



(11)

EP 3 550 075 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.10.2019 Bulletin 2019/41

(51) Int Cl.:
E01C 19/48^(2006.01)

(21) Application number: **18000318.8**

(22) Date of filing: **03.04.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

- **Schmidt, Eric**
DE-07937 Zeulenroda-Triebes (DE)
- **Baioni, Marco**
IT-48012 Glorie di Bagnocavallo RA (IT)
- **Stein, Peter**
DE-56291 Leiningen (DE)
- **Laugwitz, Niels**
DE-56112 Lahnstein (DE)

(71) Applicant: **BOMAG GmbH**
56154 Boppard (DE)

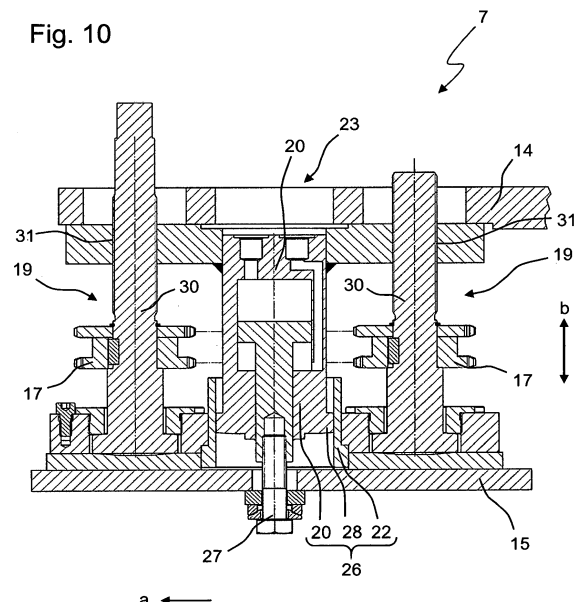
(74) Representative: **Heidler, Philipp**
Lang & Tomerius
Patentanwaltspartnerschaft mbB
Rosa-Bavarese-Strasse 5
80639 München (DE)

(72) Inventors:
• **Heusinger, Jürgen**
DE-56072 Koblenz (DE)

(54) **PAVING SCREED WITH A LOCKING DEVICE AND ROAD PAVER WITH SUCH A PAVING SCREED**

(57) Paving screed (7) for a road paver (1), comprising an upper frame (14), a lower frame (15) mounted on the upper frame (14) in a height-adjustable manner, a linear actuator configured to adjust the lower frame (15) vis-à-vis the upper frame (14) in a vertical direction, a height-adjustment drive (16) configured to drive the linear actuator, and a locking device (23) configured to immobilize the lower frame (15) in its position relative to the upper frame (14), wherein the locking device (23) is connected to the upper frame (14) and the lower frame (15) and comprises an essentially vertically oriented hydraulic cylinder (20) configured to exert a clamping force at least partially parallel to the direction of adjustment of the linear actuator on the latter so that a frictional connection is created in the linear actuator, which prevents an adjustment of the linear actuator.

Fig. 10



Description

[0001] The invention relates to a paving screed for a road paver. Moreover, the invention relates to a road paver with such a paving screed.

[0002] Road pavers are used in the construction of roads, squares as well as e.g. airfield runways. The road pavers in question are usually self-propelled construction machines that are used for producing carriage surfaces of paving material, e.g. asphalt, concrete or the like, and paving the same on site. The paving material is delivered by truck and loaded into a receptacle on the front side of the road paver. From here the paving material is transported by means of a suitable longitudinal conveying device to the rear end of the paver. The road pavers move forward in a working direction while distributing the paving material by means of a lateral conveying device connected to the longitudinal conveying device, viewed in the working direction, over the entire paving width. Usually, a paving screed is connected to the rest of the road paver via towing arms. The often heated paving screed can have e.g. a smoothing plate with which the paving material is smoothed. Moreover, the paving screed typically also has tamping bars that effect a compaction of the paving material. The main function of the paving screed of a road paver is thus the even distribution, the smoothing and the pre-compaction of the paving material during a paving operation in a floating manner over the paving material.

[0003] In order to achieve different working widths, e.g. add-on screeds can be mounted on the basic screed as segments in order to extend the basic screed by the width of the add-on screed. Moreover, so-called extendable screeds, the working width of which can be dynamically modified during operation, are also known. Combinations of add-on screeds and extendable screeds are also possible when the width of the outer add-on segments can also be modified dynamically during operation. These dynamically extendable screeds typically consist of two screed parts, one movable part positioned behind one fixed basic part, in order to realize the change of width by moving the first in lateral direction in relation to the fixed part. An important aspect here is that all screed segments ideally smooth the paving material at a uniform height, at least in adjacent areas, as otherwise unevenness can occur in the resulting carriage base at the area of transition between the segments. The paving screeds, in particular the basic screeds, of the road pavers typically are connected with e.g. the tractor of the road paver via towing arms and are towed by these during paving operation. The movable screed parts typically have an upper and a lower frame. The upper frame is connected to the basic frames by means of a guiding system which realizes the variation in width during paving operation. Moreover, the lower frame is mounted on the upper frame in a height-adjustable manner, the lower frame comprising a smoothing plate for smoothing the paving material. The paving screeds further typically

comprise a linear actuator, such as cograil with a cog or a spindle drive comprising a threaded spindle and a female thread, for the height adjustment of the lower frame relative to the upper frame, wherein the linear actuator, for example the spindle drive, is configured to adjust the lower frame vis-à-vis the upper frame on a vertical plane and is thus usually arranged between the upper and the lower frame. For this purpose, in most cases a height-adjustment device for driving the linear actuator, e.g. a hydraulic or electric motor, is provided. In order to ensure that the height of the paving screed or position of the upper frame relative to the lower frame does not change during operation, it is known to provide a locking device that is configured to lock the lower frame in its position relative to the upper frame. Such a paving screed for a road paver is e.g. described in DE 100 36 784 C1, which provides for the pressing of an extendable screed part by means of a clamp laterally against the side of the basic screed, thus preventing a height modification. However, this means of immobilization requires a comparatively large number of components, e.g. separate spring preloaded screws, which render the assembly of the paving screed more complicated.

[0004] It is thus the object of the present invention to provide a paving screed and a road paver with such a paving screed that permit a simple and thus cost-effective assembly and simultaneously enable a safe and reliable locking of the paving screed with respect to a height modification, in particular the positioning of the upper frame in relation to the lower frame of the paving screed. Simultaneously, operating the paving screed should be made as easy as possible.

[0005] The achievement of this object is realized with a paving screed and a road paver in accordance with the independent claims. Preferred embodiments are indicated in the dependent claims.

