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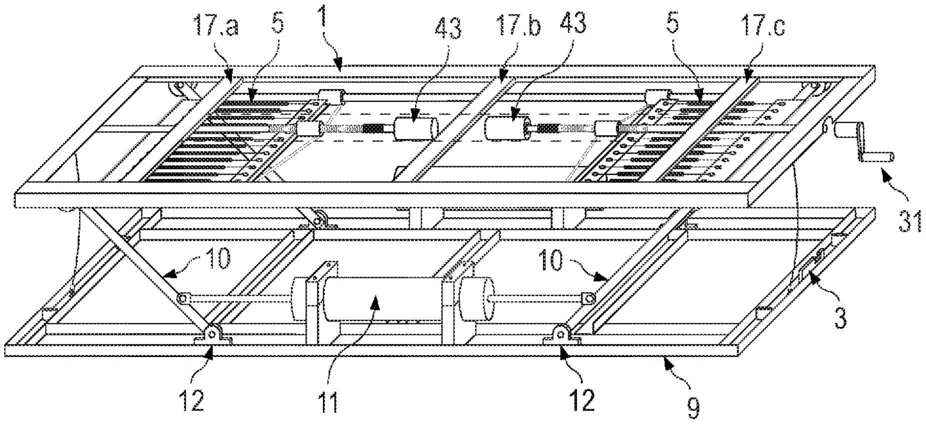

FIG. 1

(57) Abstract: This invention relates to a shock-absorbing platform for an ambulance stretcher wherein the shock-absorbing platform comprises: at least a pivoting arm connected to an upper chassis of the shock-absorbing platform and to a floor of an ambulance or to lower chassis of the shock- absorbing platform; and at least one damping system connected to the at least one pivoting arm wherein the damping system dampens shocks to the ambulance stretcher on the shock-absorbing platform.

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AMBULANCE SHOCK-ABSORBING PLATFORM FOR STRETCHER

FIELD OF THE INVENTION

[0001] This invention relates to ambulances, and in particular to an ambulance shock-absorbing platform for a stretcher.

BACKGROUND OF THE INVENTION

[0002] Ambulances are used worldwide to transport injured or sick patient from the injury site or from the patient´s home to medical centers, hospitals or to special points such as airports. Additionally, ambulances transport people with limited mobility such as, pregnant women, elderly people or people whose medical diagnosis mandate to limit their movements. The capacity to react during emergencies is a practice that saves lives and helps to prevent the worsening of adverse consequences in patients, especially those that suffered from an accident.

[0003] However, this wide known practice implies risks for patients who suffer from vertical and horizontal impacts and shocks from the transportation vehicle. In addition, the vibration produced by the irregular surfaces of the roads may seriously affect the vital function of the body especially the cardiovascular, skeletal, central nervous, and respiratory system(s) and may worsen the clinical condition of the patient.

[0004] In those cases where the patients suffer from heart attacks, shocks, have disabilities, arthritis, multiple sclerosis, spine pain or back pain it is necessary to maximize the medical care because of the high sensibility of the patient to the vibration that the irregular surfaces of the road may produce in the patient health.

[0005] Generally, patients are placed on a stretcher and, then, the stretcher is rolled onto the ambulance or the stretcher is placed by emergency medical technicians, paramedics or ambulance personnel onto the floor of the ambulance or over a rigid base that attaches to the floor of the ambulance. In other cases, patients are placed onto devices such as folding stretchers with plastic or metallic wheels; however, these devices are unable to absorb shocks. In both cases, every minor jump or bounce of the transportation vehicle caused by uneven roads will produce direct shocks to the patient who are being transported, causing them injures or affecting their health condition.

[0006] Sometimes the shocks received by patients from the transport vehicle produce more than discomfort or inconvenience. In many cases, some injures such as cervical injures, require that patients be completely tied up during the trip. Another case occurs when a pregnant woman is required to stay immobilized as much as she can in order not to give birth until she arrives to a hospital or medical center. Furthermore, it is normal to hear that pregnant women give birth when they are being transported to hospitals. Usually, the birth occurs because the patients receive a medium or strong shock when the ambulance transits through an uneven road, a bump or a pothole. These situations are not desirable when the babies or the pregnant women require further assistance in a medical center. Another undesirable case occurs when a hit to the head is received by a person whose neck is too weak to support the impact such as babies, minors or elderly people. While a hit received by a person can cause a simple and/or transitory pain, in other cases, it can produce a severe or permanent injury or can provoke the death of the person (fetus) or the fetus′ mother. Other cases include patients who suffer heart attack, stroke, or have disabilities, in these cases the patients require special care.

[0007] Another point that needs to be considered is the fact that vehicles typically used as ambulance are cargo vehicles that are relatively heavier and less comfortable and have a more rigid, stronger and/or heavier suspension system than those of passenger cars. These cargo transport vehicles -such as trucks or vans- are later customized and transformed into ambulances, however, their suspension systems remain the same (Analysis system on ambulance stretchers′, Marques Luaan, Malvezzi Fernando, Stavropoulos Konstantinos Dimitriou, DOI https://doi.org/10.21595/vp.2020.21330).

[0008] Another consequence of the transportation of patients in emergency situations consists of the fact that the vehicle must travel at high speeds to reach the medical center as soon as possible. Even though it is beneficial for the health of the patients to reach the medical center without delays, the main disadvantage is the increase of the intensity of the hits received by the patients. It can be said that there is a proportional relationship between the speed and the intensity of the hits received by the transportation vehicle. When an ambulance transits over a bump or a pothole at high speed, the hit received by the patient is stronger. A stronger hit is more capable of producing severe injuries –less than a simple discomfort- to the patient.

[0009] The consequences are worse in developing countries where routes, roads, streets and highways are uneven and present many deficiencies such as potholes, bumps, and in general a poor quality. In addition, in developing countries ambulances are less sophisticated vehicles with rigid or heavy suspension systems. Towns or small cities sometimes have no ambulances at all.

[0010] Therefore, there is a real demand to reduce the intensity of the hits received by patients when they are being transported in an ambulance.

DESCRIPTION OF THE RELATED ART

[0011] A number of approaches have been taught over the years to address this problem. It can be underlined that the different solutions suggest shock-absorbing devices by means of mechanical (e.g., springs); hydraulic (e.g. oil, water etc.) and pneumatic (air, gas, etc.) technology and/or a combination of them. In addition, some of them proposed a solution by the creation of a shock-absorbing platform different from the stretcher itself while others proposed some kind of shock-absorbing technology mounted on the stretcher itself that later is placed onto the ambulance.

[0012] U.S. Pat. Application US20130131333A1 introduces a detailed summary of the inventions that have been proposed for ambulance shock absorbing problems. The aforementioned patent states that U.S. Pat. Nos. 7,621,705; 6,890,137; 5,016,862 and 2,324,685 taught shock absorption by means of mechanical springs. However, these designs require modification of the ambulance itself, and/or complex mechanical arrangements with multiple linkages in the chase of U.S. Pat. 5,016,862 which belongs to Leyshon. Those modifications in the ambulances lead to increased cost and more complexity that discourages ambulance markers from acquiring these inventions.

[0013] U.S. Pat. No. 6,527,263 granted to Verbrugge for a shock-absorbing apparatus that combines mechanical link ages actuated by an air actuator (Pneumatic approach) and US20130133317A1 belonging to Zumbrum (Pneumatic approach using gas) suggested another absorb-shocking device. Again, the way this invention functions is complex and costly.

[0014] More recently, EMS Emergency Mobile Systems published a flyer regarding a shock absorbing hydraulic stretcher platform known as EP SA 030. In addition, another company that commercialized shock absorbing support is STEM (www.stem.it). The last-mentioned company has different shock absorbing supports (e.g. Eden, Optimus, R-3L, Mec-El, Compact-EL, MEC available at: https://www.keepandshare.com/doc22/110346/catalogo-ems-en-fr-it-web-rev-002-luglio-2020-pdf-5-3-meg?da=y. Although these products bring some solutions, they require pneumatic or hydraulic suspension or a combination of thereof. In addition, these approaches are very complex and their construction and implementation extremely costly not to mention that they all require electricity to function. Yet one more company that started commercializing shock absorbing supports is SPENCER ITALIA SRL (www.spencer.it). This company released a support called "BOB" similar to those of STEM. Again, the function of this device is hydraulic, making it complex and costly to afford, the install in the ambulance and to maintain and repair. Therefore, the mentioned devices are not suitable for many medical centers and are unaffordable for hospital in developing countries. Moreover, many times these devices need to be used in certain transport vehicles that assurance a specific standard making them more difficult to be used in universal and low cost vehicles.

[0015] On the other hand, a number of patents have been granted for shock absorption capabilities built into the stretchers themselves that later are placed onto ambulances. Some belonging to this group includes –among others- U.S. Pat. Nos 7,124,454 (Pneumatic approach); 7,111,340 (Hydraulic approach); 6,942,226 (Pneumatic approach); 5,135,350 (Hydraulic approach).

[0016] Therefore, it would be desirable to provide a simple, inexpensive, easy to install, use and repair, mechanical shock-absorbing platform based on just spring technology which can be quickly and easily mounted to the floor of an existing ambulance without further requirements and facilities, upon which a conventional stretcher may be positioned and immobilized in conventional fashion and where electricity would not be required unless for some more sophisticated alternatives.

SUMMARY OF THE INVENTION

[0017] According to the present invention, the shock-absorbing platform comprises a lower and an upper chassis. The upper chassis is connected by two pair of pivoting arms that contain at their top a pulley wheel that rolls over a guide mounted on the lower face of the upper chassis.

[0018] The pivoting arms are connected at their substantially lower part to a rod that dampens with a compression spring which is placed in a double action cylinder and at their substantially upper part with a system of tension springs that adjust according to the weight of the patients.

[0019] The tension of the tension springs occurs by the screwing of a tensor arm in a partially thread rod. The tensor arms pull a group of tension springs in order to pull the pivoting arms up and restore the platform´s height.

[0020] The tensors can adjust manually or electrically, and can adjust in an automatic or a non-automatic manner. Manually the platform can be operated by a handle. Electrically the platform can be operated by a motor or by at least one rotary actuator. The functioning of the platform can be automatically operated by the use of pressure or distance sensors mounted at a strategic place of the platform. The platform can be operated both manually and electrically with no further changes.

[0021] The platform is covered by a bellow cover and it has a ramp to load the stretcher with patients easier. The platform has a central locking system and over the upper chassis it can be placed on a loading rail for a stretcher.

[0022] As embodied and broadly described herein, an aspect of the present disclosure relates to a shock-absorbing platform for an ambulance stretcher wherein the shock-absorbing platform comprises: (a) at least one pivoting arm connected to an upper chassis of the shock-absorbing platform and to a floor of an ambulance, or (b) at least one pivoting arm connected to an upper chassis of the shock-absorbing platform and to a lower chassis of the shock-absorbing platform, and at least one damping system connected to the at least one pivoting arm wherein the damping system dampens shocks to the ambulance stretcher on the shock-absorbing platform. In one aspect, the at least one damping system is at least one of: mechanical, gas-based, hydraulic, hydraulic with valve, single or double tube, pressurized or non-pressurized, magnetic, rheological, or combinations thereof. In another aspect, the at least one mechanical damping system is spring based. In another aspect, the pivoting arms dampen with two or more damping systems. In another aspect, the two or more damping systems are at least one of: mechanical, gas-based, hydraulic, hydraulic with valve, single or double tube, pressurized or non-pressurized, magnetic, rheological, or combinations thereof. In another aspect, the at least one mechanical damping system is spring based. In another aspect, the shock-absorbing platform comprises two mechanical spring based damping system. In another aspect, the at least one damping system connects substantially perpendicular to the pivoting arms. In another aspect, at least two or more damping systems connect substantially perpendicular to the pivoting arms. In another aspect, one damping system connects to a substantially lower part of the pivoting arms and another damping system connects to a substantially upper part of the pivoting arms. In another aspect, the damping system that connects to the substantially lower part of the pivoting arms comprises at least two pairs of compression springs, one pair per half of the shock-absorbing platform. In another aspect, the damping system that connects to the substantially upper part of the pivoting arms comprises at least a tension spring per half of the platform. In another aspect, the damping system that connects to the substantially upper part of the pivoting arms comprises from 1 to 30 tension springs per half of the platform. In another aspect, the tension of the tension springs is adjustable manually, electrically or a combination of thereof. In another aspect, the manual adjustment occurs is with a handle, wheel, lever or a combination of thereof. In another aspect, the electrical adjustment occurs with at least a motor, an actuator, a drive shaft or a combination of thereof. In another aspect, the electrical adjustment of the tension springs occurs with two actuators. In another aspect, the actuators are rotary. In another aspect, the electrical adjustment of the tension springs is automatic. In another aspect, the electrical adjustment of the tension springs is automatic. In another aspect, the automatic adjustment is with at least a pressure sensor, a distance sensor or a combination of thereof. In another aspect, the automatic adjustment is with at least a pressure sensor, a distance sensor or a combination of thereof. In another aspect, the automatic adjustment is with a cam-follower mechanism mounted partially on a stick parallel to the pivoting arms and partially on the pivoting arms.

[0023] As embodied and broadly described herein, an aspect of the present disclosure relates to a method of absorbing shock to an ambulance stretcher during transport, the method comprising: (a) providing a shock-absorbing platform with at least one pivoting arm connected to an upper chassis of the shock-absorbing platform and to a floor of an ambulance; or (b) providing a shock-absorbing platform with at least one pivoting arm connected to an upper chassis and a lower chassis of the shock-absorbing platform of an ambulance; connecting at least one damping system connected to the at least one pivoting arm wherein the damping system dampens shocks to the ambulance stretcher on the shock-absorbing platform during transport.

[0024] In an alternative construction, each pair of pivoting arms can be replaced by one single arm with the shape of a fork with two prongs. In addition, an alternative construction contains only a pair of pivoting arms or only a single arm as described.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are incorporated into and form a part of the specification, illustrate several embodiments of the present invention and, together with the description, serve to explain the principles of the invention. The drawings are only for the purpose of illustrating a preferred embodiment of the invention and are not to be construed as limiting the invention. In the drawings:

[0026] FIG. 1 is an exploded view of a preferred embodiment of the ambulance shock-absorbing platform according to the present invention.

[0027] FIG. 2 is a representative view of the preferred embodiment without the chassis.

[0028] FIG. 3A is a partial sectional view of a pair of pivoting arms, an actuator and the tension springs.

[0029] FIG. 3B is a partial sectional view of a pair of pivoting arms, an actuator and the tension springs wherein the tension springs are inclined.

[0030] FIG. 4A is a representative view of connection and the parts from both sides of the pivoting arms and the tensor arms.

[0031] FIG. 4B is a representative view of connection and the parts from both sides of the pivoting arms and the tensor arms wherein the tension springs are inclined.

[0032] FIG. 5 is a representative view of the structure of a tensor arm.

[0033] FIG. 6 is an expanded view of the structure and parts of a tensor arms and its connection with the tension springs.

[0034] FIG. 7 is a view of the nut containing a flap to assemble with the tensor arms.

[0035] FIG. 8 is a representative view of the tensor arms elongated plate and tubes.

[0036] FIG. 9A is a representative view of a pair of pivoting arms and the connection between the arms.

[0037] FIG. 9B is a representative view of one single arm with the shape of a fork with two prongs.

