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(54) **Coupling system for extension sectors on screed unit for paver**

(57) Screed unit for paver finisher, of the type comprising a main screed, end plates and extension sectors which can be reciprocally aligned by means of adjusters and which can be reciprocally coupled. The main screed, end plates and extension sectors can be coupled and aligned by means of a coupling means operating according to a coupling system using fixing and clamping means with screws/bolts in fixing holes, in which alignment and disalignment means are provided of one unit to be coupled

pled with respect to the other unit to be coupled with a movement with respect to the alignment axis, the alignment and disalignment means being linked/linkable to an undercut coupling means in which the coupling means consists of a male element and a female element, one of male element and female element being fixed in correspondence with at least one of the side-walls of the screed unit, the other one of male element and female element being fixed in correspondence with at least one of the side-walls of extension sector.

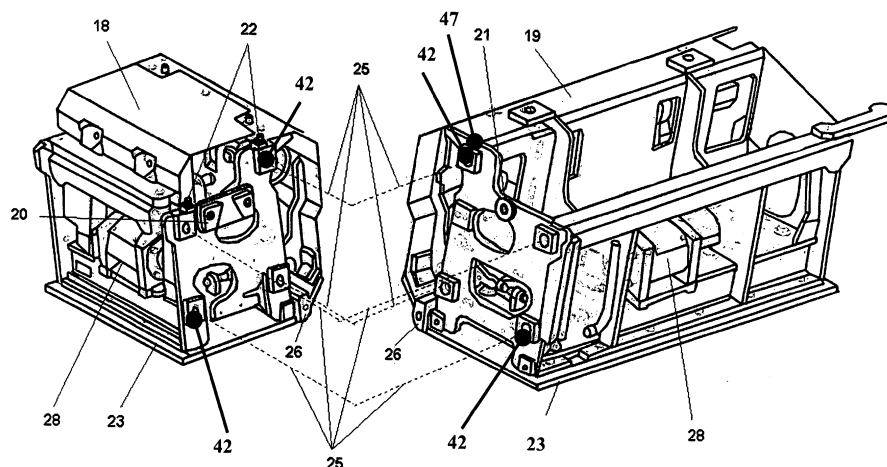


Fig. 13

Description

Technical field

[0001] The present invention relates to a screed unit for paver finisher according to the characteristics of the pre-characterising part of claim 1.

The present invention also relates to a paver finisher machine according to the characteristics of the pre-characterising part of claim 16.

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.

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 screeds:

- 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 dedicated circuits:
 - for the machine advancing,
 - for the screed material controlled feeding
 - for the screed unit operation and control

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

Technical solutions to make the extension sectors mounting easier and faster are known, for example by means of hydraulic rams or by wedge-shaped systems. In US 3712189 interlocking extension units are disclosed for extending the screed of an asphalt paving machine. Each extension unit has an open inner end having two rotatable shafts extending vertically there across. A cylindrical cam is welded to each of the shafts in an off-centre position. Disposed about each of the cams is a steel ring having a bolt extending radially therefrom beyond the inner end of the unit, the bolt being adapted to be connected to a slotted plate in the outer end of an adjacent unit. Also, arranged in such a way to protrude from the inner end of each unit, two adjustable guide studs are present each of which is adapted to mate with the slotted plate to facilitate alignment of adjacent units and provide a limiting surface against which an adjacent unit is drawn when the cams are rotated.

In US 6190087 a paver screed is described which has a main screed with two outer side walls, at least one of the side walls being provided with insertion orifices for the releasable mounting of at least one lateral screed extension by means of fastening elements capable of being inserted through the insertion orifices. A screed extension is provided with fastening elements that comprise hydraulic cylinders each of which have a piston that is spring-biased into an initial, retracted position. The cylinders are actuated by hydraulic fluid to displace or extend the piston against the biasing action of the spring. Preferably, the hydraulic cylinders are connected a hydraulic circuit of the main screed. The piston of each hydraulic cylinder carries a shank capable of being inserted through a proximal insertion orifice and which are preferably provided with an abutment element configured for attaching the cylinder to the sidewall of the main screed.

Problems of the prior art

[0004] Applying the extensions, one or more extensions for each side of the base screed, generally implies the following operations (Figs. 3, 5, 6, 13) to be carried out both when a screed having fixed width and a screed with extensible sectors are involved:

- dismantling the end plates (12) which retain the material distributed by the cochlea (4), which are generally fixed by means of bolts;
- approaching the extension sector (18) to the end, for example the left one, of the left side section (11) of the main screed (19) of the total screed unit (17). In similar way for the right end, approaching the extension sector (18) to the end of the right side section (10) of the main screed (19) of the screed unit (17). The extension sector (18) can be unloaded from a transport means (not shown) directly on the ground, or on a platform (not shown). If suitable raising and moving means are not available the same paver finisher (45) carries out the approaching of the total screed unit (17) to the extension sector (18);
- rough alignment of the extension sector (18) with the end of the total screed unit (17). This manoeuvre is generally carried out with a pry, until allowing the introduction of the fixing or coupling bolts (25) with the aid of one or more centring pins;
- inserting of the fixing or coupling bolts (25) and slight clamping of the nuts until obtaining the extension sector vertical wall (18) approach to the vertical wall of the total screed unit end (17);
- manoeuvre of the adjuster elements (22) to obtain the perfect co-planarity of the bottom plate (23) of the extension sector (18) with the bottom plate (23) of the total screed unit (17);
- definitive clamping of the fixing or coupling bolts (25);
- connection of the transmission elements of the tampers (26), typically first Cardan joints, elastic joints, toothed joints (27);

- connection of the transmission elements of the vibrators (28), typically second Cardan joints, elastic joints, toothed joints (29).

Obviously the aforementioned operations should be repeated for each extension sector (18) to be mounted and their laboriousness is evident mainly in relation to approaching the extension sector (18) to the unit and considering the important weight of these extension sectors (18) that does not allow an easy handling.

Also the solutions providing the use of hydraulic rams to make the mounting of the extension sectors easier and faster are subject to different drawbacks, among which the complexity of the hydraulic rams system and the total cost.

Moreover the known systems are not of simple workability and reliability during the coupling.

Aim of the invention

[0005] The aim of this invention is to supply a paver finisher machine comprising a fast coupling system of the screed unit extension sectors for the road paving carried out by self-propelled machines and/or by train, allowing to obtain an easy coupling of the same extension sectors in a reliable way.

Further aim of the invention is to shorten the installation time of the extension sectors.

Concept of the invention

[0006] The aim is reached with the characteristics of the main claim. The sub-claims represent advantageous solutions.

Advantageous effects of the invention

[0007] The solution in accordance with the present invention, by the considerable creative contribution whose effect constitutes an immediate and not-negligible technical progress, presents various advantages.

First of all an easy and fast coupling of the same extension sectors is possible.

Besides this the solution according to the present invention is economic with respect to the prior art techniques. Moreover the solution according to the present invention is applicable also to the existing machines, requiring a minimum amount of changes to these latter.

Description of the drawings

[0008] It is hereinafter described a solution obtained with reference to the included drawings to be considered as a non-limiting example of the present invention in which:

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

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

Fig. 3 schematically shows the coupling of the screed unit of Figure 2 with the tractor of

Figure 1 according to a plan view.

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

Fig. 5 and Fig. 6 schematically show the applying of extensions of the base screed unit.

Fig. 7 is a three-dimensional view schematically showing the female element of the fast coupling system of the screed unit extension sectors according to the present invention.

Fig. 8 is a three-dimensional view schematically showing the male element of the fast coupling system of the screed unit extension sectors according to the present invention.

Fig. 9 and Fig. 10 are three-dimensional views schematically showing the coupling between the male element and the female element of the fast coupling system of the screed unit extension sectors according to the present invention.

Fig. 11 is a side-view schematically showing the connection between the male and the female elements of the fast coupling system of the screed unit extension sectors according to the present invention.

Fig. 12 is a view from the bottom of the female element of the connection system of the fast coupling system of the screed unit extension sectors according to the present invention.

Fig. 13 is a three-dimensional view schematically showing the coupling of the components of the fast coupling system of the screed unit extension sectors according to the present invention.

