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(54) **RETRACTABLE INTELLIGENT SPEED BUMP**

(57) Collapsible smart speed bump, with a platform (12) that crosses the road (2), which can move upwards and downwards vertically, driven by an elevation mechanism arranged below the same, connected, by means of a transmission system (32) to an actuation system (33). The elevation mechanism has a fastener (28) arranged in the longitudinal direction of the platform (12), which, driven by the actuation system (33) by means of

the transmission system (32) is displaced across the road (2) and; at least a first wedge (26) fixed outside of the fastener (28), its inclined face being arranged longitudinally in the direction of the fastener (28), which comes into contact with the inclined face of at least a second wedge (24) fixed inside the box (8), in such a way that the longitudinal movement of the fastener (28) is transformed into a vertical movement of the platform (12).

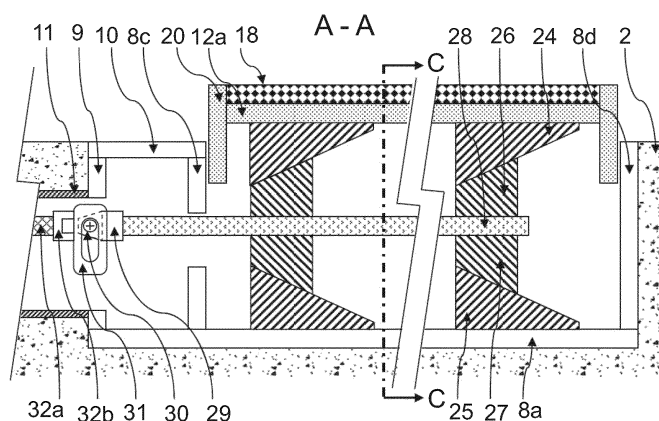


Fig. 2a

Description

Field of the invention

[0001] The present invention pertains to the technical field of street furniture and refers, more specifically, to those roadway fixtures that serve to control the speed of vehicles driving on the same. The object of the present invention is a collapsible smart speed bump, which serves to reduce the speed of vehicles and which may be adjusted at will between a minimum and maximum height, using an elevation mechanism. This speed bump may be collapsed fully in order to reduce the speed of vehicles when necessary and when traffic conditions so require. It is possible to forefend this reduction, when circumstances do not call for vehicles to be slowed down.

Background of the invention

[0002] Currently, existing speed bumps may be divided into two categories - conventional speed bumps, which are fitted to the road surface, protrude from the same and are invariable in height and form and, non-conventional speed bumps, which based on somewhat innovative principles, provide alternative solutions to conventional speed bumps. Conventional speed bumps are inexpensive and require little maintenance but ultimately present the following two problems, owing to their very nature as a permanent obstacle. Firstly, given that they are of fixed geometry, they always constitute an obstacle in the road, even when it is not necessary for them to act as such (for example, when drivers stick within the speed limits, when an emergency vehicle is passing by and should not be obstructed, etc.). Furthermore, at times they complicate traffic on certain stretches of road so much that this dissuades people from installing them. This could be very dangerous in certain situations (for example at the start and end of the school day, as statistics on getting run over or knocked down show).

[0003] Non-conventional speed bumps may be subdivided into the categories below. The main characteristics of each one of these categories are listed, alongside the advantages and disadvantages thereof:

Fake speed bumps use 3D technology to simulate fake obstacles in the road (by projecting a realistic image of a speed bump or pothole onto the surface, for example). Therefore, they do not depend on the weight, speed or impact force of a vehicle. Naturally, they cannot be activated or deactivated at will. They do not discourage drivers who pass them frequently from speeding. Although they are easy to maintain, they are expensive. One example is US patent US 7,044,679 ("Optical illusion speed bump and method of using the same").

[0004] Manually collapsible speed bumps have a working position, just like that of a conventional speed bump

and also have another position, in which they are collapsed to be level with the road, moving from one position to the other by means of manual operation, which requires tools. They may therefore be retracted but are not operated very often, except in very exceptional circumstances. They are cheap and easy to maintain. An example is US patent US 4, 012, 156 ("Retractable safety speed bump").

[0005] Non-Newtonian fluid speed bumps are designed to use shear thickening (dilatant) non-Newtonian fluid, which acts as a fluid, when the impact on the bump is mild and acts as a solid, when the bump is impacted significantly. The fluid is contained in the rubber body of the speed bump, in such a way that when a vehicle passes over it slowly, the speed bump does not jolt out but if the vehicle passes over it quickly, it impacts the vehicle. It therefore operates depending on the impact force of the vehicle. They can only be retracted in the area with which the wheels come into contact. They are easy to maintain but are of average cost. An example is the "Badén inteligente de velocidad (BIV or intelligent speed bump" produced by Spanish company "Badennova".

[0006] Passive flow restriction speed bumps are designed to use multiple small openings that restrict the passage of fluid contained in the speed bump (preferably water) when a vehicle passes over them, creating greater or lesser resistance when this vehicle passes, depending on how fast it is going and how much it weighs. Some make it possible to regulate flow in the openings. They operate according to the speed and weight of the vehicle. They may only be retracted in the area with which the wheels come into contact. They are of average cost and are easy to maintain. An example is US patent US 4,362,424 ("Speed bump"). Another example is the "New intelligent speed bump") from Mexican company "Decano Industries".

[0007] Active flow restriction speed bumps are designed to use operable valves, which block the air inside the speed bump to a greater or lesser degree, thus making it possible to regulate the resistance of the same, by controlling the valve according to the speed of the vehicle, it even being possible to cancel this resistance completely when emergency vehicles go past. They are retractable. They are expensive and difficult to maintain. An example is the "Transcalm™" produced by British firm "Dunlop". Other examples include US patents US 6,659,682 B2 ("Deformable speed hump") and US6010277 ("Road speed limiting device").

[0008] Passive fluid compression speed bumps are designed using one or many tubes or pistons, embedded into the rubber body of the speed bump, which are filled with a material dilated by the pressure of the vehicle passing over them. A spring at the end of each tube makes it possible for the speed bump to resume its form once the vehicle has passed. They therefore operate according to the weight of the vehicle. They are not retractable. They are cheap and easy to maintain. One example is US patent US 2009/0285630 A1 ("Speed sensitive traffic control

device").