[0006] The solution is specifically achieved with a paving screed as described above in which the locking device is connected to the upper frame and to the lower frame and comprises an essentially vertically oriented hydraulic cylinder configured to exert a clamping force on the linear actuator in a direction at least partially parallel to the direction of adjustment of the linear actuator so that a frictional connection is created in the linear actuator, which blocks the linear actuator. The linear actuator can for example be a spindle drive or a cograil with a cog or rack and pinion drive. In a preferred embodiment, the linear actuator is a spindle drive comprising a threaded spindle and a female thread, so that the locking device is connected to the upper frame and to the lower frame and comprises an essentially vertically oriented hydraulic cylinder that is configured to exert a clamping force on the spindle drive at least partially parallel to the direction of adjustment of the spindle drive so that a frictional connection is created between the threaded spindle and the female thread, which prevents an adjustment of the spindle drive. In the following, the linear actuator will be described as a spindle drive for simplicity's sake. However,

the person skilled in the art knows cograins with a cog or rack and pinion drives and has no problem substituting the described spindle drives with one of them. An essential idea of the invention is thus that the immobilization of the lower frame in its position relative to the upper frame occurs by means of a locking device acting directly at the spindle drive as a result of the fact that the threaded spindle and the female thread are pressed against one another in such a manner that they block each other's movement and traction is created in the thread of the spindle drive. The free play of the spindle drive in one direction is completely exhausted this way so that, by means of the action of the thread, a height modification, no matter how small, of the upper frame relative to the lower frame is no longer possible. The locking device in accordance with the invention thus jams the thread of the threaded spindle with the female thread. This jamming is realized by means of the clamping force of the hydraulic cylinder on the spindle drive, said force acting at least partially and in particular completely parallel to the direction of the adjustment of the spindle drive. This way, the friction-locked connection between the threaded spindle and the female thread is particularly reliable and simultaneously particularly easy on the thread. The clamping force here can be directed in such a way that the upper frame and the lower frame are pressed toward one another or away from one another. The important thing is that the threads of the spindle drive, i.e. of the threaded spindle and the female thread, are pressed against one another in such a way that a friction-locked connection is created. The invention has the advantage that the adjustment of the position of the upper frame relative to the lower frame is prevented directly at the spindle drive itself, which is provided for this adjustment. By means of the blockage of the spindle drive, a height modification of the lower frame relative to the upper frame is simply impossible and thus particularly reliable. Moreover, the locking of the position of the lower frame relative to the upper frame is initiated or released by means of the control of the hydraulic cylinder. A manual locking step is thus not necessary.

[0007] In general, the type of hydraulic cylinder required by the present invention can vary. For example, it can be a double-acting hydraulic cylinder. Such a hydraulic cylinder can press the lower and the upper frame both towards one another as well as away from one another so that a clamping force in accordance with the invention can be realized in both directions. A double-acting hydraulic cylinder can also be used in order to support the spindle drive during the height adjustment of the lower and the upper frame relative to one another. The invention can, however, also be realized with a simpler construction, e.g. the hydraulic cylinder can be configured to be single-acting in accordance with a preferred embodiment. For example, hydraulic fluid can be applied to the single-acting hydraulic cylinder in order to exert the clamping force on the spindle drive. In order to end the locking of the spindle drive, it is merely necessary to

release the pressure on the acting side of the hydraulic cylinder. The height adjustment of the lower frame and the upper frame relative to one another can then occur via the spindle drive without further participation from the hydraulic cylinder.

[0008] In accordance with a preferred embodiment of the invention using a single-acting hydraulic cylinder, the hydraulic cylinder comprises a spring that preloads the hydraulic cylinder in such a way that the spring loading creates a clamping force parallel to the direction of adjustment of the spindle drive. In other words, the locking of the locking device is effected by the spring force of the spring. The spring can be e.g. a coil spring, a buffer spring, an annular spring or a cup spring. In order to release the locking action, hydraulic fluid is applied to the hydraulic cylinder, whereby the hydraulic cylinder is adjusted against the spring force and the frictional connection between the threaded spindle and the female thread of the spindle drive is suspended. The height of the lower frame or the position of the lower frame relative to the upper frame can then be adjusted by means of the spindle drive. This embodiment has the advantage that e.g. the locking of the position of the lower frame relative to the upper frame is passive and thus works without the application of a driven force. Locking is thus reliably ensured e.g. even if the road paver comprising the paving screed is switched off.

[0009] In principle, different possibilities exist regarding how the hydraulic cylinder can exert a clamping force on the spindle drive. The hydraulic cylinder can be e.g. directly connected to the threaded spindle and the female thread and press these against one another. The clamping force can, however, also be transmitted indirectly to the spindle drive. For example, it can be provided that the hydraulic cylinder is attached on the upper frame and on the lower frame and either pushes the same away from one another or pulls them towards each other in order to create the clamping force. As the spindle drive is also arranged between the upper and lower frame, the corresponding force of the hydraulic cylinder also acts on the spindle drive. In order to compensate for possible movements of the upper frame and the lower frame relative to one another in the horizontal plane, the hydraulic cylinder is attached by means of a joint, in particular a pivot joint or bearing, on the upper frame and/or the lower frame according to a preferred embodiment.

[0010] In order to ensure that the clamping force created by the hydraulic cylinder on the spindle drive is as parallel as possible to the direction of adjustment of the spindle drive, several embodiments of the locking device are possible. For example, the hydraulic cylinder can be attached rigidly on the upper frame as well as rigidly on the lower frame and thus have a predetermined clamping direction. It can, however, also be provided that the hydraulic cylinder is only connected to the upper frame and/or to the lower frame in a form-fit manner when the clamping force is applied. For example, the hydraulic cylinder can be connected to an element, e.g. a screw, that

is only attached to the upper frame and/or the lower frame in a form-fit manner in a retracted or extended state of the hydraulic cylinder. It is also possible that the positive locking is brought about by the hydraulic cylinder itself. In particular in accordance with such an embodiment of the locking device, it is preferred to provide a guide that directs the movement brought about by the hydraulic cylinder in a direction essentially parallel to the direction of adjustment of the spindle drive. The guide is thus configured in such a manner that the movement of the hydraulic cylinder and thus the clamping force acts in a direction as parallel as possible to the direction of adjustment of the spindle drive even when the hydraulic cylinder is not completely vertically oriented. The guide thus directs e.g. the upper frame and the lower frame in the direction for tensioning or compacting the spindle drive or locking device. This way, the stressing of the threads of the spindle drive, i.e. of the threaded spindle with the female thread, is both reliable as well as easy on the thread of the spindle drive.

[0011] For example, it can be provided that the guide comprises an outer sleeve, an inner sleeve mounted in a sliding manner in the outer sleeve and a screw mounted in the sleeves and connected to the hydraulic cylinder and the lower frame. In particular, the drive screw can be configured in such a manner that it engages the lower frame in a form-fit connection when the hydraulic cylinder is extended or retracted and thus transmits the clamping force of the hydraulic cylinder to the lower frame and thus also indirectly to the spindle drive. The screw is completely surrounded e.g. in the space between the upper frame and the lower frame by the sleeves. The guide thus also constitutes a housing for the screw. For example, the outer sleeve is connected to the lower frame and the inner sleeve is connected to the upper frame. In order to guide their respective movements relative to one another, the inner sleeve slides in the outer sleeve. The screw runs through both sleeves and does not necessarily have to fit closely with the latter or be mounted in the same in a sliding fashion. It is sufficient if the screw is guided overall by the sleeves in a direction that is vertical or parallel to the direction of adjustment of the spindle drive.

