This invention relates to lifting devices for relieving the weight at least in part on at least one of the steering wheels of a vehicle whereby the steering wheels may be more easily turned.

An object of this invention is to provide a mechanism that will accomplish the desired results and which will not interfere with the tie rod mechanism.

Another object of this invention is to provide a construction which is sturdy and compact yet which will be light and without an excess of heavy metal in its construction.

Still another object of this invention is to permit the compression element to have movement in more than one plane and to allow for side play, both on and off of the compression element while the steering wheels are in cramped position.

Yet another object of this invention is to prevent slipping of the ground engaging portion of the compression element at or near its point of initial contact with the roadway where danger of slipping is the greatest.

A further object of this invention is to provide a device which will tend to remain in the vertical position during the movement of the steering wheels.

With these and other objects in view, which may be incident to our improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising our invention may be varied in construction, proportions and arrangement, without departing from the spirit and scope of the appended claims.

In order to make our invention more clearly understood, we have shown in the accompanying drawings means for carrying the same into practice without limiting the improvements in their useful applications or the particular constructions, which for the purpose of explanation, have been made the subject of illustration.

Our patent applications already filed show a lifting leg, or compression element, pivoted at its upper end for swinging movement, the lower end of the leg and the foot which it carries describing a curve corresponding to the arc of a circle. With this construction, when the foot engages the ground the leg necessarily is at a certain inclination to the vertical, or more correctly to a perpendicular drawn to the direction of the car's motion. The angle measuring this inclination is equal to the angle of lift, and corresponds to the angle of an inclined plane which would give an equal rate of lift for an equal forward or backward movement of the car. The value of this angle determines the magnitude of the horizontal component of the force acting on the foot due to the weight of the car during the car's initial movement, in which the foot grips the roadway.

It is desirable that this horizontal force be as small as practicable, since if too large it will, where the pavement is slippery, be in excess of the frictional force tending to resist the horizontal displacement of the foot, and the foot may slide along the pavement without immediately gripping. The angle of lift, and hence the horizontal component of the force acting on the foot due to the weight of the car, will, for a given height of vertical lift, be the smaller the greater the radius of the described arc, that is, the greater the length of the leg. However, this length is limited in practice by the height at which the leg may be pivoted at its upper end, which in general is determined by obstructions above and adjacent the front axle of the car.

By the present invention the horizontal component of the force acting on the foot during that portion of the car's motion when the weight of the car is being first applied to the foot is very greatly decreased, so that the foot can be made readily to grip even a very slippery pavement without preliminary sliding. Otherwise stated, it is possible with this construction, using a leg of the usual length, to secure an initial gripping power which, using the ordinary construction, would call for a leg of several times this length.

In the drawings:

Figures 1 and 2 are a view partly in perspective of the steering wheels of an automobile with our compression element in engagement with the ground; Fig. 2 is a detailed side elevation showing the compression element in a vertical or lifting position, the front axle being shown in cross section; Fig. 3 is a detailed front elevation of our device;

Fig. 4 is a view taken along the line 4-4 of Figure 3;

Fig. 5 is a view taken along the line 5-5 of Figure 4;

Fig. 6 is a diagrammatic illustration showing the operation of the device.

In the drawings I have shown the front axle assembly of an automobile comprising a front axle 1, front wheels 2, 3, and 4 and steering wheel 5. The steering wheel is provided with a steering post 4 provided with hooks 5 and 6. The usual steering mechanism is indicated and is of the
conventional type and will not be described. On the hooks 5 and 6 is adapted to fit a ring member 7 carrying a wire 8 which may be of the Bowden wire type, that is, adapted to slide in a sheath 9 which is affixed, as indicated at 11, to the steering post 4, and which is adapted to pass forward and, as will later be described, is adapted to raise and lower the compression element. The sheath 9 is so disposed that movement of the front axle with respect to the frame of the car will not subject the sheath to any strain. Some slack is also desirable as indicated in the curved portions of the device.

Fixed to the front axle 1 is a support casting 12 which is fastened in place by U-bolt constructions 13 to the front axle. The casting 12 comprises a plate portion 14 having an inwardly projecting member 15 and downwardly projecting web 16. This inwardly projecting member 15 and downwardly projecting web 16 fit within the upper and lower flanges, as is plainly shown in Figures 2 and 4, of the front axle 1. The member 12 is mounted on the front side of the axle 1 and is provided with a forwardly extending portion 17 which is provided with sloping webs 18. The portion 17 and the webs 18 may be integrally formed with the casting 12, and are so shown in the drawings.

