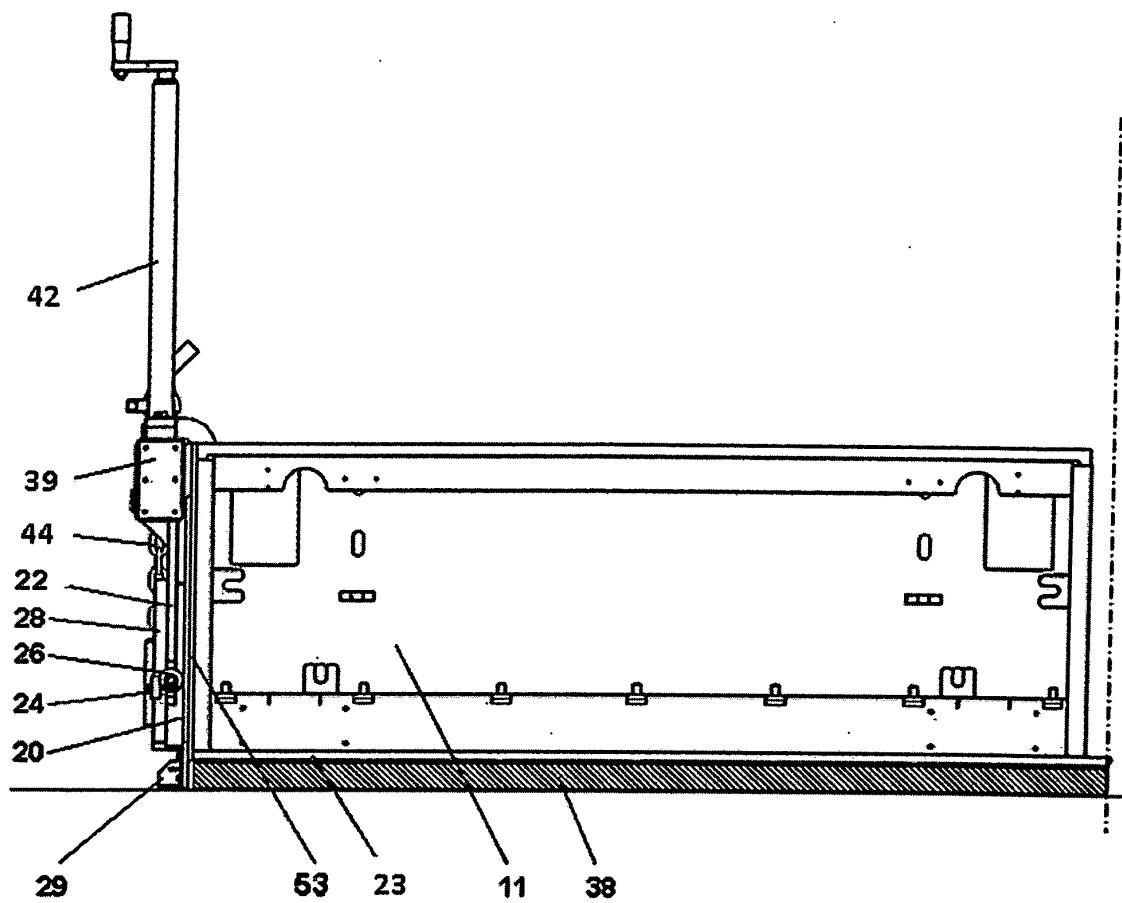


