

(12) **United States Patent**  
**Pace**

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(54) **SPRINGS, CARRIAGE**

(76) **Inventor: Henry Sr. Pace**

Henry Pace Inventor  
 Letters Patent.

The Schedule referred to in these Letters Patent, and making part of the same, containing a description in the words of the said Henry Pace Inventor himself of his improvement in the springs of Vehicles.

To whom all these presents shall come,  
 be it known that I Henry Pace Inventor of the County of Hamilton and State of Ohio, have invented a new and useful improvement in the mode of affixing and hanging carriage bodies and beds to every description of carriages that may be drawn by horse or other animal power, or by steam or other power, such as stage or mail coaches and coaches of all kinds, waggon of all kinds barouches, gigs, chaises, chairs, sulkies, caravans, cabs, carts, and all kinds of wheel carriages or vehicles whether for pleasure or other purposes by the application of levers of the denomination of the lever power of the first kind, to multiply the required spring or other power that may be applicable to the suspension of carriage bodies, or the beds to carriages and which have not hitherto been used or known to be applied to such purposes and that the full and exact description of the essential parts in my improved mode of suspending and hanging bodies to carriages with levers of the denomination of the lever power of the first kind, to multiply the required spring or other power that may be applicable to the suspension of carriage bodies, and which levers have not hitherto been used or known to be applied to such purposes, and for which I claim to be the first inventor as follows. Firstly, to attach as many perpendicular levers of the denomination of the lever power of the first kind as may be required for the use of any vehicle or carriage drawn or propelled by animal, steam or other power, one prop for each lever may be fixed on any part of the running gear of the carriage that may suit its use or form

the levers to work free, the fulcrum to be placed at any part of the bar between the weight and the power, at the option of the builder, secondly. To attach one or more springs or other applicable power, to each lever, one end of each spring or springs to be affixed either to the bottom of the body or bed, or to the running gear, and the other end of each spring or springs or other power, to be attached to the end of the long arms of the lever so as to work free, or to the running gear.

Thirdly. To attach the ends of the short arms of all the levers to the body shackles, or to the body or carriage bed (which is the weight) so that the levers and springs may work free when the carriage is in motion. In forming my improved mode of hanging carriage bodies to the running gear of carriages with levers of the denomination of the first kind, I employ these my essential points according to convenience, which admit of various modifications as to form and proportions each as must be and are quite familiar to every competent carriage manufacturer and therefore it will be sufficient for the perfect description of my improved principle of hanging carriage bodies to the running gear of carriages with the levers of the first kind, that explain some of the modes of forming and combining the essential points of my invention with the other parts of the variety of carriages and of fashions and modes which may be familiar in the work shops. Model. Thus wheel carriages. Levers to project under the body. Flat springs, either lineal, elliptic or otherwise affixed to the body at each end of the bottom. Suppose a carriage to admit of levers from two or up to twelve feet in length, more or less, but say for example that it shall be five feet. place the fulcrum at the option of the manufacturer, which may be one sixth of the length of the lever; this gives the short arm ten inches in length, the long arm four feet two inches. Then fix two props in the place of jacks or springs on the back of the carriage on the axle bed and spring bar, and two props on the front of the carriage in the same way, but the front props and levers must stand in a line of two or three inches (more or less as required) from the side of the body and towards the perch to give room for the levers to work side by side to give room for the ends of the long arms of the levers.

levers to pass each other without striking. Each prop is to have a mortise on its top, to admit a lever on each. The lever to be secured at its fulcrum in the mortise on its prop by a bolt through the sides of the mortise and the lever. The long arms of the levers to slope under the body of the carriage. The long arms of the back levers, to point towards the front and the front levers to point towards the back of the carriage to meet the springs of perhaps twenty inches long more or less, one end of each spring is affixed to the bottom of the body next to the shackle, one spring or more as required to each lever. The end of the long arms of the levers will <sup>pass each other</sup> The springs at the fore part of the carriage to be bolted on at the corner of the body in the usual place for the shackles. The two back springs to be bolted in the bottom of the body two or three inches from the sides at the corners so that the levers may pass each other without striking. A single or double lineal spring or more added together or an elliptic, to apply to each lever, one end of each spring or springs to each lever then bolted on to the bottom of the body is sloped down for its other end to be about five or six inches below the bottom of the body sufficient to give play for the lever and spring to work up and down without striking the bottom of the body. The end of the long arm of each lever to meet the end of each spring in a line under the spring to be attached to it by an oblong square link to work free. The link attaches the spring and lever together and may be two or three inches long as required for the levers to move in the arcs of their circles by the combined movement of the spring the lever and the link. If the weight is much the spring above described may have a lineal or spring of short dimensions riveted on to its end similar to that on the key to a bolt. This small spring to slope its other end to bear against the bottom of the body at which place a plate of brass will prevent wear. The short arm of each lever to be attached to the body by knob-kings or otherwise to the shackles, to work free. If the front wheels of the carriage are intended to turn under the body, then all the props the levers the springs and the shackles (or other attachments in lieu of shackles) are placed nearer or near or near to the prop as may be required to remove the levers from contact with the wheels. These levers are also calculated to have