[0009] Active fluid compression speed bumps are designed in such a way that the speed bump is supported by an inner fluid "cushion", this fluid being moved from one cavity to another by the pressure of a plunger pushed by an actuator, in order to provide vehicles with greater or lesser resistance. In one variety, a number of individual pistons are used, in which the fluid is pressurised to a greater or lesser extent by means of a motorized actuator. They operate according to the speed of the vehicle. Those with individual pistons are retractable but in those with a "cushion", only the fluid is retractable, this modifying the resistance thereof as vehicles pass; the speed bump itself is not retractable per se, since the speed bump is not hidden away. They are expensive and difficult to maintain. An example of the cushion variety is US patent US 7,476,052 B2 ("Retractable fluid-filled speed bump/vehicle restrictor"). An example of the variety with individual pistons is patent US 7,011,470 B1 ("Retractable speed bump").

[0010] Speed bumps with a passive flatten-down platform generally consist of a platform formed by two sheets forming an inverted "V" shape, fitted to the road and hinged to one another in the upper portion of the "V", which take on the form of a double ramp by means of the spring action. They become more or less flat as a result of the weight and impact force of the vehicle passing over them, until they are practically flat and level with the road. They therefore operate according to the weight and speed on the vehicle. They are not completely retractable, although the amount to which they protrude may vary. They are easy to maintain but are of average cost. An example is the "Movable speed hump" from Dutch firm "TTS". Another example is the "Speed bump" from US company "Yanko Design". Patents E01F9/047 ("Dispositivo redactor de velocidad para vías públicas", i.e. device for reducing speed on public roads) and US 6,457,900 B2 ("Speed sensitive automatic speed bump") are also based on this design.

[0011] Speed bumps with an active flatten-down platform generally consist of a platform formed by two sheets forming an inverted "V" shape, fitted to the road and hinged to one another in the upper portion of the "V". They may be unfolded in certain conditions, until they are flush with the road. They operate by means of a rod connected to a motor or a linear actuator. They are retractable and of average cost but are difficult to maintain. An example is US patent US 5,509,753 ("Retractable speed bump").

[0012] Speed bumps with a passive clamp platform consist of a sloping platform, with a pivoting edge, which may rest flush with the road on a support, retained by a passive clamp. This clamp does not require a motorised actuator, given that it is blocked and unblocked by the vehicle itself passing over the speed bump, in such a way that if this vehicle is driving slowly, the platform is clamped and does not provide resistance. They are retractable, of average cost and are of average ease to maintain. An

example is US patent US 4, 974,991 ("Vehicle speed bump device").

[0013] Speed bumps with an active clamp platform consist of a platform that may rest flush with the road on a support, retained by an operable clamp (preferably a speed sensor) or which may form a ramp (when it is not clamped), this providing greater or lesser resistance when vehicles pass. They are retractable, of average cost and average ease to maintain. Examples include patents GB 2333114 ("Vehicle speed bump"), US 2009/0022546 A1 ("Traffic control speed bump"), US 6,877, 921 B1 ("Speed hump device"), US 3,748,782 ("Traffic flow controller") and E01F9/00, E01F15/00, E01F9/047, E01F11/00 ("Mecanismo para la reducción de la velocidad del tráfico rodado en vías públicas y badén correspondiente" i.e., mechanism for reducing the speed of traffic on public roads and corresponding speed bump).

[0014] Speed bumps with a rod mechanism consist of a platform that may be elevated at will to above road level by means of an articulated rod mechanism, driven by means of a motor or similar system, according to the signal provided by a speed sensor in the vehicles. They are retractable, expensive and difficult to maintain. Examples include patents E01F9/019 ("Badén de elevación automática con detectores de velocidad", i.e. automatic elevation speed bump with speed detectors), US 4,354,771 ("Motorized curb barrier traffic-way controller") and US 7,507,052 B2 ("Speed bump devices").

[0015] Speed bumps with transversal wedges consist of a platform that may be elevated at will to above road level by means of mechanism consisting of simple, individual wedges, fitted cross-wise in the speed bump (i.e. with the gradient facing the direction in which traffic is flowing), operated by means of both hydraulic cylinders, according to the signal provided by a vehicle speed sensor. They are retractable, expensive and difficult to maintain. An example is US patent US 4,342,525 ("Retractable speed bump").

[0016] Hydraulic cylinder speed bumps consist of a platform that may be elevated at will to above road level by means of a hydraulic cylinder, which receives hydraulic pressure from a motor pump unit, controlled according to the signal provided by a vehicle speed sensor. They are retractable, expensive and difficult to maintain. Examples include patents US 5,267,808 ("Electronically controlled speed bump device") and US Re. 33,201 ("Hydraulic barrier traffic-way controller").

[0017] Energy generator speed bumps comprise a number of actuators, which are compressed and connected to an electrical energy generator, in such a way that, on the one hand they provide resistance when vehicles pass, this resistance being proportionate to the weight and speed of the same and, on the other hand, generate electrical energy, according to these variables. They are retractable, of average cost and of average ease to maintain. An example is the "Motionpower" from US company "New Energy Technologies". Other exam-

ples include Spanish patents B60K31/04 ("Limitador de velocidad para vehículos", i.e. vehicle speed limiter) and E01F13/12 ("Badén generador de energía", i.e. energy generator speed bump).

[0018] A speed bump that regulates between a minimum and maximum height efficiently was therefore desired, so that adaptations may be made to accommodate exceptional traffic circumstances, thus preventing the limitations present in systems pertaining to the prior art.

Description of the invention

[0019] The present invention resolves the problems existing in the state of the art using a collapsible smart speed bump to reduce the speed of vehicles. This speed bump may be adjusted at will between a minimum height and a maximum height and be collapsed completely under the road.

[0020] The collapsible smart speed bump is formed by a platform positioned across the road, which is able to move upwards and downwards in a vertical direction, driven by an elevation mechanism. This elevation mechanism is arranged below the platform and is in turn connected to an actuation system by means of a transmission system, which serves to enable the speed bump to move and which in turn, is controlled by an electric cabinet.

[0021] In the speed bump object of the present invention, the elevation mechanism has a fastener running lengthways in relation to the platform, which is moved across the road by the transmission system driving by the actuation system.

[0022] The elevation mechanism also has at least a first wedge fixed outside the fastener, its inclined face arranged lengthways in the direction of the fastener, which comes into contact with the inclined face of at least one second wedge fixed inside the box, in such a way that it transforms the longitudinal movement of the fastener into a vertical movement of the platform.

[0023] According to a preferred embodiment of the invention, the elevation mechanism has a first upper wedge, arranged in the upper portion of the fastener, its inclined face arranged lengthways in the direction of said fastener, which comes into contact with the inclined face of at least a second upper wedge, fixed in the upper portion of the inside of the box. Moreover, the elevation mechanism has a first lower wedge, arranged in the lower portion of the fastener, its inclined face arranged lengthways in the direction of said fastener, which comes into contact with the inclined face of at least a second lower wedge, fixed to the lower portion of the inside of the box. In this way, the longitudinal movement of the fastener is transformed into movement, in this case, owing to the two sets of wedges, resulting in greater vertical movement than if there were just one set of wedges, from the same horizontal movement of the fastener, thereby making this embodiment very convenient at times when there is little space.