Fig. 8

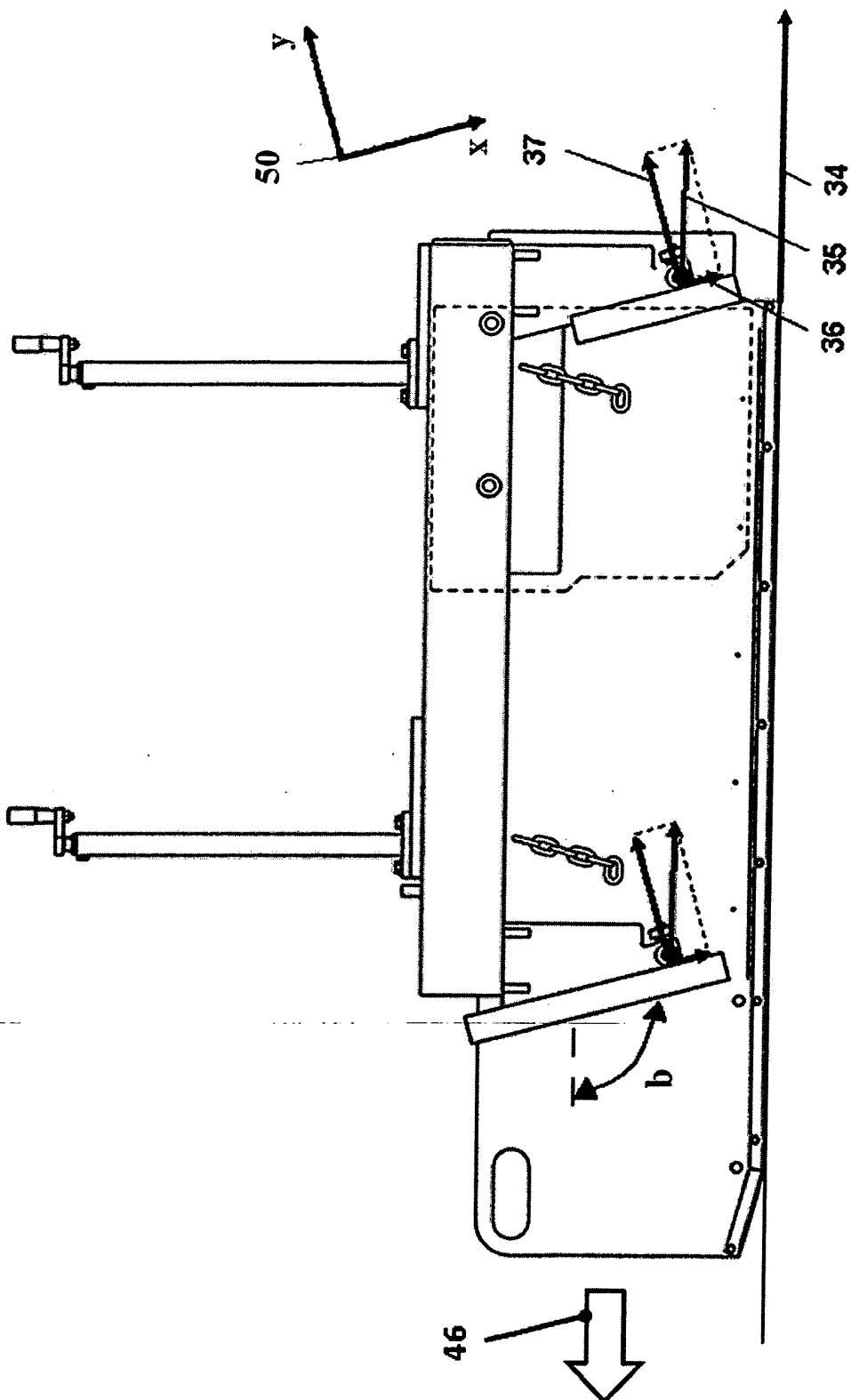