Description of the invention

[0009] Fig.1 schematically shows a wheeled tractor (13) and includes:

- a hopper (1) for the collection of the material to be spread: 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 size 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 delivering cochlea (4), generally consisting of two independent sections, with the purpose to distribute the material evenly on the screed unit total width (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 Fig. 2, the screed unit (17) includes:

- a fixed length central section (8). The central section (8) generally consists of a first sub-section (30) and of a second sub-section (31) centrally hinged to one another to obtain different screed transverse sections;
- in the case of extensible screed unit (17): one right side section (10) and one left side section (11). The right side (10) and left side (11) sections each have 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 fixed width screed unit (17) there is only the central section (8);
- two end plates (12) retaining the delivered material.

Other known types of screed unit (17) configuration that however do not influence or prejudice in any way the applying of the invention, which may be used for a generic screed unit (17), both extensible and with fixed width are possible.

Referring to Fig. 3, the paver finisher (45) obtained from 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 couple at the tractor's towing points (3).

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

[0010] The screed unit (17) is connected with the towing arms (9) by a pin (14) and a fixing system (15), able to change the angle between the arms and the screed unit (17).

According to prior art, the screed unit (17), is connected by means of articulations (32) only to the tractor's two towing points (3) to have a floating action. Its arrangement is determined by the equilibrium of the forces acting on it: towing force, material frictional resistance, material bearing capacity. The arrangement of the screed unit (17) in equilibrium conditions shows an angle (16) of the bottom plate (23) 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 pre-compact it.

The screed unit (17) is furthermore generally equipped with accessories of known art, as reciprocate motion blades, called tampers (26), having vertical action to facilitate the inserting of the material below the bottom plate

(23), and vibrators (28) to give the screed a good finishing, as well as a heating system (not shown) to avoid the adhering of the material to the bottom plate (23) and to the tamper (26) in the case of hot bituminous conglomerate screed.

During the screed to avoid the material to overflow outside the screed unit (17) width, appropriate retaining end plates (12) are provided. The end plates (12) are used to retain the material distributed by the cochleas in front of the screed unit (17) and to convey the material toward the machine longitudinal axis when the screed width tightens in case of screed unit (17) with extensible sectors.

[0011] As previously considered, when a screed width larger than the main screed (19) base width is required, extension sectors (18) are applied at the ends of the same screed 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.

[0012] The applying of the extension sectors (18), one or more sectors for each side of the main screed (19), as previously explained, generally implies the following operations (Figs. 3, 5, 6, 13) to be carried out both for a fixed width screed unit and for a screed unit with extensible sectors:

- dismantling of the end plates (12) retaining the material distributed by the cochlea (4), which are generally fixed by means of bolts;
- approaching of the extension sector (18) to the end, for example left one, of the left side section (11) of the main screed (19) of the total screed unit (17). In similar way for the right end, approaching of the extension sector (18) to the end of the right side section (10) of the main screed (19) of the total screed unit (17). The extension sector (18) can be discharged from a transport means (not shown) directly on the ground, or on a platform (not shown). If appropriate raising and movement means are not available the same paver finisher (45) carries out the approaching of the total screed unit end (17) to the extension sector (18);
- rough alignment of the extension sector (18) with the end of the total screed unit (17). This manoeuvre is generally made with a pry, until allowing the introduction of the fixing or coupling bolts (25) with the aid of one or more centring pins;
- inserting of the fixing or coupling bolts (25) and slight clamping of the nuts until obtaining the approaching of the extension sector (18) vertical wall with the total screed unit (17) vertical wall;
- manoeuvre of the adjuster elements (22) to obtain the perfect co-planarity of the bottom plate (23) of the extension sector (18) with the bottom plate (23) of the total screed unit (17);
- definitive clamping of the fixing or coupling bolts (25);

- connection of the transmission elements of the tamper (26), typically first Cardan joints, elastic joints, toothed joints (27);
- connection of the transmission elements of the tampers (28), typically second Cardan joints, elastic joints, toothed joints (29).

Obviously the aforementioned operations should be repeated for each extension sector (18) to be mounted and their laboriousness is evident above all in relation to the approach of the extension sector (18) to the screed unit and thinking of the considerable weight of these extension sectors (18) that does not allow their easy handling.

[0013] The object of the invention consists in a system essentially consisting of two blocks (Figs. 7, 12, 8) which make up a coupling:

- a male element (21) preferably (Fig. 8) of frustum conical shape (21), whose end (34), with an area minor than the corresponding base (33), is fixed to the external vertical wall of a fixed width screed unit, or to the equivalent and corresponding wall of the movable sector of an extensible unit;
- a female element (20) able to house the male element (21) and made up (Figs. 7, 12) of two elements opportunely shaped to get in contact with the surface of said male element (21) with limited clearance.

The female element (20) is mounted on the internal vertical wall of the extension sector (18), and the female element (20) has an opportunely flared profile downwardly. The male element (21) is also mounted on the outer wall of the extension sector (18) to allow the coupling of other extension sectors (18), or of the end plate (12) as conclusion of the arrangement.

Figs. 9, 10, 11 show the coupling in detail:

- a) in the pre-approaching step of the screed unit (17) to the extension sector (18), the screed unit (17) is kept in a lower position with respect to the extension sector (18), namely the male element (21) is kept in a lower position with respect to the female element (20);
- b) with the male element (21) approached to the seat (36) of the female element (20) and before (Fig. 9) of the screed unit (17) raising;
- c) with the male element (21) completely inserted (Fig. 10) in the seat (36) of the female element (20) following the raising of the screed unit (17);
- d) the clearance "p" (Fig. 11) allows the total disengaging of the male element (21) from the seat (36) of the female element (20) after the adjustment of the adjusters (22) for the co-planarity of the sliding plates (23) and the definitive clamping of the fixing or coupling bolts (25).

What described hereinafter applies for both sides of the screed unit (17), namely both for the right side section

(10) and for the left side section (11).

The extension sector (18) is discharged from the transport means and left slightly lifted from the ground, for instance laid on wooden blocks. The paver finisher (45) approaches the end of its own screed unit (17) to the inside vertical wall of the extension sector (18); the operation does not require any excessive positioning precision and is facilitated by the machine manoeuvrability and by the same screed unit (17) hydraulic movement.

Referring to Fig. 13, the end of the screed unit (17), possibly already coupled with other extension sectors (18), is arranged below the extension sector (18) to be mounted, so that the male element (21) can be inserted in the seat (36) of the female element (20) from the bottom to upwards. The following raising of the screed unit (17) causes the complete inserting of the male element (21) in the seat (36) of the female element (20) and holds the extension sector (18) approached to the screed unit (17). The positioning of the female and male elements (21) (20) is made so that in the end of stroke position the bottom plate (23) of the extension sector (18) is opportunely placed slightly below the plane of the bottom plate (23) of the screed unit (17) or more precisely of the main screed (19), and well aligned with it in the machine advancing direction (46). By means of suitable adjusters (22) the co-planarity of the bottom plates (23) of the total screed unit (17) is successively obtained and the coupling bolts (25) are therefore mounted by being completely clamped. The operations for adjusting the adjusters (22) and for clamping the coupling bolts (25) slightly unyoke the male element (21) from the seat (36) of the female element (20), preventing the reciprocal transmission of any stress.

In general, it is not necessary that the female element (20) has an opportunely downwardly flared profile, but may have simply a trapezoidal-shaped section suitable for the inserting and guiding of the male element (21).

In general, therefore, according to what previously described, the present invention relates to a coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12) on screed unit (17) with bottom plates (23) for paver finisher (45) using fastening and clamping means with screws/bolts (25) in fixing holes (42), in which alignment and misaligning means of a unit to be connected (12, 18, 19) with respect to the other unit to be connected (12, 18, 19) with a movement with respect to the alignment axis are provided. The alignment axis is the one according to which the support bases of the different component elements are reciprocally aligned, except for the possible deformations of the profile caused by the wearing; it is also necessary to observe that, in general, being the support bases inclined with respect to the ground, the alignment axis will be the one corresponding to the alignment of the support bases of the different component elements according to the desired operative inclination with respect to the ground. The alignment and misaligning means are associated/associable to an undercut coupling means

(24). For example, in addition to the shown configuration, it may be provided that the female element (20) is made up of a couple of L-shaped plates welded on the wall thus defining an essentially quadrangular inserting seat of the male element (21).