[0024] The wedges are preferably at an angle, the tangent of which is shorter than the friction coefficient of the material with which the surface of these wedges has been made, so that the vertical movement thereof is irreversible, it only being possible to overcome this by applying deliberate force to the elevation mechanism, the load therefore being supported by the wedges, even if the elevation mechanism is uncoupled from the actuator, in this case neither the same nor the transmission system being submitted to the exceedingly high forces of the weight and speed of the vehicles.

[0025] Using a slanted tab and an idler roller, a coupling system enables the small vertical movement component in the elevation mechanism to be absorbed, (owing to the gradient of the wedges), thus making it possible to drive the elevation mechanism by means of a motorized linear actuator or any other system, the main movement component of which is parallel to the longitudinal axis of the speed bump.

[0026] The platform may be formed, uniquely, by a central horizontal tile and by two inclined side tiles, which form entry and exit ramps to and from the central tile for the vehicle. This central horizontal tile is driven vertically by the elevation mechanism and the two side tiles are supported on the lateral edges of the speed bump box and on the lateral edges of the central tile, both forming entry and exit ramps to said central tile, which are also pulled upwards and downwards by the abovementioned central horizontal tile, until they form a hump or lie completely flat at road level, respectively.

[0027] Equally, according to different specific embodiments, the speed bump platform may have an elastic coating, be it continuous or divided up into various parts, which serves to cushion the impact of the vehicle.

[0028] The advantages of this speed bump over other speed bumps known about in the state of the art are as follows:

It is collapsible, which means that it can be retracted completely and may disappear completely, the platform thereof being flush with the road. This is extremely important when one wishes to cancel the speed bump given that the traffic conditions do not require it at that time.

[0029] The height at which it sticks out may be adjusted at will, meaning that this protrusion can be adapted to traffic conditions, only operating at certain times a day (controlled by an hourly programme), raising or lowering it according to the speed of vehicles (detected by means of sensors fitted in the direction of the speed bump), being deactivated upon emergency vehicles passing over them (which lock the speed bump in its lowest position using a radio signal), linking its state to other nearby speed bumps (on the opposite side of the road or on the same side of the road in the opposite direction to traffic flow, etc.).

[0030] The wedge mechanism design makes it possi-

ble for the same to support the vehicle load, rather than the actuator and transmission system, meaning that the actuator is less powerful and the speed bump lighter and more active.

[0031] Given that it only requires a linear movement to be applied on the push mechanism and only requires low power, it is possible for the actuator to constitute a simple, electric motor, which can operate without fluids, thereby making the piece of equipment and maintenance thereof, cheaper.

Brief description of the drawings

[0032] In order to facilitate better understanding of the invention, below is a series of figures, which represent a non-limiting example of one embodiment thereof.

Figure 1 is a plan view of the speed bump, object of the present invention, fitted across both sides of a road with kerbed pavements. It also represents the electric cabinet, which serves to power the actuator and control the speed bump, as well as the chest in the pavement, which serves to house the actuator.

Figure 2a is a section view of a cut along the A-A plane shown in Figure 1, running along the middle of the speed bump, only covering the area located in the roadway. It represents the main parts crossed by the cut plane, namely: the speed bump box, the coupling box for the transmission system, the elevation mechanism and the coupling mechanism, when the speed bump is in its highest position, i.e. protruding as far as possible from the road surface.

Figure 2b represents the same view as Figure 2a, however in this figure, the speed bump is in its lowest position, i.e. protruding from the road surface the least amount possible, preferably meaning that it is level with the same.

Figure 3a is a section view of a cut along the B-B plane shown in Figure 1, along the middle of the speed bump, only covering the area located in the pavement and the shoulder of the road. It represents the main parts crossed by the cut plane, namely: the transmission system, actuator and chest, when the speed bump is in its highest position, i.e. protruding as far as possible from the road surface.

Figure 3b represents the same view as Figure 3a but when the speed bump is in its lowest position, protruding from the road surface the least possible, preferably being level with the same.

Figure 4a is a section view, according to the cut along plane C-C of Figure 1, cutting across the speed bump just in front of one of the sets of wedges, in a similar way to the cut shown in Figure 2. It represents the main parts and elements comprised by the body of the speed bump, as well as the configuration and arrangement of the same, especially the box, the elevation mechanism and platform or hump, when the speed bump is in its highest position, i.e. protrud-

ing as far as possible from the road surface.

Figure 4b is the same view as that shown in Figure 4a, however, in this figure, the speed bump is in its lowest position, protruding from the road surface the least amount possible, preferably being level with the same.

[0033] In these figures, reference is made to a number of elements, which are as follows:

1. speed bump
2. road
3. pavement
4. kerb
5. electric cabinet
6. chest
7. chest lid
8. mechanism box
- 8a. base of the mechanism box
- 8b. side wall of the mechanism box
- 8c. front wall of the mechanism box
- 8d. back wall of the mechanism box
9. coupling box
10. coupling box lid
11. protective tube
12. platform
- 12a. central tile of the platform
- 12b. side tile of the platform
13. central tile skirt
14. central tile guide
15. transversal box reinforcement
16. side tile drag
17. side tile support
18. elastic element
19. elastic element screw
20. head
21. head groove
22. side tile lug
23. side tile lug support
24. second upper box wedge
25. second lower box wedge
26. first upper fastener wedge
27. first lower fastener wedge
28. fastener
29. coupling fork
30. coupling roller
31. coupling tab
32. transmission system
- 32a. transmission system rod
- 32b. first latch
- 32c. second latch
33. actuator
- 33a. actuator motor
- 33b. gear actuator
- 33c. actuator translation screw
34. actuator support

Detailed description of the invention

[0034] The object of the present invention is a collapsible smart speed bump 1, which serves to reduce the speed of vehicles and may be adjusted between a maximum and minimum height, the latter preferably being level with the road 2.

[0035] The speed bump 1 is placed across the road 2 and may occupy one or both sides thereof. Figure 1 represents a speed bump 2 that occupies the entire road 2, the same having kerbed pavements 3. The power needed to move the speed bump 1 is achieved using an actuator 33 and a transmission system 32, which are housed in a chest 6 with a lid 7, located in the pavement 3, along with the kerb 4 of the same. The electric unit needed to power the actuator 33 and control the speed bump 1 is contained in an electric cabinet 5, which is fitted in the pavement 3, near to the chest 6 and kerb 4.

