

Description

Field of the invention

[0001] The present invention generally refers to the sector of road safety devices, and in detail concerns a guardrail fixing device.

[0002] The present invention also concerns a method of junction of guardrail portions by means of the above device.

Background art

[0003] The usage of guardrail for protecting roads is universally known.

[0004] It is further known that guardrails are subject to be joined by so-called "joints" for ensuring the continuity of protection along the entire length of the road.

[0005] The traditional joints are nothing more than simple bars provided with slotted holes, that neither provide the right safety nor allow for a correct adaptation to the thermal dilation of the guardrail.

[0006] In fact, the applicant observed that the guardrails are subject to two macrotypes of deformations, macrotypes that are based on the deformation speed itself. The first macrotype is exactly the thermal dilation, that is a type of deformation which is very slow. The second macrotype, instead, is the deformation due to impact, characterized in contrast to a significantly higher speed.

[0007] The applicant knows guardrail junction systems of a more advanced type, one of which is produced by Freyssinet. It deals with a junction realized with a pre-contraction strand, permanently anchored to an end of the device on a first steel block (so-called passive) arranged in a junction between two guardrails. The device furthermore comprises a second block, so-called active, fixed to the adjacent junction. The strand, that passes also through the active block, is prolonged also over this last in such a way to allow the operation of the junction in normal conditions, being therefore capable of freely move within the active block without impeding the opening or closure of the junction of the barrier.

[0008] In case of accident, in proximity of the device it takes place a strain that tends to separate the anchoring blocks of the device, and this activates the functioning of the device itself that firmly anchors the strand in the active block.

[0009] The device produced by Freyssinet is complex and lowly effective in managing the blockage of the two guardrail portions in case of impact.

[0010] Nonetheless, the device produced by Freyssinet is not newly usable in case of impact, since the active block rests damaged.

[0011] The scope of the present invention is therefore to describe a guardrail fixing device that allows to solve aforementioned drawbacks.

[0012] A further scope of the present invention is to describe a method of junction of guardrail portions which

allows to solve the aforementioned drawbacks and advantageously allows to meet the guardrail thermal dilations or contractions without for this leaving space for failures or risk that the vehicle exits from portions of road wherein said guardrail misses.

Summary of the invention

[0013] According to the present invention is realized a fixing device for guardrails, suitable of being interposed between a first and a second portion of guardrail, characterized in that it comprises at least one first configuration of lower longitudinal extension and a second configuration of greater extension, wherein said second configuration of greater extension takes place when said device is longitudinally stretched following an impact of a vehicle against one of said two guardrail portions;

[0014] said device comprises elastic means operating in combination with a hydromechanic organ linearly extensible and causing a selective blocking of the longitudinal extension on said second configuration of greater extension according to a speed and/or impulse of force exerted between a first and a second end of said device, and in particular when said speed and/or impulse of force exerted exceeds a predetermined threshold value realizing an inertial block.

[0015] According to an aspect of the present invention, said device comprises furthermore a piston linearly extensible secured in correspondence of a first end thereof to an end of said device and to a second end thereof opposed to said first end, in correspondence of said elastic means on a rotating support in turn secured to said elastic means.

[0016] According to an aspect of the present invention, said device is characterized in that said threshold value is determined in accordance to a retention force exerted by said elastic means and by a viscous friction force exerted by said piston.

[0017] According to an aspect of the present invention, said rotating support is pivoted on the body of said fixing device; said pivoting takes place on a pin arranged in such a way to detect a rotation axis orthogonal respective to a plane onto which said device extends between said first and said second configuration.

[0018] According to an aspect of the present invention, said means of selective blocking further comprises a toothed bar, having a first and a second end; in said first end said bar comprises a plurality of teeth suitable for being engaged on an blocking arm of said rotating support, wherein said blocking arm has a terminal portion opposed respective to the portion jointed to the principal body of said rotating support provided with at least an engagement tooth; in said second end said toothed bar is jointed to an extensible plunger of said piston.

