(No Model.) 2 Sheets—Sheet 1.

E. P. ROBBINS.

MOVABLE VEHICLE STEP.

No. 438,021. Patented Oct. 7, 1890.

Fig. 1.

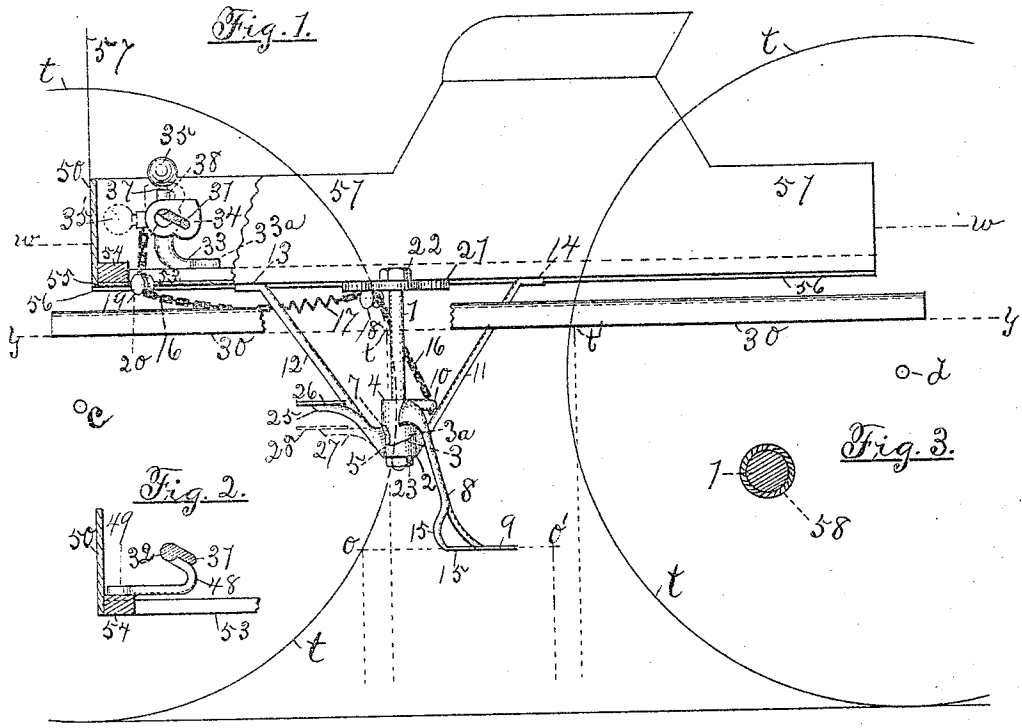


Fig. 2.

Fig. 3.

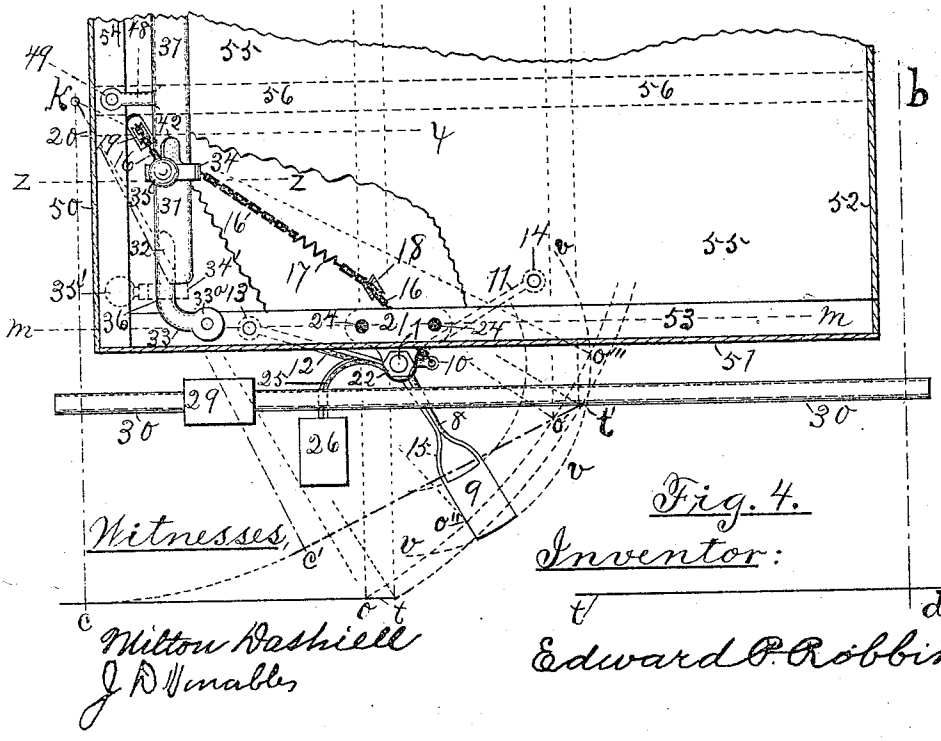


Fig. 4.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

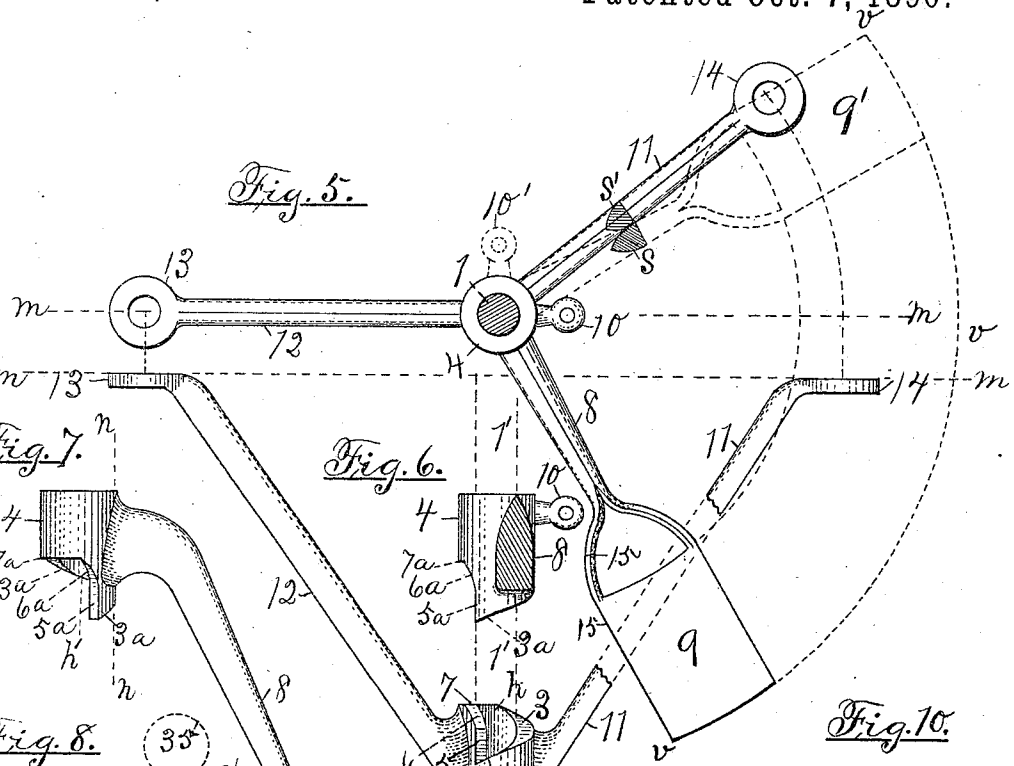


Fig. 7.