[0036] As can be seen in the figures, the speed bump 1 has a platform 12 arranged across the road 2, which can move upwards and downwards vertically, in order to position itself at or anywhere between its maximum and minimum height, the latter preferably being level with the road 2.

[0037] The platform is driven upwards and downwards by an elevation mechanism, arranged below the same, this element being connected by means of a transmission system 32 to an actuation system 33. The elevation mechanism has a fastener 28 arranged along the length of the platform, which, upon being driven by the actuation system 33 by means of the transmission system 32, is moved across the road 2.

[0038] In addition, the elevation mechanism has at least a first upper wedge 26 attached outside the fastener 28, its inclined face arranged lengthways in the direction of the fastener 28. This inclined face comes into contact with the inclined face of at least a second upper wedge 24 fixed inside the box 8 that houses the elevation mechanism, in such a way that it transforms the longitudinal movement of the fastener 28 into a vertical movement of the platform 12.

[0039] In the simple upper wedge formation, the first upper wedge 26 moves the platform 12 away from the box 8, pushing the second upper wedge 24 of the platform 12, smoothing the lower face of the fastener 28 out on the upper portion of the base 8a of the box 8, where there will be no wedges.

[0040] In the simple lower wedge formation, with simple wedges arranged symmetrically to the wedges described above, the first lower wedge 27 moves the platform 12 away from the box 8, going up the slope of the second lower wedge 25 in the upper portion of the box 8 base 8a, in this case smoothing the upper face of the fastener 28 out by the lower face of the platform 12, where there will be no wedges.

[0041] Figures 2a and 2b represent a preferred embodiment of the invention, in which the elevation mechanism has a first upper wedge 26 arranged in the upper

portion of the fastener 28, with its inclined face arranged lengthways in the direction of said fastener 28, which comes into contact with the inclined face of at least one second upper wedge 24, attached in the upper portion of the inside of the box 8 that houses the elevation mechanism and a first lower wedge 27 arranged in the lower portion of the fastener 28, with its inclined face arranged longitudinally in the direction of said fastener 28, which comes into contact with the inclined face of at least a second lower wedge 25, attached to the lower portion of the inside of the box 8 that houses the elevation mechanism. Therefore, the first upper wedge 26 and the first lower wedge 27 of the fastener 28 form a double wedge, which doubles the vertical progress of one wedge alone, along the same horizontal trajectory of the fastener 28.

[0042] In the preferred embodiment of the present invention, the platform 12 protrudes from the road surface the least amount in the minimum trajectory of the fastener 28, when the same is further away from the actuator 33, as can be seen in Figures. 2b, 3b and 4b. In contrast, the platform 12 protrudes farthest from the road surface in the maximum trajectory of the fastener 28, when the same is closer to the actuator, as can be seen in Figures 2a, 3a and 4a. Owing to the gradient of the first upper 26 and/or lower 27 wedges, vertical movement is produced when the fastener 28 travels horizontally.

[0043] The box 8 that houses the elevation mechanism is formed by a base 8a, two side walls 8b, a front wall 8c and a back wall 8d. The box 8 is open at the top, so that the platform 12 can come out of the speed bump 1. The box 8 is built into the road 2, with the upper edge of the walls 8b, 8c and 8d thereof being level with the same. The side walls 8b and back wall 8d thereof are closed, whilst the front wall 8c thereof has an opening to allow the fastener 28 to pass through, wedges 26 and 27 pushing wedges 24 and 25 of the box 8. The box 8 has a number of lateral guides 14 welded to it, to prevent the speed bump 1 platform 12 from moving in a cross-wise direction. Various reinforcements 15 fitted along the length of the box 8 serve to join the lateral guides 14 transversally to the side walls 8b and base 8a, acting as structural "ribs" for the box 8 in the cross-wise direction.

[0044] The wedges 24, 25, 26 and 27 are angled at a tangent smaller than the friction coefficient with the material with which the surface of said wedges (24, 25, 26 and 27) is made from.

[0045] In figures 4a and 4b, it is possible to observe a preferred embodiment of the invention, in which the platform 12 is formed by a central horizontal tile 12a and by two inclined side tiles 12b, in such a way that they form entry and exit ramps to the central tile 12b for the vehicles crossing the speed bump 1.

[0046] The platform 12 is only fitted into the speed bump 1, being supported or guided by means of other elements but without being joined to the same, in such a way that it only moves vertically.

[0047] According to this preferred embodiment, the platform 12, including both the central tile 12a and the

two side tiles 12b, run along the entire length of the speed bump 1 in the longitudinal direction of the same, as can be seen in figures 2a and 2b. The lower face of the platform 12 has various second upper wedges 24 attached to it, which are spaced out along the length of their average longitudinal plane (see figures 2a and 2b). In the preferred embodiment, these second upper wedges 24 are joined to the lower part of the central tile 12a. The gradient of these wedges 24 can be increased towards the actuator 33 side, this constituting the preferred embodiment shown in the figures or towards the opposite side. When the base 8a of the box 8 has second lower wedges 25, the gradient of the same must reach towards the same side as the gradient of the second upper wedges 24 of the central tile 12a. The central tile 12a has a skirt 13 attached to each long side and a head 20 at each end, which serve to make it resistant and guide it vertically. Each skirt 13 is guided by the corresponding lateral guide 14 of the box 8. Each head 20 is guided by the corresponding wall of the end of the box 8, i.e. the front 8c or back 8d wall. As can be seen in figures 4a and 4b, each skirt 13 has a drag 16 joined to it, which pushes the internal edge of the corresponding side tile 12b upwards when the central tile 12a rises. The external edge of the side tile 12b is supported on the box 8 side wall 8b support 17, pivoting around this support 17 freely when it goes up or down. Each side tile 12b is confined at the sides by the side walls 8b of the box 8, as it moves up or down, these walls limiting the outer edges of the tile. It is also confined by means of the ribs in the central tile 12a, which limit the inner edge. The ends of the side tiles 12b are confined by the heads 20 welded to the central tile 12a. Therefore, in the preferred embodiment the side tiles 12b are supported freely (not being joined) on the supports 17 and drags 16. The side tiles 12b are pushed upwards by the drags 16 when the central tile 12a rises. The side tiles 12b are moved downwards, mainly by means of gravity, when the central tile 12a is withdrawn downwards, although they may also be helped by springs or other elastic elements. In the preferred embodiment, each side tile 12b has a lug 22 fastened to the same by means of a support 23, said lug 22 being pushed downwards by the sloped ramp of the groove 21 of the corresponding head 20, when said head 20 goes down parallel to itself, owing to the fact that it is joined to the central tile 12a.