[0012] Additionally or alternatively to the described sleeves, the hydraulic cylinder itself can also be mounted at least partially in one of the two sleeves. It is e.g. preferably provided that the guide comprises an outer sleeve and that the hydraulic cylinder is mounted at least partially in an outer sleeve. In particular, the hydraulic cylinder is mounted either on the upper frame or on the lower frame in a fixed manner, while the other end of the hydraulic cylinder is movable vis-à-vis the upper and/or lower frame. In particular this movable end of the hydraulic cylinder is then at least partially mounted in the outer sleeve in such a way that the movement of the hydraulic cylinder is directed in a direction that is essentially parallel to the direction of adjustment of the spindle drive. According to this embodiment, the hydraulic cylinder itself is also a part of the guide.

[0013] A particularly precise guiding of the hydraulic cylinder in the outer sleeve is achieved when the hydraulic cylinder comprises a slide bearing and is mounted with the sliding bearing in the outer sleeve in a sliding fashion. For example, the hydraulic cylinder can have an annular projection corresponding to the width of the sleeve so that the hydraulic cylinder can be arranged with this sliding bearing in the sleeve. In this case, the sliding bearing of the hydraulic cylinder is in contact with the inner surface of the sleeve. This way, the play of the hydraulic cylinder in the guide is minimized, whereby a particularly precise conducting or guiding of the movement of the hydraulic cylinder and thus also of the clamping force parallel to the direction of adjustment of the spindle drive is achieved. Furthermore the force applied to the lower frame during paving can be properly transmitted to the upper frame.

[0014] In principle, the arrangement of the hydraulic cylinder on the paving screed can be varied. Further elements of the paving screed can thus be taken into consideration by arranging the hydraulic cylinder in places where there is sufficient installation space available. For example, it is possible to arrange the hydraulic cylinder outside of the space between the upper frame and the lower frame, in particular completely outside of this space. The transmission of force from the hydraulic cylinder to the upper frame and/or the lower frame can then occur e.g. indirectly via a space-saving, thin constructional element, e.g. a screw or the like. This way, the amount of space available for additional components in the space between the upper frame and the lower frame of the paving screed is greatly increased.

[0015] Alternatively, it is also possible to arrange the hydraulic cylinder essentially completely in the area between the upper frame and the lower frame. In particular, the hydraulic cylinder may be arranged in the area between the upper and the lower frame in such a way that it does not protrude beyond the paving screed. For example, the hydraulic cylinder may end in such a manner that it is flush with the upper and/or lower frame. This embodiment is particularly compact and has the advantage that the paving screed can be made as small as possible.

[0016] Typically, the height at which the smoothing plate smooths the paving material is not the only variable to be set via the adjustment of the lower frame of the paving screed. Generally, the angle of the lower frame to the horizontal plane is also set to a desired value, which e.g. can be different as a function of the paving material. In order to vary the angle of application of the lower frame, at least two spindle drives may be arranged behind one another in the working direction on the paving screed. A different adjustment of the spindle drives thus leads to an adjustment of the angle of application, i.e. the angle of the underside of the lower frame relative to the horizontal plane. The locking device is thus preferably configured in such a manner that it blocks the adjustment of several spindle drives on the paving screed in and in

particular of all spindle drives present on the paving screed. For this purpose, it is preferred e.g. that the hydraulic cylinder is arranged between two spindle drives arranged behind one another in the working direction of the paving screed. The hydraulic cylinder is arranged here on an axis with the spindle drives in the working direction. This way, the clamping force exerted by the hydraulic cylinder acts evenly on both spindle drives, whereby the threads of the spindle drives are each blocked by friction. This way, the hydraulic cylinder can be used for locking several spindle drives, thus enabling a simple and cost-efficient construction of the invention.

[0017] As already mentioned above, paving screeds often comprise several screed segments. For example, one or several add-on screed parts can be attached to a basic screed in order to increase the paving width of the road paver. Additionally or alternatively, extendable screed parts can be attached to the basic screed or to add-on screed parts. Such extendable screeds can be modified dynamically in their working width during the operation of the screed. These extendable screeds have an upper frame and a lower frame. Here it is particularly important that the rear edge of the lower frame of the movable part is set in the same vertical position as the rear edge of the fixed part of the extendable screed in order to avoid that an unevenness is created in the surface layer left behind by the paving screed. Each extendable screed segment typically thus has a height-adjustment device in the form of at least one spindle drive. All of these spindle drives must naturally be locked against any height modification during the operation of the paving screed. It is thus preferably provided that the paving screed comprises a basic screed and at least one add-on and/or extendable screed and that each extendable screed comprises a locking device. The locking device is configured as described above. The invention can thus be used with paving screeds that have several segments.

[0018] The invention also relates to a road paver with a paving screed as described above. The object of the present invention is also realized with such a road paver. Accordingly, all features and advantages of the paving screed described above also apply to the road paver. In order to avoid repetition, reference is made to the explanations given above.

[0019] The invention is elucidated below with the aid of the embodiments shown schematically in the examples. Specifically, the figures show:

- Figure 1: a side view of a road paver;
- Figure 2: a top view of a road paver;
- Figure 3: a top view of a road paver with an extended extendable screed;
- Figure 4: a paving screed with a spindle drive and locking device;

Figure 5: a first embodiment of a locking device in accordance with the invention;

Figure 6: a second embodiment of a locking device in accordance with the invention;

Figure 7: a third embodiment in accordance with the invention;

Figure 8: a fourth embodiment in accordance with the invention;

Figure 9: a spindle drive and a locking device in accordance with a further embodiment of the invention;

Figure 10: a spindle drive and a locking device in accordance with a further embodiment of the invention.

[0020] The same assembly parts / components or elements with the same function are designated in the figures with the same reference numbers. Elements seen in different figures are not necessarily designated in each figure.

[0021] Figure 1 shows a road paver 1 in accordance with the invention with an operating platform 2 and a machine frame or chassis 3. The road paver 1 comprises a drive motor 4 as well as crawlers 6 with which it can travel in the working direction a. The crawlers 6 are chain track drives in the embodiment shown, but wheels can just as easily be used. During the operation of the road paver 1, the road paver 1 receives paving material delivered by truck in the store or receptacle 5 and transports this through the so-called tunnel against the working direction a to the rear end of the machine, to which the paving screed 7 in accordance with the invention is connected via towing arms 8. The paving material is distributed via a screw conveyor in front of the paving screed 7 laterally over the working width of the road paver 1. By means of the paving screed 7, a smoothing and a pre-compaction of the paving material is carried out so that a surface layer is created behind the road paver 1, which in some cases has to be compacted. As also indicated in Figure 1, the paving screed 7 has an upper frame 14 and a lower frame 15.