Fig. 6.

Fig. 8.

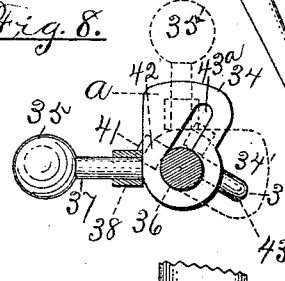
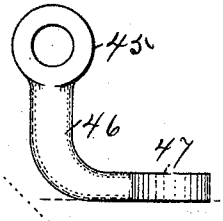


Fig. 10.



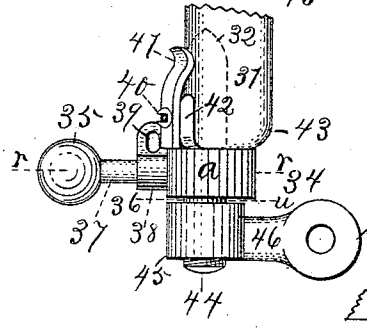


Fig. 9.

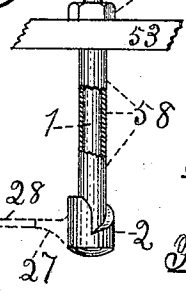


Fig. 12.

Fig. 11.

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Fig. 13.

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UNITED STATES PATENT OFFICE.

EDWARD P. ROBBINS, OF CINCINNATI, OHIO.

MOVABLE VEHICLE-STEP.

SPECIFICATION forming part of Letters Patent No. 438,021, dated October 7, 1890.

Application filed March 25, 1886. Serial No. 196,584. (No model.)

To all whom it may concern:

Be it known that I, EDWARD P. ROBBINS, a mechanical engineer, and a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Movable Vehicle-Steps and Connections; and I do declare the following, to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to a movable vehicle-step and connections, and is intended to be adapted to four-wheeled vehicles having bodies placed high above ground—as buggies and express-wagons—and where the forward wheels turn in against the sides of the body or under it when turning short. A four-wheeled box-body side-bar buggy will be taken as a type.

The object of my invention is to provide a movable vehicle-step which may be placed nearer the ground and farther out from the vehicle-body than has previously been practicable and near the rim of the fore wheel when the latter is in line with the hind wheel, so that when the fore wheel is turned away from the body the said movable step will be in the most convenient position possible for stepping into or out of the vehicle.

As steps have been previously constructed for high buggies, they have been placed so high from the ground and so located with reference to the movement of the fore wheel that it has always been difficult and awkward for ladies and children and still more so for aged persons to get into or out of a buggy. The object of this invention, then, is to overcome these difficulties. A second and stationary step, which may be directly combined in construction with the supports of the said movable step, or which may be independently attached to the vehicle-body or the framing, and which may be the usual step or may occupy a position similar to that of the usual pendent step, may be used in connection with the said movable step. When the said steps are ready for use, the stationary step will be above and nearer the vehicle-body than the movable step. Another stationary step may be placed above the former one and attached to the vehicle-body or its framing, as will be set forth.

The movable step is arranged to be turned about a vertical axis out of the way of the adjacent fore wheel when not in use; but this axis of rotation could be inclined somewhat from a vertical position outward from the vehicle-body, if desirable. The said step may also be arranged to move up and down along the said axis of rotation. The said axis of rotation may be so located with reference to the vehicle-body and the adjacent fore wheel and with reference to the inward movement of the latter when turning that if the movable step should be unintentionally left in its lowest and outermost position, or should in an accident drop to the latter position, then the said fore wheel in turning in against or under the body will automatically push the movable step inward out of its way, so that the step cannot catch in the wheel. This provision for the automatic movement of the step by the fore wheel is one of the essential features of this invention, for without it no movable step could be placed in certain positions intended, as a slight turn of the fore wheel would cause the step to catch between the spokes. It would not be practicable to have a step fixed at as low a position as that of the movable step when in use, as the fixed step would catch or strike obstructions, especially in the country and in fields, where stumps, rocks, brush, and undergrowth must be driven over, while such fixed steps would make the vehicle appear unsightly.

Various means may be employed for raising and lowering the movable step; but when the requirements thereof are considered with reference to the various styles of vehicle-bodies it will be seen that the means herein illustrated and described are the only ones which will be well adapted to the varying conditions consequent to the changes of styles made in the front part of buggy-bodies. All such vehicle-bodies must have a front adapted to receive and support the feet, and while the style of the body may be continually changing this part must remain approximately the same. The means illustrated for raising and

lowering the movable step is well adapted to permit variations in buggy-bodies, and hence is preferred. Again, such means must be convenient of operation whether the operator is mounted upon the seat or stands upon the ground, and none of the parts must be in the way nor liable to catch clothing, especially in jumping from the vehicle in case of accident, and such means must be so adapted to a given style of vehicle as not to mar its appearance whatever the style of the vehicle-body. Further, the means employed for operating the movable step must have a positive action in order that children or aged persons may be able to operate it with certainty, and there must be no possible chance for an accident on account of the movable step being negligently left down or on account of its being dropped by any accident in case of a runaway.

It is believed that the invention herein set forth will answer all of the above requirements.

Figure 1 is a side view of a four-wheeled box-body side-bar buggy having my improved step and connections, the sections being along the lines 20, *x*, and *z z* of Fig. 4. Fig. 4 is a plan of one-half of the same, the section of the body being along the line *w w* of Fig. 1 and the bottom 55 being partly broken away. In both Figs. 1 and 4 the parts of the step and step-connections are made on a slightly larger scale than the other parts of the buggy to insure perfect illustration. Fig. 5 is a plan of the movable step and its supporting-framing, the upright 1 being in section along the line *y y* of Fig. 1. Fig. 6 is an elevation of the same corresponding to the view in Fig. 1, the upright 1 being partly shown in dotted outline, and the shank 8 of the movable step being shown removed exterior to its section along the line *n n* of Fig. 7. The lines *m m* in Figs. 4, 5, and 6, indicate the relative positions of the parts. Fig. 7 shows the movable step 9, its shank 8, and boss 4 separate from other parts. Figs. 11, 12, and 13 show modifications in the construction of the details of the movable step and its supporting-framing. Figs. 2, 3, 8, 9, and 10 show details of the movable step-connections.

The same letters or numbers indicate the same or corresponding parts, and the prime numbers the dotted positions which those parts may occupy when moved from the positions shown, dotted lines also indicating the movement of those parts.