[0048] Furthermore, as can be seen in Figures 2a, 2b, 4a and 4b, the speed bump preferably has an elastic coating for the platform 12, formed by at least one elastic element 18. The elastic coating 18 is joined to the upper face of the platform 12, preferably by means of screws 19 or any other means that ensures a strong hold (for example vulcanization, industrial adhesives and other chemical agents). As already mentioned, this coating may or may not be divided into various elastic elements 18. It is preferably composed of various elastic elements 18 arranged one after the other along the length of the speed bump 1, in such a way that each element 18 covers

the entire width, therefore spanning the central tile 12a and the two side tiles 12b, which makes the assembly formed in this way somewhat cohesive. The coating is confined at the sides by the upper edges of the box 8 side walls 8b. The coating is confined by two heads 20 at the ends of the speed bump 1. When in resting position, each elastic element 18 takes on the form of a set of soft waves, distinctly aligned with the level of the road 2, as can be seen in figure 4b, in such a way that the slight peaks and valleys in the elastic elements 18 do not bother the vehicle passing over the speed bump 1 but serve to "remind" the driver of its existence, by way of crosswise warning strips. When the speed bump 1 platform 12 rises, the elastic element 18 stretches out, as can be seen in Figure 4a, its geometry adapting to that of the double bridge ramp that the side tiles 12b and central tile 12a form, becoming an almost perfect cylinder, which looks like the "hump" of a conventional speed bump. The ergonomics thus achieved are reinforced by the shock-absorbing effects of the elastic elements 18 used in the coating.

[0049] As can be seen in Figures 2a and 2b, the speed bump 1 object of the present invention may have a coupling box 9, which leans against the front wall 8c of the mechanism box 8, with a lid 10 level with the road 2, in order to facilitate access to the coupling mechanism that connects the end of the fastener 28 to the transmission system 32, this access being possible in the resting position shown in Figure 2b***. The front part of the coupling box 9 has a protective tube 11 joined to it, built into the shoulder area of the road 2, which connects this coupling box 9 to the chest 6 in the pavement 3, where the actuator 33 is housed. The coupling mechanism serves to absorb the vertical movement of the fastener 28, in order to facilitate use of an actuator 33 without any problems and a transmission system 32, the movement of which is linear alone and not suitable for absorbing forces outside the operational line of its axis.

[0050] Use of the coupling mechanism thus makes the speed bump 1 more versatile, given that it enables the same to be driven by a wider range of devices. Although said coupling mechanism is not prescriptive, it does form part of the preferred embodiment as shown in Figures 2a and 2b. As can be seen in these figures (2a and 2b), the coupling mechanism is formed by a coupling tab 31, with a vertically slanted drill hole through which a roller 30 travels, this roller rotating freely around its axis and being fixed to a fork 29. In the preferred embodiment, the coupling tab 31 is fastened to the transmission system 32 and the fork 29 is joined to the fastener 28. In an alternative version of this preferred embodiment, the same effect may be achieved by fitting the elements the other way around, i.e. with the coupling tab 31 fastened to the fastener 28 and the fork 29 joined to the transmission system 32.

[0051] According to the preferred embodiment, the transmission system 32 transmits the movement generated in the actuator 33, sending it to the fork fastener 28

through the coupling mechanism described above. Nevertheless, this may also be done directly in alternative embodiments. The transmission system 32 is preferably formed by a rod 32a, joined by means of a first latch 32b to the coupling tab 31, on the fastener side 28, as shown in figure 2 and joined by means of a second rod 32c to the screw 33c of the actuator 33, on the same side, as can be seen in Figure 3. The rods 32b and 32c may, preferably be threaded joints or any other kind of joint that can be easily dismantled, for example flanges. The transmission system 32 is buried under the road 2, protected up to the chest 6, by the protective tube 11 joined to the coupling box 9.

[0052] Any kind of actuator 33 capable of providing a linear movement of power course and speed needed to drive the speed bump 1 fastener via the transmission system 32 may be used, for example that shown in Figure 3. There are many solutions available for producing this kind of movement, whether commercial, by means of simple mechanisms or combinations of both systems. According to a preferred embodiment, represented in the figures, one of the simplest options is shown, in which the actuator 33 is formed by an electric motor 33a, the output axis of which is connected to a gear 33b, which moves a translation screw 33c, joined by means of a latch 32c to the rod 32a of the transmission system 32. The actuator 33 is attached to a support 34 anchored in the lower part of the chest 6 in the pavement 3, in which it is housed. The chest 6 has a lid 7 in order to access the actuator 33.

[0053] The electric cabinet 5 is uniquely located with the chest 6, in order to store the elements needed to power the motor, the electric protection devices and the control for the various operational modes of the speed bump 1, whether by detecting excess speed, by means of hourly programming, by being linked to other nearby speed bumps, by being locked in the lowest position when emergency vehicles pass (these vehicles sending the corresponding radio signal) or by means of manual control (for maintenance and initiation), etc.

[0054] According to a preferred embodiment of the invention, a set of sensors may be connected to the speed bump 1, which are arranged in the same direction as the speed bump 1, in order to detect excessive speed in vehicles and send the corresponding signal to the electric cabinet 5, which will use it in accordance with the operational logic established.

[0055] After having described the invention clearly, it must be pointed out that details of the particular embodiments described above may be amended, provided that this does not alter the fundamental principle and essence of the invention.

Claims

1. Collapsible smart speed bump for reducing the speed of vehicles, of the variety that may be adjusted

between a minimum and maximum height, comprising:

- a platform (12) arranged across the road (2), which can move upwards and downwards vertically, driven by
 - an elevation mechanism, which is arranged under the platform (12) and which, in turn, is connected, by means of a transmission system (32) to
 - an actuation system (33), which enables the speed bump (1) to move and is controlled by
 - an electric cabinet (5),
- said collapsible smart speed bump (1) being **characterised in that** the elevation mechanism comprises:
- a fastener (28) arranged in the longitudinal direction of the platform (12), which, driven by the actuation system (33) by means of the transmission system (32), is displaced across the road (2),
 - at least a first wedge (26) fixed outside the fastener (28) with its inclined face arranged longitudinally in the direction of the fastener (28), which comes into contact with
 - the inclined face of at least a second wedge (24) attached to the inside of the mechanisms box (8), which houses the elevation mechanism, transforming the longitudinal movement of the fastener (28) into a vertical movement of the platform (12).