have the thick end of the flat spring or springs affixed and riveted on to the end of the long arm of each lever (in lieu of fixing the spring to the body) so that the other end of the spring shall reach near to the axle, to which it may be attached by means of a staple and an oblong square link. If the levers are made of iron part of the long arm of each may be made of steel to spring towards the end; and the end of the spring to be attached to the bolster as above; or the spring may be riveted on the lever. The spring may be much longer than when attached to the body, and made more springy. If the lever is made of wood the same principle can be continued with mode VII. and mode VII. will answer well to combine with this mode I. [see mode VII].

The end of a lever (one foot long) rises or descends six inches, nearly one and a half inch from a perpendicular line by the motion of the lever in the arc of its circle; one of two feet rises or descends  $\frac{7}{16}$  of an inch in the ascent of six inches one of three feet ascends nine sixteenths of an inch, one of four feet seven sixteenths, one of five feet, one third of an inch. As the short arm of the lever, will have but little rise and fall the play of the gearing when in motion may answer to the motion of the lever in the arc of its circle; or a mortise of an inch more or less as required can be made in each of the front levers in lieu of the hole for the bolt at the fulcrum by which the front levers will slide backwards and forwards to the motion of the short arms in the arcs of their circles. The long arms are allowed for their motions in their arcs of circles by an extra length of link which attaches each to its respective spring. The patentee might here have rested his right to have carriage bodies with levers of the first kind; but he has added the following variety of modes in his new application of the principle, a principle which is so well calculated to amalgamate with the spirit and knowledge of the times, and with the progressive increase of the most fanciful and brilliant embellishments.

Mode II. Four wheel carriages with levers to project under the body. Flat or springs affixed to the running gear. The prop levers and shackles to be affixed or attached agreeably to the mode and principle described in mode I. with the following variations viz. Fix an elliptic or linear  
 Spring

Spring on and across the midway of the length of the perch. Six another directly under the perch and across it with the horns or points of the springs to horn up (or down) the same as the upper one if elliptic. Place a bolt through the top of the perch and the two elliptics in their centers to hold both fast. The two elliptics will then form half elliptics on each side of the perch and are prepared to connect with the ends of the two long arms of the two back levers. Fix two more elliptics in some manner across the perch, side by side with the first two for the two front levers; they are then prepared to be attached to the two long arms of the first levers by links as described in Model, with this difference that this lever, with the springs affixed to the running gear will work over the springs to which they are attached; and also the levers are shorter and do not pass each other as in model, but reach only to the springs at the midway of the perch. Also the levers and props are affixed at the four corners of the running gear; as also all the shackles to the four corners of the body. If the front or wheels are to turn under the body the hind levers and props may remain as they are, but the front props and levers are to be placed triangularly that is, the ends of the short arms of the front levers are at their appropriate shackles at the corner of the body and the ends of the long arms to go near and point to the side of the perch; but the props and shackles are to be fixed in a line to the levers. The springs if flat to be affixed on the perch, in a line with the levers to be attached to them as before; or a spiral spring can be attached to the perch one or more on each side, or if this shall not combine with the form or fashion of the carriage, then the front levers with their props and shackles may be placed nearer or near to the perch. In this case a short bar may be fixed across and under the perch to which it is to be bolted about one foot from the axle or rather at a proper distance from the horns or horn bar to prevent their collision. A live or other spring or springs are then affixed to one end of the cross bar, the same to the other end and each spring or springs if flat to project in a line with and under their respective levers to the end of the front long arms  
or in

or in line of a bar the springs may be affixed at their thick ends to the axle bed or any part of the front gearing that may be applicable, but then the springs will have to be as long as the long arm of the front levers to extend in a line under them to be united to their ends but it is to be considered whether the weight be carried (if it is great) will not force the axle bed on the bolted end of the springs from their fixtures. — Mode III. Four wheel carriages with levers to project under the body. Spiral springs attached to the running gear bolt two bars across and under the perch at midway of its length side by side of each other, <sup>the</sup> springs to be attached by the middle to the four ends of the two bars and to stand upright with their mid lengths one half below the bar, the other above to give space for the play of the levers. The ends of the bars to be made to line with the ends of the long arms of the levers. one or more springs may be attached to each end of the two bars (or 4 arms) in a position to work to the levers; The ends of the long arms of the levers to run to the spring to which they are to be attached as in mode II. If the front wheels are to turn under the body pursue the described mode of II. by shortening the front bar which contains the front spiral springs. The spiral springs may be made enclosed with caps and posts for props, in lieu of a cylinder which is apt to clog with the dust of the roads; The spring is worked by a piston introduced down its middle with a cap fixed to the bottom end of the piston and a ring at the upper end. The ring to be attached to the end of the long arm of the lever to work free.