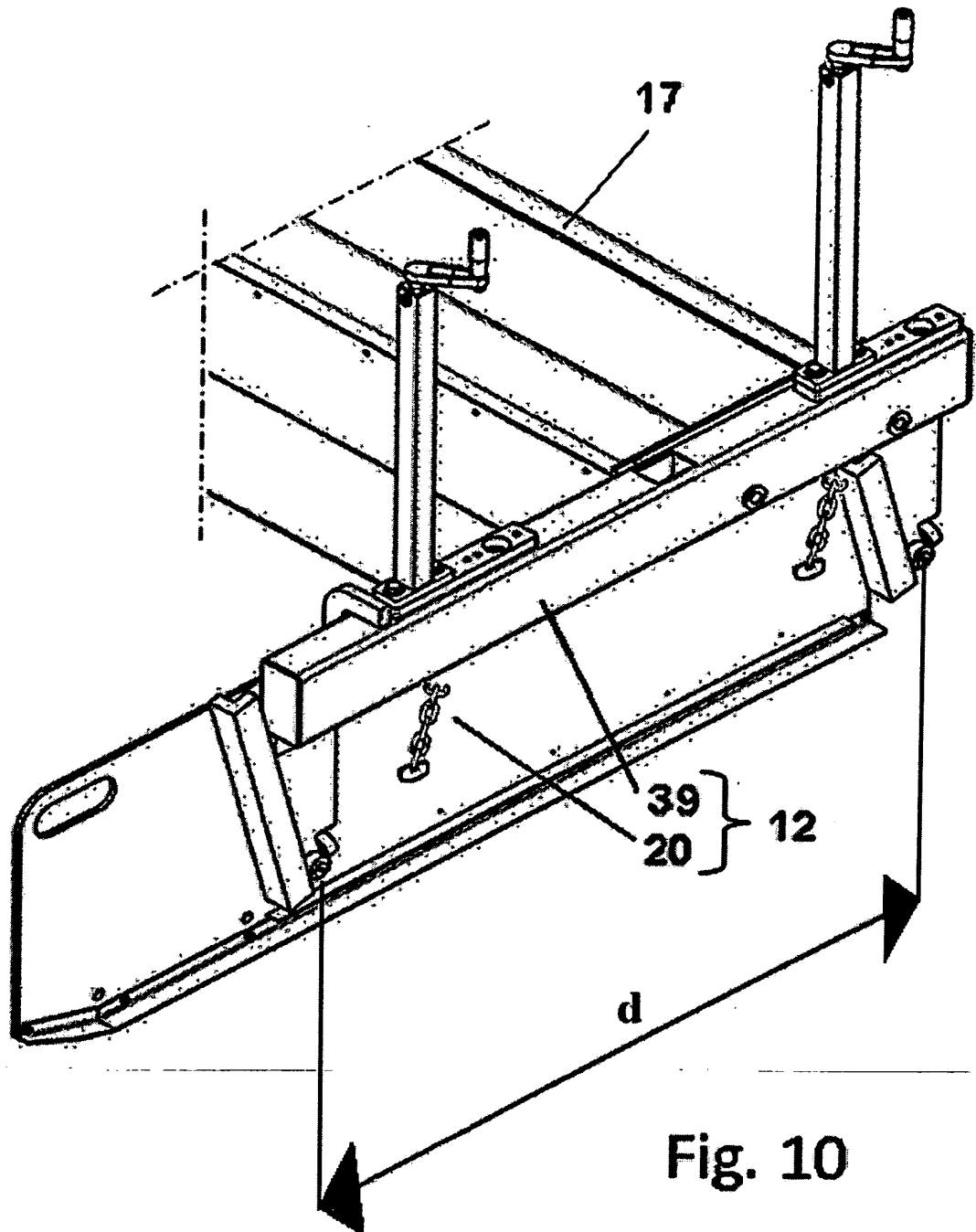