In Figs. 1 and 4, 50 and 52 are the body ends, 51 the sides, and 55 the bottom. 53 is the side or bottom frame-piece, and 54 is the front-end cross frame-piece. 56 is the usual bottom middle stay and support, and 57 is the dash. *k* is the king-bolt; *c*, the center of the fore wheel; *d*, that of the rear wheel. The line *k c* represents one-half of the front axle, the line *b d* one-half of the rear axle, and *t* represents the tires. 30 is a side bar.

The invention is illustrated as applied to a side-bar buggy, because that kind of a buggy is adapted for the use of various improved springs, some of which are placed crosswise and others lengthwise of the body, and it is intended to show that it is practicable to use my movable step and its connections in building side-bar buggies with almost any kind and arrangement of springs, as well as when building buggies having a plain body supported upon the ordinary elliptic springs.

In Figs. 1 and 4 a step-supporting frame 1 11 12 is shown, which is intended to be forged, and which consists of an upright 1, having a circular cross-section and attached at its upper end indirectly to the vehicle-body, a brace 12 running at an angle from the lower end of the upright 1 forward to the side of the bottom, where it is attached, and a second brace 11 running at an angle backward and upward from the lower end of the upright 1 to a suitable point under the vehicle-body, where it is attached. These three parts 1, 11, and 12 when attached together at their lower ends and attached at their upper ends to the vehicle-body form with the latter a pyramidal frame having great strength for a small amount of metal used and capable of standing considerable inward pressure at the apex or place where the three parts unite. This triangular frame is an important part of the preferable mode of supporting and guiding the movable step. This frame may be constructed as shown in Figs. 1, 5, and 6, where the upright 1 may be an ordinary bolt having a body 1, head 22, and nut 23, where the braces 11 and 12 unite and a boss 2 is formed with a central hole *h*, through which the lower end of the bolt 1 passes and in which it is secured, where the brace 12 has a boss 13 and hole for attaching it by means of a small bolt to the body side piece 53, and where the brace 11 has a boss 14 and hole for similarly attaching it to the body-bottom 55. By incasing the body 1 of the bolt within a thin metal tube extending from the body side piece 53 to the boss 2 this tube may be compressed between the said parts when the nut 23 is tightened, and thus the triangular frame 1, 11, and 12 be made rigid and the parts be prevented from becoming loose and rattling. Fig. 3 shows a cross-section of the bolt-body 1 and the said exterior tube 58. The latter has an important additional function to perform, which will be considered later.

The movable step 9 (shown in Figs. 1, 4, 5, 6, and 7) has a shank 8, extending from a boss 4, which has a central hole *h*, through which the upright 1 is passed before the parts of the said triangular frame are secured in place. The perforated boss 4 is adapted to rotate about the upright 1. It is also adapted to be moved up and down upon the latter. Again, it may be rotated about the upright 1 while being raised or lowered. When the boss 4 is in its lowest position, the step 9 should be in position for use, as shown in Figs. 1 and 4. When the boss 4 is in its elevated position, it

should be turned away from the adjacent fore wheel and under the vehicle-body, and it is preferable to provide means for preventing the step when in the elevated position from swinging loose or rattling. Again, when the movable step 9 is in position for use, it must by some means be prevented from displacement. Otherwise a person would be liable to slip or fall.

In Figs. 1, 4, 5, 6, and 7 a simple and efficient means is shown for holding the movable step stationary while being used. The said means is at the same time adapted and has been adopted to guide the movable step in its rotation about the upright 1 from its inner to its outer position. The supporting-boss 2 is forged integral with the frame-supporting parts 11 and 12, has an inclined guiding and supporting surface 3, a plane surface 7 at right angles to the upright 1, and a plane surface 5 parallel with the upright 1. The lower part of the step-boss 4 has a construction to correspond—that is, an inclined guiding-surface 3^a, a plane surface 7^a, and a plane surface 5^a—so that when the boss 4 is in its lowest position the said surfaces on its lower end come into contact with the said corresponding surfaces on the upper end of the supporting-boss 2.

If the movable step is first supported in its elevated position and turned in under the buggy-body and then dropped or permitted to lower from that position, the inclined surface 3^a near to 5^a will come into contact with the corresponding inclined surface 3 of the supporting-boss 2, but near the plane surface 7, and if the said surfaces 3 and 3^a are sufficiently inclined then the boss 4 will continue to descend and the surface 3^a will slide upon and be guided by the corresponding surface 3 until the plane surface 5^a comes into contact with the corresponding surface 5, or the plane surface 7^a comes into contact with the corresponding surface 7, during which sliding action the movable step 9 will be rotated about the upright 1 from its innermost to its outermost position. It is easy to imagine that a buggy may sometimes be standing upon an uneven or an inclined surface, such as would so incline the said parts of the movable step and its supports that were the movable step to be dropped from its elevated and innermost position it might in falling be rotated by gravity about the upright 1, more or less, through the angle required to bring it to its lowest position, as shown in Figs. 1 and 4. Cases might happen where it would be rotated through even a greater angle before the lowest point on the boss 4 would touch the boss 2, in which cases the lower end of the inclined surface 3^a would first come into contact with the boss 2 at some point farther around than the plane surface 5, and were the construction as so far explained then the boss 4 would not seat itself properly upon the boss 2. In order to provide for such contingency, an inclined surface 6 may be formed on the boss 2 between the plane surfaces 5 and 7 and a corresponding inclined surface 6^a be formed on the boss 4 between the corresponding plane surfaces 5^a and 7^a, as shown clearly in Figs. 6 and 7, the surfaces 6 and 6^a being inclined downward from in front around in an opposite direction to the downward incline of the surfaces 3 and 3^a. With this additional formation, were the lowest point on the boss 4 to touch beyond the plane surface 5, the movable step would be arrested in its outward rotation and be guided by the inclined surface 6 backward until it could drop to position. In fact, the said inclined surfaces 6 and 6^a could replace the plane surfaces 5 and 5^a and 7 and 7^a, respectively, whereby an angular upward projection would be formed on the inner side of the upper end of the boss 2 and an angular depression would be formed on the outer side of that end. By these means provision will be had for guiding the boss 4 positively to its seat.

When the boss 4 is properly seated upon the boss 2, as shown in Fig. 1, the movable step 9 is in position for use, as seen in Figs. 1 and 4. The downward pressure of the foot upon the step 9 when in this position will tend to firmly seat the boss 4 in its bearings upon the boss 2. Any lateral pressure around forward will be opposed by the contact of the parallel surfaces 5 and 5^a. The horizontal component of a downward pressure acting to force the step inward will be opposed by the inclined surface 3 of the boss 2. Consequently when the foot presses upon the movable step 9 the latter will be maintained stationary, and there can be no danger of its becoming displaced and causing a person to fall; but when there is no downward pressure upon the step 9 a slight lateral pressure exerted against the front edge of the step will cause it to rotate inward and the surface 3^a of the boss 4 to slide upon the corresponding incline 3 of the supporting or stationary boss 2. Consequently when the adjacent fore wheel is turned inward toward the buggy-body, if the step-boss 4 is seated upon the stationary boss 2, the tire *t* will strike against the step 9 and force it around under the buggy-body.