[0038] FIG. 10 is vertical view of the lower chassis.

[0039] FIG. 11 is a view of a roller bearing unit.

[0040] FIG. 12 is a representative view of the foldable and adjustable anchorage support for roller bearing unit.

[0041] FIG. 13 is a view of another roller bearing unit that is mounted to the floor of the ambulance.

[0042] FIG. 14 is a representative view of bushing guide and the connection with the protrusion that extends from the cross beams of the upper chassis.

[0043] FIG. 15 is a cutting plane view of the double action cylinders.

[0044] FIG. 16 is another cutting plane view of the double action cylinders where is underlined the taps of the cylinders.

[0045] FIG. 17 is a representative view of the foldable cylinder´s fastener.

[0046] FIG. 18 is a representative view depicting the platform´s central locking system.

[0047] FIG. 19 is a representative view of the most preferred embodiment for the upper chassis, in which the actuators are placed in the central part of the chassis.

[0048] FIG. 20 is a representative view of the upper chassis, in which the actuators are placed on the ends of the chassis.

[0049] FIG. 21 is an exploded view of the ambulance shock absorbing platform according to the present invention, depicting the actuators at the ends of the upper chassis as it does Fig. 20.

[0050] FIG. 22 is a representative view of the upper chassis when it is constructed to place two motors at the ends of the upper chassis.

[0051] FIG. 23 is a representative view of the upper chassis when it is constructed to place one single motor at one ends of the upper chassis. The motor is draw with dash line.

[0052] FIG. 24 is a representative view of the platform showing the platform covered with a bellow cover, containing a stretcher´s ramp and in dash line is depicted the location for placing a stretcher´s load system.

[0053] FIG. 25 is a representative view of the mechanism that disconnect the actuator from the partially thread rod.

[0054] FIG. 26 is zoom in view of the disconnection between the tip of the actuator and the partially thread rod.

[0055] FIG. 27 is an exploded view of the ambulance shock absorbing platform according to the present invention, depicting only one pair of pivoting arms at one end of the platform and an adjusting mast at the other end.

DETAILED DESCRIPTION AND PREFERRED EMBODIMENTS

[0056] Although this invention has been described in detail with particular reference to the preferred embodiments, other embodiments can achieve almost the same results. Variations and modifications of the present invention will be considered obvious to those skilled in the art and it is intended to cover in the appended claims all such modifications and equivalents.

[0057] It is contemplated that any embodiment discussed in this specification can be implemented with respect to any method, kit, reagent, or composition of the invention, and vice versa. Furthermore, compositions of the invention can be used to achieve methods of the invention.

[0058] The present invention is an ambulance shock-absorbing platform described is formed by a upper chassis that is connected whether to the floor of the transportation vehicle or to a lower chassis by two pairs of pivoting arms operating by a damping system that includes at least the function of two tensing arms operated by an manual or by an electrical adjustable spring system according to a patient´s weight. The adjustment of the adjustable spring system is operated by a handle, when the adjustment is manual, and by, at least, a motor, an actuator or a drive shaft, when the adjustment is electric. Additionally, the electric adjustment can be automatic by using a pressure sensor or a distance sensor that determines the adjusting work of the motor, actuators or driveshaft.

[0059] The shock-absorbing platform for stretcher of this invention, not only reduce the suffering of the patients who are transported but also help doctors, paramedics and relatives to focus on their tasks (e.g., doctors can provide first aid the patients; relatives can concentrate on medical insurances or accommodations issues) rather than try to lessen the discomforts or pain that the hits of the transportation vehicle cause to the patient. Moreover, this invention helps the ambulance driver to drive more comfortably to the medical center since the driver will have the certainty that even when driving fast the patient is unlikely to be hurt as a consequence of his driving, braking, or sudden movement of the vehicle incurred by a pothole, bump, etc.

[0060] As shown in FIGS. 1 to 27, according to the present invention, the shock-absorbing platform comprises a lower chassis 9 and an upper chassis 1. The lower and upper chassis (1, 9) are generally rectangular with a range of measures as follow: from 1 meter to 2.5 meters of length and from 0.50 to 1.5 meters of width, preferably of 1.7 meter of length and 0.70 meter of width that represents the standard measure for a standard ambulance stretcher.

[0061] Over the central part of the lower chassis 9, on its sides, are placed four mounted roller bearing units 12, two per each lateral side of the lower chassis 9. These mounted roller bearing units 12 are placed and mounted on the floor (e.g., the floor of the ambulance or to the bottom chassis 9) on the lateral sides of the lower chassis 9 in a position approximately a quarter from each edge and in an equidistant of placing two pairs of pivoting arms 10 that will work using a fixed lower point for every mounted roller bearing units 12 previously mentioned. When instead of the pair of arms 10 the platform contains the single arm with the fork shape with two prongs 51 two roller bearing units 12 are placed and mounted on the middle of the bottom chassis 9.

[0062] As shown in FIG. 3A or 3B, each pair of pivoting arms 10 are connected on its lower end to a mounted roller bearing unit 12 and on its upper end to a pulley wheel 2. The pivoting arms 10 are placed parallel between themselves.

[0063] Over the lateral side of the lower chassis 9 are installed one or more double action cylinders 11 that each contain a central partition wall 48 that divides the cylinder 11 into two identical parts; two compression springs 4 (half is right side action and half is left side action); and two rods 15 (one for each side of the cylinders). As shown in FIG. 15, the rod 15 crosses the compression spring 4 and joins a head 49 which is placed on the opposite end of the eye of the rod 15. This eye of the rod 15 can be a female joint thread rod end bearing 50. The rod 15 may have a groove or notch (such as a quadrant) for adjustment purposes. As shown in FIG. 2, Each cylinder 11 is mounted -with screws or track master pins- on at least one fastener 23, preferably two fasteners 23 per cylinder. The base of each cylinder is welded on the lateral sides of the lower chassis 9. The cylinders 11 may contain a screw hollow tap 47 (a) that screw on a thread 47 (b) part of the cylinders making the assembly of the cylinders 11 easier as shown in FIG. 16.

[0064] As shown in FIGS. 3A and 3B, the rods 15 of the cylinders 11 are mounted on a substantially lower part of each of the pivoting arms 10. The end of the rod 15 that connects to the pivoting arms 10, ends in a thread portion on which a female joint thread rod end bearing 50 is screwed.

[0065] In the substantially lower part of each pivoting arms 10, in orientation to the center of the shock-absorbing platform, is mounted a fork-shape protrusion 7. The connection between each rod 15 and each pivoting arm 10 is produced by the joint of the female thread end bearing 50 and the fork-shape protrusion 7 that extends from each pivoting arm 10. The structure of this joint, e.g., the female joint thread rod end bearing 50, prevents rigidness and the wear that could take place between the fork-shape protrusion 7 and the rod 15, providing the joint with certain mobility and flexibility. In an alternative embodiment, the end of the rod 15 could have a fork-shape or other different constructions where those constructions allow –preferably- flexibility to the joint of the pivoting arm 10 and the rod 15.

[0066] Ideally, the cylinders 11 shown in FIG. 15, contain compression springs 4 with inside diameter ranges from 1 mm to 200 mm, and an outside diameter ranges from 2 mm to 400 mm, preferable these compression springs 4 have an inside diameter that ranges from 20 to 50 mm and outside diameter that ranges from 30 mm to 100 mm. More preferable, the compression springs 4 have an inside diameter of 28 mm and an outside diameter of 40 mm, with a wire diameter of 6 mm and a length of 130 mm and a length of the spirals of the spring of 13 mm with a total of ten spirals.

[0067] Alternatively, it can be used other compression springs 4 with a different wire diameter that ranges from 1 mm to 40 mm and a length that ranges from 10 mm to 500 mm and a length of the spiral that ranges from 3 mm to 500 mm with a total of spirals that ranges from 1 to 50.

[0068] In an alternative version, the double action cylinders 11 have compression springs 4 that can be replaced for a single action cylinder containing the compression springs 4. Each single action cylinder containing the compression springs is positioned opposite to one another and works respectively for the right and left pivoting arms 10. Each single cylinder contains ideally a compression spring similar to those mentioned in this invention for the double actions cylinders. Since the double action cylinders 11 contains two compression springs 4 (right and left action) in just one piece, it brings more stability and will be easier to install than the simple action cylinder.

[0069] In an alternative embodiment, the double action cylinders 11, whether double or single, can be replaced with a shock-absorbing system made of: gas, hydraulic, hydraulic with valve, mixed or combined, single or double tube, pressurized or non-pressurized, magnetic, rheological and/or a combination of them. In every case, the desirable effect is to pull the pivoting arms 10 so they can stand up when the weight of the patient and the shocks recline the pivoting arms 10. This action of absorbing the shocks and vibration is obtained because of the rolling of the pulley wheel 2 over the guide for pulley wheels 18 -positioned on the lower face of the lateral side of the upper chassis 1- to the center of the shock-absorbing platform. Consequently, this action brings back the optimal high of the upper chassis 1, over which, the ambulance stretcher with the patient is placed.

[0070] The lower chassis 9 contains three cross beams 16 that are positioned in an equidistant away from one another, while the upper chassis 1 may contain from three to five cross beams 17(a-c) depending on the multiple embodiments as is mentioned in the coming paragraphs.

[0071] The upper chassis 1, is a rectangular structure crossed by many cross beams depending on each alternative or embodiment. In all the alternatives, the upper chassis 1 contains a guide 18 for pulley wheels that is mounted on the lower faces of the lateral sides of the upper chassis 1, placed preferably towards the end of the chassis 1. Over these guides 18 roll the pulley wheels 2. In total are four guides 18 each of them mounted on the lower face of the upper chassis 1. In an alternative embodiment, the pulley wheels 2 can be replaced by wheels, balls or objects that allow the rolling, and the guides 18 can be alternatively replaced for channels, tubes, scaffolding or elements that permit the scaffolding.

[0072] In a preferred embodiment, as shown in FIG. 1, the upper chassis 1 contains three cross beams 17, respectively 17 (a), 17 (b) and 17 (c). The cross beam 17 (b) is called the central cross beam and it is positioned in the center of the upper chassis 1 while the cross beams 17 (a) and 17 (c) are positioned toward the ends of the upper chassis 1 preferably in a range of five to thirty centimeters and more preferable to a range of six and eight centimeters of the ends of the upper chassis 1 when it is measured from the center of the cross beam 17 (a) or 17 (c) to the outside length border of upper chassis 1.

[0073] As shown in FIG. 23, the three cross beams 17, contain toward their ends two hollow protrusions 40 that contain at least a set screws 6 or a similar fixation screw. The function of the hollow protrusions 40 is to serve as a support structure for a bushing lateral guide 28. In total there are two bushing lateral guides 28, one of them will be placed on the left side of the lower face of the upper chassis 1 and the other will be placed on the right side of the lower face of the upper chassis 1. Each bushing lateral guide 28 contains –preferably- three set screws 6, one per each hollow protrusion 40 as shown in FIG. 14. In an alternative embodiment, the bushing lateral guides 28 are in a fixed position in the protrusions 40 dispensing with the set screw 6. In this alternative embodiment, the bushing lateral guides 28 and the protrusions 40 are a single piece. Nonetheless, this last mentioned embodiment does not allow mounting and dismounting the bushing lateral guides 28 easily.

[0074] In a preferred embodiment, the cross beams 17(a) and 17(c) contain –each of them- in their lower and central part a foldable and adjustable anchorage support 8 for a roller bearings unit 22. The adjustable anchor is placed vertically with respect to the upper chassis 1 and orientated towards the center of the upper chassis 1. Meanwhile, the central cross beam 17 (c) contains two supports for actuators 42, one left-orientated and the other right-orientated. Each support for actuators 42 contains, at least, a fixation hole to fasten an actuator 43. The joint between the actuator 43 and the support for actuator 42 is mediated by at least a screw, dowel or fixation element.

[0075] Finally, as shown in FIG. 19, between the different cross beams 17, there will be a rectangular crossbar 44, left and right, one for each half of the ambulance shock-absorbing platform. The rectangular crossbar 44 contains on each lateral side a fold and in its lower face on the end closer to the center of the ambulance shock-absorbing platform an actuator fastener 41. Preferably, the shape of the actuator fastener 41 will adapt the shape of the actuator 43. In this invention, the actuator 43 is cylindrical so that the shape of the actuator fastener 41 will contain a semi-circular shape and a semi-circular staple or fastener will join the actuator 43 with the actuator fastener 41. In other different embodiments, the crossbar 44 will connect others cross beams 17 that the invention may have.

[0076] As it was stated before, the upper ends of the pivoting arms 10 are connected, each of them, to a pulley wheel 2. Each pulley wheel 2 rolls from the center to the ends of the upper chassis 1 and vice versa, over the guide 18 that is fixed on each of the lower faces of the lateral sides of the upper chassis 1.

[0077] As shown in FIGS. 4A. or 4B, the pivoting arms 10 are connected together through a round bar 19 that is attached on the substantially upper part of the pivoting arms 10 below the union of the pivoting arms 10 and the pulley wheel 2. This round bar 19, preferably of a resistant material such as steel wire-drawing, passes through and serves as an axis for a tube 20 that has connected to it an elongated plate 21 with, at least, one circular perforation where at least one tension spring is placed. Preferably, the elongated plate 21 has, at least, two circular perforations where, at least, two tension springs 5 are placed. More preferably, the elongated plate 21 has at least three circular perforations where at least three tension springs 5 are placed. More preferably, the elongated plate 21 contains at least four circular perforations where at least four tension springs 5 are placed. More preferably, the elongated plate 21 contains at least eight circular perforations where at least eight tension springs 5 are placed. Ideally the elongated plate 21 has more than ten circular perforations where at least ten tension springs 5 are placed. In the present innovation, the elongated plate 21 contains thirteen circular perforations where thirteen tension springs 5 are placed and this works for a patient average weight between 60 and 75 kilograms. In an alternative embodiment, the elongated plate with perforations 21 may contain from one to thirty perforations for placing from one to thirty tension springs 5 respectively. The structure created by the bar 19 and the tube 20 allows the tube 20 –including the fixed elongated plate 21 with holes- to move when the ambulance shock-absorbing platform receives vertical shocks as it happens when the ambulance drives through uneven routes, potholes or speed bumps. Alternatively, the bar 19 and the tube 20 can be a single piece although this alternative reduces the mobility and flexibility of the entire structure.

[0078] Therefore, on one end, the tension springs 5 are connected to the elongated plate 21, this plate 21 is connected to the bar 19 and with the tube 20, and this later mentioned structure connected to the pivoting arms 10. On the other end, the tension springs 5 are connected to a tensor arm 24 (in a preferred embodiment there are two tensor arms 24, each of them for one side –left and right- of the ambulance shock-absorbing platform).

[0079] The cross beams 17 (a) and 17 (c) have positioned in their lower face at the center of them, an adjustable anchorage support 8 (FIG 12) for a roller bearings units 22 (FIG. 11). The two roller bearing units 22 are crossed in their central part respectively by two partially thread rod 14 (one per half of the ambulance shock-absorbing platform, in other words, half for the right part and half for the left part of the platform). At the end towards to the center of the upper chassis 1, the tips of the partially thread rods 14 are smooth (non-thread) and connect to the actuators 43 by a retractable connector tube 45, as it is shown in FIG. 3A or 3B. At the other end, the tips of the partially thread rods 14 have a square shape that is used to place a handle 31 to adjust the partially thread rods 14 as it is shown in FIG. 1. The square shape of the tips of the partially thread rods 14 can adopt other shapes such as circular, triangular, pentagonal, hexagonal and/or a combination of thereof, in order to permit the use of a handle that permits the assembling and to manually rotate the partially thread rods 14. In an alternative embodiment, the handle 31 and the partially thread rod 14 can be one single piece. In addition the partially thread rods 14 may have a groove or notch (such as a quadrant) for adjustment purposes in places others than at their ends.