2. Collapsible smart speed bump, according to claim 1, **characterised in that** the elevation mechanism comprises:

- a first upper wedge (26) arranged in the upper portion of the fastener (28), with its inclined face arranged longitudinally in the direction of said fastener (28), which comes into contact with the inclined face of at least a second upper wedge (24) attached in the upper part of the inside of the box (8) and
- a first lower wedge (27) arranged in the lower portion of the fastener (28), with its inclined face arranged longitudinally in the direction of said fastener (28), which comes into contact with the inclined face of at least a second lower wedge (25) attached to the lower part of the inside of the box (8), transforming the longitudinal movement of the fastener (28) into a vertical movement of the platform (12).

3. Collapsible smart speed bump, according to any of the previous claims, **characterised in that** the wedges (24, 25, 26 and 27) are angled at a tangent smaller than the friction coefficient of the material with which the surface of said wedges (24, 25, 26

and 27) is made.

4. Collapsible smart speed bump, according to any of the previous claims, **characterised in that** the platform (12) comprises:
 - a central horizontal tile (12a) and
 - two inclined side tiles (12b), which form entrance and exit ramps to the central tile (12a) for the vehicle.
5. Collapsible smart speed bump, according to any of the previous claims, **characterised in that** it comprises an elastic coating for the platform (12), which comprises at least an elastic element (18).
6. Collapsible smart speed bump, according to any of the previous claims, **characterised in that** the transmission system (32) comprises:
 - a rod (32a), which is joined to the fastener (28) by means of
 - a first latch (32b) and joined to the actuator (33) by means of
 - a second latch (32c).
7. Collapsible smart speed bump, according to any of the previous claims, **characterised in that** the actuator (32) comprises:
 - an electric motor (33a), the output axis of which is connected to
 - a gear (33b) which moves
 - a translation screw (33c), which is joined to the transmission system by means of the second latch (32c).
8. Collapsible smart speed bump, according to any of the previous claims, **characterised in that** it comprises a plurality of sensors, which are connected to and arranged near to the same, which detect the speed of the vehicles and send the corresponding signal to the electric cabinet 5, which uses this in accordance with the operational logic established.