The step-shank 8, together with the length of the step 9, can be so proportioned and the upright 1 so located with reference to the vehicle-body and the adjacent fore wheel as to be applicable to any given style of vehicle upon which it is proposed to use the said movable step, and the said proportions may be such that the tire *t* will remain in contact with the step when the fore wheel is turned inward as far as the body and running-gear will permit; but in order that the step 9 shall not require to be made too long, and consequently out of proportion, the shank 8 is divided into two branches, which diverge and connect with the step 9 at its rear corners in such manner that the outer edge of one branch is made continuous with the corresponding outer edge of the step, as shown clearly in

Figs. 1, 4, and 5. The fore wheel may then rub against the continuous edge 15 of the step 9 and the shank branch.

In Figs. 1 and 4 geometrical projection is used in explaining the relative motions of the movable step 9 and the fore wheel *c t*.

Referring to both Figs. 1 and 2, when the fore wheel *c t* is turned inward, the front axle *k c* rotates horizontally about the king-bolt *k*, and the point *t*, Fig. 4, on the tire of the fore wheel is supposed to be on a level with the lower edge of the side bar 30, as shown by the dotted projection-line connecting the point *t* in Fig. 4 with *t* in Fig. 1. Were this point rotated horizontally about *k*, as shown in Fig. 4, it would strike the side bar 30 at the point *t'*, Figs. 1 and 4. The point *o* on the tire in Fig. 4 is on a level with the step 9, as shown by the projection in Fig. 1. Were this point to rotate horizontally about *k* along the arc *o o'''*, Fig. 4, it would strike the step 9 at *o''*, and if the wheel *c t* were turned inward still farther it would push the step ahead of it, and the point of contact *o''* would move in the arc *o'' o'''*. When the fore wheel *c t* is turned inward as far as the side bar 30 will permit without tilting the body, its tire will be in contact with the side bar 30 at *t'*, Figs. 1 and 4, and the tire *c t* is then represented in plan in Fig. 4 by the dotted line *c' t'*, the axle being then in the position *k c'*. When the point *t* reaches the position *t'*, Figs. 1 and 4, the tire will have pushed the contact-point *o''* along the arc *o'' o'''* to the position *o'* within the circular arc *v v v*, having its center in the axis of the upright 1. Now, if the wheel *c t* is pushed farther inward (by being forced under the side bar 30) the point of contact between the tire and the step 9 would move farther along the arc *o o'' o'''* and could be moved as far as the position *o'''* before the tire could slip past the outer end of the step 9 and permit the latter to catch between the spokes of the wheel *c t;* but it would require a greater turn than would ever occur, except in some peculiar accident—as a runaway—to move the point of contact as far inward as the point *o'''*.

Figs. 1 and 4 show the upright 1 vertical and its upper end secured in a projecting plate 21, which may be attached to the under side of the side frame-piece 53 by means of small bolts passing through the holes 24. As seen, by the use of the projecting plate 21 the upright 1 may be placed beyond the edge of the buggy-body. In a side-bar buggy, where the side bar is placed a little distance from the buggy-body, as shown in Fig. 4, this arrangement is preferable, especially with a narrow body and wide tread, as otherwise the shank 8 would require to be made longer; but it must clear the side-bar, as shown in Fig. 4, and not interfere with the vibration of the body upon the springs.

In Fig. 5 the upright 1 is shown in the line *m m*, and when so located its upper end is secured directly to the side frame-piece 53 by being passed down through a hole in piece 53 just inside of the side wall 51. It is preferable, except with very narrow bodies, to secure the upright 1 thus with a plain body without side bars; but with a very narrow body it may be preferable to use a projecting fastening, as a plate 21, for the upper end of the upright 1, and with such an arrangement a stationary step could be attached to or made integral with the plate 21.

It is evident that the upright 1, which is adapted to permit the boss 4 to be rotated about it or to be slid up and down upon it, or to be both rotated about it and slid up and down upon it, is the essential element of the step-supporting frame. Consequently the brace 11 alone might have a boss 2 and be combined with the upright 1, or the upright 1 and the brace 11 might be forged in common with a boss 2 at their juncture, or the brace 12 alone might have a boss 2 and be combined with the upright 1, or the upright 1 and the brace 12 might be forged integral with a boss 2 at their juncture. Again, were the upright 1 comparatively short and thick, it might have a boss 2 for a head and have the nut 23 placed at the upper end, as shown in Fig. 13.

For some vehicles it might be desirable to place the upright 1 sufficiently near the front end of the body or to make the shank 8 so short that the circular arc *v v v* would always be inside of and clear the fore wheel when turned in against the body, as shown by the dotted line *c' t'*, Fig. 4, in which case the movable step 9 could be moved up and down without reference to the fore wheel, or it could be turned in under the vehicle-body when not in use.

For some vehicles it might be desirable to place the upright 1 so that the movable step 9 would always clear the fore wheel when turned in or so that the movable step would be pushed inward by the fore wheel, as previously explained, and yet where it would not be desirable or necessary to raise and lower the movable step. In this case a short upright 1 could be used, having a length just sufficient to permit the boss 4 to be elevated by the inclined surface 3 on the supporting-boss 2.

With some vehicles the coupling-frame might be so located or made that the movable step would require to be raised vertically from the seating position to its highest position before being turned in under the body, while with other arrangements it might be necessary to turn the step around under the body and not raise it much. These features may be provided for by slightly changing the location of the first pulley 18 of the lifting or turning chain, or when no pulleys are used by the direct pull upon the lifting or turning chain by the hand.

In any of the arrangements shown or sug-

gested the same means is adapted to rotate the movable step about the upright 1 and hold it in its elevated or innermost position.

In Figs. 1, 4, 5, 6, and 7 a short arm 10 may be cast or forged integral with a boss 4 or be otherwise suitably secured to it, and a chain be attached thereto, by means of which the movable step may be elevated or lowered. The upper end of this chain may be movably attached within or without the vehicle-body and in a manner such as to be easily reached by the hand by a person mounted upon the seat or standing upon the ground; but it is believed preferable, in order to easily adapt the step-connections to any style of body, to arrange them as shown in the figures.

In Figs. 1 and 4 a chain 16 is connected at one end to the movable step-arm 10 and passed over a small pulley 18, supported in a suitable frame, which may be attached beneath the buggy-bottom 55 and then directed forward to the middle of the bottom and near the front end 50, where there is a hole 20, through which the chain is passed. As shown, a pulley 19 may be placed in the hole 20 for the chain 16 to pass over, and may be supported in a suitable frame, which may be attached to the buggy-body. However arranged, the upper end of the lifting-chain should have some kind of a handle attached thereto, and the handle or the upper end of the chain should be arranged to be fastened to some stationary device in such manner as to hold the step up firmly in its elevated position and arranged to be held within reach, and so that the chain may be slack and the boss 4 properly seat itself upon the boss 2 when the step is in its lowest position.