[0080] In one embodiment the actuator 43 is a 12 volts rotary actuator. The connection between the partially thread rod 14 and the actuator´s stem may be given by retractable connector tube 45 that has, at least, a fastener element such as a screw that fasten the actuator´s stem with the partially thread rod 14. In a preferred embodiment shown in FIG 25, the disconnection between the partially thread rod 14 and the actuator´s stem is produced by a mechanism that comprises: a partially thread stick 52 that starts at one end of the platform and crosses -towards the center of the platform- a thread bushing 53 that is mounted on the central upper chassis cross beam 17 (b) or the resulting central cross beam of that embodiment. When adjusted, the tip of this partially thread stick 52 next to the center of the platform hits a lever arm 62 that is connected to a pinion 54 that has mounted two chains 55 on opposite sites. When the partially thread stick 52 adjusts – manually from the other end of the stick with a handle, such as the same handle 31- on the thread bushing 53, it moves the lever arm 62 and therefore the pinion 54, making it to roll up the two chains 55 on the pinion 54. On the other ends, the chains 55 connect to a plate 56, on each side of the platform, with at least a hole through which crosses the stem of each actuator 43. The tip of the stem of the actuator has attached a hexagonal tube 57 that fits on a hexagonal tip 61 mounted on the partially thread rod 14. In addition, the tip 61 of the partially thread rod 14 may contain a protrusion such as a needle 58 that fits on the hexagonal tube 57 making the connection stronger as it is shown in FIG. 26. The hexagonal tube 57 has a hollow where the needle 58 fits. Consequently, when the chains 55 roll up on the pinion 54, they pull each plate 56, disconnecting the partially thread rod 14 from the stem of the actuator 43. As shown in FIG. 25, a second pinion 59 mounted on the cross beam 17 (b) (or central cross beam) only in one haft of the platform, helps to stabilize a chain 55. The importance to disconnect the partially thread rod 14 from the stem of the actuator 43, either by the retractable connector tube 45 or the mechanism that uses the partially thread stick 52 before explained, is to adjust, calibrate and/or settle the platform to the weight the patient. This means to adjust the partially thread 14 into the tensor arm 24. Without this disconnection, the actuators 43 would prevent any kind of adjustment of the partially thread rod 14, locking the rods 14 to a standard position and patient´s weight that may be not recommended in certain cases. In other words, to be able to adjust the platform to a specific weight of patients improves the specificity of the platform making it more weight sensible.

[0081] For each half of the ambulance shock-absorbing platform will be a partially thread rod 14, left thread and right thread. Preferably, the partially thread rod 14 are of 7/8 inches by 1,9 centimeters. Each partially thread rod 14 will cross –screwing- a nut 13 that is attached to each tensor arm 24 as it is shown in FIGS. 3A and 3B. There are two nuts 13, one attached to the left tensor and the other attached to the right tensor 24. The nut 13 contains in its lower part a flap that serves to connect to the tensor arms 14. Preferable the nut 13 is of a non-oxidant element such as copper that help the smooth screwing of the partially thread rod 14 in the nut 13 without restrictions or frictions. Thus, the ambulance shock-absorbing platform has two tensors 24 arms, one in the left haft and the other in the right haft of the upper chassis 1, with the structure that is explained as follows.

[0082] FIG. 5 shows that each tensor arms 24 is formed by a metallic or resistant material structure with the same shape of an isosceles triangle that comprises: a) a bar 25 that plays the role of the side of uneven length and b) two bars of the same length 26 that play the role of the even sides of the triangle. In the lateral vertex of the triangle, that is the union between the uneven sides with the even side, is a bushing 27 and in the central vertex of the triangle, in other words, in the union of the two even sides, is the nut 13 previously mentioned.

[0083] The bar 25 serves as an axis that crosses the tubes 38, respectively right 38(a) and left 38(b). Both tubes are attached to an elongated plate 29 that contains at least one circular perforation where at least one tension spring is place. Preferably, the elongated plate 29 has two circular perforations where at least two tension springs 5 are placed. More preferably, the elongated plate 29 has at least three circular perforations where at least three tension springs 5 are placed. More preferably, the elongated plate 29 has at least four circular perforations where at least four tension springs 5 are placed. More preferably, the elongated plate 29 has at least eight perforations where at least eight tension springs 5 are placed. Ideally the elongated plate 29 has more than ten tension springs 5. In the present innovation, the ambulance shock-absorbing platform 29 contains thirteen perforations where thirteen tension springs 5 are placed. In an alternatively embodiment, the elongated plate 29 may contain from one to thirty perforations for placing from one to thirty tension springs 5 respectively. The tension springs 5 of the present invention are of 160 millimeters of length inside ends and of 90 millimeters of body length and of outside diameter of 23 millimeters.

[0084] The structure formed by the bar 25 and the tubes 38 (a) and 38 (b) and the elongated plate 29 is similar to the structure formed by the bar 19 and the tube 20 and the elongated plate 21 with the difference that instead of an entire tube 20 are two smaller tubes 38 (a) and 38 (b) that are designed in that way to allow placing the nut 13 into the tensor arm 24.

[0085] The bars 26 counteract the opposite force that the tensioning of the tension springs 5 produces and is explained later on. In an alternative embodiment the bars 26 can disappear as long as the bar 25 is resistant enough and is not likely to bend. In addition, in an alternative embodiment the tension springs 5 can be replaced by bands or connectors with elastic and resistant properties.

[0086] The bushings 27 –located are the ends of the tensor arms 24- slide through bushing lateral guides 28 that are placed in the lower face of the lateral sides of the upper chassis 1.

[0087] Thus, it can be seen that each tensor 24 and its respectively structure –bar 25, tubes 38 (a) and (b) and the elongated plate 29- is connected by the tension springs 5 to the upper pivoting arms 10 and their respectively structure –bar 19, tube 20 and elongated plate 21. More specifically, the tension springs 5 are connected on one side to an elongated plate 29 that belongs to the tensor 24, and on the other side, are connected to the elongated plate 21 that belongs to the pivoting arms 10.

[0088] As shown in FIG. 6, with this conformation, the function of the tension springs 5 is to join each structure of both sides. Since the nut 13 locks the tensor 24 at a certain and desirable point, this will act as a fixed point for the tension springs 5 connected to them. Therefore, the tension springs 5 will tend to pull the structure connected to them on the other side, this is the structure that comprises the pivoting arms 10, pulling up the pivoting arms 10 every time that they recline over the lower chassis 9 as a result of a shock produced by a pothole or a bump of the road. These movements of the pivoting arms 10 –reclining over the lower chassis 9 and pulling up recovering the height of the upper chassis- are the movements responsible for absorbing the shocks received by the ambulance. In this sense, when the ambulance passes over a pothole or over a bump, the shock will be transmitted to the floor of the vehicle lifting the floor of the vehicle and, as a consequence, lifting the lower chassis 1 that will shorten the existing distance between the two chassis. This shortening of distance between the two chassis is possible by the rolling of the pulley wheels 2 toward the ends of the lateral side of the upper chassis 1. The height of the chassis is recovered when the tension springs 5 pull the pivoting arms up. The ideal range of height of the chassis to absorb the shocks is from ten to one hundred centimeters, preferably, from twenty to thirty five centimeters and more preferably from twenty three to twenty seven centimeters.

[0089] On the other hand, the tension of the tension springs 5 is adjustable according to the degree of screwing of the partially thread rod 14 into the nut 13 of the tensor arms 24. The tension of the tension springs 5 depends on the weight of the patient, the number of tension springs 5 used in the platform and the resistance of these tension springs 5. The weightier the patient, the more tension that the tension springs 5 required to pull up the pivoting arms 10. In every case, the combination of: i) the number of tension springs 5, ii) the resistance of the tension springs and iii) the tension of the tension springs 5 need to ensure the restoration of the ideal height of the upper chassis 1 before mentioned.

[0090] The screwing of the partially thread rod 14 into the nut 13 can be made manually by a handle 31 or electrically by at least one motor 30 or by at least one actuator 43. Likewise, the electric tension can be automatic or not automatic. The screwing of the partially thread rod 14 into the nut 13 –and therefore the tension of the tension springs 5- is automatic by a distance sensor that is positioned on the upper side of the lower chassis 9 or in the lower side of the upper chassis 1 and indicates when the ideal height between the chassis is reached. When the ideal height is reached the electricity power stops and the platform is ready to be used. An alternative embodiment is presented using a pressure sensor that is programmed to adjust the partially thread rod 14 according to the weight of the patients.

[0091] According to this description, the tensor arms 24 and the pivoting arms 10 form a functional structure that will work together and in harmony as it is stated as follows.

[0092] The ambulance shock-absorbing platform starts at an initial position in which the upper chassis 1 is reclined over the lower chassis 9 at a minimal distance. In this initial position, the pivoting arms 10 are at a minimal angle (e.g. from five to thirty degrees) with respect to the lower chassis 9. At this position, the ambulance stretcher with the patient is placed on the ambulance shock-absorbing platform and the stretcher is locked in the anchorage/s for stretcher 36 with a stretcher locking hook 37.

[0093] After the patient is placed on the ambulance stretcher and the ambulance stretcher is placed on the ambulance shock-absorbing platform, it is necessary to distinguish if the platform is operated manually or electrically. If the platform is operated manually, either on the case that the platform has no motor nor actuator or in the case that it has, the paramedic needs to turn the handle(s) 31 screwing the partially thread rods 14 into the nut 13 until the ideal height from both half of the platform is reached. The ideal height is detected by a signal such as an alarm that is emitted when the distance sensor measures the ideal height. There is a notch at both side of the ends of the upper chassis 1 that permit the connection between the partially thread rods 14 and the handles 31. According to what was mentioned on paragraph 76, if the platform contain actuators 43, they first need to be disconnected from the partially thread rod 14. On the other hand, if the platform is operated electrically, at least, a distance sensor is placed at the lower face of the upper chassis 1 and/or at the upper face of the lower chassis 9. Once the patient with the ambulance stretcher is placed at the platform, the platform is unlocked inactivating a central locking system 3 and the motor/s 30 or actuators 43 start working screwing the partially thread rod 14 into the nut 13 and the motor/s 30 or the actuators 43 will stop once the optimal height is reached shutting off the motor/s 30 or the actuators 43 (central locking system is shown in FIG. 18). Instead of distance sensors they can be used pressure sensors that are placed at the top of the upper face of the upper chassis 1. Once the number of tension springs 5 and their resistance is chosen, the pressure sensors will determine how much the motor/s 30 or the actuators 43 will screw the partially thread rods 14 into the nut 13 according to the weight of the patient.

Alternatively, if no sensor is likely to be used, a stick can be placed parallel to the pivoting arms 10 containing a cam-follower mechanism. In this alternative, the pivoting arms 10 contain a protrusion at a certain part of them and when that protrusion touches the cam-follower mechanism mounted on the parallel stick, meaning that the optimal height was reached, the system will shut off the electricity of the respectively motor/s 30 or actuators 43. The platform can be operated manually or electrically not damaging the motor/s 30 or the actuators 43 using motor 30 or actuators 43 that can be programmed to unlock a rigid position or by using a disconnection link such as the retractable tube 45 or the disconnection mechanism mentioned on paragraph 76 . Both mechanisms permit the paramedic to temporally disconnect the partially rods 14 with the stem of the actuator 43 and to adjust manually the partially rods 14 using the handle 31.

[0094] In the previously mentioned automatic structure, it is observed that the motor/s 30 or the actuators 43 adjust or loosens the tension of the tension springs 5 when screwing or unscrewing the partially threaded rod 14. The motor/s 30 may have an electronic interlock that allows the change of direction of rotation with, e.g., a 12 volt direct current contactors. Due to the aforementioned interlock, it joins a normal open double pushbutton (N.O.) and two normal closed switches (N.C.).

[0095] Once that the ambulance stretcher is placed and fastened on the ambulance shock absorbing platform and the desirable height is reached, the ambulance starts travel to the medical center. The potholes or the bump will produce shocks that will lead to the pivoting arms 10 to move up and down. This shock absorbing effect is produced due to the vertical movements, up and downs, of the pivoting arms 10 that occur due to the sliding of the pulley wheels 2 over the guides for pulley wheels 18 mounted on the lower face of the upper chassis 1 for one and the other side, shortening and enlargement of the distance between the chassis 1 and 9, thus, absorbing the shocks received by the vehicle.

[0096] To counteract the crushing between the chassis 1 and 9 that occurs when the platform receives a shock and in order to restore the ideal height desirable to absorb the shocks, act the tension springs 5 and the compression springs 4. On the one hand, the tension springs 5 will pull the pivoting arms 10 up toward the center of the chassis 1. On the other hand, as shown in FIG. 15, the compression springs 4 located inside the double action cylinder 11, whose compression springs 5 were compressed for the pushing of head 49 of the rod 15 attached to the pivoting arms 10, will tend to expand restoring their normal length, and by doing this, the compression springs 4 will push again the head 49 of the rods 15 towards the center of the lower chassis 9 what at the same time will pull the pivoting arms 10 up recovering the ideal height between the chassis which absorbs the shocks.

[0097] Summing up, the ambulance shock-absorbing platform will work as follows:

i) Shorting of the distance between the upper chassis 1 and the lower chassis 9: The pivoting arms 10 recline over the lower chassis 9 by rolling of the pulley wheels 2 through the guides for pulley wheels 18 towards the external ends of the platform absorbing the shocks by shortening the distance between the chassis.

ii) Lengthening of the distance between the upper chassis 1 and the lower chassis 9: Once the shock stops, the tension springs 5 that have been expanded when the pivoting arms 10 reclined toward the lower chassis 9, pull again the pivoting arms 10 toward the center of the upper chassis 1. The same is done by the compression springs 4 that pull the pivoting arms 10 from the substantially lower part of the pivoting arms 10. In this scenario, the pulley wheels 2 roll back toward the center of the chassis 1 increasing and restoring the distance between the chassis.

[0098] In order to avoid that a strong shock damage the chassis by splitting them apart a fasten wire 32 (shown in FIG. 18) from a resistant material such as steel, is placed on the edges of the chassis. On the other hand, in order to avoid that a strong shock damages the chassis and their elements –in particular the motors 30 or the actuators 43- a pair of rubber studs 39 (a) that are screwed on stud supports 39 (b) in the upper chassis 1 and in the lower chassis 9 (See FIG. 18). In a preferred embodiment, the rubber studs 39 (a) are placed in the upper part of the pivoting arms 10 on the face that is most proximately to the upper side of the lower chassis 9.

[0099] In addition, the ambulance shock-absorbing platform has a ramp 33 to make it easier to place the stretcher onto the platform.