[0019] In detail, said toothed bar linearly moves on a predefined path and moves parallel to said piston.

[0020] In detail, said blocking arm engages on said plurality of teeth when said speed and/or impulse of force

exerted exceed a predetermined threshold value, with an extension of said piston causing a compression and/or extension of said elastic means.

[0021] According to an aspect of the device object of the present invention, said elastic means are configured for keeping said supporting element in a neutral position centrally defined respective to a plurality of unstable positions wherein said support rotates respective to said neutral position, said supporting element being capable of pivoting respective to said neutral position centrally defined.

[0022] According to a preferred and non-limiting aspect of the present invention, said piston comprises a plunger secured to a first end of said device in turn configured for being rigidly jointed to a first portion of guardrail; said device comprises a principal body detecting a second end opposed to said first end, said second end being joined to a second portion of guardrail.

[0023] Preferably, said device - in correspondence of the said first and second end - comprises fixing plates respectively to said first and second portion of guardrail; said fixing plates comprising a plurality of holes suitable for housing means of pivoting on said guardrail portions.

[0024] According to the present invention it is further realized a method of junction of guardrail portions, characterized in that it comprises the installation of the device according to the present invention, further characterized in that it comprises, before the step of installation of said device between a first and a second portion of guardrail not connected each other, a step of calculation of a speed of thermal dilation of said guardrail portions, a subsequent step of calculation of speed of deformation of at least one of said guardrail portions following an impact of the vehicle against thereto, said speed of deformation being calculated in relation to the position of said device with said guardrail; said method comprising furthermore a step of calculation of a maximum threshold speed or force impulse such that to cause said blockage of longitudinal extension of said device in accordance to said speed of deformation and in accordance to an elastic constant of said elastic means in combination to a coefficient of viscosity of said hydromechanic organ linearly sliding, so that a speed of deformation below said threshold keeps said device free to extend. Preferably, said method comprises a step of calculation of an angle of rotation necessary to said arm of said supporting element for coming into contact with said plurality of teeth of the said toothed bar, and a calculation of a coefficient of compression and/or extension of at least one of said elastic means in accordance to said rotation angle.

Description of the figures

[0025] The invention will now be described referring to the annexed figures wherein:

- Figure 1 shows a lateral section view of the fixing device for guardrails in a first configuration of use;

- Figure 2 shows a front view of the device of figure 1;
- Figure 3 shows a lateral section view of the fixing device for guardrails in a second configuration of use;
- Figure 4 shows a detail of the fixing device for guardrails according to the present invention.

Detailed description of the invention

[0026] With reference to figure 1, with the reference number 100 is shown in its complex a fixing device for guardrails, in detail for disjointed portions of a guardrail by means of the realization of a selective inertial blocking.

[0027] The device 100 comprises a principal body 101 a boxed structure detecting a first end wherein there is a plate 102 of fixing to a first portion of guardrail.

[0028] In detail, the plate 102 develops along a plane which is orthogonal respective to that of the principal body, and is provided with holes 103, positioned on its four edges, for introducing the pins or equivalent means of engagement and fixing on the guardrail itself.

[0029] Inside the principal body 101 is furthermore comprised a piston 120, provided with a cylinder fixed to said principal body and a plunger linearly extensible respective to said cylinder. Said plunger ends in an end thereof opposed respective to that which is introduced in the cylinder, on a second end of the device in turn provided with a plate 102, laying on the same plane of the other plate 102 and as it possessing a plurality of holes 103 positioned on its four edges for the introduction of pins or equivalent means of engagement and fixing to the guardrail itself.

[0030] The plate 102 is jointed to the plunger of the piston 120 by means of a bracket 104a that is oriented orthogonally respective to the plate itself thereby resulting among the other jointed to this last, and that is provided with a hole for the engagement with the piston. Clearly, the relative position of plunger or cylinder of the piston shall not be intended as limiting, in fact so that the elements could be in contrast installed - cylinder secured to the second end of the device and plunger secured to principal body 101 of the device 100 - without modifying the operation of the device object of the present invention.