[0014] The system provides the following operative steps:

- misaligning of the two units to connect (12, 18, 19);
- head approach of the two units to connect (12, 18, 19);
- transverse movement of a unit (12, 18, 19) with respect to the other unit (12, 18, 19) obtaining the coupling of the coupling means (24) and the alignment;
- locking by the fixing and clamping means with screws/bolts (25) of the two units to connect (12, 18, 19) to form an aligned single body.

Preferably the undercut coupling means (24) is a dovetailed coupling means, because this configuration allows an effective coupling and alignment of the two elements. In general, as previously observed, it is not necessary for the coupling means to have the shown configuration with the female element (20) "funnel"-like shaped. In fact it could also have a rectilinear configuration, however obtaining a considerable part of the advantages offered by the present invention. The configuration in which the female element (20) is configured "funnel"-like, however represents a preferred form because a better guide function of the corresponding male element (21), namely a better guide function in the coupling step of the units to be coupled is obtained.

The alignment and misaligning means of a unit to connect (12, 18, 19) with respect to the other unit to connect (12, 18, 19) can consist of means of regulation/adjustment/ (22) of the reciprocal position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of one of said units to be coupled (12, 18, 19) with respect to the other of said units to be coupled (12, 18, 19). For example they may be the adjusters (22) usually used for such adjusting, or may also be external adjusting means or other equivalent means. In the preferred solution of the present invention they are in general the regulation/adjustment means (22) of the reciprocal position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of one of said units to connect (12, 18, 19) with respect to the other of said units to connect (12, 18, 19) and the coupling operation is made by means of:

- variation of the reciprocal position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of the two units to connect (12, 18, 19) determining a reciprocal misaligning of a unit to connect (12, 18, 19) with respect to the other unit to connect (12, 18, 19);
- head approach of the two units to connect (12, 18, 19);

- reciprocal adjusting position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of the two units to connect (12, 18, 19) until the coupling of the coupling means (24) is reached;
- reciprocal position adjusting in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of the two units to connect (12, 18, 19) until the reaching of the alignment of the support bases (23) of said two units to connect (12, 18, 19);
- inserting of the fixing and clamping means with screws/bolts (25) and locking of the two units to connect (12, 18, 19) in a single body.

In this specific case of the preferred embodiment of the present invention, the transverse movement of a unit (12, 18, 19) with respect to the other unit (12, 18, 19) corresponds to a coupling of the coupling means (24) and the alignment is made by means of:

coupling movement of a unit (12, 18, 19) with respect to the other unit (12, 18, 19) with coupling of the coupling means (24) until stroke end of the coupling movement and with raising of the unit that is coupled by the coupling unit that is moved in coupling; for example this condition can be obtained with the configuration of the female element as shown with the previously described "funnel" configuration, but also with the previously described and generic undercut configuration in which the upper end of the undercut configuration is closed by a backing plate, which causes the raising of the coupled unit;

- alignment of a unit to connect (12, 18, 19) with respect to the other unit to connect (12, 18, 19) by using means of regulation/adjustment (22) of the reciprocal position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of one of said unit to connect (12, 18, 19) with respect to the other of said units to connect (12, 18, 19). This alignment will happen, for example, by means of adjusters (22) that also allow to obtain the desired inclination with respect to the ground of the coupled unit with respect to the inclination of the coupling unit and with respect also to the wearing conditions of the bottom plates (12) of the two units.

In general, the fixing holes (42) have a greater dimension than the dimension in section of said fixing and clamping means with screws/bolts (25), in order to allow the reciprocal adjusting position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of the two units to connect (12, 18, 19) until the alignment of the support bases (23) of the

two units to connect (12, 18, 19), keeping in consideration also the wearing conditions of the bottom plates (12) of the two units is reached.

[0015] More in detail, the fixing holes (42) are a substantially-vertical developed slot. Also the slot allows, therefore, the reciprocal adjusting position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of the two units to connect (12, 18, 19) until the alignment of the support bases (23) of the two units to connect (12, 18, 19), keeping in consideration also the wearing conditions of the bottom plates (12) of the two units is reached.

Relative to the means of regulation/adjustment (22) of the reciprocal position in height and in transverse reciprocal inclination with respect to the advancing direction of the machine (46) of a unit to connect (12, 18, 19) with respect to the other unit to connect (12, 18, 19), as previously observed, the coupling of the coupling means (24) occurs up to an end-stroke condition of the same coupling movement. Preferably this condition corresponds to a condition in which the unit to connect that is coupled (12, 18, 19) is in a lower position with respect to the alignment position with the corresponding coupling unit. As coupling unit one intends the unit on which the extension sector is coupled (18), or the end plate (12), while as coupled unit one intends the main screed (19) or a previously coupled first extension sector (18) and to which an additional extension second sector (18) or an end plate (12) should be coupled. The unit that is coupled (12, 18, 19) is endowed with such means of regulation/adjustment (22) of the reciprocal position in height and in transverse reciprocal inclination with respect to the machine (46) advancing direction of a unit to connect (12, 18, 19) with respect to the other unit to connect (12, 18, 19). In one embodiment the means of regulation/adjustment (22) are a couple of screws whose end acts in pushing on a backing zone (47) of the frame of the coupling unit. A screw is a front screw placed on the unit to connect (12, 18, 19) at the front with respect to the advancing direction of (46) of the machine, while the other screw is a back screw placed on the unit to connect (12, 18, 19) rearward with respect to the advancing direction (46) of the machine. In this way, the screwing action of the screws initially involves the entry in abutment of the end of the screws with the corresponding backing zones (47) of the frame of the coupling unit. The additional screwing of the front screw corresponds to a raising of the forepart of the unit to connect (12, 18, 19) and to a possible inclination of the unit to connect (12, 18, 19) with respect to the coupling unit. The additional screwing of the back screw corresponds to a raising of the back part of the unit to connect (12, 18, 19) and to a possible inclination of the unit to connect (12, 18, 19) with respect to the coupling unit. The successive screwing action on the two back and front screws involves the progressive alignment of the unit to connect (12, 18, 19) with the coupling unit.

[0016] The present invention relates to, in general, also a screed unit (17) for paver finisher, of the type compris-

ing a main screed (19), end plates (12) and reciprocally lineable extension sectors (18) by means of adjusters (22) and reciprocally fixable by means of screws/bolts (25) and fixing holes (42), of the type in which the main screed (19), the end plates (12) and the extension sectors (18) are reciprocally couplable and lineable by means of a coupling means (24) operating according to the previously described coupling system. The coupling means (24) consists of:

- a male element (21), shaped with a base (33) and a reciprocally spaced end (34) and connected by a inclined side (35). The base (33) will have, in virtue of the presence of the inclined side (35), a superficial area greater than the superficial area of the end (34) of said male element (21), but in general, for example in the case of a generic undercut coupling, the base (33) and the end (34) can also have the same area;
- a female element (20), comprising a seat (36) having a trapezoidal-shaped section delimited by inclined sides (41) according to an inclination angle corresponding to the inclination angle of said inclined sides (35) of said male element (21), the longitudinal development of said inclined sides (41) constituting a couple of guiding surfaces (37) of said male element (21) within said seat (36); it will be evident that as trapezoidal-shaped one intends to include also the quadrangular limit configuration, corresponding, for example to the previously described undercut coupling. As a result the expressions "trapezoidal-shaped configuration" and "trapezoidal" as here used must be intended as also including such limit condition.

About the reciprocal fixing of male element (21) and female element (20), one of the male element (21) and female element (20) is fixed in correspondence with at least one of the side-walls of the screed unit (17), namely in particular in correspondence with the main screed (19), while the other of said male element (21) and female element (20) is fixed in correspondence with at least one of the side-walls of the extension sector (18).

[0017] It will be obvious that, though the preferred solution of the present invention provides that the male element (21) is fixed on the main screed (19) or coupling unit and the female element (20) is fixed on the extension sector (18) or coupled unit, it is also possible to reverse this configuration providing that the female element (20) is fixed on the main screed (19) or coupling unit and the male element (21) is fixed on the extension sector (18) or coupled unit. Equally it may be also be provided that the female element (20) is rotated of a certain angle with respect to the shown vertical direction, up to be also rotated of 180 degrees with respect to the shown configuration, both in the case of fixing of the female element (20) on the main screed (19), and in the case of fixing of the female element (20) on the extension sector (18).