[0100] In order to avoid that the ambulance shock-absorbing platform can by accident turn on, the platform contains a central locking system 3 mounted on the lower chassis 9. The central locking system 3 locks a hollow protrusion that extends from the upper chassis 1, preventing the elevation of the pivoting arms 10 and therefore, the elevation of the upper chassis 1. The central locking system 3 not only locks mechanically both chassis 1 and 9 but also shuts down the electricity for the actuator 43 and/or the motors 30 to work. Additionally, the platform may contain a kill switch also called emergency switch that shuts off the entire electricity of the platform.

[0101] As shown in FIG. 24, the ambulance shock-absorbing platform has a bellow cover 34 around their lateral walls and at the top of the upper face of the upper chassis 1 is placed a top 35 containing at least two anchorages 36 –optimally four anchorages- to place the ambulance stretcher. These anchorages 36 are fixed and/or screwed on the top 35. The anchorages 36 contain at least a locking hook 37 to fasten the ambulance stretcher.

[0102] In another embodiment, it can be mounted on the top of the upper chassis 1 a rail load system 46 to load automatically a stretcher with a patient such as the Power-Load™ of Stryker.

[0103] In a preferred embodiment, the ambulance shock-absorbing platform contains two rotary actuators 43 of low rpm, preferred in the range of 10 to 300 rpm and more preferred in the range of 70 to 100 rpm placed in the middle of the upper chassis 1. In an embodiment it was used a Welter™ (Córdoba – Argentina) 12 volts rotary actuator of 75 rpm.

[0104] In an alternative embodiment, the ambulance shock-absorbing platform contains two rotary actuator 43 that are placed not at the center but at the ends of the upper chassis 1.

[0105] In an alternative embodiment, the ambulance shock-absorbing platform contains only one motor 30, and only a thread rod that is half right thread and half left thread. However, in this embodiment, the elevation of both sides of the platform –left half side and right half side- must be done simultaneously since the motor 30 will work the same time for both sides. Since the motor 30 works the same time for the weightier half of the platform (that is the side that supports the thorax and head of the patient) as for the lighter half of the platform (that is the side that supports the legs of the patient) it is recommended to have less tension springs 5 or less resistance springs 5 on the lighter half side of the platform so as to balance and obtain the same height and an even height on both side of the platform.

[0106] In an alternative embodiment, the ambulance shock-absorbing platform contains a single thread rod half left and half right thread rod operated by a handle 31 without any motor or actuator.

[0107] In another embodiment the double action cylinders 11 and the pivoting arms 10 are mounted directly on the ambulance´s floor eliminating the lower chassis 9. In this embodiment, the central locking system 3, the base for the fastener wire 32 and the bellow cover 34 are placed on the ambulance´s floor. This alternative reduces space but is not as stable and rigid as when the lower chassis 9 is mounted to the ambulance´s floor.

[0108] FIG. 9A is a representative view of a pair of pivoting arms and the connection between the arms. FIG. 9B is a representative view of one single arm with the shape of a fork with two prongs. In an alternative construction, each pair of pivoting arms can be replaced by one single arm 51 with the shape of a fork with two prongs as it is shown in FIG. 9B. In this embodiment there will be need two roller bearing units 12 to connect the bottom part of the arm to the floor of the platform. In addition, the platform may be constructed with two pivoting arms 10 on a half of the platform and a single arm 51 on the other half part of the platform.

[0109] As it is shown in FIG. 27, an alternative construction contains only a pair of pivoting arms 10 or only a single arm as 51 on only on half part of the platform, the half part that support the heaviest part of the patient (chest and head). On the other part of the platform, that on without arm, is mounted an adjustable mast 60 with a standard height. This construction simplifies the construction of the platform at the expense of reducing shocking absorb capacity of the platform.

[0110] Additionally, it was tested that proving an inclination to the tensor springs 5 when connection the pivoting arms 10 and the tensor 24 such as is shown in FIG. 3B and 4B. improved and increased the pulling force of the tension springs 5.

[0111] Finally, another damping system whether tension spring or compression spring can be added to the arm/s proving the whole platform with two double cylinders 11 with compression springs 4 or a second group of tension spring 5 to the tensor arms and/or a combination of thereof.

[0112] It will be understood that particular embodiments described herein are shown by way of illustration and not as limitations of the invention. The principal features of this invention can be employed in various embodiments without departing from the scope of the invention. Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, numerous equivalents to the specific procedures described herein. Such equivalents are considered to be within the scope of this invention and are covered by the claims.

[0113] All publications and patent applications mentioned in the specification are indicative of the level of skill of those skilled in the art to which this invention pertains. All publications and patent applications are herein incorporated by reference to the same extent as if each individual publication or patent application was specifically and individually indicated to be incorporated by reference.

[0114] The use of the word “a” or “an” when used in conjunction with the term “comprising” in the claims and/or the specification may mean “one,” but it is also consistent with the meaning of “one or more,” “at least one,” and “one or more than one.” The use of the term “or” in the claims is used to mean “and/or” unless explicitly indicated to refer to alternatives only or the alternatives are mutually exclusive, although the disclosure supports a definition that refers to only alternatives and “and/or.” Throughout this application, the term “about” is used to indicate that a value includes the inherent variation of error for the device, the method being employed to determine the value, or the variation that exists among the study subjects.

[0115] As used in this specification and claim(s), the words “comprising” (and any form of comprising, such as “comprise” and “comprises”), “having” (and any form of having, such as “have” and “has”), “including” (and any form of including, such as “includes” and “include”) or “containing” (and any form of containing, such as “contains” and “contain”) are inclusive or open-ended and do not exclude additional, unrecited elements or method steps. In embodiments of any of the compositions and methods provided herein, “comprising” may be replaced with “consisting essentially of” or “consisting of”. As used herein, the phrase “consisting essentially of” requires the specified integer(s) or steps as well as those that do not materially affect the character or function of the claimed invention. As used herein, the term “consisting” is used to indicate the presence of the recited integer (e.g., a feature, an element, a characteristic, a property, a method/process step or a limitation) or group of integers (e.g., feature(s), element(s), characteristic(s), property(ies), method/process steps or limitation(s)) only.

[0116] The term “or combinations thereof” as used herein refers to all permutations and combinations of the listed items preceding the term. For example, “A, B, C, or combinations thereof” is intended to include at least one of: A, B, C, AB, AC, BC, or ABC, and if order is important in a particular context, also BA, CA, CB, CBA, BCA, ACB, BAC, or CAB. Continuing with this example, expressly included are combinations that contain repeats of one or more item or term, such as BB, AAA, AB, BBC, AAABCCCC, CBBAAA, CABABB, and so forth. The skilled artisan will understand that typically there is no limit on the number of items or terms in any combination, unless otherwise apparent from the context.

[0117] As used herein, words of approximation such as, without limitation, “about”, "substantial" or "substantially" refers to a condition that when so modified is understood to not necessarily be absolute or perfect but would be considered close enough to those of ordinary skill in the art to warrant designating the condition as being present. The extent to which the description may vary will depend on how great a change can be instituted and still have one of ordinary skill in the art recognize the modified feature as still having the required characteristics and capabilities of the unmodified feature. In general, but subject to the preceding discussion, a numerical value herein that is modified by a word of approximation such as “about” may vary from the stated value by at least ±1, 2, 3, 4, 5, 6, 7, 10, 12 or 15%.

[0118] All of the compositions and/or methods disclosed and claimed herein can be made and executed without undue experimentation in light of the present disclosure. While the compositions and methods of this invention have been described in terms of preferred embodiments, it will be apparent to those of skill in the art that variations may be applied to the compositions and/or methods and in the steps or in the sequence of steps of the method described herein without departing from the concept, spirit and scope of the invention. All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope and concept of the invention as defined by the appended claims.

[0119] To aid the Patent Office, and any readers of any patent issued on this application in interpreting the claims appended hereto, applicants wish to note that they do not intend any of the appended claims to invoke paragraph 6 of 35 U.S.C. § 112 as it exists on the date of filing hereof unless the words “means for” or “step for” are explicitly used in the particular claim.

[0120] For each of the claims, each dependent claim can depend both from the independent claim and from each of the prior dependent claims for each and every claim so long as the prior claim provides a proper antecedent basis for a claim term or element.

CLAIMS

What is claimed is:

1. A shock-absorbing platform for an ambulance stretcher wherein the shock-absorbing platform comprises:

(a) at least one pivoting arm connected to an upper chassis of the shock-absorbing platform and to a floor of an ambulance, or

(b) at least one pivoting arm connected to an upper chassis of the shock-absorbing platform and to a lower chassis of the shock-absorbing platform, and

at least one damping system connected to the at least one pivoting arm wherein the damping system dampens shocks to the ambulance stretcher on the shock-absorbing platform.

2. The shock-absorbing platform as defined in claim 1, wherein the at least one damping system is at least one of: mechanical, gas-based, hydraulic, hydraulic with valve, single or double tube, pressurized or non-pressurized, magnetic, rheological, or combinations thereof.

3. The shock-absorbing platform as defined in claim 2, wherein the at least one mechanical damping system is spring based.

4. The shock-absorbing platform as define in claim 1, wherein the pivoting arms dampen with two or more damping systems.

5. The shock-absorbing platform as defined in claim 4, wherein the two or more damping systems are at least one of: mechanical, gas-based, hydraulic, hydraulic with valve, single or double tube, pressurized or non-pressurized, magnetic, rheological, or combinations thereof.

6. The shock-absorbing platform as defined in claim 5, wherein the at least one mechanical damping system is spring based.

7. The shock-absorbing platform as defined in claim 6, wherein the shock-absorbing platform comprises two mechanical spring based damping system.

8. The shock-absorbing platform as defined in claim 7, wherein the at least one damping system connects substantially perpendicular to the pivoting arms.

9. The shock-absorbing platform as defined in claim 8, wherein at least two or more damping systems connect substantially perpendicular to the pivoting arms.

10. The shock-absorbing platform as defined in claim 9, wherein one damping system connects to a substantially lower part of the pivoting arms and another damping system connects to a substantially upper part of the pivoting arms.

11. The shock-absorbing platform as defined in claim 10, wherein the damping system that connects to the substantially lower part of the pivoting arms comprises at least two pairs of compression springs, one pair per half of the shock-absorbing platform.

12. The shock-absorbing platform as defined in claim 10, wherein the damping system that connects to the substantially upper part of the pivoting arms comprises at least a tension spring per half of the platform.

13. The shock-absorbing platform as defined in claim 10, wherein the damping system that connects to the substantially upper part of the pivoting arms comprises from 1 to 30 tension springs per half of the platform.

14. The shock-absorbing platform as defined in claim 13, wherein the tension of the tension springs is adjustable manually, electrically or a combination of thereof.

15. The shock-absorbing platform as defined in claim 14, wherein the manual adjustment occurs is with a handle, wheel, lever or a combination of thereof.

16. The shock-absorbing platform as defined in claim 14, wherein the electrical adjustment occurs with at least a motor, an actuator, a drive shaft or a combination of thereof.

17. The shock-absorbing platform as defined in claim 16, wherein the electrical adjustment of the tension springs occurs with two actuators.

18. The shock-absorbing platform as defined in claim 17, wherein the actuators are rotary.

19. The shock-absorbing platform as defined in claim 14, wherein the electrical adjustment of the tension springs is automatic.

20. The shock-absorbing platform as defined in claim 17, wherein the electrical adjustment of the tension springs is automatic.

21. The shock-absorbing platform as defined in claim 19, wherein the automatic adjustment is with at least a pressure sensor, a distance sensor or a combination of thereof.

22. The shock-absorbing platform as defined in claim 20, wherein the automatic adjustment is with at least a pressure sensor, a distance sensor or a combination of thereof.

23. The shock-absorbing platform as defined in claim 20, wherein the automatic adjustment is with a cam-follower mechanism mounted partially on a stick parallel to the pivoting arms and partially on the pivoting arms.

24. A method of absorbing shock to an ambulance stretcher during transport, the method comprising:

(a) providing a shock-absorbing platform with at least one pivoting arm connected to an upper chassis of the shock-absorbing platform and to a floor of an ambulance; or

(b) providing a shock-absorbing platform with at least one pivoting arm connected to an upper chassis and a lower chassis of the shock-absorbing platform of an ambulance;

connecting at least one damping system connected to the at least one pivoting arm wherein the damping system dampens shocks to the ambulance stretcher on the shock-absorbing platform during transport.