[0031] For said reason the device 100 object of the present invention, is therefore linearly extensible, between at least one first and a second position, in such a way to being capable to adapt in joining exactly in correspondence of the plates 102 a couple of guardrail portions whose distance could not be always equal.

[0032] Figures 1 and 3 show respective configurations of a minimum and maximum linear extension of the device 100 object of the present invention in a resting condition, that is not being "photographed" in a dynamic motion condition of its mobile portions.

[0033] In detail, not only the distance between the two guardrail portions is not the same due to the fact that their relative position could vary from case to case, but also because the guardrails, being realized in metallic

material, are subject to thermal dilations that, precisely into the direction of maximum extension thereof, are far from being negligible.

[0034] The cylinder of the piston 120 is jointed to the principal body 101 not directly but with the interposition of a supporting element 150 rotating respective to a pin fixed on the principal body and extending along a direction orthogonal respective to the direction and the plane along which the device 100 is capable of linear extend therein.

[0035] In detail the supporting element 150 pivots respective to a central resting position, onto which is retained by two opposed springs 140, each one having a first end directly fastened on the principal body 101 and a second end fastened to a wing 170 of said supporting element 150.

[0036] Clearly, the use of springs shall not be considered limitative, since they can be substituted by equivalent elastic means without for this departing from the operation described into the present description.

[0037] The two springs 140 preferably but in a non-limiting extent are of the same type, for ensuring that the force of rotation of the supporting element 150 respective to the central position is equivalent into both the clockwise and anticlockwise rotation direction (this last being defined by the arrow A in figure 3).

[0038] Therefore, in case the supporting element 150 is rotated respective to the central position of equilibrium, a first of the two springs 140 is compressed while the second is extended.

[0039] Consequently, any rotated position of the supporting element 150 - both in clockwise that in anti-clockwise direction - is per se unstable, since the force of compression and respectively extension exerted by the springs 140 on the wing 170 is so that the supporting element 150 tends to return into the same starting position.

[0040] The supporting element 150 comprises a teathed arm that is suitable for engaging on a teathed portion 104d of a teathed bar 104.

[0041] The teathed bar 104 is arranged below than the supporting element 150, and the arm 151 faces towards said lower direction on a side of the supporting element 150 that, once observed the annexed figures, results being on its left side. The constraint of the piston 120 on the supporting element takes further place on the opposite side, and that is from the right.

[0042] The teathed bar 104 extends at least partially within said principal body 101 and has an end portion opposed respective to the teathed portion 104d that is jointed to the plate 102 of the second end of the device object of the present invention, and is therefore further jointed also to the terminal portion of the stem of the plunger of the piston 120.

[0043] The teathed portion 104d of the said teathed bar 104 faces towards the arm 151 of the supporting element 150.

[0044] In detail, therefore, during the rotation of the

supporting element 150 respective to the own central equilibrium position, if the rotation takes place in anti-clockwise direction the arm 151 engages on the teathed portion 104d impeding further extensions of the device 100.

[0045] In contrast, a rotation in clockwise sense, causes a distancing of the arm 151 respective to the teathed bar 104, rendering this last free of sliding back within the principal body 101.

[0046] The device 100 object of the present invention therefore operates on a selective blocking of the elongation of the first end respective to the second. Said selective blocking is an inertial block generated according to an action of force of extension exerted on the device 100 and a contrasting action to the extension itself operated by the assembly of the piston 120 and of the springs 140 with the rotating supporting element 150. Said selective blocking allows for causing a free adaptation of the length of the device 100 object of the present invention to the extension or contraction of the guardrails due to a thermal dilation, but at the same time allows for blocking the elongation of the device in case of impact of a vehicle against the guardrail or against the device itself.

[0047] In fact, the thermal excursion and impact elongation are characterized by an elongation speed (for example in mm/h) and impulse of force strongly different, in the order of 100 or more times. The speed of extension of a guardrail following of impact is closer to the magnitude order of a meter per second than to some mm/h as in the case of the thermal dilation.