[0022] Figures 2 and 3 show a road paver 1 in a top view. The paving screed 7 of the road paver 1 in accordance with Figure 2 comprises a basic screed 9 as well as two extendable screed segments 10 attached to the tractor of the road paver 1 via towing arms 8. The extendable screed segments 10 are shown in a retracted position. Each of the extendable screed segments 10 of the road paver 1 comprise two locking devices 23, which are described below in more detail. The locking devices 23 are connected to a control device 13 via a control line 12. The control device 13 is located on the operating platform 2 of the road paver 1. Using the control device

13, the operator can enter control commands for the locking devices 23. The control device 13 is coupled e.g. with the control device for the height adjustment of the lower frame 15 vis-à-vis the upper frame 14 of the paving screed 7 so that the operator merely needs to activate the height adjustment of the lower frame 15 vis-à-vis the upper frame 14 in the desired manner and the control device 13 automatically releases the locking device 23, which prevents the movement of the lower frame 15 vis-à-vis the upper frame 14, and then relocks the locking device 23. The control device 13 can also be connected to a sensor sensing the state of the locking devices 23. For example, a pressure sensor sensing the pressure in the hydraulic cylinders of the locking devices 23 can be used. The control device 13 can thus be used to make sure that paving can only start when the sensor confirms the activation of the locking devices 23, which makes sure that no inadvertent displacement of the screed occurs. In the embodiment shown, the extendable screed segments 10 of the road paver 1 have a height adjustment device in the form of a spindle drive on both sides so that a locking device 23 is also provided on both sides. Instead of the spindle drive, for example a cograil with a cog, also called rack and pinion drive, could also be employed. For simplicity, only the spindle drive will be described further, but a rack and pinion drive could be used instead.

[0023] Figure 3 shows a road paver 1 with a paving screed 7 in which the extendable screed segments 10 are in a state of maximum extension. The same configuration results when add-on segments whose working width cannot be adjusted in combination with extendable add-on screed segments at the outer sides are used in accordance with a further embodiment. The extendable screed segments 10 also have at least one locking device 23 in order to immobilize their respective lower frames 15 vis-à-vis their upper frames 14. All locking devices 23 are connected via control lines 12 to the control device 13, by means of which all locking devices can be controlled, in particular simultaneously. The control of the locking devices 23 occurs in particular in coordination with the control of the height adjustment device of the screed segments. However, separate control of the locking devices 23 via the control device 13 is also possible. For example, the user can unlock the locking devices 23 while the height adjustment device is not operating to adjust the angle of attack of the mobile frames of the paving screed 7.

[0024] Figure 4 shows essential elements of the screed segment of the paving screed 7 in a longitudinal sectional view through the paving screed 7. An upper frame 14 is connected to a lower frame 15 via a height-adjustment device configured as a spindle drive 19. The upper frame 14 comprises connecting elements 33, with which the upper frame 14 is attached via a guiding system to a basic screed 9 or to further add-on segments of the paving screed 7. The lower frame 15 comprises, among other things, the smoothing plate 32, with which the paving

material is smoothed during the working operation of the road paver 1. The lower frame 15 is height-adjustable relative to the upper frame 14 via the spindle drives 19. This is realized by means of a height-adjustment drive 16, which is configured as a hydraulic drive in the embodiment shown. The height-adjustment drive 16 drives at least one of the spindle drives 19 via driving means 17. The driving power of the spindle drive 19 can then e.g. be distributed via further driving means 18 to the remaining spindle drives 19 as well. Typically, the spindle drives 19 are arranged behind one another in the working direction a of the road paver 1 or the paving screed 7. In Figure 4, however, they are shown next to one another transversally to the working direction a for the sake of illustration.

[0025] The paving screed 7 in accordance with Figure 4 further comprises two locking devices 23 each with a hydraulic cylinder 20 mounted on the upper frame 14 and the lower frame 15 by means of joints, in the case shown in the form of pivot bearings 34. The hydraulic cylinder 20 runs essentially vertically and in a direction parallel to the spindle drives 19. By means of the hydraulic cylinders 20, both by means of an extension as well as a retraction of the hydraulic cylinder 20, a clamping force can be exerted on the spindle drives 19, which presses the threads of the spindled drives 19 together in such a manner that a height adjustment of the lower frame 15 vis-à-vis the upper frame 14 is prevented by means of the frictional connection created. The hydraulic cylinder 20 comprises connections to connect to the hydraulic system of a road paver 1. The hydraulic circuit of the hydraulic cylinder 20 can also comprise load retention valves or load-holding valves. These valves avoid uncontrolled pressure drops in the hydraulic cylinders 20 due to leakages, failure of hoses or the like. As can also be seen in Figure 4, the screed segment of the paving screed 7 shown has two height-adjustment devices in the form of two spindle drives 19. A locking device 23 is provided for each of the respective height-adjustment devices. Like the height-adjustment devices, the locking devices 23 are also located at the respective lateral ends of the screed segment of the paving screed 7. In principle, the locking devices 23 can be arranged in any position on the screed segment. However, it is preferred to arrange the locking devices 23 in the area of or close to the height-adjustment devices or spindle drives 19.

[0026] Different embodiments of the locking device 23 are shown in the Figures 5-8. The locking device 23 of Figure 5 comprises a double-acting hydraulic cylinder 20 extending between the upper frame 14 and the lower frame 15. The hydraulic cylinder 20 has two supply lines 24 for hydraulic fluid, e.g. hydraulic oil. The embodiment of the locking device 23 with a double-acting hydraulic cylinder 20 has the advantage that the clamping force of the hydraulic cylinder can press the upper and lower frame 14, 15 both toward one another as well as away from one another. Moreover, the hydraulic cylinder 20 can also be used for supporting the height adjustment or

the adjustment of the position of the upper frame 14 relative to the lower frame 15 via the spindle drives 19.

[0027] The locking devices 23 of Figures 6 and 7 respectively comprise a single-acting hydraulic cylinder 20 with only one supply line 24 for hydraulic fluid. The hydraulic cylinder 20 of Figure 6 is configured to press the upper frame 14 and the lower frame 15 away from one another and thus bring about the clamping force on the spindle drives 19. The hydraulic cylinder 20 of Figure 7, on the other hand, is configured to pull the lower frame 14 and the upper frame 15 toward one another and thus apply the clamping force to the spindle drives 19 or their threads. In order to cancel the blocking of the spindle drives 19, the pressure applied at the supply line 24 merely needs to be drained so that the hydraulic cylinder 20 is unblocked and the clamping force on the spindle drives 19 is lifted.