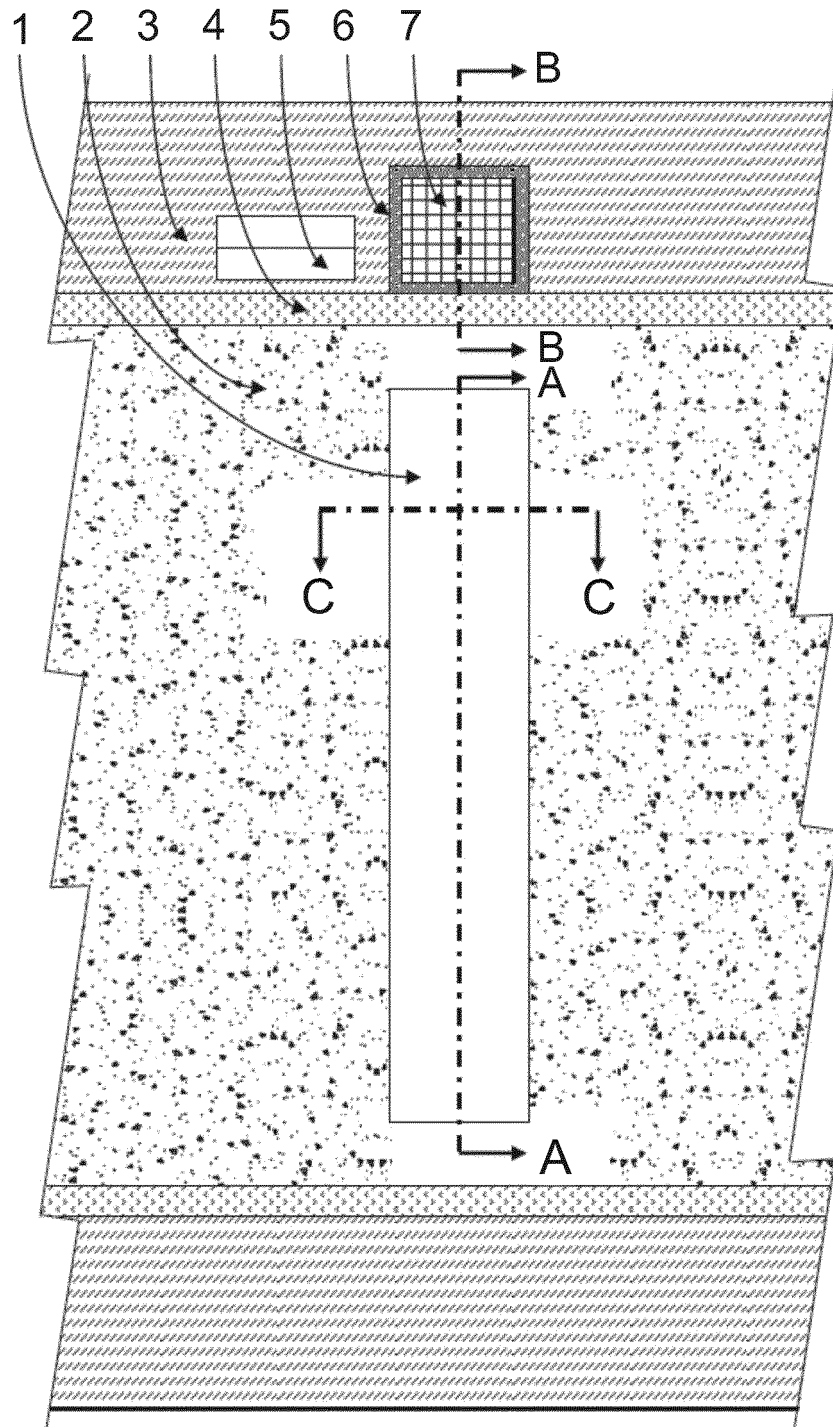


Fig. 1

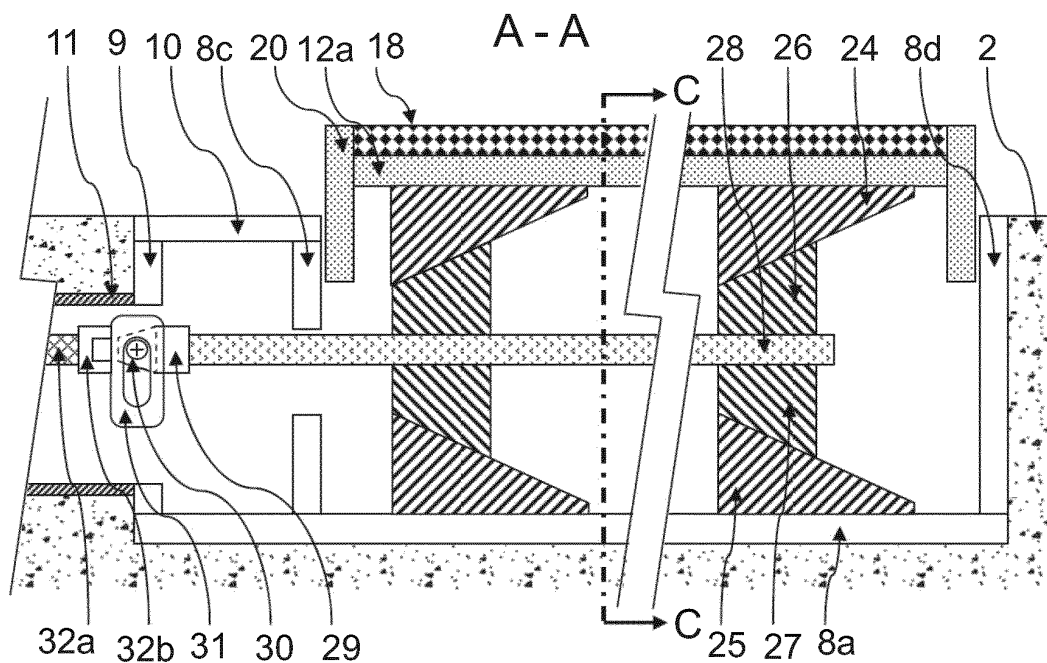


Fig. 2a

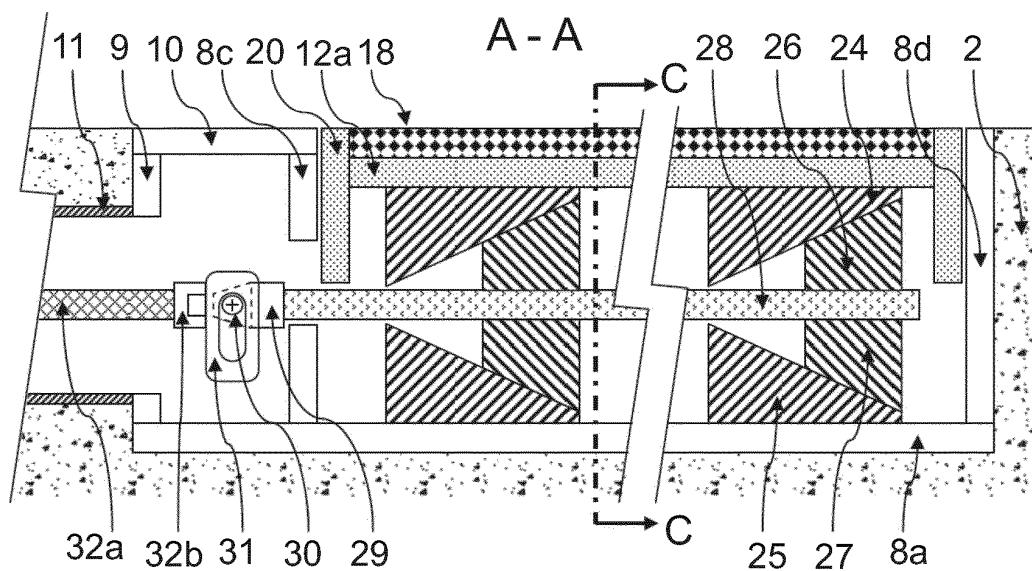


Fig. 2b

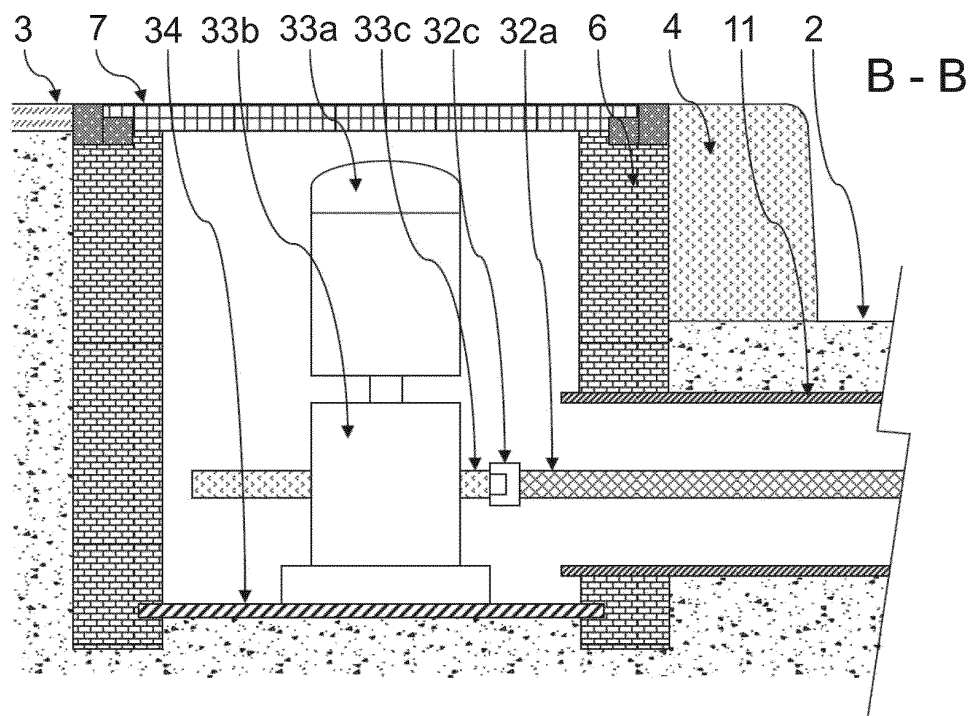


Fig. 3a

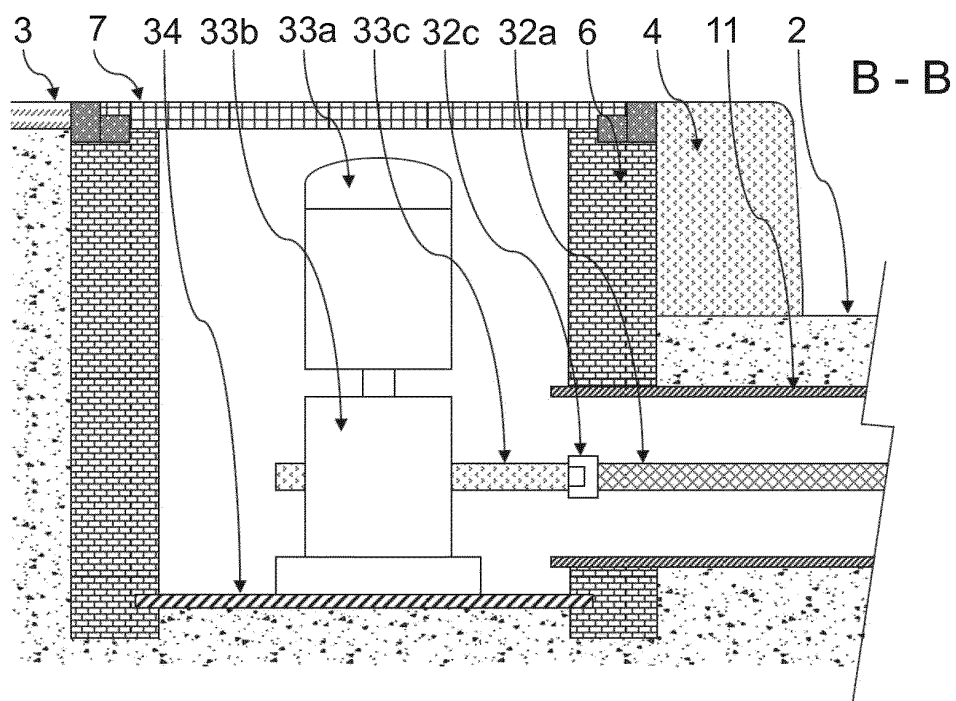


Fig. 3b

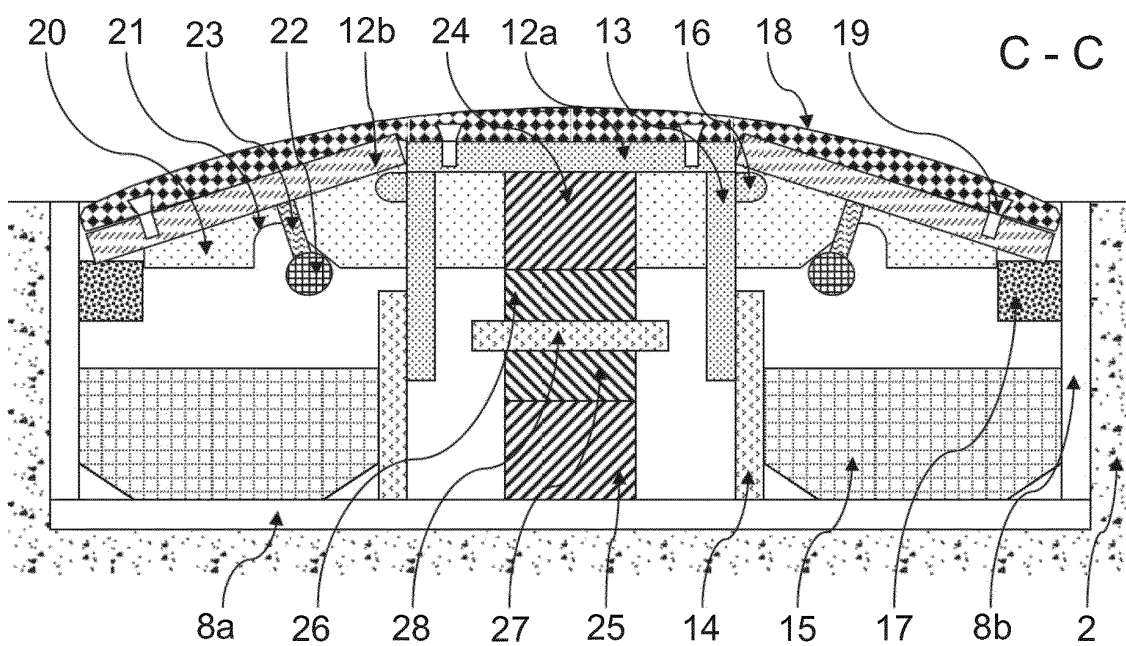


Fig. 4a

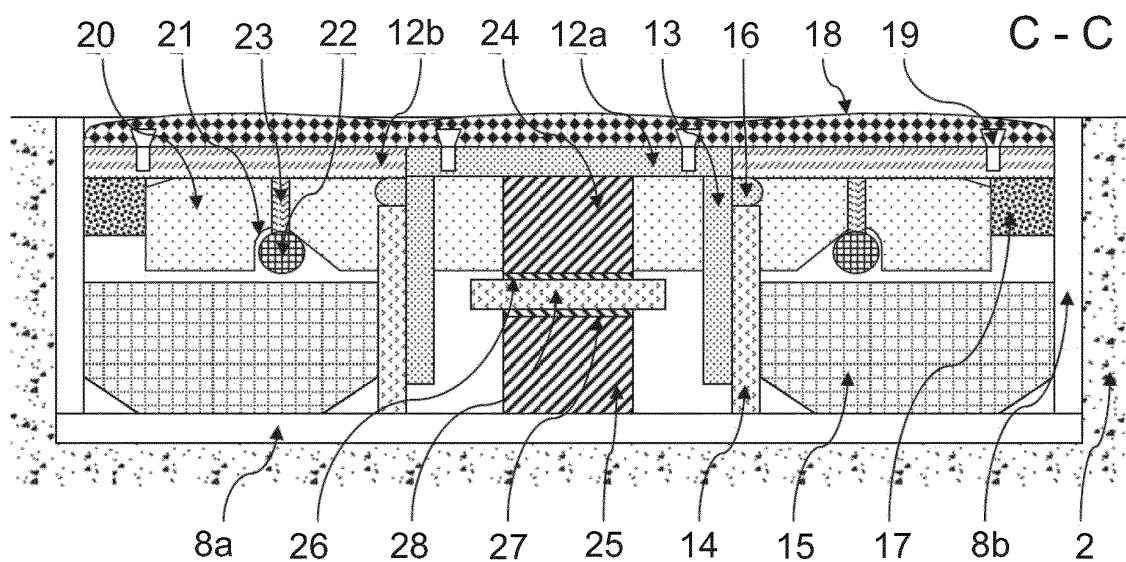


Fig. 4b

INTERNATIONAL SEARCH REPORT

International application No

PCT/ES2013/070735

A. CLASSIFICATION OF SUBJECT MATTER

INV. E01F9/047 E01F13/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 4 342 525 A (MASTRONUZZI JR CARL T) 3 August 1982 (1982-08-03) the whole document -----	1
A	FR 2 665 465 A1 (BUDENDORFF ETS [FR]) 7 February 1992 (1992-02-07) the whole document -----	1
A	WO 2011/099842 A2 (JOHNSON & NICHOLSON M SDN BHD [MY]; ALAN CHEW HONG MENG [MY]; CHEW JOO) 18 August 2011 (2011-08-18) the whole document -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

21 February 2014

Date of mailing of the international search report

06/03/2014

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/ES2013/070735

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