In general, therefore, the male element (21) is fixed on

the coupling unit and the female element (20) is fixed on the coupled unit; the coupling unit will be selected from the group consisting of main screed (19) and extension sectors (18), while the coupled unit will be selected from the group consisting of extension sectors (18), end plates (12), because, as previously observed, the coupling means (24) is applicable not only in the coupling between main screed (19) and extension sector (18), but also between two adjacent extension sectors (18) and between an extension sector (18) and an end plate (12).

In particular, with regard to the coupling between two extension sectors (18), a first extension sector (18) includes, on the side-wall opposite with respect to the wall on which there is the coupling element relative to the possible coupling with a previous unit, for example main screed or another extension sector (18), an additional coupling element selected from the group consisting of male element (21) and female element (20). An additional second extension sector (18) will include in correspondence with the side-wall suitable to connect with the side-wall of such first extension sector (18) the other one of the coupling elements selected from the group consisting of male element (21) and female element (20). Finally, the inserting of the male element (21) within the seat (36) of the female element (20) will happen according to the direction corresponding to the longitudinal development of the inclined sides (41) and the condition of reciprocal engaging of the male element (21) and of the female element (20) will correspond to a combined condition and pre-alignment of the side-wall of the first extension sector (18) with the corresponding side-wall of the second extension sector (18).

In particular, with regard to the coupling between an end plate (12) and an extension sector (18), the screed unit (17) will include at least one end plate (12) in correspondence with at least one end of the screed unit (17). In this context as screed unit (17) one intends in general the main screed (19) if necessary including one or more extension sectors (18). The end plate (12) will include a coupling element selected from the group consisting of male element (21) and female element (20) connecting with the other element selected from the group consisting of male element (21) and female element (20) present in correspondence with the end of the screed unit (17) suitable to connect with the end plate (12).

In general, the essential characteristic is that the inserting of the male element (21) within the seat (36) of the female element (20) occurs according to the direction corresponding to the longitudinal development of the inclined sides (41), the condition of reciprocal engaging of male element (21) and female element (20) corresponding to an approaching and pre-alignment condition of the side-wall of the screed unit (17) with the corresponding said side-wall of said extension sector (18).

[0018] In the preferred form of embodiment the seat (36) of the female element (20) has a varying section according to one vertical direction (39). The seat (36) has a trapezoidal-shaped section, and the inclined sides (41)

of said trapezium progressively approach one another reciprocally in the sequence of sections of the seat (36) taken along the vertical direction (39). Namely the seat (36) is delimited by two guide surfaces (37) reciprocally diverging according to the vertical direction (39) and reciprocally diverging with respect to an orthogonal horizontal direction (40) with respect to the vertical direction (39) and facing the support (38) on which the projections including the guide surfaces (37) are present.

It will be evident that in general it will be only necessary that the inclined sides (41) of the female element (20) and the sides (35) of the male element (21) have a corresponding shape. Thus, in general, the inclined side (35) of the male element (21) and the inclined side (41) of the female element (20) can have, for example, a reciprocally corresponding curvilinear development, or a reciprocally corresponding linear development.

Preferably said base (33) and the end (34) of the male element (21) are circular, and the male element (21) has a frustum conical shape.

As previously observed, moreover, the seat (36) of the female element (20) can have a greater depth than the thickness of the male element (21). The reciprocal engaging of the male element (21) and of the female element (20) occurs with a clearance (p). When the clamping of the coupling bolts (25) occurs there is the spacing of the male element (21) with respect to the female element (20) within the seat (36). Such spacing, in general, will have a distance not lower than the clearance (p). The operations of the adjusters (22) adjusting and of the coupling bolts (25) clamping, therefore, slightly disengage the male element (21) from the seat (36), preventing the reciprocal transmission of any stress.

In general it will be only necessary that the inclined side (35) of the male element (21) and the inclined side (41) of the female element (20) have a reciprocally corresponding development.

[0019] In the preferred form of execution of the present invention the base (33) and the end (34) of the male element (21) are circular and connected by a linear development surface in section, namely the male element (21) has a frustum conical shape.

Finally, the seat (36) of the female element (20) will preferably have a greater depth than the thickness of the male element (21). The reciprocal engaging of male element (21) and female element (20) will occur with a clearance (p) and the clamping of the screws/bolts (25) will cause, the spacing of the male element (21) with respect to the female element (20) within the seat (36) of a distance not much minor than said clearance (p).

Finally the present invention also relates to a paver finisher (45) of the type comprising a tractor (13) and a screed unit (17) in which:

- the screed unit (17) for paver finisher is of the type comprising a main screed (19), end plates (12) and reciprocally lineable extension sectors (18) by means of adjusters (22) and reciprocally fixable by

means of screws/bolts (25) and fixing holes (42), of the type in which at least one pair among said main screed (19), said end plates (12) and said extension sectors (18) is reciprocally coupleable and lineable by means of a coupling means (24) operating according to the previously described coupling system.

- the screed unit (17) is of the previously described type.

[0020] The description of the present invention has been made with reference to enclosed figures in a preferred form of execution of the same, but it is evident that many possible alterations, changes 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, changes and variants in accordance with the appended claims.

Used nomenclature

[0021] With reference to the identification numbers reported in the enclosed figures, the following nomenclature was used:

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. Angle between bottom plate and ground

17. Screed unit
18. Extension sector
- 5 19. Main screed
20. Female element
21. Male element
- 10 22. Adjusters
23. Bottom plate
- 15 24. Coupling system or means
25. Coupling bolts
26. Tamper
- 20 27. First Cardan joints, elastic joints, toothed joints
28. Vibrators
- 25 29. Second Cardan joints, elastic joints, toothed joints
30. First sub-section
31. Second sub-section
- 30 32. Articulation
33. Base
- 35 34. End
35. Side
36. Seat
- 40 37. Guide surface
38. Support
- 45 39. Vertical direction
40. Horizontal direction
41. Inclined Side
- 50 42. Fixing holes
43. Extension first sector
- 55 44. Second extension sector
45. Paver finisher

46. Machine advancing direction
47. Backing zone
- p. Clearance between female and male element 5

Claims

1. Screed unit (17) for paver finisher, of the type comprising a main screed (19), end plates (12) and extension sectors (18) which can be reciprocally aligned by means of adjusters (22) and which can be reciprocally coupled by means of screws/bolts (25) and fixing holes (42), of the type in which said main screed (19), said end plates (12) and said extension sectors (18) can be reciprocally coupled and aligned by means of a coupling means (24) operating according to a coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12) on screed unit (17) provided with bottom-plates (23) for paver finisher (45) of the type using fixing and clamping means with said screws/bolts (25) in said fixing holes (42), in which alignment and disalignment means are provided of one unit to be coupled (12, 18, 19) with respect to the other unit to be coupled (12, 18, 19) with a movement with respect to the alignment axis, said alignment and disalignment means being linked/linkable to an undercut coupling means (24) in which the following operative steps are provided:
 - disaligning said two units to be coupled (12, 18, 19);
 - head approaching said two units to be coupled (12, 18, 19);
 - transverse movement of one unit (12, 18, 19) with respect to the other unit (12, 18, 19) obtaining the coupling of said coupling means (24) and the alignment;

locking, by means of said fixing and clamping means with screws/bolts (25), said two units to be coupled (12, 18, 19) forming an aligned single body, **characterised in that** said coupling means (24) consists of:

 - a male element (21), shaped with a base (33) and an end (34) which are reciprocally spaced and connected by an inclined side (35), said base (33) having a surface-area which is greater than or equal to the surface-area of said end (34) of said male element (21);
 - a female element (20), comprising a seat (36) having a trapezoidal shaped section which is delimited by inclined sides (41) according to an inclination
 - angle corresponding to the inclination angle of said inclined sides (35) of said male element

(21), the longitudinal development of said inclined sides (41) forming a couple of guiding surfaces (37) of said male element (21) within said seat (36);

one of said male element (21) and female element (20) being fixed in correspondence with at least one of the side-walls of said screed unit (17), the other one of said male element (21) and female element (20) being fixed in correspondence with at least one of the side-walls of said extension sector (18), the insertion of said male element (21) within said seat (36) of said female element (20) occurring according to the direction corresponding to the longitudinal development of said inclined sides (41), the reciprocal engagement condition of said male element (21) and said female element (20) corresponding to an approaching and preliminary-alignment condition of said side-wall of said screed unit (17) with said corresponding side-wall of said extension sector (18).