[0028] The locking device 23 of Figure 8 also comprises a single-acting cylinder 20, which, however, is preloaded by a spring 25. In the embodiment of Figure 8, the spring 25 causes the hydraulic cylinder 20 to extend so that the spring force of the spring 25 pushes the upper frame 14 and the lower frame 15 apart, whereby the spring force gives rise to the clamping force on the thread of the spindle drive 19, which leads to a blocking of any height adjustment. In order to release the lock, hydraulic fluid is pumped into the hydraulic cylinder 20 via the supply line 24, wherein the hydraulic pressure counteracts the spring force and leads to a contraction of the spring. This way, the height adjustment of the upper frame 14 relative to the lower frame 15 is unlocked and the spindle drives 19 can adjust the frames 14, 15 relative to one another. Naturally, an embodiment is also possible according to which the spring 25 generates a tensional force that pulls the upper frame 14 and the lower frame 15 toward one another so that a clamping force is created at the spindle drives 19. In this case, unlocking occurs by expanding the spring 25 by means of the introduction of hydraulic fluid into the hydraulic cylinder 20. Since the clamping force is created passively by the spring 25 in this embodiment in accordance with Figure 8, the road paver 1 does not need to apply hydraulic pressure actively at the hydraulic cylinder 20 in order to ensure a locking of the height adjustment of the paving screed. A corresponding locking is thus also reliably ensured when the road paver 1 is turned off.

[0029] Figure 9 shows a schematic section through a height-adjustment device with two spindle drives 19 and a locking device 23. Such combinations of a height-adjustment device and a locking device 23 can be provided singly or repeatedly on each extendable paving screed segment of the paving screed 7. For example, such combinations are arranged in the respective lateral end areas of the extendable screed segments so that each screed segment comprises two locking devices 23 and four spindle drives 19. The upper frame 14 is connected to the lower frame 15 by means of the spindle drives in a height-adjustable manner. Both spindle drives 19 are arranged

spaced apart from one another in the working direction a and can thus be used both for the height adjustment of the upper frame 14 relative to the lower frame 15 as well as for the setting of the angle of application of the lower frame 15 with respect to the paving material or a horizontal plane. The spindle drives 19 each comprise a threaded spindle 30 and a female thread 31 threaded on the threaded spindle 30. Both the threaded spindle 30 as well as the female thread 31 have an intermeshing thread. By means of the height-adjustment drive 16, the spindle 30 is turned by means of a driving means 17 so that the threaded spindle 30 moves in a linear fashion through the female thread 31. This way, the position of the lower frame 15 can be adjusted relative to the upper frame 14.

[0030] A locking device 23 is located between the spindle drives 19 of Figure 9. In the embodiment shown in Figure 9, this comprises a hydraulic cylinder 20 which is attached on the upper frame 14 and which is located outside the area between the upper frame 14 and the lower frame 15. The hydraulic cylinder 20 is connected to the drive screw 21, which starts from the hydraulic cylinder 20 and runs through the upper frame 14 and the lower frame 15. The screw 21 is not rigidly connected with the lower frame 15 here, but configured in such a way that it can be pulled by the hydraulic cylinder 20 in the direction of the upper frame 14, whereby a form fit between the screw 21 and the lower frame 15 results. This way, the screw 21 strikes the lower frame 15 and pulls the same in the direction of the upper frame 14 when the hydraulic cylinder 20 contracts. The hydraulic cylinder 20 thus presses the upper frame 14 and the lower frame 15 toward one another and thus creates a clamping force on the spindle drives 19 or on the intermeshing threaded spindle 30 and female thread 31. By means of the frictional or friction-locked connection thus created, a height adjustment of the spindle drives 19 is blocked.

[0031] The locking device 23 of Figure 9 further comprises a guide 26, which in turn comprises the screw 21, an outer sleeve 22 and an inner sleeve 29. In the embodiment shown in Figure 9, the outer sleeve 22 is attached to the lower frame 15, while the inner sleeve 29 is attached to the upper frame 14. The free end of the inner sleeve 29 comprises a sliding bearing and is received, i.e. is mounted in a sliding manner, inside the outer sleeve 22. When the height of the lower frame 15 is adjusted vis-à-vis the upper frame 14, the inner sleeve 29 thus slides in the outer sleeve 22. The screw 21 is guided through the sleeves 22, 29. The sleeves 22, 29 thus shield the outside of the screw 21 and simultaneously ensure that the direction of movement of the hydraulic cylinder 20 is essentially parallel to the spindle drives 19. The sleeves 22, 29 together with the screw 21 are considerably thinner and thus more space-saving than the hydraulic cylinder 20 itself, which is why the embodiment in accordance with Figure 9 is particularly suitable for saving constructional space in the area between the upper frame 14 and the lower frame 15.

[0032] Figure 10 shows a view analogous to the one shown in Figure 9 with a different embodiment. In order to avoid unnecessary repetition, reference is made to the above explanations regarding Figure 9 and merely the differences to the previous embodiment are explained below. Figure 10 shows specifically an alternative embodiment of the locking device 23. Although the hydraulic cylinder 20 of the locking device 23 is attached to the upper frame 14, it is, however, located in the area between the upper frame 14 and the lower frame 15. In particular, the hydraulic cylinder 20 does not protrude over the upper frame 14 and the lower frame 15. The hydraulic cylinder 20 is connected to a straining screw 27, which, analogous to the screw 21 of Figure 9, is moved by the hydraulic cylinder 20 and engages in a form-fit connection with the lower frame 15 when the hydraulic cylinder 20 contracts. This way, the clamping force of the hydraulic cylinder 20 is applied to the spindle drive 19. The embodiment according to Figure 10 also has a guide 26. In the present case, this comprises the hydraulic cylinder 20 itself, which is mounted at least partially within the outer sleeve 22. Analogously to Figure 9, the outer sleeve 22 is attached to the lower frame 15 and extends into the area between the upper frame 14 and the lower frame 15. Specifically, the hydraulic cylinder 20 comprises a sliding bearing 28 with which it fits against the inside of the outer sleeve 22 and is mounted in a sliding manner inside the latter. When the height of the upper frame 14 is adjusted relative to the lower frame 15 and also when the hydraulic cylinder 20 contracts and/or expands, the latter slides with its sliding bearing 28 in the outer sleeve 22. This way, the movement of the hydraulic cylinder 20 is guided to be parallel to the spindle drives 19. The clamping force created by the hydraulic cylinder 20 is thus also aligned so as to be parallel to the direction of adjustment of the spindle drives so that the threads of the threaded spindle 30 and the female thread 31 can be pressed against one another in this direction. The embodiment of Figure 10 is characterized by the particularly compact configuration of the entire paving screed, as the hydraulic cylinder 20 is arranged in the area between the upper and lower frame 14, 15.