[0048] The selection of a threshold of intervention for the selective blocking, that is a threshold of maximum speed or impulse of force, is scientifically calculated in accordance to the viscosity and force which is necessary to extend the piston 120 in relation to the force of compression and extension (elastic constant) of the springs 140.

[0049] Therefore the speed and impulse force caused by the thermal elongation or contraction of the guardrail is such that it causes a traction force on the plate 102 of the second end so that to extend the piston 120 without causing a compression/extension of the springs 170 that causes a rotation of the supporting element 150 so that to make the arm 151 rotate up to engage on the teathed portion 140d of the teathed bar 140.

[0050] In this configuration the device object of the present invention finds itself therefore in a first configuration of free extension, wherein the means of selective blocking in accordance to a speed and impulse of force do not become operative for blocking the longitudinal extension of the device 100 itself.

[0051] Therefore before a phase of installation of said device 100 between the two guardrail portions of a same side of the road, at first it shall proceed with a compared analysis of the elastic constant of the springs, of the viscosity of the piston 120 and of the coefficient of elongation of the guardrail portions themselves. Only then the springs and the piston are selected in accordance to the

aforementioned analysis, in such a way that modifications in the extension of the device 100 due to thermal dilations or contractions do not cause a blockage of the device itself (second configuration).

[0052] In detail, considered the rotation of the supporting element for causing the blockage, it is therefore performed a step of calculation of an angle of rotation necessary to said arm of said supporting element 150 for coming into contact with the plurality of teeth 104d of the toothed bar 104, further calculating a coefficient of compression and/or extension of at least one of said elastic means or springs 140 in accordance to said rotation angle.

[0053] Then in the phase of installation, if necessary, it takes place a manual elongation of the device, from the configuration of minimal extension (figure 1), conveniently used for transporting the device 100 itself, to a further configuration with greater extension, so that the plates 102 are in proximity of the guardrail portions to be jointed and can be fixed thereto.

[0054] Then the device object of the present invention is ready to operate.

[0055] In contrast, in case of impact of a vehicle on the guardrail or on the device 100 itself, the speed of elongation or the impulse of force are such that the viscosity of extension of the piston 120 exceeds that of the compression/extension of the springs 140, that consequently cause a rotation in anti-clockwise direction (arrow A, figure 3) of the arm 151 of the supporting element 150 so that to render its end engaged on the toothed portion 104d of the toothed bar 104.

[0056] Consequently the device blocks, acting as an element of rigid union between two guardrail portions one another separated.

[0057] This is particularly advantageous, since it impedes that the guardrail bends up to the point of causing an exiting of the vehicle from the road path, allowing at the same time for adapting separate guardrail portions without risking deformations due to the thermal contraction or extension thereof.

[0058] In detail, the device 100 object of the present invention is furthermore reusable. In fact, following of the block caused by the compression of the springs 140, in case the impulse of force ceases or anyway goes below the predefined threshold, the rotating supporting element 150 returns into the resting position wherein the forces of the two counterposed springs equal one another, and the arm 151 rigidly jointed thereto disengages the toothed bar 104, that can newly return to extend or include itself within the principal body in accordance to thermal compression or dilation phenomena of the guardrail portions thereto jointed on the plates 102.

[0059] This is particularly advantageous since excepting accidents capable of breaking the device 100 of the present invention, said device automatically returns into the first configuration wherein it supports the thermal dilation or contraction of the guardrail portions, without needing human intervention.

[0060] Not only the costs of substitution are reduced, but eventual costs of re-initialization into the first configuration are therefore canceled.

[0061] The advantages of the device object of the present invention are clear in view of the preceding description.

[0062] It is finally clear that to the object of the present invention additions, adaptations or variants obvious for a technician expert in the art can be brought, without for this departing from the scope of protection provided by the annexed claims.