The space in the front end of the buggy-body adjacent the dash has been chosen as most suitable for locating the parts of the step-connections which are to be operated by the driver on account of being out of the way of the clothing, feet, and wraps of persons seated in the vehicle, and because the parts to be handled may be reached by the driver while remaining seated or when standing upon the ground. Further, with the connections shown in Figs. 1 and 4 provision is made for operating the parts by the foot when seated, as well as by the hand. A guide placed crosswise in the angle between the dash and the floor 55 and suitably attached to the framing, bottom, or walls of the body, along which and to which the means for attaching the handle end of the chain may be moved and fastened, is believed to be essential, especially for flat-bottomed vehicles. For simplicity and economy of material and space the said guide has been combined with a foot-rest, so as to make the same cross-piece answer for the ordinary foot-rest and also for a suitable means of guiding and attaching the said handle-fastening device.

It has been discovered that with most vehicles having room for two persons upon the same seat the width of the body is more than twice the distance through which the boss 4 is required to be moved in elevating or lowering the movable step, so that each step may have a handle device arranged to slide upon and be fastened to the half of the said cross-guide nearest it. When the movable step is in the elevated position, it is preferable to have the said handle-fastening located in the corner of the body nearest the corresponding step and as near the front and side walls as possible, so as to be out of the way of the feet and clothing. Since the movable step on one side of the buggy only is used at a given time, when the handle-fastening of one step is moved along the said cross-guide the handle-fastening for the other step remains at its corresponding end of the said cross-guide, and consequently they do not interfere in being operated.

Figs. 1 and 4 show a combined foot-rest and cross-guide 31 33, located in about the position usually occupied by the ordinary foot-rest, the part 31 extending across the body and having shanks 33 at its ends, which support the part 31 at the proper elevation and which are adapted to be bolted to the frame-piece 53. The part 31 may also have a middle support 48, Figs. 2 and 4. The details of these parts of the step-connections can be best explained by referring to Figs. 8, 9, and 10.

The cross-guide 31 may vary as to the shape of its cross-section, and the corresponding connected parts may be varied in construction to suit; but the construction shown is believed to be preferable. The middle portion of the cross-guide 31 proper is flat or oblong in cross-section, in order to adapt it for a foot-rest, and each end has a rounded portion 32, which may be forged integral with part 31, the front edge of the rounded portion and that of the flat portion being continuous or coincident. The rounded part extends beyond the end of the flat part 31 into the rounded part 36, and with the construction shown in Figs. 1 and 4 the part 36 is made continuous with the supporting-shank 33. The end 43 of the flat part 31 is rounded off, as shown in Fig. 9. A device 34, having a circular hole corresponding in size to the rounded part 36 and a slot 43^a, opening into this circular hole and having a size corresponding to the flat portion 31, is placed upon and fitted to the parts 36 and 31 before the shank 33 is bent out of line with the rounded part 32 36 and the boss 33^a is formed at the end.

As so far described, it is seen that when the device 34 is in the position shown by solid lines in Figs. 8 and 9, it is adapted to be turned about the part 36, but is then prevented from sliding along the part 31 on account of the solid part being locked behind the end 43 of the flat portion 31, and that when turned to the dotted position 34′, Fig. 8, it may be slid along the part 31.

A stem 37 projects from the locking and sliding device 34, and preferably has a knob

35 at its outer extremity, which may be of metal or wood, or of metal covered with some heat-non-conducting material, as leather, for the said knob is intended to serve as a handle to be grasped when operating the said locking and sliding fastening device 34 for the lifting or turning chain 16. The said knob 35 is also intended to act as a counterpoise when the device 34 is in the position shown in Fig. 9, so that the latter may remain locked behind the end 43 of the flat portion 31. The end of the chain 16 may be attached directly to the device 34. Fig. 9 shows a clasp 38 fastened around the stem 37 and having a hole 39 for fastening the chain.

When the device proper 34 is of sufficient width, it may be drawn along the bar 31 by a pull on the chain 16 without catching; but when narrow it may be desirable to have a projection 42, Figs. 4 and 9, formed on its side, so as to prevent tilting and catching.

The primary operation of the essential parts of the movable step-connections shown may now be described. Suppose the movable step shown in Figs. 1 and 4 to be supported in the elevated position by the chain 16 and the device 34 to be in the locked position shown in Figs. 8 and 9. When the parts are so arranged, the locking device 34 will fasten the upper end of the chain 16 to the cross-guide 31 36 33 and maintain the movable step elevated and in its innermost position. When the locking device 34 is turned to the dotted position 34′, Fig. 8, the weight of the movable step 4 8 9 will cause the step 9 to descend and the chain 16 to draw the device 34 along the cross-guide 31 to the position shown in Figs. 1 and 4, when the boss 4 will properly seat itself upon the boss 2 and the movable step 9 will be in position for use. After use, whether the driver is standing upon the ground or mounted upon the seat, he may grasp the knob 35 in the hand and draw it to the end of the cross-guide 31 and turn it forward to the position shown in Figs. 8 and 9, when it will lock behind the end 43 of the cross-guide 31, and the movable step will be raised and turned to its elevated position. As seen in Figs. 4, 5, and 6, the arm 10 and the pulley 18 are so located that as the step is drawn up by the chain 16 it will be pulled around the standard 1 to its innermost position. The pulley 18 may be so located that the end of the arm 10 may be brought against it, and consequently the movable step 9 may be prevented from swinging about the standard 1 while the vehicle is moving, and, further, that when the step is allowed to descend from such position the lowest point on the boss 4 will strike one or the other of the inclined surfaces mentioned on the upper end of the boss 2 and thus be guided around the upright 1 to position for use. However, when the brace 11 or the pyramidal frame 1 11 12 is used, it is preferable to make the cross-section of the brace 11 angular, as shown by the section S′ in Fig. 5, and the cross-section of the shank 8 angular, as shown by the section S, Fig. 5, and to place the pulley 18 in about the position shown in Figs. 1 and 4, so that when the shank 8 is pulled around far enough its back lower edge will come into contact with the outer and opposite edge of the brace 11, and so that the chain 16 may pull the shank 8 snugly against the brace 11 and hold it firmly against the latter when the movable step is at the elevated position. When the step is so held, any rattling or swinging thereof will be positively prevented. In addition to such means of preventing rattling, a spiral spring 17 may be introduced into the chain 16 in such place as not to interfere with the guiding-pulleys 18 and 19, so that when the device 34 is slid to the locking position the spring will be sufficiently extended to continually pull the shank 8 against the brace 11. By making the stroke along the cross-guide sufficiently great the chain may be slack and the spring free from tension and the boss 4 properly seat itself upon the boss 2 when the step 9 is in its lowest position. The shank 8 and the brace 11 are given the angular cross-sections S and S′, respectively, so that their opposing edges only may come into contact, and consequently the paint may not be rubbed off of them to any extent that would mar the appearance of the said parts.

It may be mentioned here that it is not intended that the fore wheel adjacent the movable step shall under any ordinary circumstances rub against and thereby disfigure the edge of the step 9 or its shank 8, for the movable step is not to be lowered except when the adjacent fore wheel is turned out of line with the hind wheel and away from the vehicle-body. The provision set forth for the contact and automatic co-operation of the wheel and step is intended to prevent accidents where restless horses are used or in runaways and the like. In this connection, also, it may be stated that the additional function previously referred to of the tube 58 on the upright 1 is to furnish a surface to the latter which shall not be disfigured by the frequent sliding of the boss 4 upon it. By using a tube of brass or other non-oxidizable alloy or metal the same may be kept polished and always have a presentable appearance.