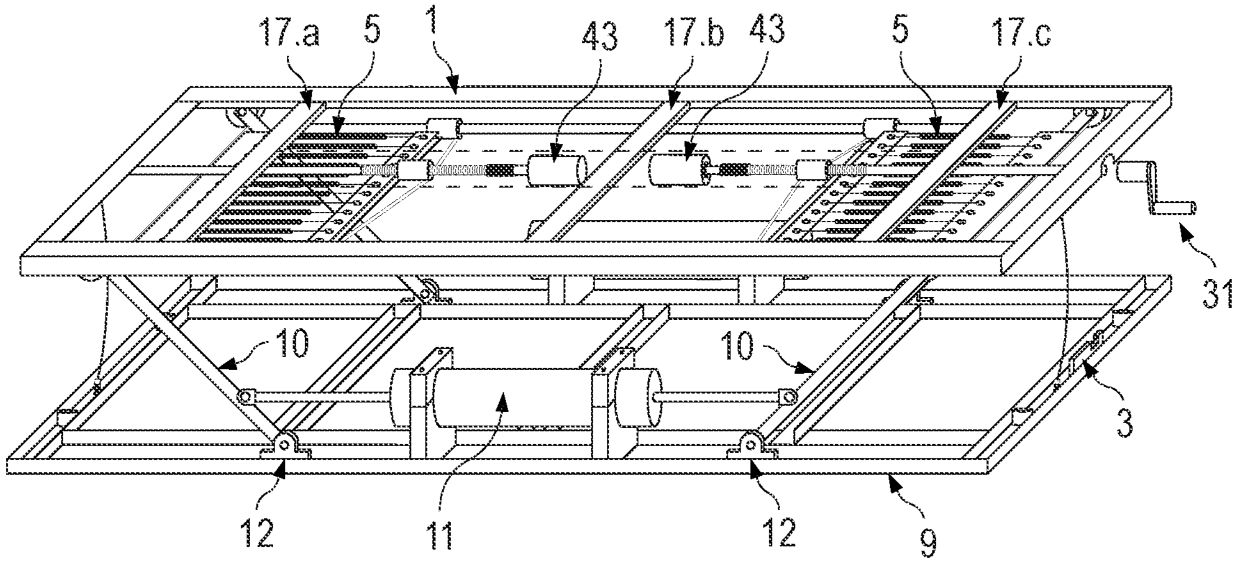

FIG. 1

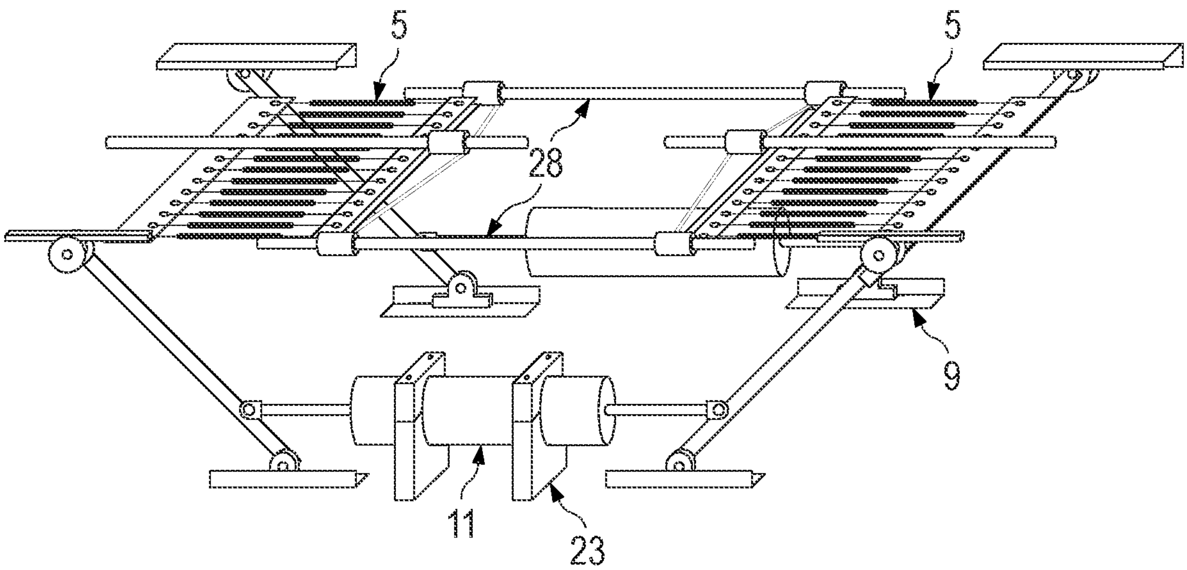

FIG. 2

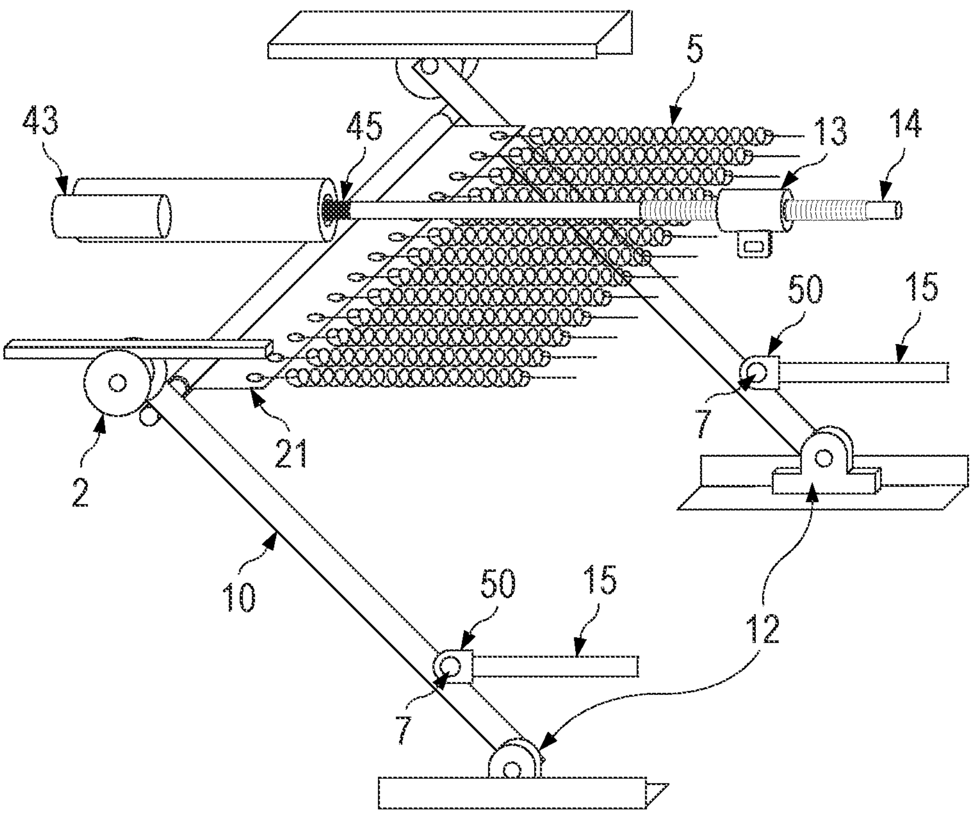
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FIG. 3A

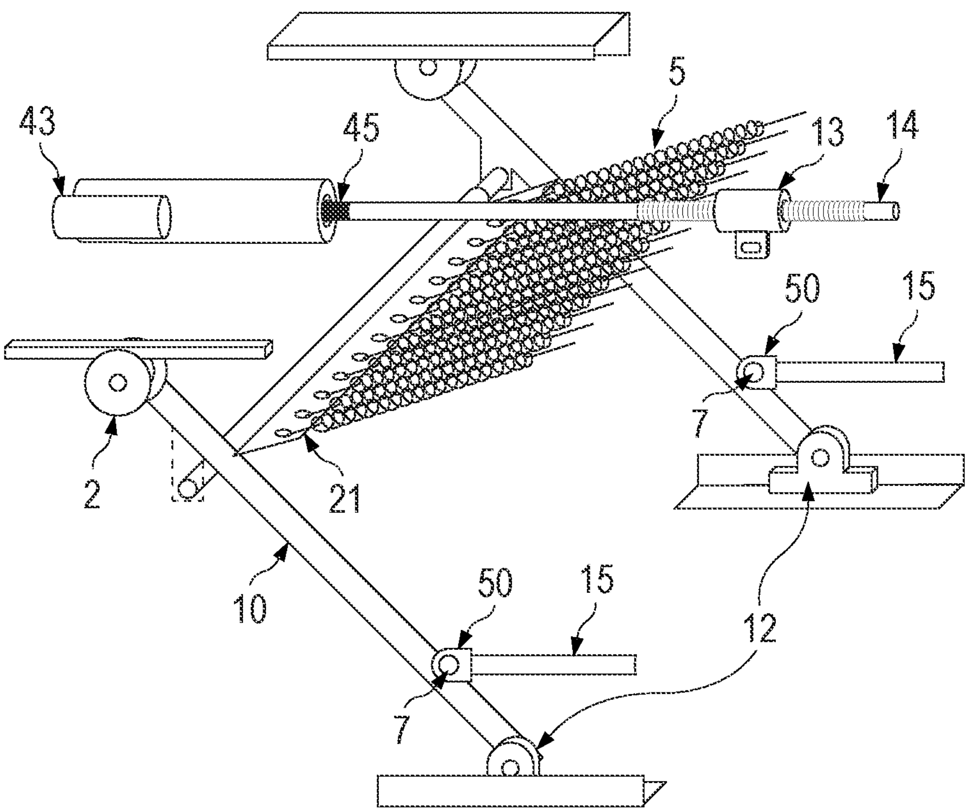
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FIG. 3B