Claims

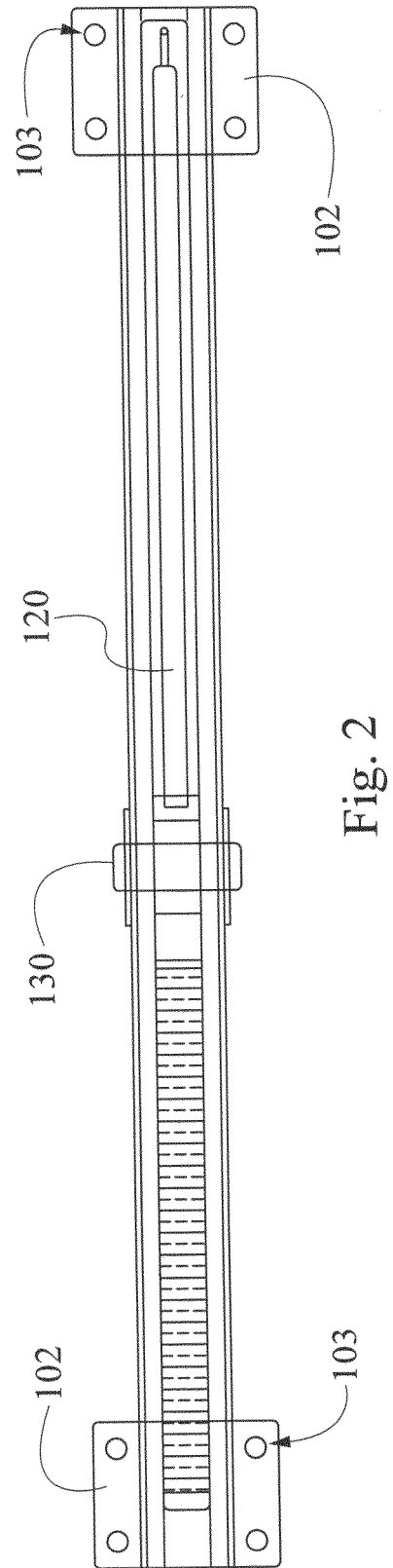
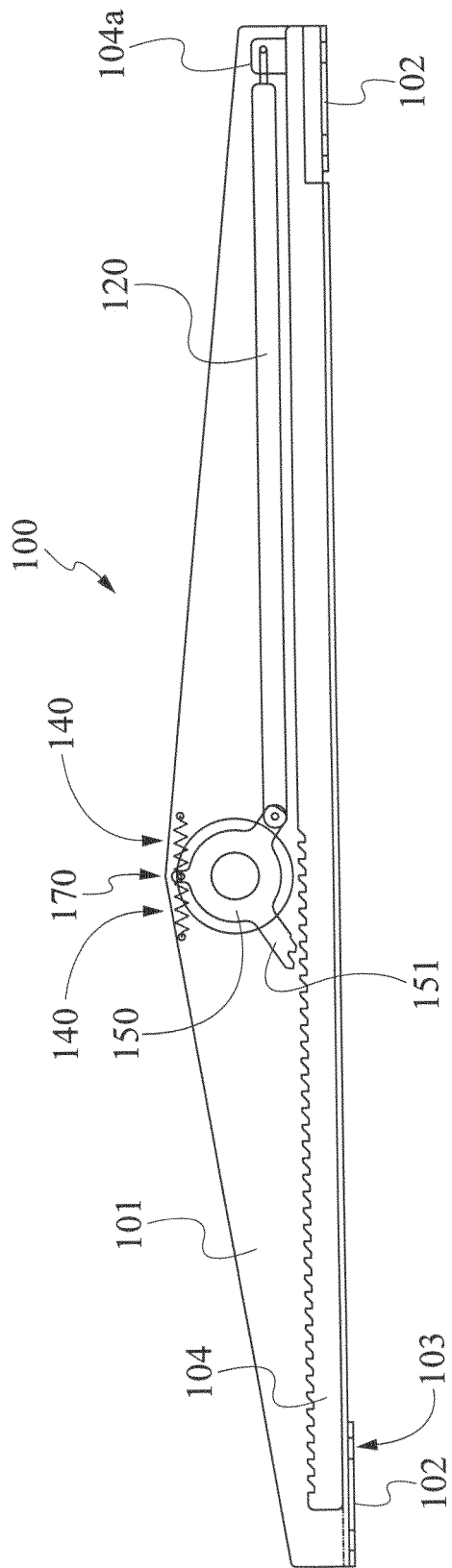
1. A fixing device (100) for guardrails, suitable for being interposed between a first and a second portion of guardrail, **characterized in that** it comprises at least one first configuration of lower longitudinal extension and a second configuration of greater extension, wherein said second configuration of greater extension takes place at least in case said device (100) is longitudinally in case said device (100) is slowly stretched by said portions of guardrail for thermal dilation; said device (100) comprises elastic means (140) operating in combination with a hydromechanic organ (120) linearly extensible and causing a selective blocking of the longitudinal extension on said second configuration of greater extension according to a speed and/or impulse of force exerted between a first and a second end of said device (100), and in particular in case said speed and/or impulse of exerted force exceed a predetermined threshold value realizing an inertial block.
2. Device (100) according to claim 1, **characterized in that** said hydromechanic organ (120) is a piston linearly extensible secured in correspondence of a first end thereof to an end of said device (100) and to a second end thereof opposed to said first end, in correspondence of said elastic means (141) on a rotating support (150) in turn secured to said elastic means (141).
3. Device (100) according to any of the preceding claims, **characterized in that** said threshold value is determined in accordance to a retention force exerted by said elastic means (141) and by a viscous friction force exerted by said piston (120).
4. Device (100) according to any of the preceding claims 2-3, **characterized in that** said rotating support (150) is pivoted on the body of said fixing device (100); said pivoting takes place on a pin arranged in such a way to detecting a rotation axis orthogonal respective to a plane onto which said device (100) extends between said first and said second config-