2. Screed unit (17) for paver finisher according to the previous claim **characterised in that** in said coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12), said undercut coupling means (24) is a dovetail coupling means.
3. Screed unit (17) for paver finisher according to any of the previous claims 1 to 2 **characterised in that** in said coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12), said alignment and disalignment means of one unit to be coupled (12, 18, 19) with respect to the other unit to be coupled (12, 18, 19) consist of regulation/adjustment means (22) of the reciprocal position in height and of the reciprocal transverse inclination with respect to the machine advancing direction (46) of one of said units to be coupled (12, 18, 19) with respect to the other of said units to be coupled (12, 18, 19) in which the coupling operation occurs by means of:
 - varying the reciprocal position in height and the reciprocal transverse inclination with respect to the machine advancing direction (46) of said two units to be coupled (12, 18, 19) causing a reciprocal disalignment of one unit to be coupled (12, 18, 19) with respect to the other unit to be coupled (12, 18, 19);
 - head approaching said two units to be coupled (12, 18, 19);
 - adjusting the reciprocal position in height and the reciprocal transverse inclination with respect to the machine advancing direction (46) of said two units to be coupled (12, 18, 19) until the coupling of said coupling means (24) is obtained;
 - adjusting the reciprocal position in height and

- the reciprocal transverse inclination with respect to the machine advancing direction (46) of said two units to be coupled (12, 18, 19) until the alignment is obtained of the support base plates (23) of said two units to be coupled (12, 18, 19);
 - inserting said fixing and clamping means with screws/bolts (25) and locking said two units to be coupled (12, 18, 19) in a single body.
4. Screed unit (17) for paver finisher according to any of the previous claims 1 to 2 **characterised in that** in said coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12), the transverse movement of one unit (12, 18, 19) with respect to the other unit (12, 18, 19) corresponds to a coupling of said coupling means (24) and the alignment occurs by means of:
- coupling movement of one unit (12, 18, 19) with respect to the other unit (12, 18, 19) with coupling action of said coupling means (24) until the end of stroke of said coupling movement and with a lifting action of the unit which has to be coupled by the coupling unit which is moved for the coupling;
 - alignment of one unit to be coupled (12, 18, 19) with respect to the other unit to be coupled (12, 18, 19) by means of regulation/adjustment means (22) of the reciprocal position in height and the reciprocal transverse inclination with respect to the machine advancing direction (46) of one of said units to be coupled (12, 18, 19) with respect to the other of said units to be coupled (12, 18, 19).
5. Screed unit (17) for paver finisher according to the previous claim **characterised in that** in said coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12), said coupling action of said coupling means (24) until the end of stroke of said coupling movement corresponds to a condition in which said unit to be coupled which has to be coupled (12, 18, 19) is placed in a lower position with respect to the alignment position with said coupling unit, said unit which has to be coupled (12, 18, 19) being provided with said regulation/adjustment means (22) of the reciprocal position in height and the reciprocal transverse inclination with respect to the machine advancing direction (46) of one of said units to be coupled (12, 18, 19) with respect to the other of said units to be coupled (12, 18, 19), said regulation/adjustment means (22) being a couple of screws whose end operates pushing on a striker zone (47) of the frame of said coupling unit, one of said screws being a front screw which is located on said unit to be coupled (12, 18, 19) in a frontal position with respect to
- the machine advancing direction (46), the other one of said screws being a rear screw which is located on said unit to be coupled (12, 18, 19) in a rear position with respect to the machine advancing direction (46), the screwing action of said screws initially causing the abutment condition of the end of said screws with the corresponding striker zones (47) of the frame of said coupling unit, the further screwing action of said front screw corresponding to a raising of the frontal part of said unit to be coupled (12, 18, 19) and to a possible inclination of said unit to be coupled (12, 18, 19) with respect to said coupling unit, the further screwing action of said rear screw corresponding to a raising of the rear part of said unit to be coupled (12, 18, 19) and to a possible inclination of said unit to be coupled (12, 18, 19) with respect to said coupling unit, the subsequent screwing action on said two front and rear screws causing the progressive alignment of said unit to be coupled (12, 18, 19) with said coupling unit.
6. Screed unit (17) for paver finisher according to any of the previous claims 1 to 5 **characterised in that** in said coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12), said fixing holes (42) have a dimension which is greater than the dimension in section of said fixing and clamping means with screws/bolts (25), said greater dimension of said fixing holes (42) allowing the adjustment of the reciprocal position in height and the reciprocal transverse inclination with respect to the machine advancing direction (46) of said two units to be coupled (12, 18, 19) until the alignment is obtained of the support base plates (23) of said two units to be coupled (12, 18, 19).
7. Screed unit (17) for paver finisher according to any of the previous claims 1 to 6 **characterised in that** in said coupling system for two units selected from the group consisting of main screed (19), extension sectors (18), end plates (12), said fixing holes (42) are slots having a substantially vertical development, said slots allowing the adjustment of the reciprocal position in height and the reciprocal transverse inclination with respect to the machine advancing direction (46) of said two units to be coupled (12, 18, 19) until the alignment is obtained of the support base plates (23) of said two units to be coupled (12, 18, 19).
8. Screed unit (17) for paver finisher according to any of the previous claims 1 to 7 **characterised in that** a first extension sector (18) includes, on the opposite side-wall with respect to the side-wall on which there is the coupling element relative to the possible coupling with a previous unit, an additional coupling element selected from the group consisting of said

male element (21) and said female element (20), a further second extension sector (18) comprising the other of said coupling elements selected from the group consisting of said male element (21) and said female element (20) at the side-wall intended to be coupled with the side-wall of said first extension sector (18), the insertion of said male element (21) within said seat (36) of said female element (20) occurring according to the direction corresponding to the longitudinal development of said inclined sides (41), the reciprocal engagement condition of said male element (21) and said female element (20) corresponding to an approaching and preliminary-alignment condition of said side-wall of said first extension sector (18) with said corresponding side-wall of said second extension sector (18).

9. Screed unit (17) for paver finisher according to any of the previous claims 1 to 8 **characterised in that** it further includes at least one end plate (12) in correspondence with at least one end of said screed unit (17), said end plate comprising a coupling element selected from the group consisting of said male element (21) and said female element (20) coupling with the other element selected from the group consisting of said male element (21) and said female element (20) which is present in correspondence of said end of said screed unit (17).
10. Screed unit (17) for paver finisher according to any of the previous claims 1 to 9 **characterised in that** said seat (36) of said female element (20) has a variable cross-section according to a vertical direction (39), said seat (36) having a trapezoidal shaped section, the inclined sides (41) of said trapezoidal shape progressively reciprocally approaching in the sequence of sections of said seat (36) taken along said vertical direction (39), said seat (36) being delimited by two guiding surfaces (37) which are reciprocally diverging surfaces with respect to said vertical direction (39) and which are reciprocally diverging surfaces with respect to a horizontal direction (40) which is orthogonal with respect to the vertical direction (39) and oriented towards a support (38) on which there are the projections including said guiding surfaces (37).
11. Screed unit (17) for paver finisher according to any of the previous claims 1 to 10 **characterised in that** said male element (21) is fixed on the coupling unit and the female element (20) is fixed on the coupled unit, said coupling unit being selected from the group consisting of main screed (19) and extension sectors (18), said coupled unit being selected from the group consisting of extension sectors (18), end plates (12).
12. Screed unit (17) for paver finisher according to any of the previous claims 1 to 11 **characterised in that**

said inclined side (35) of said male element (21) and said inclined side (41) of said female element (20) have a reciprocally corresponding curvilinear shape-development.