Mode IV. Four wheel carriages. Upright Levers. Spiral springs attached to the running gear. Six props on the axle beds one at each corner of the carriage. Each prop to be formed by fixing two posts sufficiently apart to admit the lever to be placed between them. The props may be twenty eight inches long more or less as the carriage may admit. The levers thirty two more or less. The levers to be placed upright to work backwards and forwards between the posts or props, and suspended by a bolt placed through the sides of the

the posts or prop and the lever at its fulcrum. The posts to slope one  
 or two inches from an upright position and leaning from the  
 body so as to admit the levers to stand upright or in any other way  
 to work correct. The ends of the long arms of the back levers to extend  
 down three inches (or as may suit) below the running gear and  
 between the axle tree, and spring and nut bars so as to be attached  
 to the pistons in the spiral spring. The front levers in the same way  
 but must be in a mode consonant to the gearing of the hounds the  
 horn work, and the bolter, or axle. The spiral spring is attached  
 to an arm fixed to the spring bar, and axle underneath and hori-  
 zontal under the carriage in a line with the perch. The ring at the  
 top of the piston to the spiral spring is to be two or three inches from  
 the end of its respective lever. A mortise must be made in the arm  
 to which the spring is attached at that part of it which extends between  
 the spring bar and the axle tree to admit the end of the lever to pass  
 down through the mortise to be attached to the piston in the spring  
 to work free. The short arms of the levers to be attached to the  
 body shackles by a buckle and leather strap as usual. The spiral  
 spring made as described in mode III. This mode cannot inter-  
 fere with the wheels. --- Mode V. Four wheels carriages with  
 upright levers. Flat springs affixed to the running gear. Six an  
 elliptic spring on its edge on or underneath and across the perch,  
 near or close, to the axle tree or bed as may suit, confine the spring  
 at its center with a staple to go over and across the spring and  
 through the perch. The horns of the elliptic spring may be either  
 from or towards the levers at the back of the carriage to be at-  
 tached by link or chain to the ends of the long arms of their re-  
 spective levers as before. The same with the front levers & springs  
 with this difference that the spring at the front may have to be  
 fastened on the perch at a distance from the axle tree sufficient  
 to clear the hounds or horn work if required and to have a  
 chain attached to the lever and spring. Mode VI. Horizontal  
 levers may work across the front and back of the body and carriage  
 gear

gears, with either spiral or flat springs. In this mode the two upright levers and the two props at the front of the carriage, and the two at the back are to be placed for the levers to lay and work across the carriage. The body shackles to be affixed to extend out on the sides of the body and across the running-gear, at the four corners of the body so as to meet the ends of the short arms of the four levers, which also extend out from their props beyond the sides of the body. A leather strap and buckle may attach the end of the short arm to the shackle; so also a leather strap to be attached to the end of the long arms of the levers (one to each) and to the running-gear, to hold the lever from working sideways as the weight in the body will pull the lever sideways by bearing on the short arms. This mode will not suit but very occasionally but it allows of more length of lever than to the upright one. The spiral springs to stand upright and attached ~~to~~ outside the off and near nutting bars that are fixed between the axle and spring bar, in a direction under the mass of the long arms of their respective levers. The flat springs to lay horizontal on the top and across the gearing at the back and at the front of the body, to work to their levers, or the props with their levers may be turned about half a quarter round towards the middle of the axle and moved more to the middle, so that the ends of the short arms shall bear directly under each corner of the body and the long arms to cross each other. The springs affixed horizontally under the axles. Mode VII. Sloping levers with their props, springs and shackles may be made of wood, to any uses of the denomination of one horse fanky waggons or other appropriate vehicles, affix four (more or less as required) wooden props and levers as before described in mode I. Bore an auger hole of an inch diameter or more through the bolster or axle tree to admit the foot of each prop; or if the hole shall weaken the bolster fix a staple horizontally through the bolster on the inside under the body to admit the foot of the prop. The prop to have a shoulder to rest on the bolster; the short arm of the levers to be