uration.

5. Device (100) according to any of the preceding claims 2-4, **characterized in that** said means of selective blocking comprise furthermore a toothed bar (104), having a first and a second end; in said first end said toothed bar (104) comprises a plurality of teeth (104d) suitable for being engaged on of a blocking arm (151) being part of said rotating support (150), and being furthermore **characterized in that** said blocking arm (150) has a terminal portion opposed respective to the portion jointed to a principal body of said rotating support (150) provided with at least an engagement tooth; in said second end said toothed bar (104) is jointed to an extensible piston of said piston (120). 5
6. Device (100) according to claim 5, **characterized in that** said toothed bar (104) linearly moves on a pre-defined path and moves parallel to said piston (120). 10
7. Device (100) according to claim 6, **characterized in that** said blocking arm (151) engages on said plurality of teeth (104d) in case said speed and/or impulse of force exerted exceeds a predetermined threshold value, with an extension of said piston causing a compression and/or extension of said elastic means (141). 15
8. Device (100) according to claim 7, **characterized in that** said elastic means (141) are configured for keeping said supporting element in a centrally defined neutral position respective to a plurality of unstable positions wherein said supporting element (150) rotates respective to said neutral position, said supporting element (150) being capable of pivoting respective to said centrally defined neutral position. 20
9. Device (100) according to claim 8, **characterized in that** said piston (120) comprises a piston secured to a first end of said device (100) in turn configured for being rigidly jointed to a first portion of guardrail; said device (100) comprises a principal body (101) detecting a second end opposed to said first end, said second end being jointed to a second portion of guardrail. 25
10. Device (100) according to claim 9, **characterized in that** it comprises - in correspondence of the said first and second end -fixing plates (102) respectively to said first and second portion of guardrail; said fixing plates (102) comprising a plurality of holes (103) suitable for housing means of pivoting on said guardrail portions. 30
11. Method of junction of guardrail portions, **characterized in that** it comprises the installation of the device (100) according to any of the preceding claims 1-10 35

and characterized furthermore **in that** it comprises, before the step of installation of said device (100) between a first and a second portion of guardrail disconnected one another, a step of calculation of a speed of thermal dilation of the said portions of guardrail, a subsequent step of calculation of speed of deformation of at least one of the said portions of guardrail following of an impact of the vehicle against the same, said speed of deformation being calculated in relation to the position of said device (100) with said guardrail; said method comprising furthermore a step of calculation of a threshold of maximal speed or impulse of force capable of causing said block of longitudinal extension of said device (100) in accordance to said speed of deformation and in accordance to an elastic constant of said elastic means (140) in combination to a coefficient of viscosity of said hydromechanic organ (120) linearly sliding, so that a speed of deformation below said threshold keeps said device (100) free to extend.