13. Screed unit (17) for paver finisher according to any of the previous claims 1 to 12 **characterised in that** said inclined side (35) of said male element (21) and said inclined side (41) of said female element (20) have a reciprocally corresponding shape-development.
14. Screed unit (17) for paver finisher according to any of the previous claims 1 to 13 **characterised in that** said base (33) and said end (34) of said male element (21) are circularly shaped and they are connected by a surface having linear shape-development in section, said male element (21) having a frusto-conical shape.
15. Screed unit (17) for paver finisher according to any of the previous claims 1 to 14 **characterised in that** said seat (36) of said female element (20) has a depth which is greater than the thickness of said male element (21), the reciprocal engaging of said male element (21) and said female element (20) occurring with a clearance (p), the clamping action of said screws/bolts (25) causing the spacing of said male element (21) with respect to said female element (20) within said seat (36) by a distance which is greater than zero and lower than said clearance (p).
16. Paver finisher (45) of the type comprising a tractor (13) and a screed unit (17) **characterised in that** said screed unit (17) being of the type according to any of the previous claims 1 to 15.

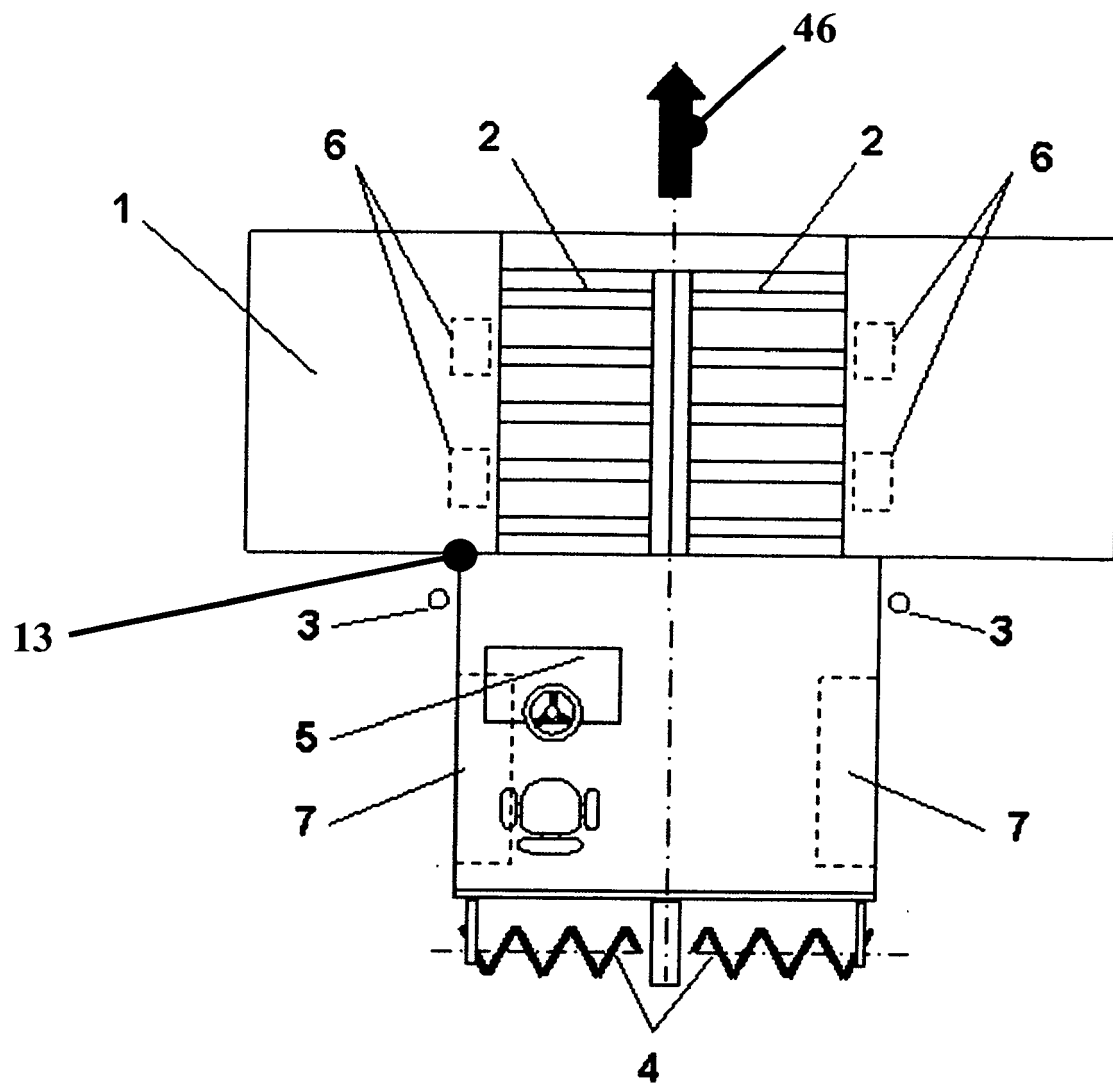