Claims

1. Paving screed (7) for a road paver (1), comprising
 - an upper frame (14),
 - a lower frame (15) mounted on the upper frame (14) in a height-adjustable manner,
 - a linear actuator configured to adjust the lower frame (15) vis-à-vis the upper frame (14) vertically,
 - a height-adjustment drive (16) configured to drive the linear actuator, and
 - a locking device (23) configured to immobilize the lower frame (15) in its position relative to the

upper frame (14),

characterized in that

the locking device (23) is connected to the upper frame (14) and to the lower frame (15) and comprises an essentially vertically oriented hydraulic cylinder (20) configured to exert a clamping force on the linear actuator in a direction at least partially parallel to the direction of adjustment of the linear actuator so that a frictional connection is created in the linear actuator, which blocks the linear actuator.

2. Paving screed (7) according to claim 1,

characterized in that

the linear actuator is a spindle drive (19), comprising a threaded spindle (30) and a female thread (31), wherein the hydraulic cylinder (20) is configured to exert a clamping force on the spindle drive (19) in a direction at least partially parallel to the direction of adjustment of the spindle drive (19) so that a frictional connection is created between the threaded spindle (30) and the female thread (31), which blocks the spindle drive (19).

3. Paving screed (7) according to one of the previous claims,

characterized in that

the hydraulic cylinder (20) is single-acting.

4. Paving screed (7) according to one of the previous claims,

characterized in that

the hydraulic cylinder (20) comprises a spring (25) that preloads the hydraulic cylinder (20) in such a way that the spring preloading creates the clamping force parallel to the direction of adjustment of the linear actuator.

5. Paving screed (7) according to one of the preceding claims,

characterized in that

the hydraulic cylinder (20) is attached to the upper frame (14) and/or the lower frame (15) by means of a joint, in particular a pivot bearing (34).

6. Paving screed (7) according to one of the preceding claims,

characterized in that

a guide (26) is provided that guides a movement caused by the hydraulic cylinder (20) in a direction essentially parallel to the direction of adjustment of the linear actuator.

7. Paving screed (7) according to claim 6,

characterized in that

the guide (26) comprises an outer sleeve (22), an inner sleeve (29) mounted in the outer sleeve (22) in a sliding manner and a screw (21) mounted in the

sleeves (22, 29) and connected to the hydraulic cylinder (20) and the lower frame (15).

8. Paving screed (7) according to claim 6,
characterized in that 5
the guide (26) comprises an outer sleeve (22) and
in that the hydraulic cylinder (20) is mounted at least
partially in the outer sleeve (22).

9. Paving screed (7) according to claim 8, 10
characterized in that
the hydraulic cylinder (20) comprises a sliding bearing (28) and is mounted with the sliding bearing (28) in a sliding manner in the outer sleeve (22). 15

10. Paving screed (7) according to one of the previous claims,
characterized in that
the hydraulic cylinder (20) is arranged outside the area between the upper frame (14) and the lower frame (15). 20

11. Paving screed (7) according to one of claims 1 to 8,
characterized in that
the hydraulic cylinder (20) is arranged essentially completely in the area between the upper frame (14) and the lower frame (15). 25

12. Paving screed (7) according to one of the previous claims, 30
characterized in that
the hydraulic cylinder (20) is arranged between two linear actuators, for example spindle drives (19), arranged one behind the other in the working direction (a) of the paving screed (7). 35

13. Paving screed (7) according to one of the preceding claims,
characterized in that
the paving screed (7) comprises a basic screed (9) and at least one add-on and/or extendable screed (10) and **in that** each extendable screed (10) comprises a locking device (23). 40