12. Method according to claim 11, **characterized in that** it comprises a step of calculation of a an angle of rotation necessary to said arm of said supporting element (150) per coming into contact with said plurality of teeth (104d) of the said toothed bar (104), and a calculation of a coefficient of compression and/or extension of at least one of said elastic means (140) in accordance to said rotation angle. 40



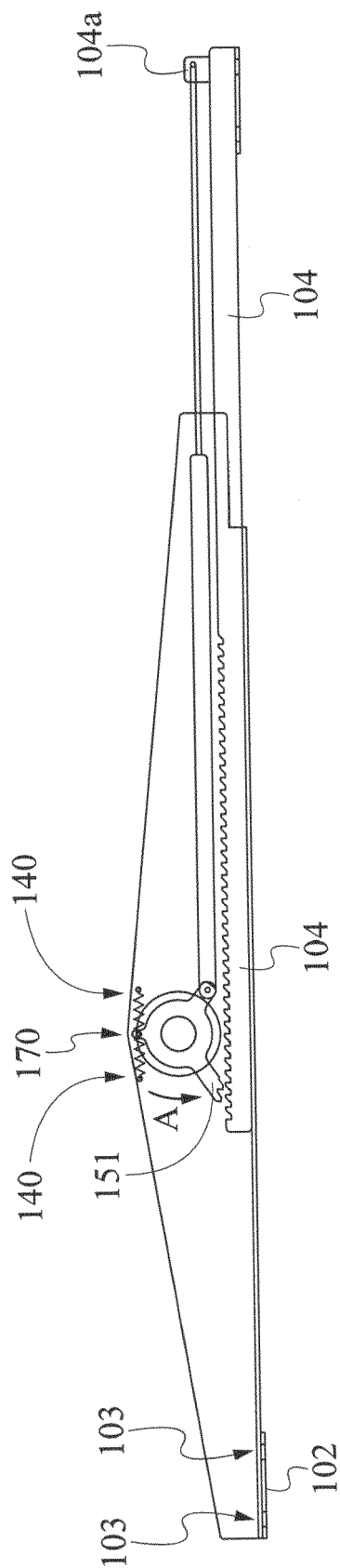


Fig. 3

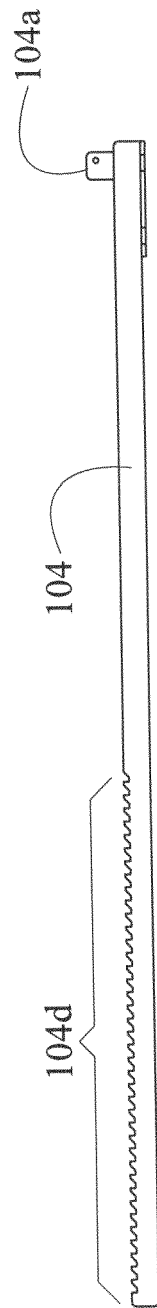


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 16 17 1353

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	GB 2 497 811 A (VERSCO LTD [GB]) 26 June 2013 (2013-06-26) * page 1, paragraph 1 * * page 2, paragraph 2 - page 3, paragraph 5 * * page 4, paragraph 4 - page 7, paragraph 5 * * figures 1-3 *	1,3,11 2,4-10,12	INV. E01F15/04
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			TECHNICAL FIELDS SEARCHED (IPC)
			E01F E01D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 September 2016	Examiner Kremsler, Stefan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 17 1353

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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
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21-09-2016

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