Fig. 9



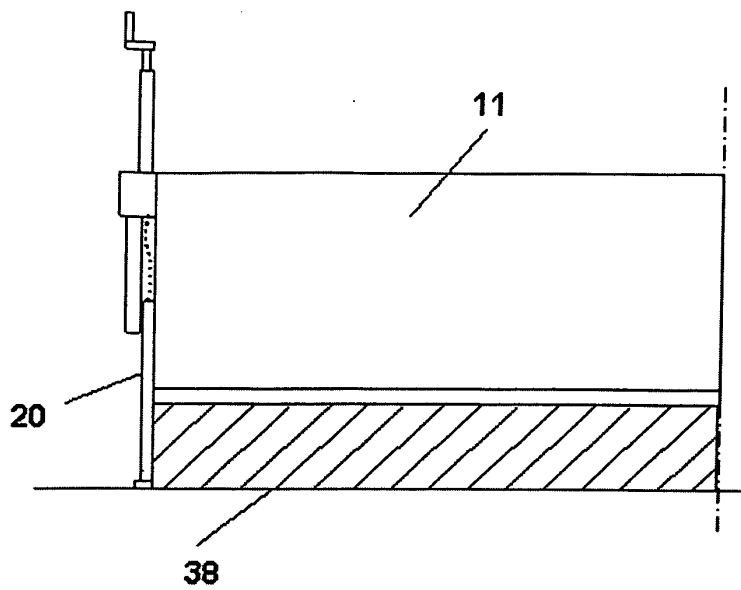


Fig. 11

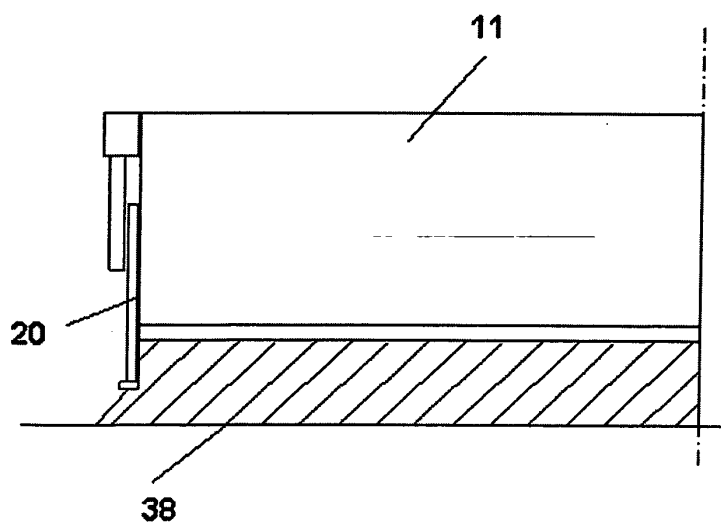


Fig. 12

Fig. 13

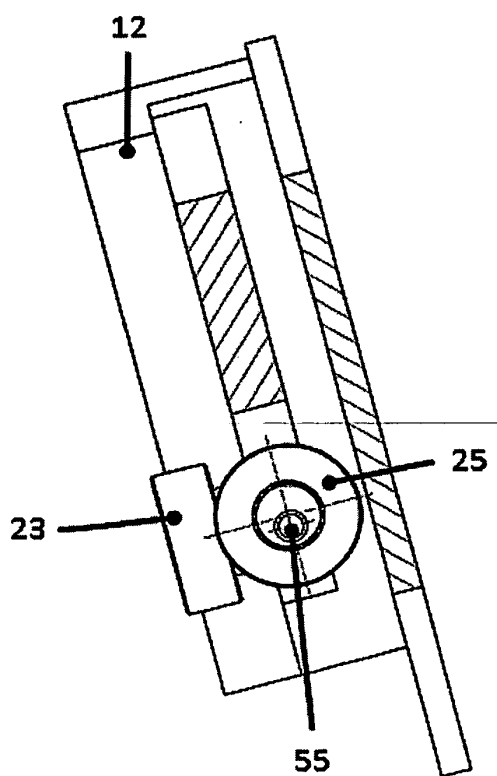
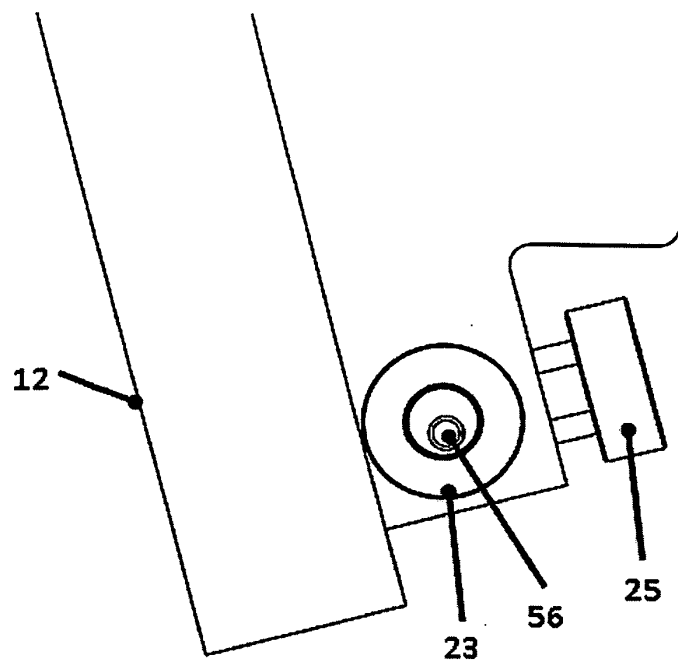


Fig. 14