Fig. 1

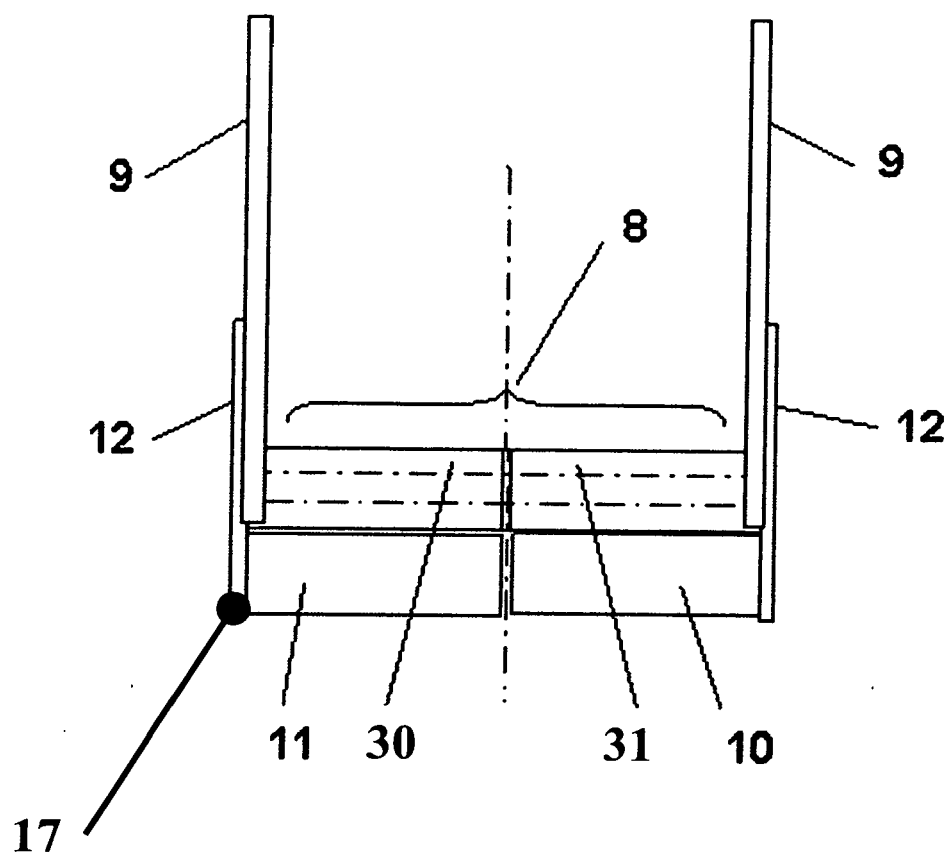


Fig. 2

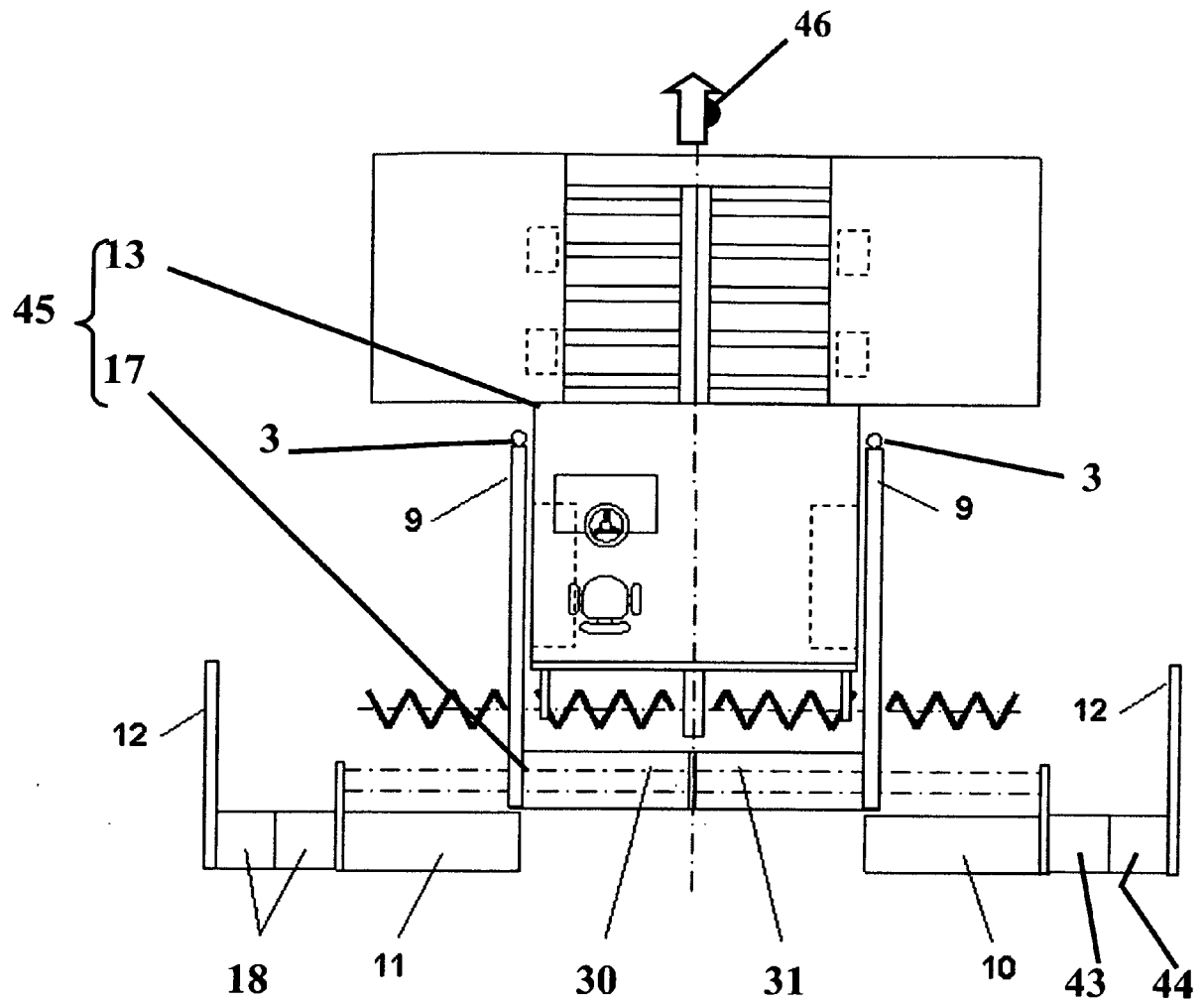


Fig. 3

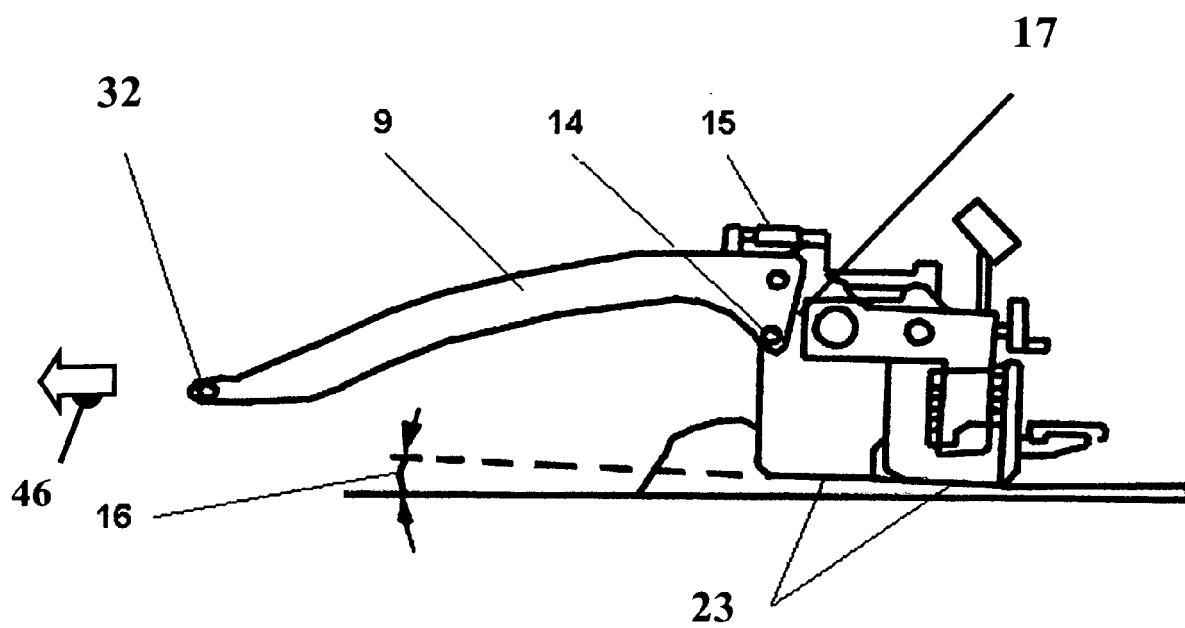


Fig. 4

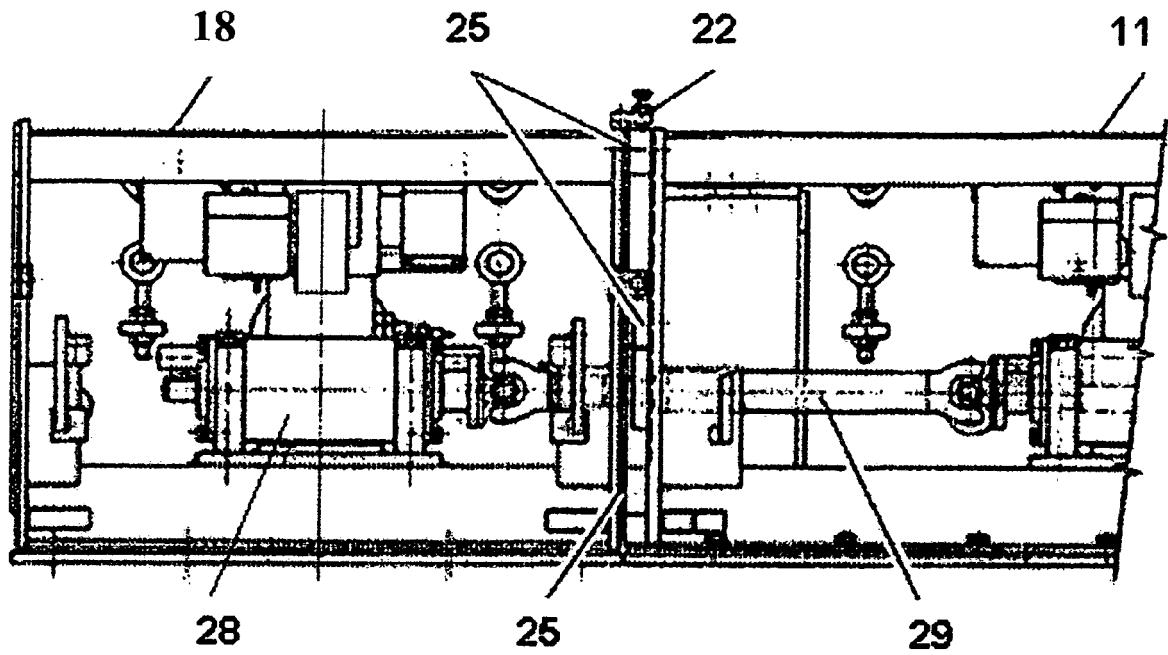


Fig. 5

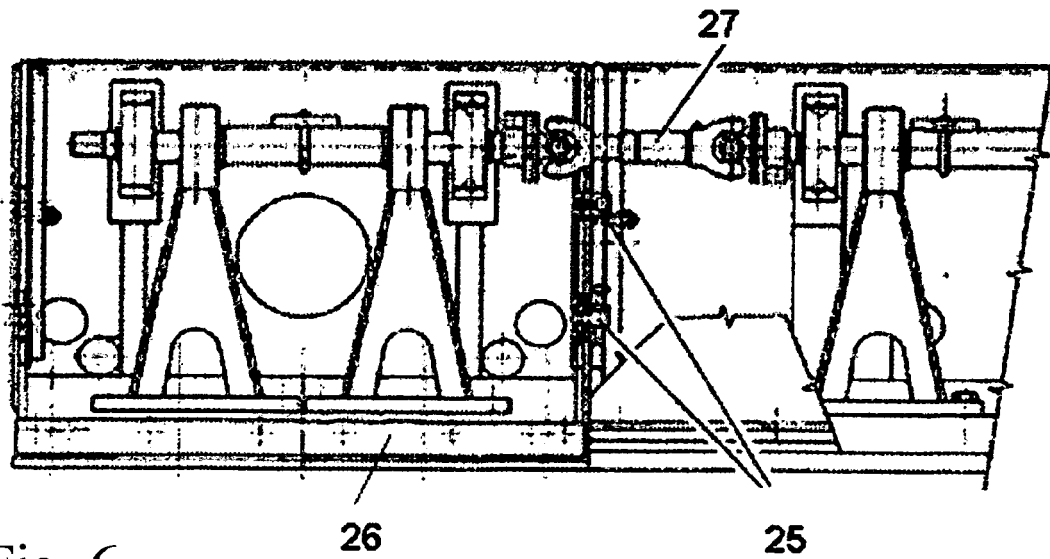


Fig. 6

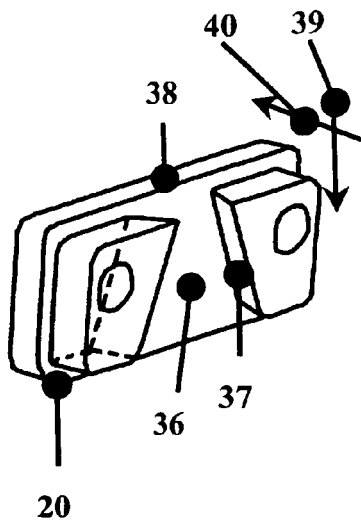


Fig. 7

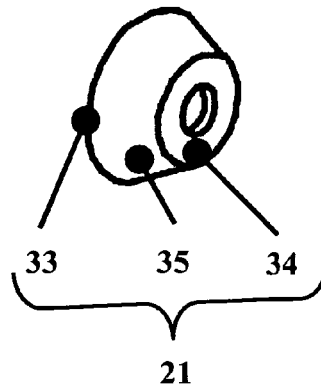


Fig. 8

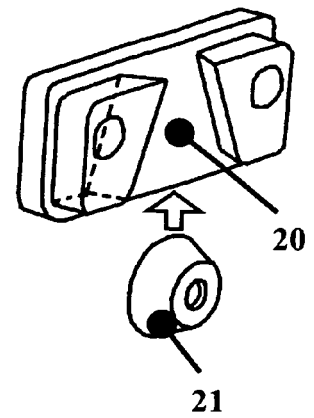


Fig. 9

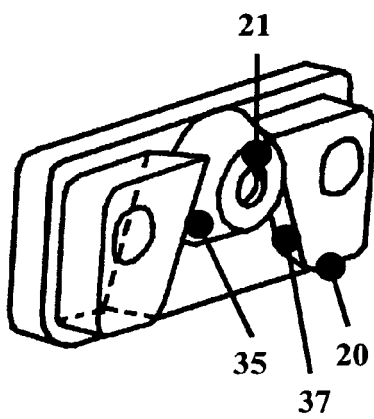


Fig. 10

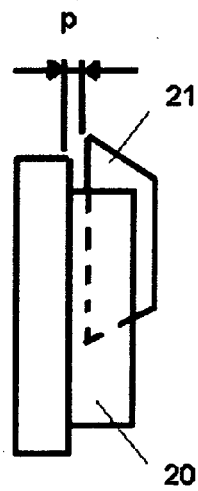


Fig. 11

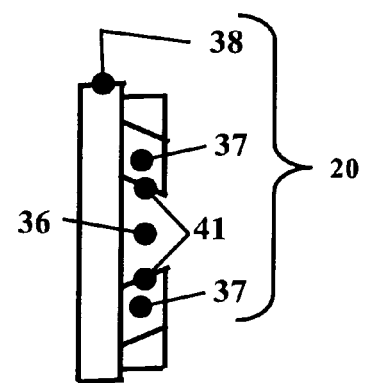


Fig. 12

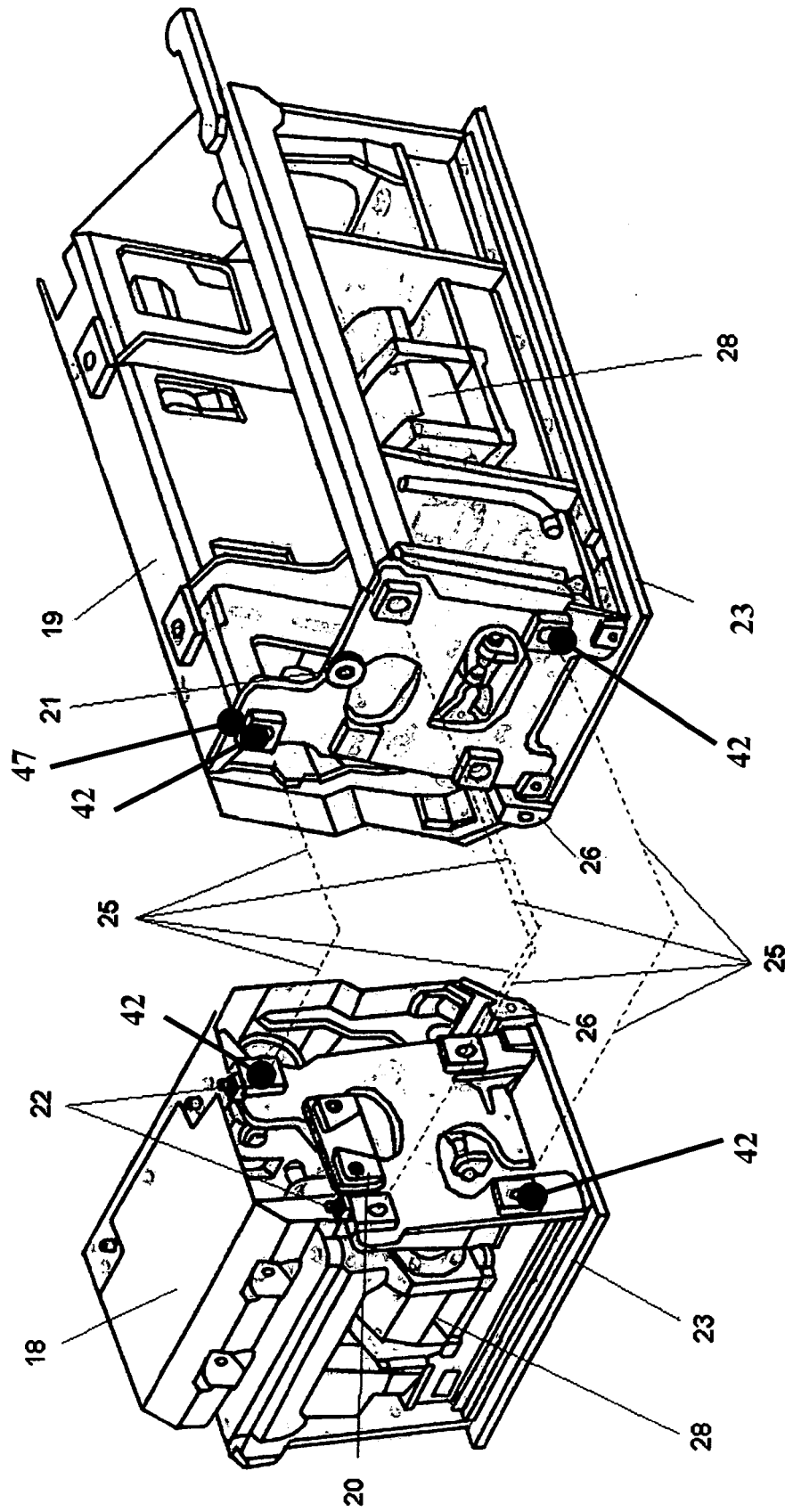


Fig. 13

REFERENCES CITED IN THE DESCRIPTION

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