The upright 1 might be covered with leather and the boss 4 bushed with some such material in order to attain the same end; but I prefer the use of a metal tube.

The upright 1 itself might be made of a material which would not corrode or become disfigured by rubbing.

Where the body is very narrow and all the space possible is required for the motion of the device 34 along the cross-guide 31 and a projection 42 or a friction-spring 41 is used on the guide 34, the middle support 48 may be made, as shown in Fig. 2—that is, it may be bent as shown, and fastened to the under side of the cross-guide 31 and have a boss 49,

by which and a small bolt it may be attached to the end frame-piece 54. Such construction also permits of a rounded part, as 32, Figs. 8 and 9, being continued the whole length of the guide 31, as is shown by the section in Fig. 2, when so desired. Where the buggy-body is exceedingly narrow it would be preferable to omit the middle support 48.

It may be desirable to so arrange the step-connections that the weight of the movable step 4 8 9 would not of itself be sufficient to cause the step to suddenly drop to position if the device 34 should purposely or by accident be released, as any consequent noise might frighten a wild horse. This end may be attained by the means shown in Figs. 8 and 9, where a spring 41 is attached by means of a screw 40 to the side projection 42 on the locking device 34 and may be arranged to press upon the rounded front edge of the cross-guide, as shown. The arrangement shown permits of any required amount of friction between the spring 41 and the cross-guide 31, and consequently is adapted to hold the sliding device 34 at any required position on the cross-guide or to prevent the sudden descent of the movable step. Of course the spring 41 could be attached directly to the main part of the device 34 where no projection 42 was used; but when the parts 42 41 40 are placed as shown in Fig. 9, where the device 34 is in the locked position, they are liable to catch a lady's dress in jumping from the vehicle. It is therefore preferable to continue the rounded part 32 the whole length of the cross-guide and place the parts 42 41 40 beneath and close to the flat portion 33 of the cross-guide when the device 34 is in the locked position, so that when it is rotated to the dotted position 34′, Fig. 8, the said parts 42 41 40 will still be behind and beneath the foot-rest.

When the rounded part 32 does not extend the whole length of the cross-guide 31, as shown in Fig. 10, it should have such length that the spring 41 will press upon it with the same force at any of the positions occupied by the device 34 when rotating about the circular bearing 36, for then the spring 41 will not only prevent the device 34 from sliding along the bar 31 when on the bearing 36 and in the position 34′, Fig. 8, but will assist the weight of the knob 35 in preventing rotation on account of a jar when the locking device 34 is in the position shown in Fig. 9.

A locking device, as a spring-catch, might be attached to the side wall 51 or the side frame-piece 53 in such manner that the stem 37 could be pushed under it, and the sliding device 34 be thus locked and prevented from rotating about the bearing 38; but the means illustrated in Figs. 8 and 9 are of more general application and believed preferable. The device shown in Figs. 8 and 9 is also adapted to be operated by the foot of the driver when seated.

The part *a* of the device 34 extends somewhat away from the cross-guide 31 and has a curved outer surface, which may be roughened, as with transverse ridges, so that when the device 34 is locked, as in Figs. 8 and 9, if the foot is placed upon the said extending part the device 34 may be rotated backward to the position 34′, Fig. 8, from which it may be permitted to slide along the cross-guide 31, or it may be pushed along by the side of the foot. The step may be elevated by the foot by pushing against the side of the said extending part of 34 until the device 34 is moved onto the bearing 36, when the device 34 may be rotated forward and locked by the driver inserting the toe of his boot under it and turning it upward and forward.

When both of the locking devices 34 are locked in their respective corners, they are out of the way of the feet, and the projecting parts *a* are then in position to serve as stops to prevent the feet from slipping off of the ends of the foot-rest and striking the painted side walls 51.

While the method of making the ends of the cross-guide 31 36 (shown in Figs. 1 and 4) might be least expensive, there is no provision for replacing a new locking device 34 in case of breakage. To provide for this and to enable all of the parts of the cross-guide and also the main parts of the locking device 34 35 37 to be cast, if so desired, the construction shown in Figs. 9 and 10 may be used. There the bearing 36 is extended into a projection 44, on which a screw-thread is cut. A boss 45, tapped for the reception of the screw end 44, is formed on the end of a support 46, Fig. 10, having a boss 47, with a hole for a small bolt, by means of which the support 46 is secured to the body side piece 53.

In Figs. 1 and 4 a stationary step 26 is shown supported by means of an arm 25, projecting from and forged integral with the forward brace 12 of the pyramidal frame and so as to be midway between the movable step 9 when in position for use, and the stationary step 29, Fig. 4, placed on top of the side bar 30. When the movable step 9 is elevated and turned under the body, the pyramidal frame 1 11 12 and the stationary step supported thereby would have a better appearance if the stationary step were on a level with the boss 2, as shown dotted at 28, Fig. 1, where the supporting-arm 27 is shown dotted also. In Fig. 13 a similar step 66 is shown in dotted outline projecting from the boss 2. The stationary step supported by the pyramidal frame may be placed at any suitable elevation which will best divide the distance between the movable step 9 and a stationary step supported independently from the side bar 30 or the body. Since the step 26 corresponds in position and elevation to the usual pendent step supported from the side bar or the body, it may be omitted in the construction of the said pyramidal frame or of any of the step-supports set forth, as in Figs. 5 and 6, and may be supported in the

usual manner in a position such as to make its use in connection with the movable step 9 convenient.

Figs. 11 and 12 show a modification of the movable-step-supporting frame, where, while the construction is varied, the principle remains the same. Here the braces 11 and 12 are shown continuous and with a boss 59 welded (or otherwise suitably secured) to them at their juncture. The boss 59 has a central hole, through which the lower end of the upright 1 passes and in which it is secured. The lower portion 60 of the brace 11 is bent upward and around the boss backward and inward, something like a spiral, to a point 63, whence it may be continued straight to the boss 14, by which it is attached to the body-bottom. The boss 4, to which the step-shank 8 is attached, is plane on its lower end, and the shank 8 projects outward sufficiently before bending downward to permit of an inclined face 62, Fig. 12, being given to its under side, such as to correspond with the inclined upper surface of the part 60 of the brace 11, so that the shank 8 may slide upon the said portion 60 when the movable step 9 is turned from its outermost to its innermost position. This construction also permits the fore wheel to push the movable step out of its way in turning inward. When the shank 8 has been slid along the curved portion 60 of the brace 11 to the point 63, it will remain in contact with the brace 11 from the point 63 until it reaches its elevated position 8′, Fig. 12, when the boss 4 is drawn upward by the lifting-chain. (Shown in Figs. 1 and 4.) When the movable step is dropped, the shank 8 will slide in contact with the brace 11 and be guided by the curved part 63 60 to position. When the movable step 9 is in position for use, the side of the shank 8 rests against a lug or projection 61, which corresponds to the stop-face 5 of the boss 2 in the former modification, and, like the face 5, it, too, may be replaced by a surface inclined so as to guide the shank 8 backward to a proper seat.