14. Road paver (1) with a paving screed (7) in accordance with one of the preceding claims. 45

50

55

Fig. 1

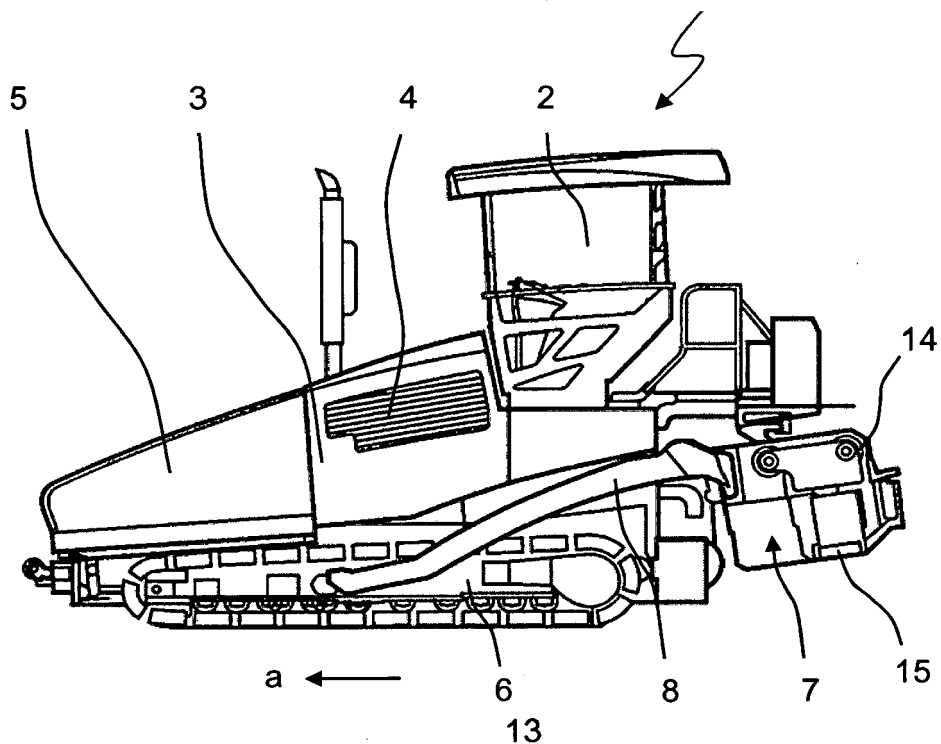


Fig. 2

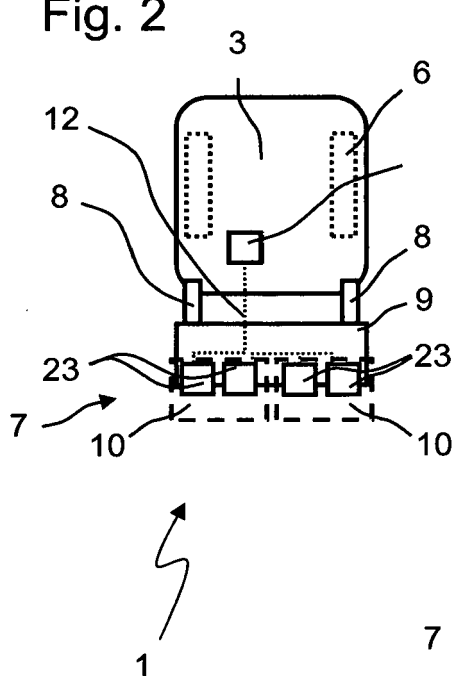


Fig. 3

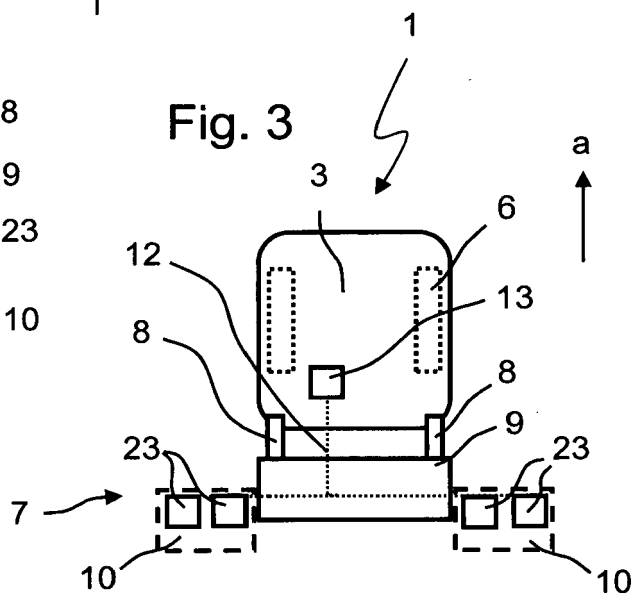


Fig. 4

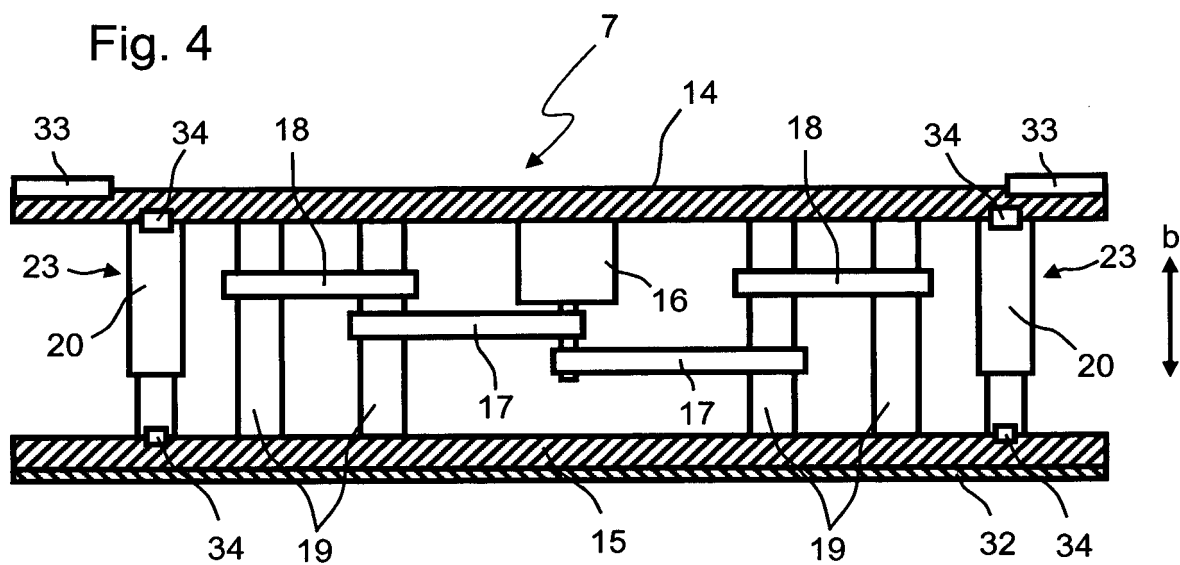


Fig. 5

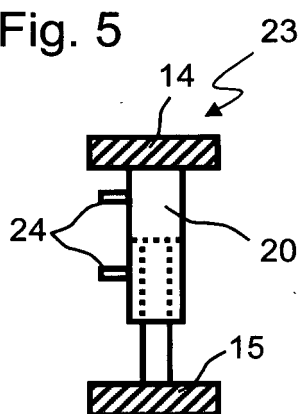


Fig. 6

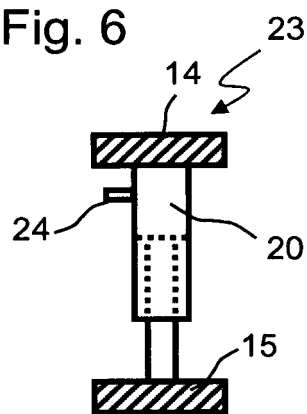


Fig. 7

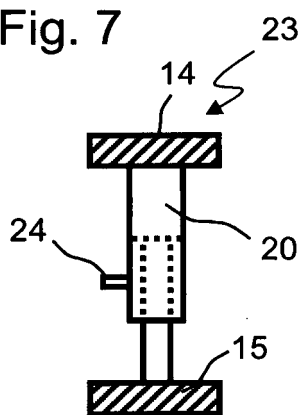


Fig. 8

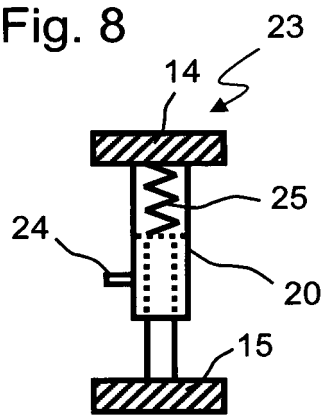


Fig. 9

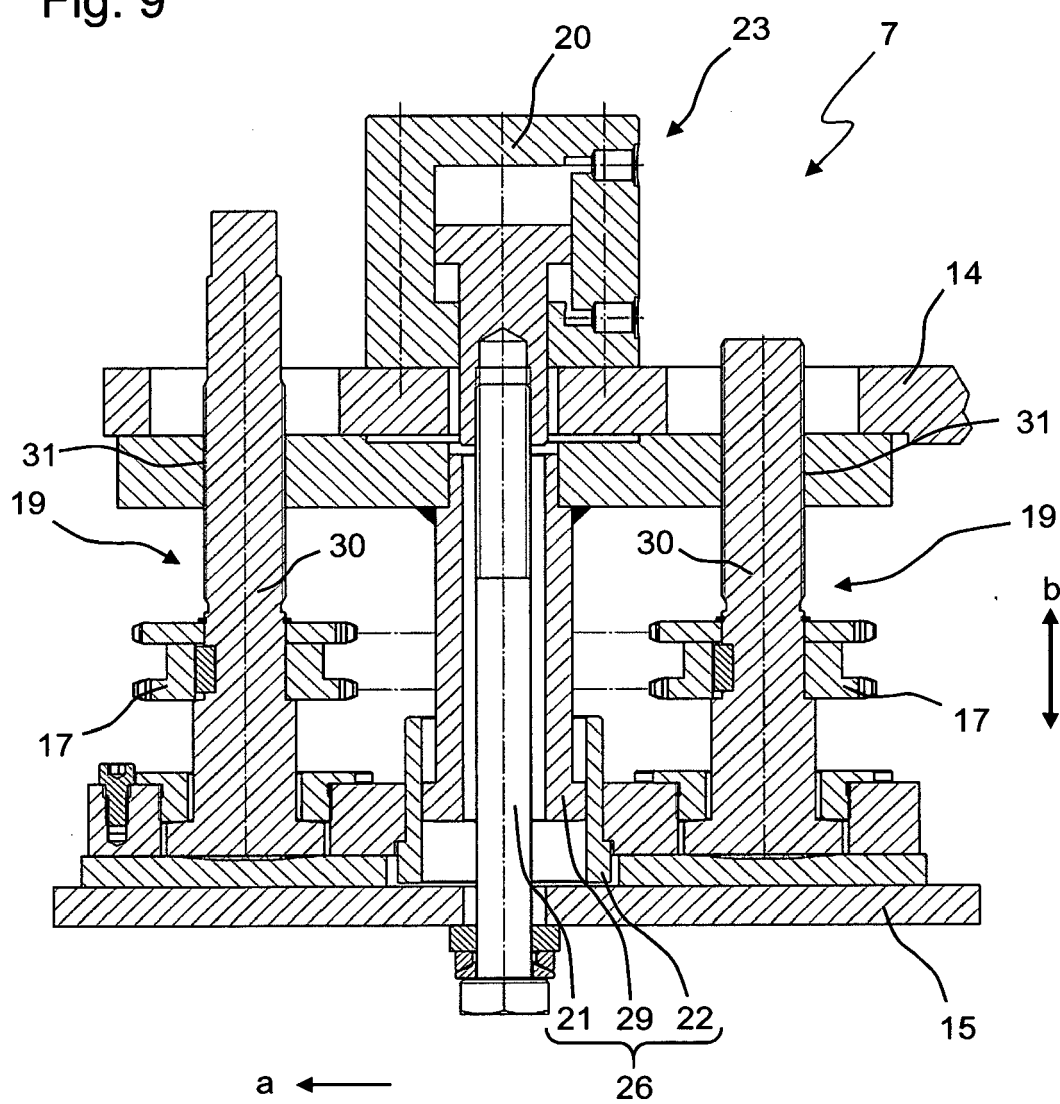
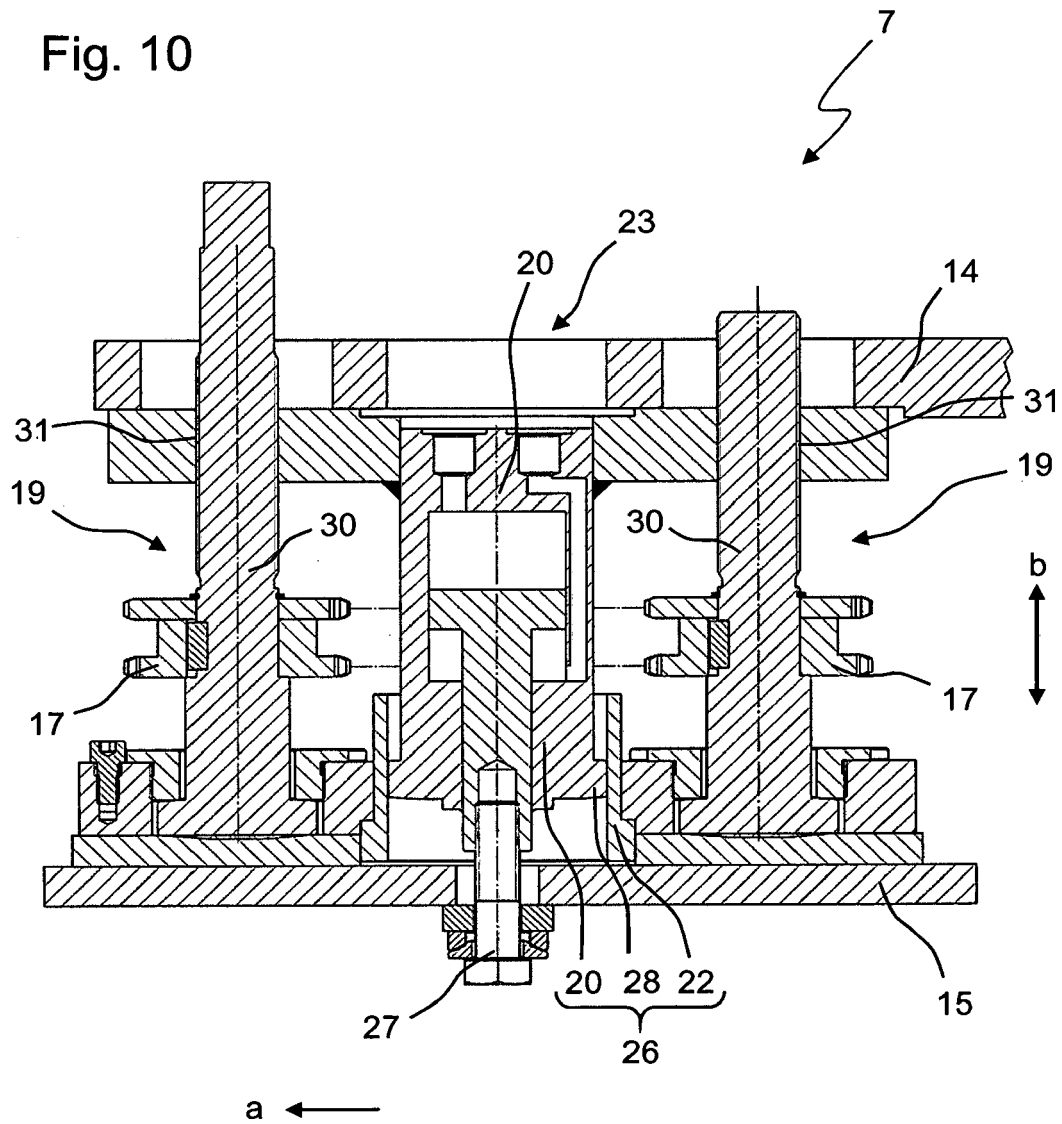


Fig. 10





EUROPEAN SEARCH REPORT

Application Number
EP 18 00 0318

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	DE 100 36 784 C1 (ABG ALLG BAUMASCHINEN GMBH [DE]) 20 September 2001 (2001-09-20) * the whole document *	1-14	INV. E01C19/48
A	CN 102 926 313 B (ZOOMLION HEAVY IND SCI & TECH) 24 December 2014 (2014-12-24) * the whole document *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			E01C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 September 2018	Examiner Beucher, Stefan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 00 0318

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-09-2018

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10036784 C1	20-09-2001	CA 2354485 A1	28-01-2002
		CN 1336463 A	20-02-2002
		DE 10036784 C1	20-09-2001
		EP 1176256 A2	30-01-2002
		JP 3713551 B2	09-11-2005
		JP 2002081015 A	22-03-2002
		US 2002041793 A1	11-04-2002

CN 102926313 B	24-12-2014	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 10036784 C1 [0003]