to be attached to the body by wooden hinge work so as to work  
 free. The levers to run the whole length of the perch, between the front  
 and back axles. The thick ends of the springs to be bolted on to the  
 bottom of the body at its front (the same same behind) immediately  
 over their respective levers. A bolt to go through both shackle  
 and spring together, to attach them to the body, and the other end  
 of the spring to extend with the whole length of the lever, and both  
 lever and spring to be attached together by an oblong link, the lever  
 to work under the spring, and both to work free. With some exceptions  
 this is applied agreeably to Mode I. The ends of the levers & springs  
 may in some cases require rivets as may also the bolts through  
 the foot of each prop. The parts of friction may be plated with  
 iron and brass or steel. The levers, props, and shackles may be  
 placed as in Mode I. for the front wheels to turn under the body.  
 insufficient has been shown of the principle of attaching the dif-  
 ferent kinds of levers and springs to form wheel carriages  
 to enable the manufacturer to vary the mode to suit all kinds of  
 carriages whether constituted with two or more wheels. Two  
 wheel gigs, chairs, chaises, sulkies and other vehicles may  
 have their bodies suspended by laying the levers either on  
 length ways or across the running gear as may best suit by  
 fixing two props on the axle or by any mode of gearing and by  
 fixing clip-stays, on the ends of the short arms of the levers,  
 and to the body. A sulky may be suspended by one lever and  
 spring in this way. A caravan or long bodied wagon or coach  
 with heavy burden may have three or four levers at each end  
 and also a bar fixed on and across the perch at its midway between  
 the hind and fore wheels to sustain props and levers to work in  
 across the gearing. — Most workmen understand that the levers  
 must be proportionate to the strength required in the short arm  
 and at and about the fulcrum and to be made proportionately  
 there to the end of the long arm, for if a spring or power of 100  
 lbs. is attached at the end of the long arm it requires more  
 strength

Strength at that end than will support the 250 lbs. but if the short arm is  
 sometimes shorter than the long one the short arm will have to support  
 2950 lbs. Thus the four levers with springs or other power of 150 lbs. to  
 each lever will bear on the ends of their short arms, four tons and a half  
 The flat springs to be thick and strong at the ends, which are bolted  
 on. The spiral springs must not be made to draw more 150 lbs each, three  
 of which attached to each lever (one lever at each corner) will bear a  
 weight of 10,800 lbs of the short arms if the levers are one seventh of  
 the whole length. if the loading or weight is 8800 lbs. there will remain  
 a spring power of 2,880 lbs. to act against jolts on the roads. Again the  
 lever with short arm one fifth of its length with a spring to draw 300  
 lbs. gives 1800 lbs power to each lever, or 4,800 lbs to the four. If the  
 weight is 3,200 lbs. there remains 1600 lbs. to act against jolts on the  
 roads. or a lever with short arm one fourth of the length of the lever  
 spring to draw 200 lbs gives the four levers 2,400 lbs power. Thus the  
 weight 1600 lbs leaves 800 lbs. It may be necessary to notice for  
 heavy loading the manufacturer need not be very fastidious whether  
 he makes the short arm of the lever (more especially if it is a  
 long lever) one fifth or one seventh of the whole length (more or less)  
 as it is proved that a very small movement in the rise and fall  
 when in a continued springing motion will cause both the bag-  
 gage and wagon from the solid force of jolts on the roads to sup-  
 port the shocks of which the manufacturer is necessitated to build  
 carriages very ponderous when without springs.

The props, levers, springs, shackles &c. may be made of any suitable  
 material, but it is proper where the value of the carriage will afford  
 it, to make the springs (particularly the spiral which are consider-  
 ed to be advantageous) of good English sheer steel manufactured by  
 the best workmen in that art. The levers and springs may be made  
 of figured or other ornamental castings either in brass or other  
 varieties of beautiful mixed metals where ornament and but  
 little strength are required. P. S. four steel springs of three  
 pounds weight each, and twenty inches long, two broad at the  
 bolt

bolt hole at one end (by which each spring is bolted to the bottom of the carriage body) and the breadth decreased to one inch two eighths and a half broad at the other end; the spring made bowed and fixed on the bottom of the carriage body in a slope downwards so that the bow turns upwards (like the lower section of the elliptic spring with its end or point, at the distance of seven inches from the bottom of the carriage body as described in Mode A. will draw more than 100 lbs. with ease, which if the lever is forty inches long the short arm might the spring will bear up five times 100 lbs; The experience of the patentee leads him to believe that this kind of a spring is the best for when the spring bows with the bow it is not liable to break as when the springing motion is opposed to the bent of the spring as is the case with the elliptic springs now in common use. Thus the four springs bear up 3,200 lbs.

Witnesses

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