In both the modifications of a pyramidal frame shown, as well as where an upright only is used, a stationary inclined surface is formed upon a part or parts of the movable step-support as a means of guiding the movble step to position for use, and an abutting surface is formed upon a part or parts of the same as a means of stopping the rotation of the step and forming in connection with the said inclined surface a suitable seat for corresponding parts of the movable step, and whereby provision is had for moving the said step out of the way of the fore wheel or of enabling the fore wheel to automatically push the step out of its way when it is turned in against or under the vehicle-body.

It is not intended that the movable step set forth shall be used each time any person gets into or out of the vehicle, as gentlemen having good use of their limbs need not use it at all, since the stationary step 26 will be found as convenient as were it the usual stationary step for which it is a substitute; but the movable step is always ready for use and will be found of great convenience and even indispensable for women, children, and infirm persons.

The movable step is especially convenient and desirable for use upon a buggy having a top extending well forward, as when the top of a buggy is up and the stationary steps are arranged, as was previously necessary, it is often quite inconvenient even for supple grown persons to get into or out of the buggy.

When the vehicle-supporting springs are placed lengthwise and directly under the side bar 30, they will not extend below the side bar at the location of the upright 1, and when they are placed crosswise of the body they are or may be so located as not to interfere with any of the parts of the movable step or its connections, so that there need be no difficulty in attaching my improvements to various styles of vehicles.

The modification of a movable vehicle-step and supports herein specifically shown and described has a stationary upright and a perforated boss; but the inclined guiding-surfaces described could be formed on the parts and perform the same functions were the step-boss connected to the upright and the supporting boss perforated, as when the upright 1 is arranged to slide within the boss 2.

I claim—

1. In a movable vehicle-step and supports, the combination of the movable step and its support, the same being provided with the inclined guiding-surfaces, substantially as set forth.

2. In a movable vehicle-step and support, a stationary upright supported from the vehicle-body by being connected directly or indirectly to the body, in combination with a movable step having a perforated boss adapted to slide up and down upon the said upright, substantially as and for the purposes set forth.

3. In a movable vehicle-step and support, a stationary upright supported directly or indirectly by the vehicle-body, in combination with a movable step having a perforated boss adapted to slide up and down upon the said upright and also to turn about it, substantially as and for the purposes set forth.

4. In a movable vehicle-step and support, the combination of a stationary upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about, or both slide upon and turn about, the said upright, and the upright having integral therewith or attached thereto a downwardly-inclined guiding-surface, and some part or parts in common with the movable step being adapted to slide upon and be guided by the

said guiding-surface belonging to the upright, and the said inclined surface, substantially as and for the purposes set forth.

5. In a movable vehicle-step and support, the combination of a stationary upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about, or both slide upon and turn about, the said upright, and the upright having integral therewith or attached thereto a downwardly-inclined guiding-surface and an abutting surface or part, and some part integral with the movable step or attached thereto being adapted to slide upon and be guided by the said guiding-surface of the upright, and the same or another part thereof being adapted to rest against the said abutting surface or part of the upright, and the said inclined and said abutting surfaces or parts, substantially as and for the purposes set forth.

6. In a movable vehicle-step and support, the combination of a stationary upright, a movable step having a perforated boss adapted to slide upon or turn about the said upright, one or more braces for the upright, and a boss at the juncture of the upright with the brace or braces, the upright being connected directly or indirectly at its upper end to the vehicle-body and attached to or made integral with the brace or braces and the said boss at its lower end, and the said brace or braces being connected with the vehicle-body, substantially as and for the purposes set forth.

7. In a movable vehicle-step and support, the combination of an upright, a tube inclosing the body of the upright, and a movable step having a perforated boss adapted to slide upon or turn about the said incased upright, substantially as and for the purposes set forth.

8. In a movable vehicle-step and support, the combination of a movable step having a perforated boss adapted to slide upon or turn about a stationary upright, the said upright, and one or more braces, the upright being secured at its upper end directly or indirectly to the vehicle-body and one of the said braces extending from the lower end of the upright inward and upward to the vehicle-body and having a narrow edge against which a similar edge of the movable step or step-shank may strike or rub, substantially as and for the purposes set forth.

9. In a movable vehicle-step and support, the combination of an upright attached directly or indirectly at its upper end to the vehicle-body and incased in a tube, the said tube, a movable step having a perforated boss adapted to slide upon or turn about the said incased upright, and one or more braces connecting the latter boss with the vehicle-body, the said parts being arranged so that the said tube may be compressed between its end bearings, substantially as and for the purposes set forth.

10. In a movable vehicle-step and support, the combination of an upright, a movable step having a perforated boss adapted to slide upon or turn about the said upright, one or more braces for the upright, a boss at the juncture of the upright with the brace or braces, and a stationary step supported by the said stationary parts or independent thereof, substantially as and for the purposes set forth.

11. In a movable vehicle-step and support, the combination of an upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about the upright, and a projecting device attached to or integral with a part of the movable step, whereby the said step may be raised or lowered or may be turned about the said upright, substantially as and for the purposes set forth.

12. In a movable vehicle-step and connections, the combination of an upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about the upright, a projecting device attached to or integral with a part of the movable step, and a chain connected with the said projecting device at its lower end and suitably held within reach at its upper end, as described, substantially as and for the purposes set forth.

13. In a movable vehicle-step and support, the combination of a vehicle-body mounted upon four wheels and where the forward wheels are arranged to turn in toward the body, one of the said forward wheels, and a movable step adjacent the said wheel, and supported by the vehicle-body, the movable step being arranged to turn about an axis located in or near the side of the body and to turn toward and from the said wheel, and the parts of the movable step having a guiding-edge against which the tire of the said wheel may strike or rub, and the relative positions of the said axis, wheel, and movable step and the proportions of the parts being such that the step shall not catch in the wheel, and the relative motions of the wheel and the step being such that the wheel in turning in toward the body may automatically move the step out of the way, substantially as and for the purposes set forth.

14. In a movable vehicle-step and connections, the combination of an upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about the upright, a chain attached at one end directly or indirectly to a part of the movable step, and one or more chain-pulleys suitably supported directly or indirectly by the vehicle-body, the chain being suitably held within reach at its upper end, as described, and being adapted to lift or turn, or both lift and turn, the movable step, substantially as and for the purposes set forth.

15. In a movable vehicle-step and connections, the combination of an upright supported directly or indirectly by the vehicle-body, a movable step having a perforated

boss adapted to slide upon or turn about the upright, a chain attached at one end directly or indirectly to a part of the movable step, one or more chain-pulleys suitably supported directly or indirectly by the vehicle-body, and a hole in the body-bottom, the chain being passed through the said hole and suitably held within reach at its upper end, as described, and being adapted to lift or turn, or both lift and turn, the movable step, substantially as and for the purposes set forth.