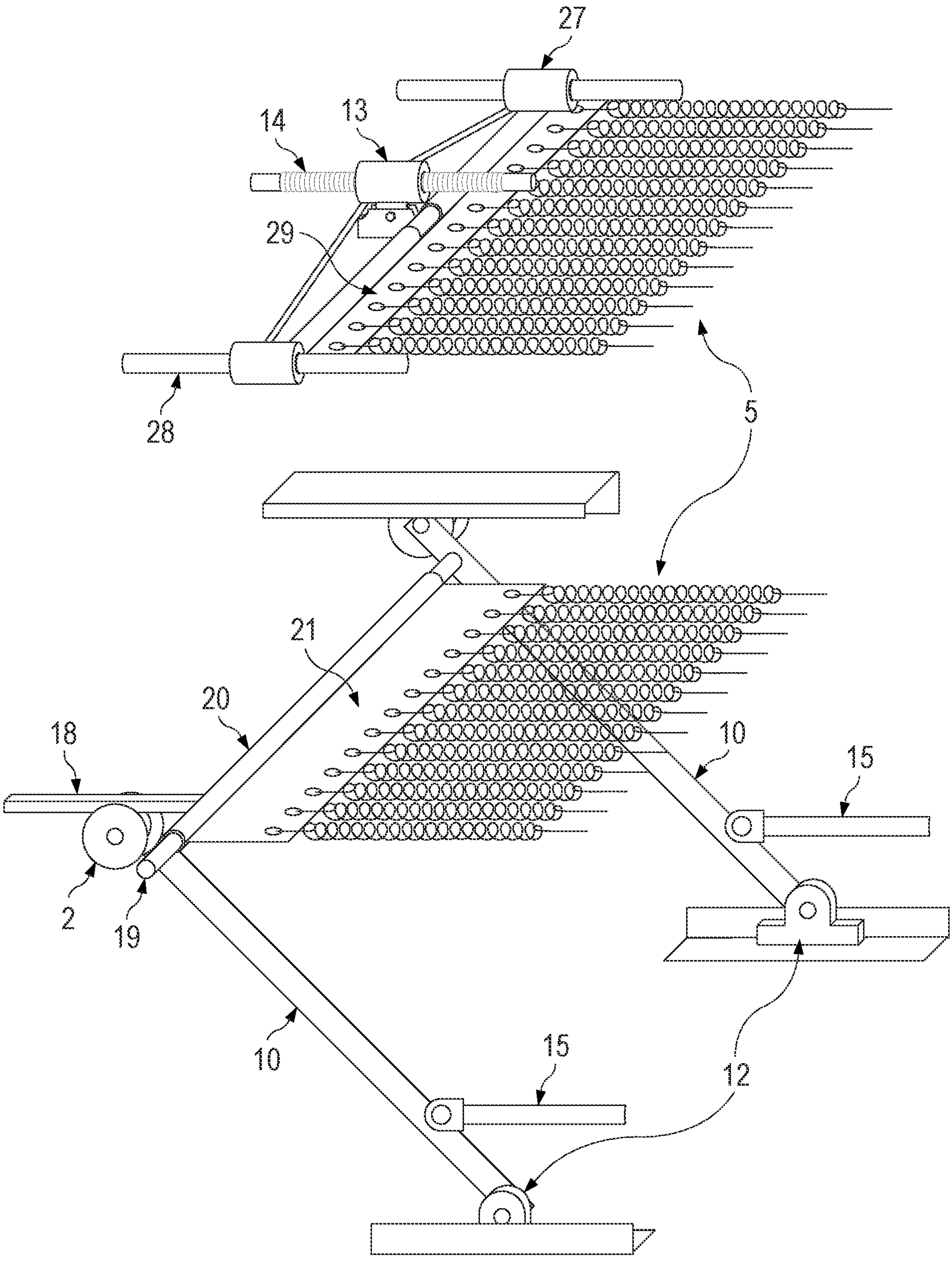

FIG. 4A

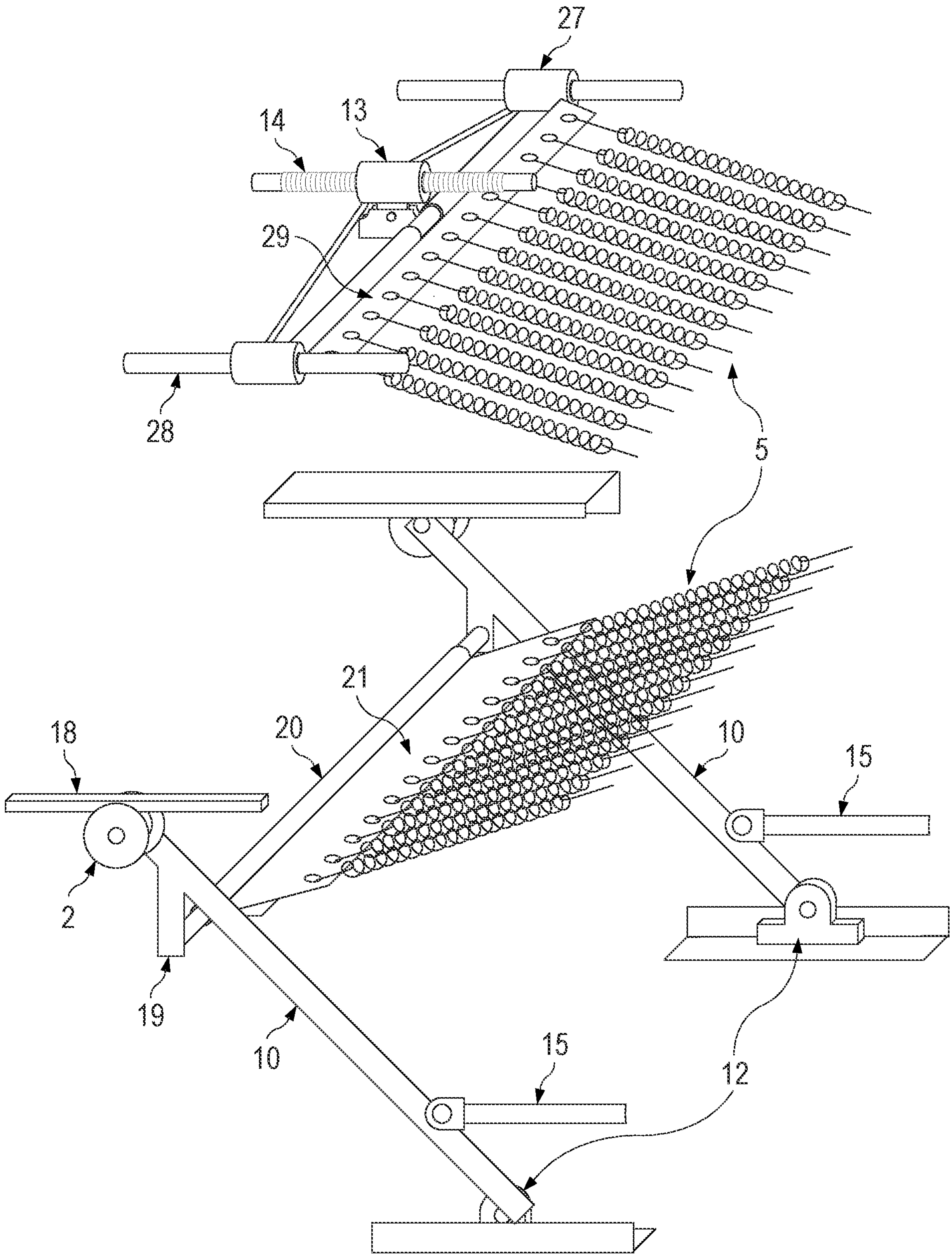

FIG. 4B

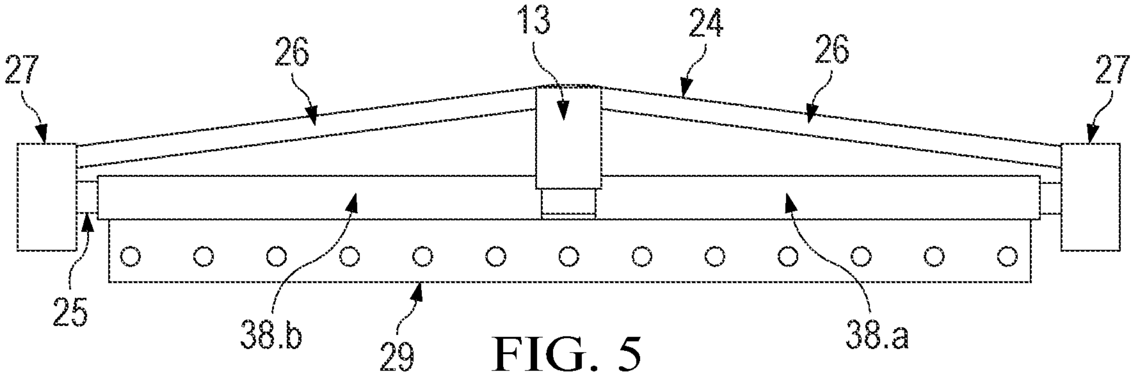

FIG. 5

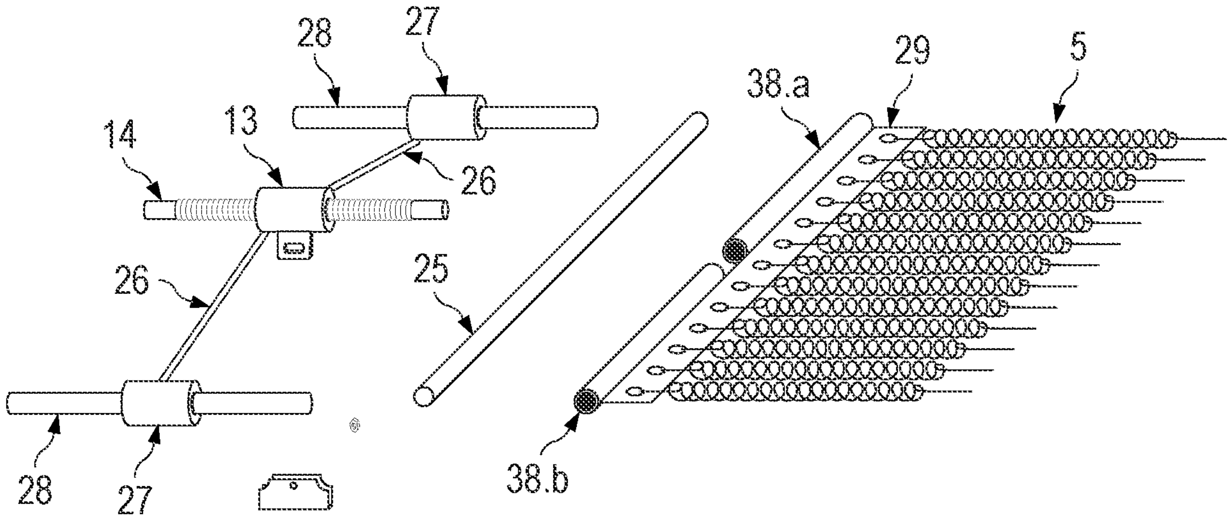

FIG. 6

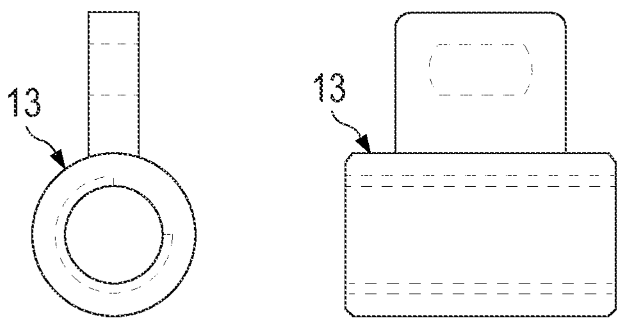

FIG. 7

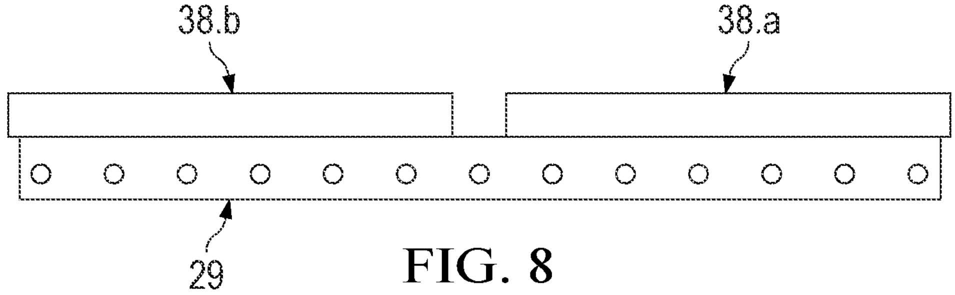

FIG. 8

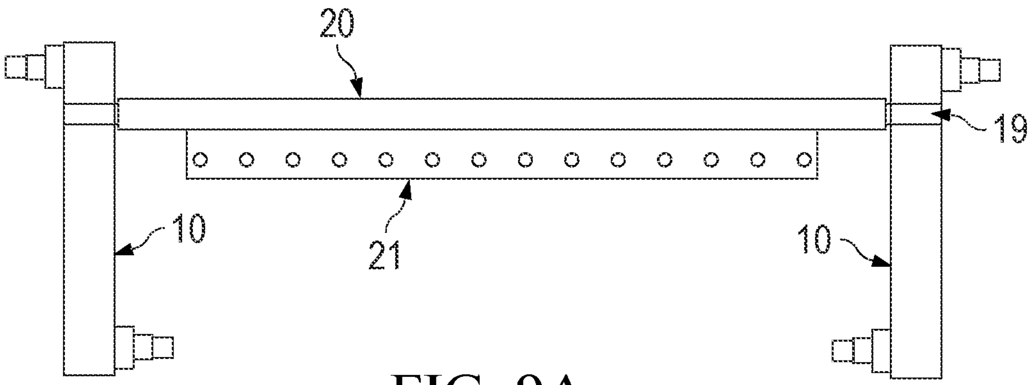

FIG. 9A

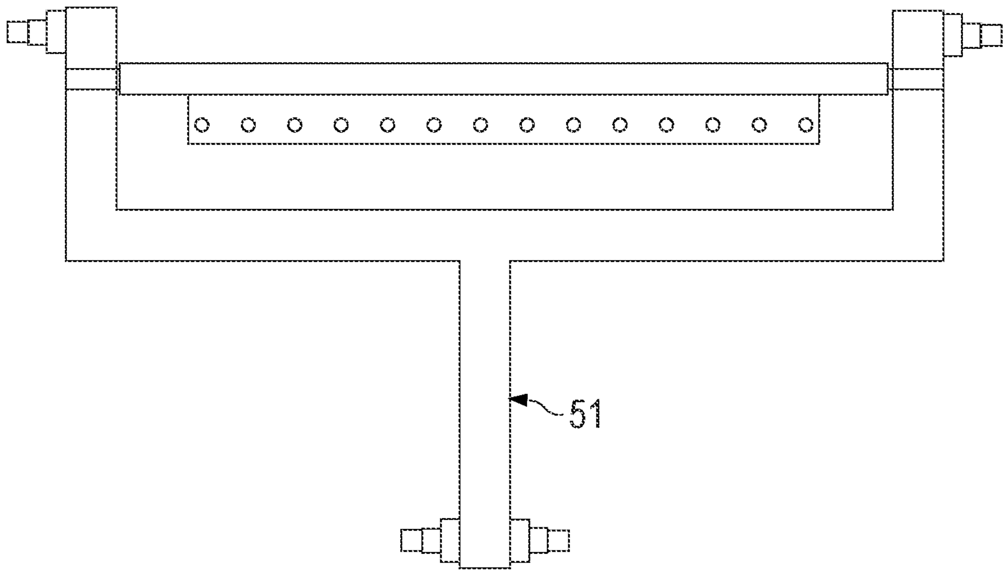

FIG. 9B

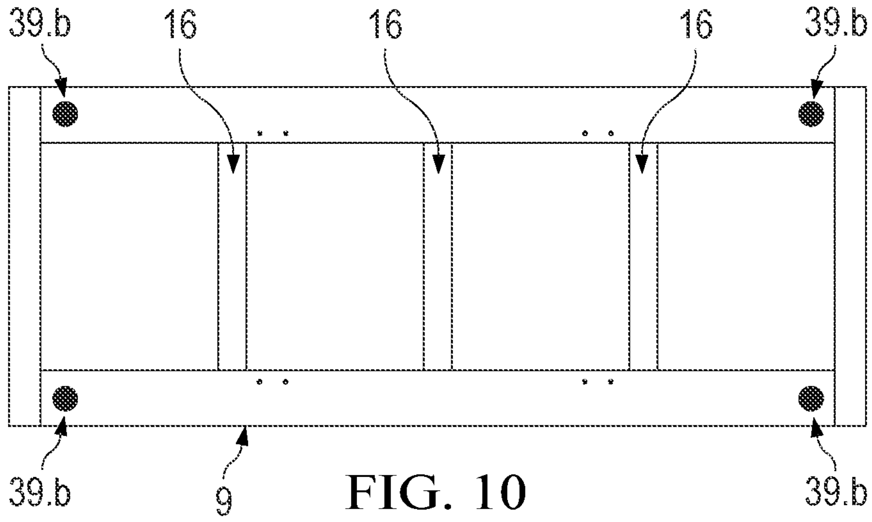

FIG. 10

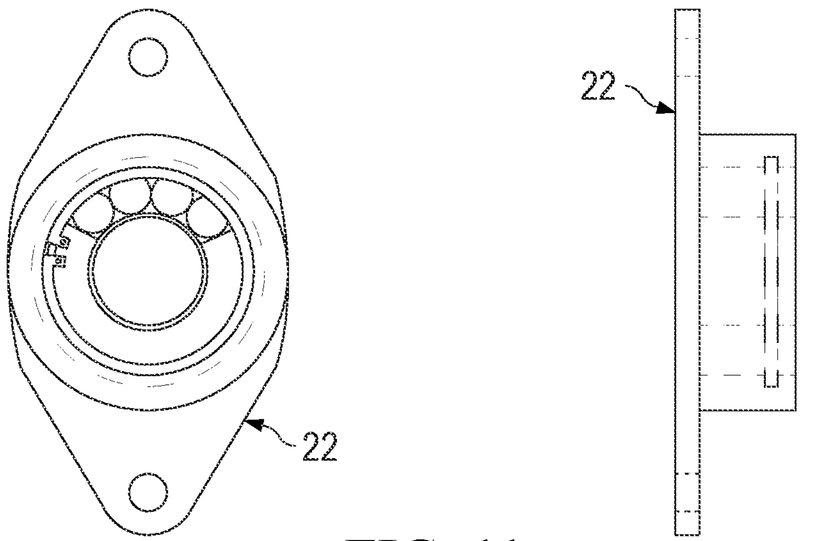

FIG. 11

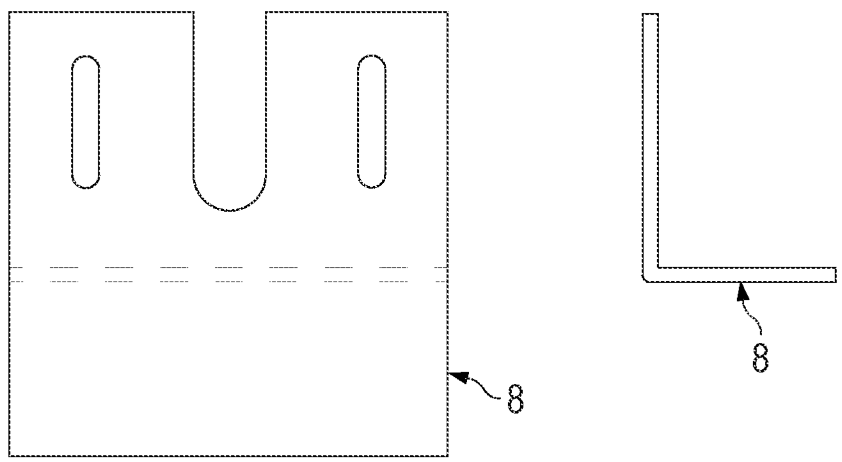

FIG. 12

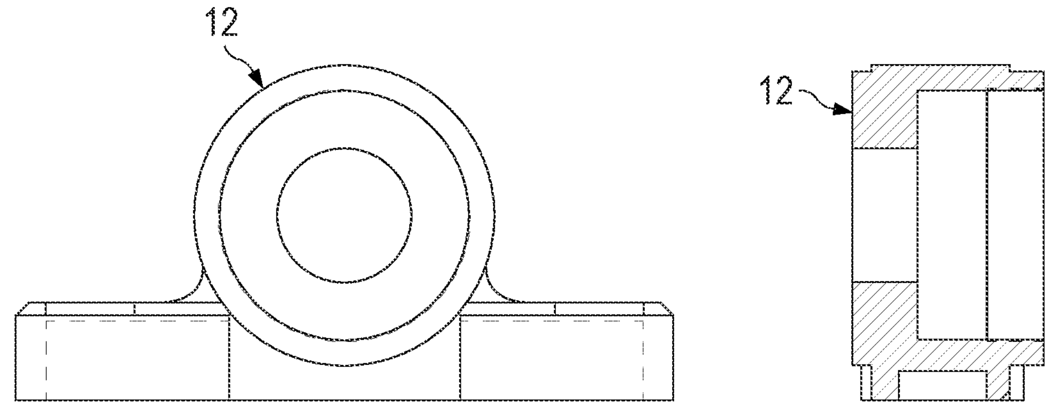

FIG. 13

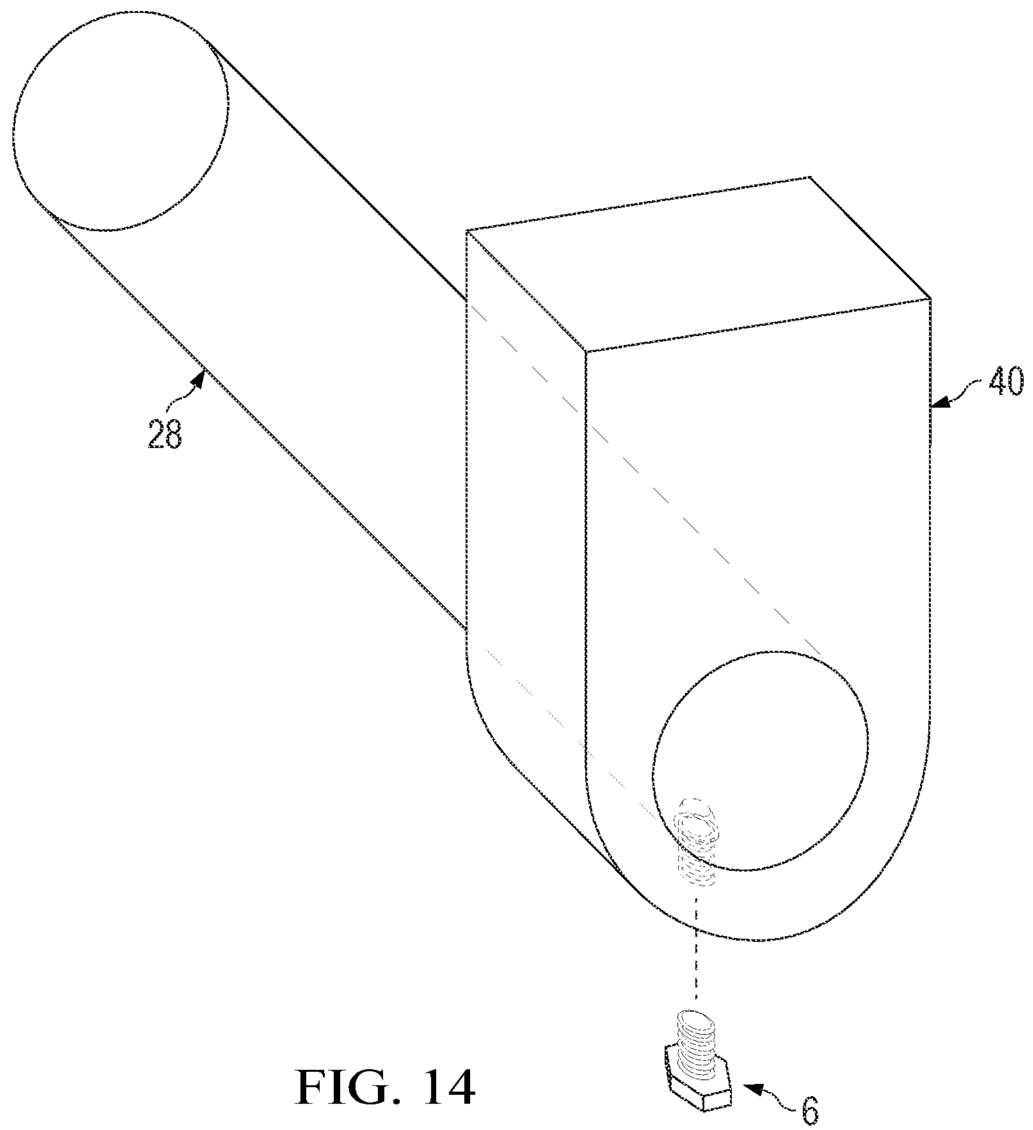

FIG. 14

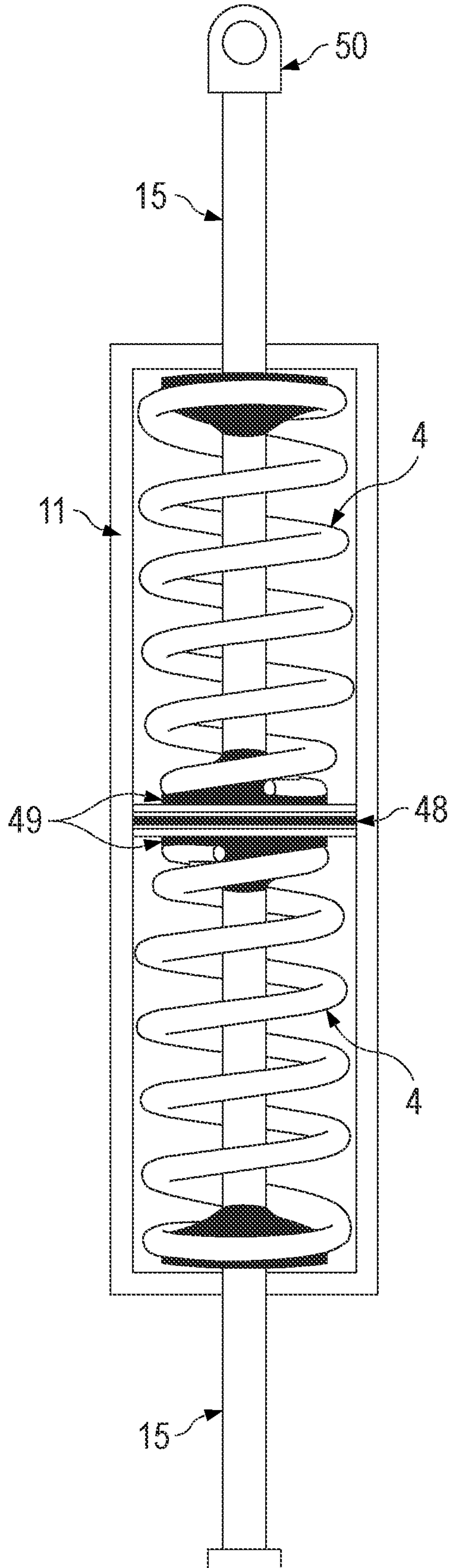

FIG. 15

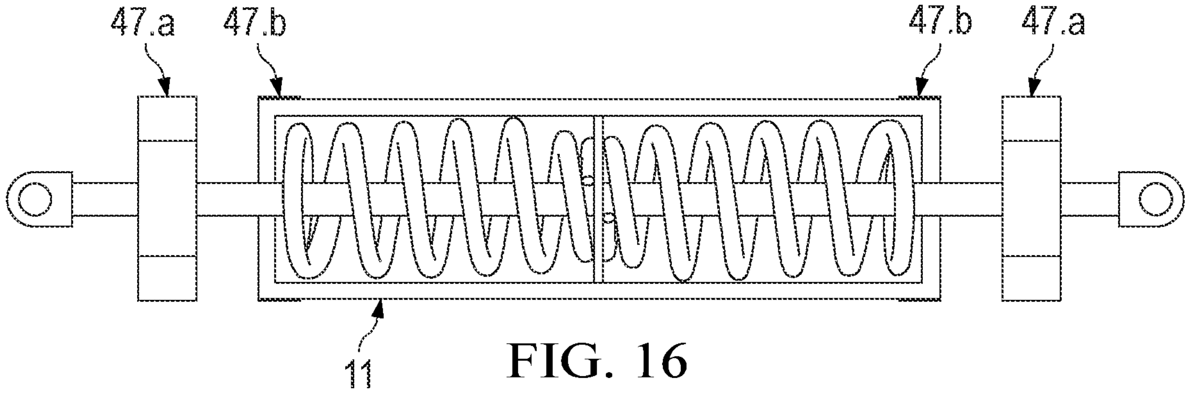

FIG. 16

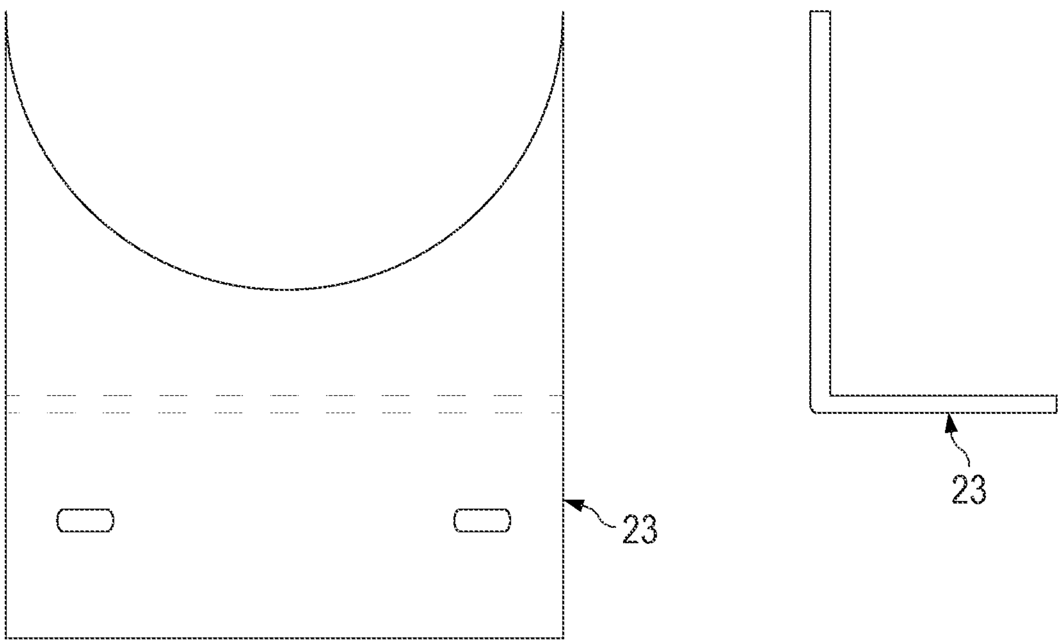