16. In a movable vehicle-step and connections, the combination of an upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about the upright, a chain attached at one end directly or indirectly to a part of the movable step, one or more chain-pulleys suitably supported directly or indirectly by the body, a hole in the body-bottom, and a tightening device, as a spring, the chain being passed through the said hole and suitably held within reach at its upper end, as described, and the said tightening device being interposed between the movable step and the fastening for the upper end of the chain, as in the body of the said chain, substantially as and for the purposes set forth.

17. In a movable vehicle-step and support, the combination of an attaching-bar for a fastening device for the upper end of the lifting or turning chain, the said fastening device, and the said chain, the bar having recessed or projecting portions at the attaching-points as means of engaging with the fastening device, and the fastening device having surfaces adapting it to engage and attach itself to the said bar at the place of attachment, substantially as and for the purposes set forth.

18. In a movable vehicle-step and connections, the combination of a guiding-bar for the sliding fastening device for the upper end of the lifting or turning chain, the said fastening device, and the said chain, the guiding-bar being suitably connected with and supported by the vehicle-body, and the said sliding-chain supporting device having its parts formed so as to adapt it to adhere to and slide along the said guiding-bar, substantially as and for the purposes set forth.

19. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the fastening device for the upper end of the lifting or turning chain, the said fastening device, and the said chain, the bar extending crosswise of the body and placed adjacent the dash end and suitably connected with and supported by the adjacent body parts, substantially as and for the purposes set forth.

20. In a movable vehicle-step and connections, the combined attaching-bar and foot-rest having a suitable bearing, as 36, and a locking projection, as 43, at each end, in combination with integral or separable end supports, substantially as set forth.

21. In a movable vehicle-step and connections, the combined guiding-bar and foot-rest having its central portion formed so as to constitute a guide for a suitable fastening device for the upper end of the lifting or turning chain and also constitute a suitable foot-rest, the said sliding fastening device, and the said chain, the bar being supported in a suitable manner at its ends, substantially as set forth.

22. In a movable vehicle-step and connections, the combined attaching and guiding bar and foot-rest having a suitable bearing, as 36, and a locking projection, as 43, at each end, and an extension 44 at the end, in combination with the separable support 45 46 47, adapted to be connected with the end 44 by having a hole in the part 45, in which the end 44 may be suitably secured, as by being screwed into it, substantially as set forth.

23. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the fastening device for the upper end of the lifting or turning chain, and having provision, substantially as described, for rotating and locking the said fastening device, the said chain, and the said fastening device, the fastening device having a hole shaped to correspond with the cross-section of the said bar at the locking position and with the cross-section of the part along which it slides, and the said hole and the surrounding part of the fastening device serving to move the latter to and secure it in the locking position, substantially as and for the purposes set forth.

24. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the fastening device for the upper end of the lifting or turning chain, and having provision, substantially as described, for rotating and locking the said fastening device, the said chain, and the fastening device, the fastening device having a hole shaped to correspond with the cross-section of the said bar at the locking position and with the cross-section of the part along which it slides, and the said hole and the surrounding part of the fastening device serving to move the latter to and secure it in the locking position, and the body of the fastening device having attached thereto or integral therewith a suitable part or parts adapted to be grasped by the hand or moved by the foot, or both, substantially as and for the purposes set forth.

25. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the upper end of the lifting or turning chain, and having recessed or projecting portions at the attaching-points as means for engaging the fastening device, the said chain, and the fastening device, the fastening device having surfaces adapting it to

engage and attach itself to the said bar at the place of attachment, and having integral therewith or attached thereto a projecting handle, as 37 35, substantially as and for the purposes set forth.

26. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the fastening device for the upper end of the lifting or turning chain, and having recessed or projecting portions at the attaching-points as means for engaging the fastening device, the fastening device, and the chain, the fastening device having surfaces adapting it to engage and attach itself to the said bar at the place of attachment, and having integral therewith or attached thereto a projecting part, substantially as *a*, for engaging the driver's foot, whereby the said attaching and sliding device may be moved into or out of locking position or moved along the guide-bar or prevent the foot from slipping off the end of the guide-bar, substantially as and for the purposes set forth.

27. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the upper end of the lifting or turning chain, and having recessed portions at the attaching-points as means for engaging the fastening device, the said chain, the fastening device, and a friction device, as a spring, the said fastening device having surfaces adapting it to engage and attach itself to the said bar at the place of attachment, and having integral therewith or attached thereto a suitable part or parts adapted to be grasped by the hand or moved by the foot, or both, and the said friction device being carried by the fastening device and adapted to press the said guiding-bar with any desired pressure when the fastening device is at the place of attachment or at any point along the guiding-bar or at either of such places, substantially as and for the purposes set forth.

28. In a movable vehicle-step and connections, the combination of an attaching and guiding bar for the upper end of the lifting or turning chain, and having recessed portions at the attaching-points as means for engaging the fastening device, the said chain, the fastening device, and a middle support, as 48 49, the said fastening device having surfaces adapting it to engage and attach itself to the said bar at the place of attachment, and the said middle support being attached to the guiding-bar and the vehicle-body and in such manner and being so formed with reference to the parts of the said fastening device that it will not interfere with the parts of the latter, substantially as and for the purposes set forth.

29. In a movable vehicle-step and connections, the combined attaching and guiding bar and foot-rest 31 32, having end bearings 36, and the chain attaching and guiding fastening device 34, having a hole adapting the device 34 to turn about the bearing 36 and to slide along and adhere to the body of the bar, and having a projecting portion adapted to engage the driver's foot, substantially as described, and having a stem 37 and ball 35 and a suitable attaching-place for a friction device, substantially as described, in combination with the device 34, one or more screws for attaching the friction device to the part 34, the said friction device, and provision for connecting the lifting or turning chain, substantially as described, and the said chain, the ends of the said bar being suitably connected with and supported by the adjacent body parts, substantially as and for the purposes set forth.

30. In a movable vehicle-step and connections, the combination of an upright supported directly or indirectly by the vehicle-body, a movable step having a perforated boss adapted to slide upon or turn about the upright, a lifting or turning chain attached at one end directly or indirectly to a part of the movable step, one or more chain-pulleys suitably supported directly or indirectly by the vehicle-body, a hole in the body-bottom for the passage of the chain, a fastening device for the upper end of the chain, and a bar suitably supported by the adjacent parts of the vehicle-body and adapted, as described, for the attachment of the chain-fastening device or for guiding the latter, or for both attaching and guiding the fastening device, the said fastening device having surfaces adapting it to engage and attach itself to the said bar or to slide along and adhere to it, or both, and having integral therewith or attached thereto a suitable part or parts adapted to be grasped by the hand or moved by the foot, or both grasped by the hand and moved by the foot, and the said fastening mechanism being adapted to either turn the movable step about the said upright or to lift the step, or both, substantially as and for the purposes set forth.

In testimony whereof I now affix my signature in presence of two witnesses.

EDWARD P. ROBBINS.

Witnesses:

MILTON DASHIELL,

WILLIAM C. BEISER.