FIG. 17

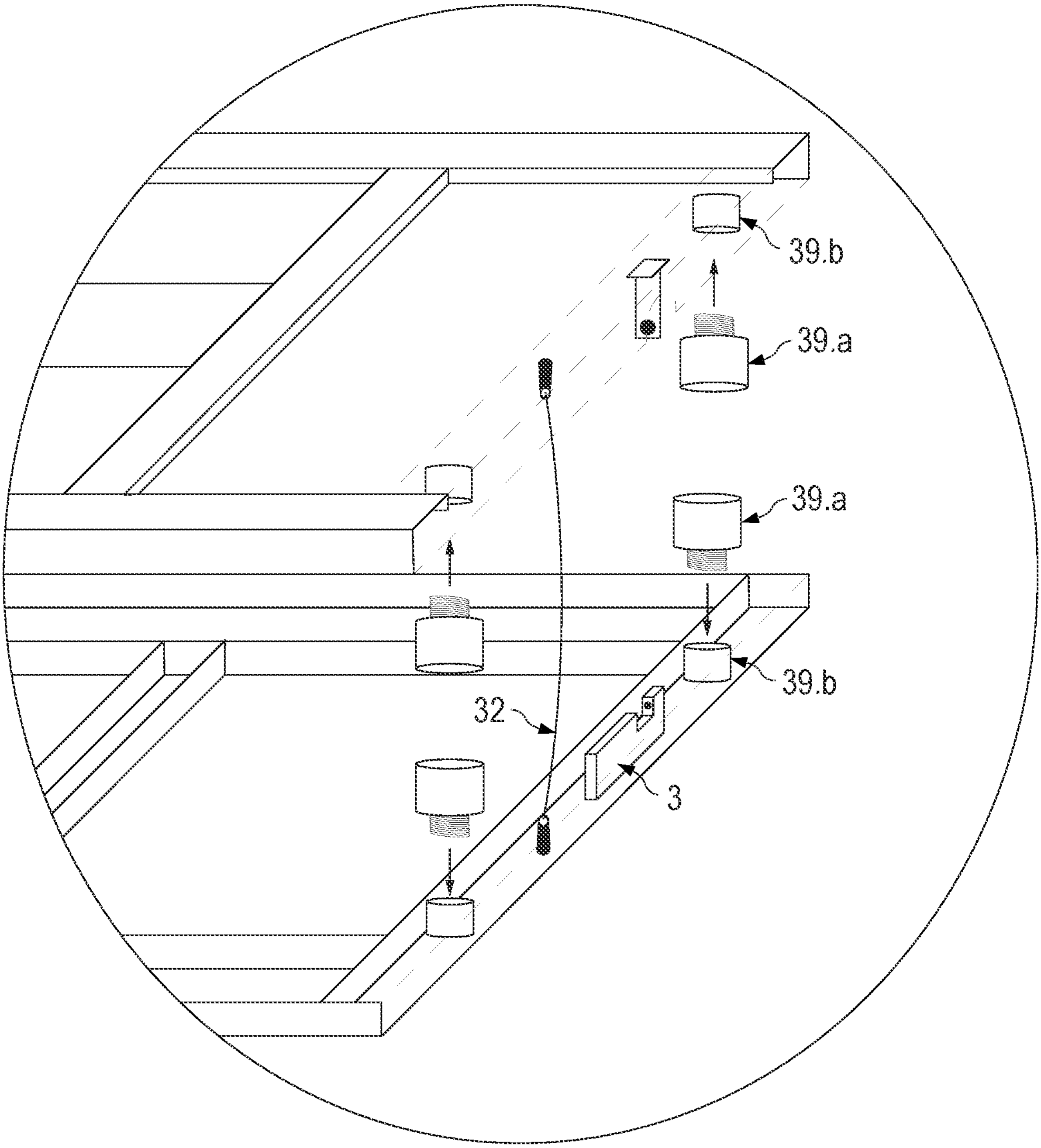

FIG. 18

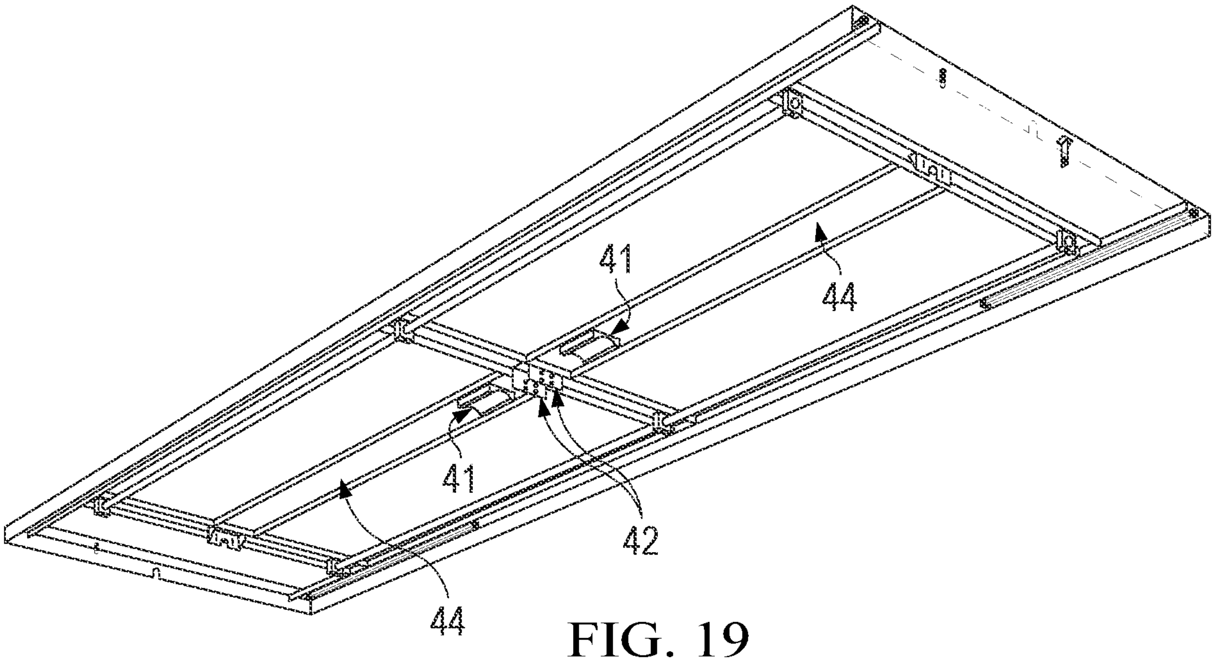

FIG. 19

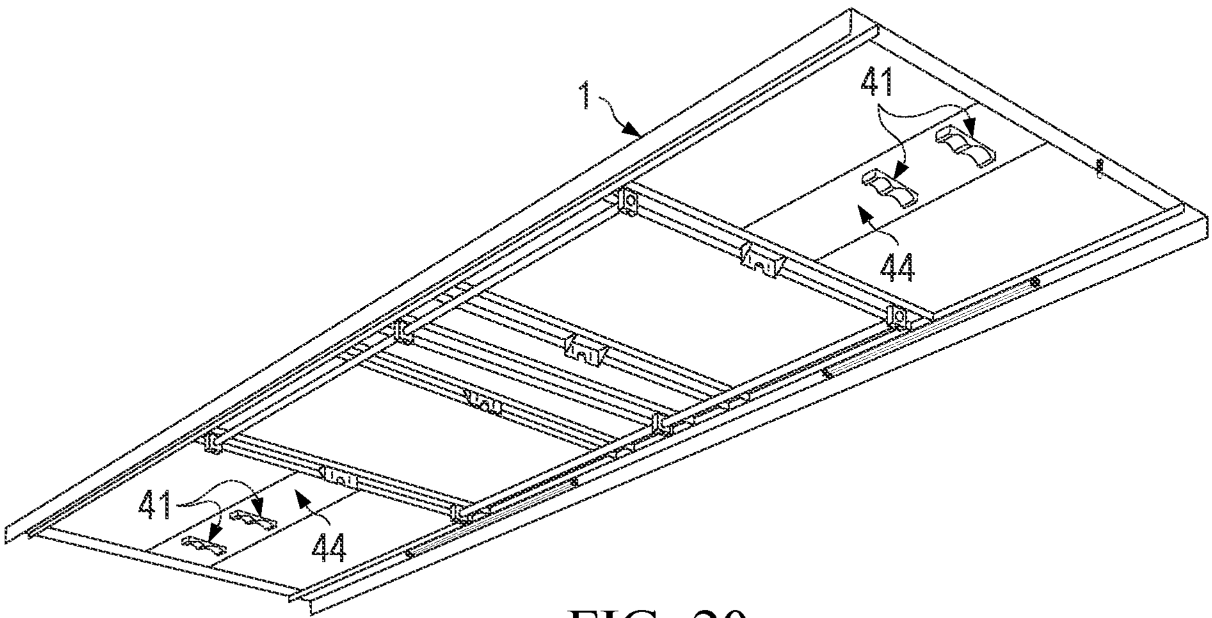

FIG. 20

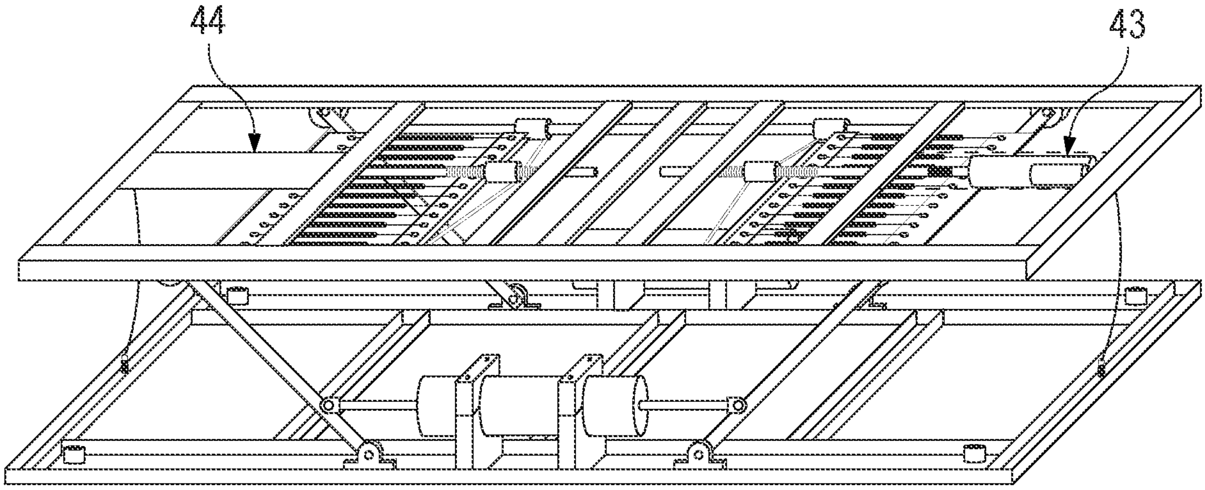

FIG. 21

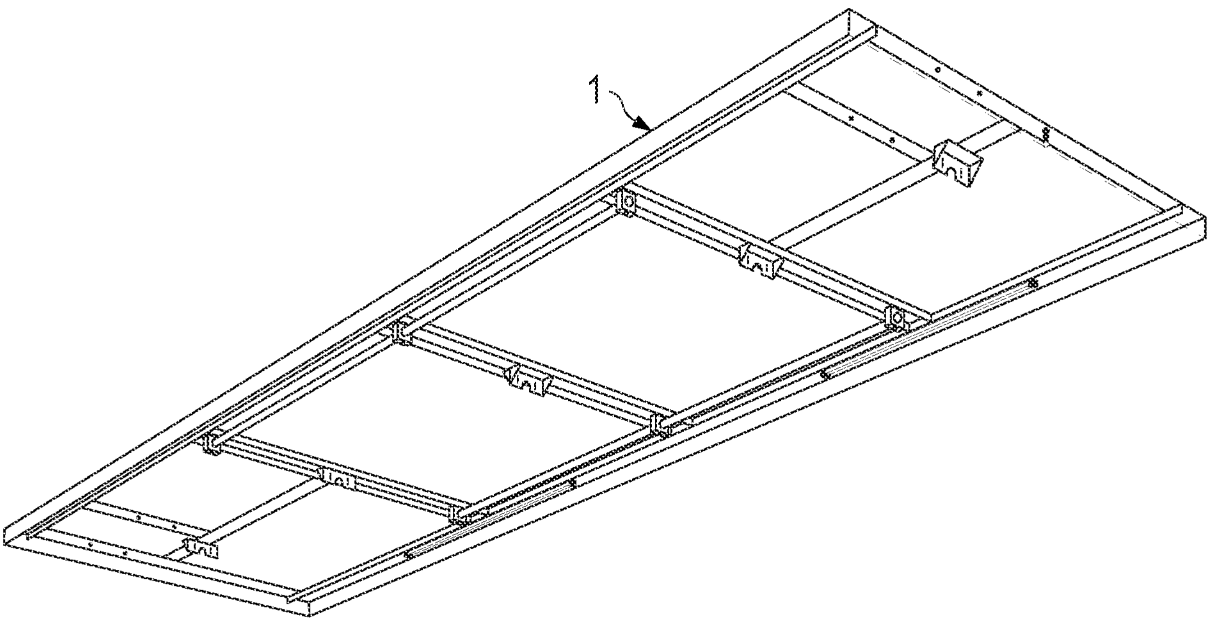

FIG. 22

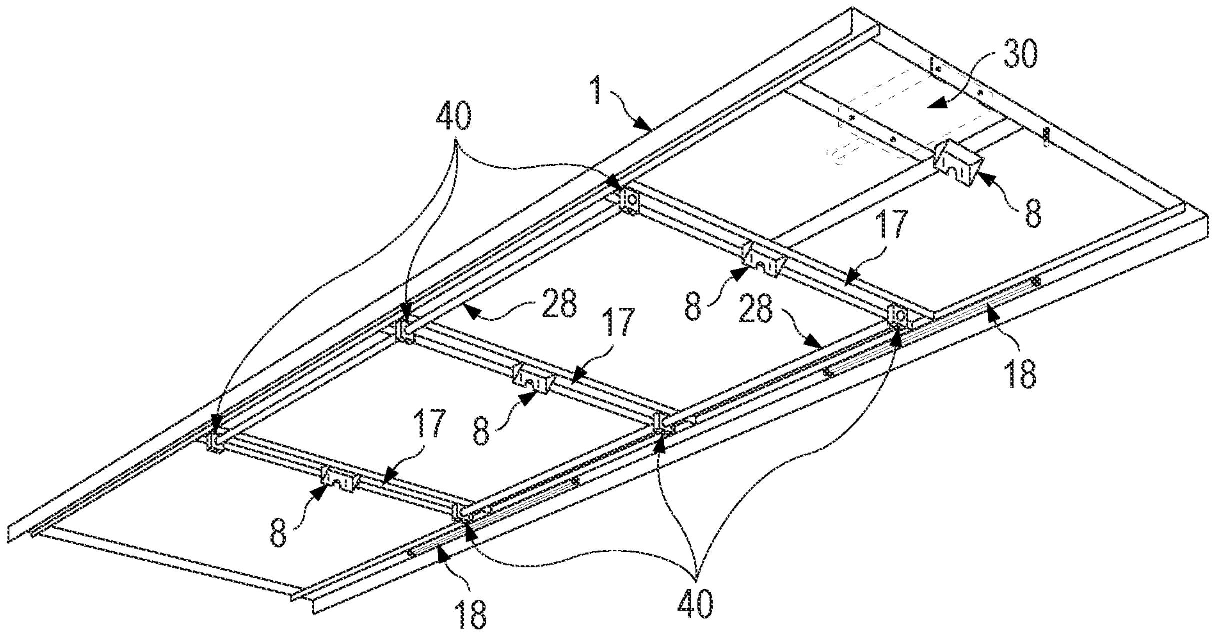

FIG. 23

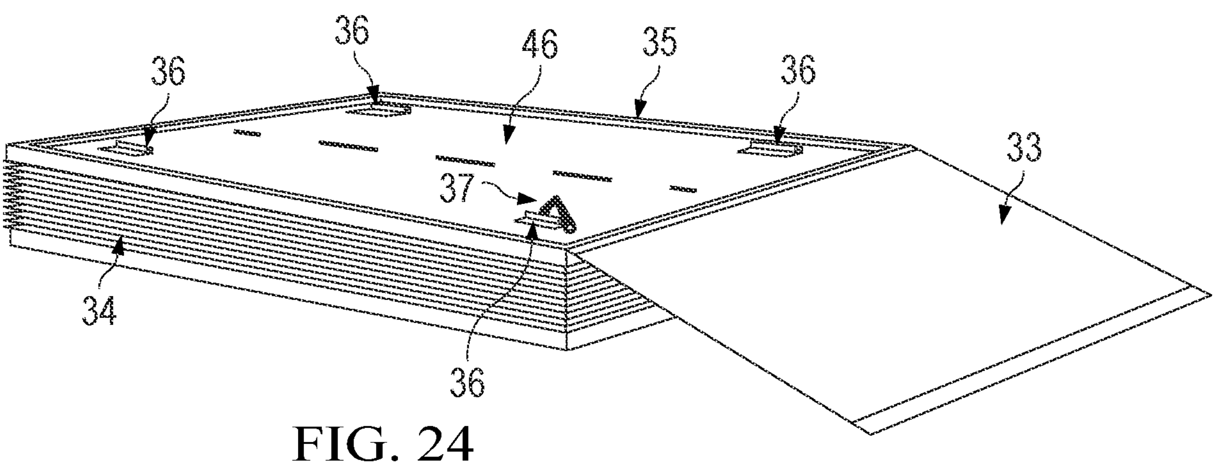

FIG. 24

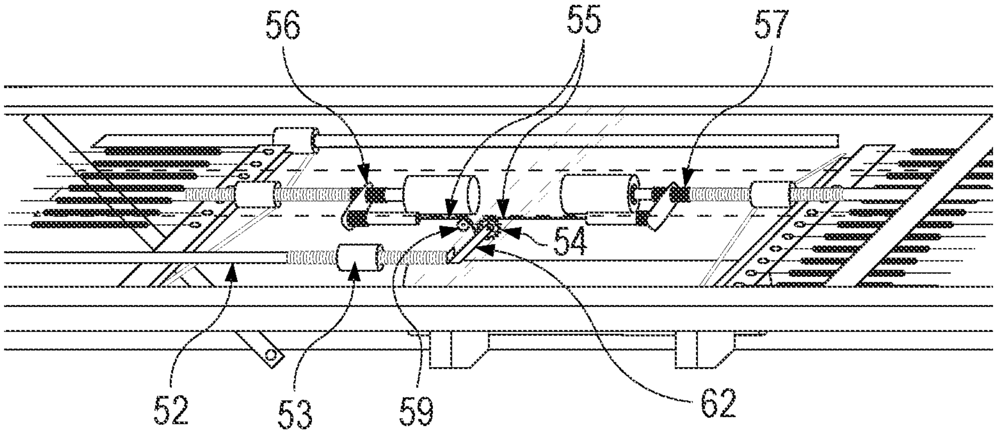

FIG. 25

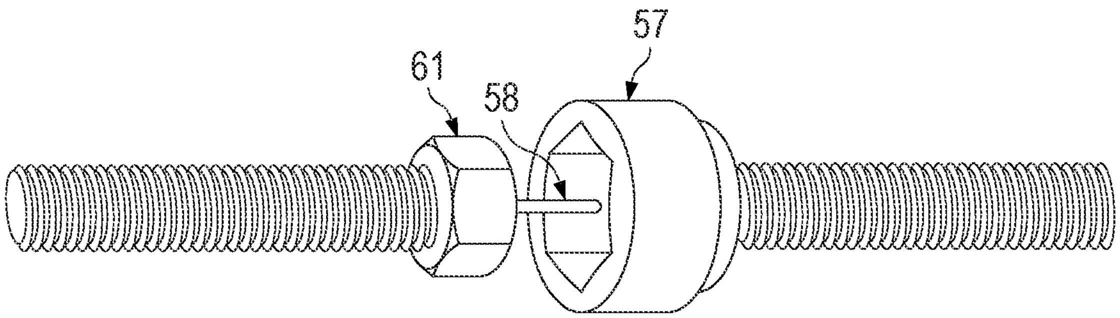

FIG. 26

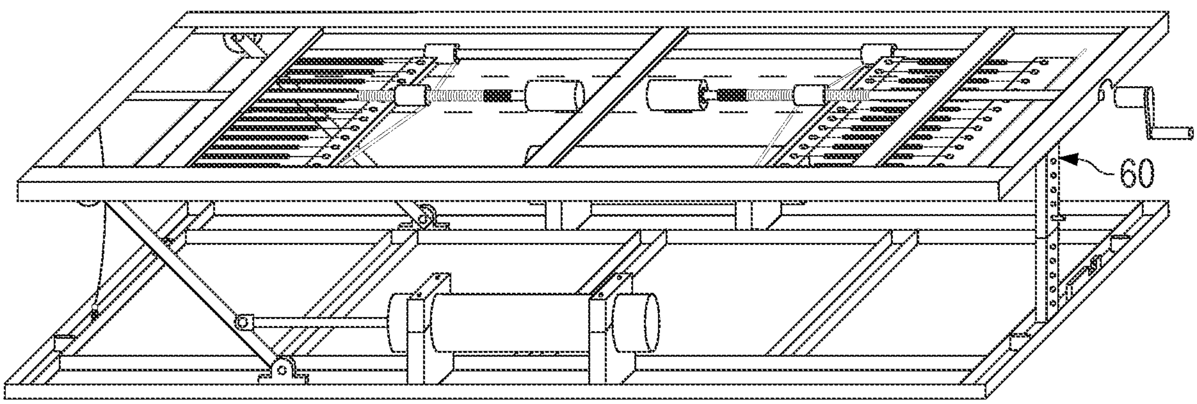

FIG. 27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 21/65372

A. CLASSIFICATION OF SUBJECT MATTER
IPC - A61G 1/06 (2022.01)

CPC - A61G 1/06

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)
See Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- A	JP H1-192353 A2 (SHINMEIWA KOGEI KK) 02 August 1989 (02.08.1989) entire document	1-10, 24 ----------- 11-23
X -- A	JP H5-31139 A (SHINMEIWA RIBITETSUKU KK) 09 February 1993 (09.02.1993) entire document	1-9, 24 ----------- 11-23
X -- A	DE 73 25 846 U1 (CHRISTIAN MIESEN FAHRZEUG-UND KAROSSERIEWERK GMBH) entire document	1-7, 24 ----------- 11-23
X -- A	US 4,541,134 A (BLACK et al) 17 September 1985 (17.09.1985) entire document	1, 2, 4, 5, 24 ----------- 11-23
X -- A	EP 0 150 254 A2 (BINZ GMBH & CO) 07 August 1985 (07.08.1985) entire document	1, 2, 24 ----------- 11-23

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 March 2022 (04.03.2022)	MAR 30 2022
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Kari Rodriquez Telephone No. PCT Helpdesk: 571-272-4300