The portions 15 and 16 of the member 12, because they fit within the flanges on the axle 1, give a strong support to the entire assembly. Pivoted in the portion 16 of the member 12 is a pivot 19, and pivoted at the forward portion 17 thereof is a pivot 20. The pivots 19 and 20 carry a cam support 22 to which they are suitably fastened.

The cam support 22 has a central slot 23 into which fits the tongue 24 of a cam plate 25, the two parts being suitably fastened as by rivets 26.

The pivots 19 and 20 are held in holes formed at opposite ends of the support 22, being affixed therein by rivets 25; thus the whole construction is such that the support 22, pivots 19 and 20, and the cam plate 25 are united.

There is a compression element or leg 27 which is provided at its foot with a ball 28 which fits into a socket formed in a foot piece 29. The ball 28 is held in position in the socket formed in the foot piece 29 by a plate 30, which may be bolted, or otherwise suitably attached, to the foot piece 29. The foot piece 29 has a universal movement on the ball 28 and the foot piece 29 is adapted to contact with the ground, as is indicated in Figures 2 and 1.

The compression element 27 has bifurcated extensions 32 which fit over and have sliding contact with the cam plate 26. Between the bifurcated extensions 32 is a roller 33 which is pivoted at 34. These bifurcated extensions are provided with slots 35. Passing through the cam plate 26 is a rivet member 36 having a round head 37 and a round washer 38 of similar dimensions to the head 37. The rivet 36 is riveted in place, as is indicated in Figure 5. The assembly is such that the compression element 27 may pivot on the rivet 36 and the roller 33 may follow the cam plate 26. Figure 6 shows all of the construction is in Figure 7, the support portion 17 of the support casting 12, and the support casting 12 is provided with an opening at the top permitting free pivoting of the cam plate 26 and the assembled parts.

The sheath 9 of the Bowden wire is held in place in the support 33 by means of a screw 41 held in place by a lock nut 42. The support 39 is provided with a conical aperture 43 to permit free play of the Bowden wire 8, as is indicated especially in dotted lines. The Bowden wire 8 is attached, as indicated at 44, to one of the bifurcated ends 32 of the compression element 27.

When the compression element 27 is in its up position, as indicated in Figure 4, it swings upwardly in front of the axle and in cam, and the roller 33 engages an outward projection 45 of the cam surface formed on the cam plate 26, which causes the compression element 27 to be moved to a position in which the rivet head 37 and the washer 38, on the rivet 36, contact the upper end of the slots 35. When the Bowden wire is pulled upwardly in the position shown in Figure 4, the ring 7 is moved upwardly and slipped over the hook 5 on the steering post 4 and the parts are held thus firmly in position to prevent undue motion or vibration.

Pivoted over the top of the cam support 22 is a spring plate 46 which, in the position of the parts shown in Figure 5, rests against the top of the cam support 22 (see solid lines in Figure 5). This spring plate 46 is supported by bolts 47 provided with heads 48. The bolts 47 are secured, as indicated at 49, in projecting ears 50 formed on the sloping webs 18. The plate 46 is provided with elongated holes or slots 53, which permit flexing of the plate over the bolts 47 and in contact with the bolt heads 48. Flexing occurs when the compression element 27 is moved into the position indicated in dotted lines in Figure 5, at which time the spring plate 46 is flexed.

This sidewise motion of the compression element 27 can only take place up to the point where the element comes in contact with the sloping webs 18 which limit the sidewise motion. The spring plate 46 is always tending to return the parts to the position shown in Figure 5—in other words, to center the compression element with respect to its pivoting on the axle represented by which may be bolts 18 and 21. This is of importance in that it tends to cause the lift given by the compression in each operation to be made uniform, and also prevents undue movement of the element 21 by reason of the rotation of the foot piece 29 in its initial contact with the ground.

When the compression element is lowered, such as occurs when the Bowden wire is moved into the position shown in Figure 1, at which time the ring 7 may be placed on the hook 5 on the steering post, the parts are in position for the operation which will relieve at least one of the steering wheels of the tendency to rotate the steering wheels, such as is advantageous in parking a car or maneuvering it in small spaces.

The length of the compression element 27 is such as to give sufficient lift to the front axle so that to 33. The former is relieved on at least one of the front wheels 2 sufficiently to facilitate the turning of the steering wheel 3 when the parts are in the position shown in Figures 1 and 2.

The cam surfaces on the cam plate 26, in combination with the mechanism described, are arranged so that, in its initial position, the compression element with the ground, i.e., at the point of initial lift, there shall be small
lift for movement of the car either forward or backward over the compression element in proximity to this initial gripping of the foot on the compression element with the ground. The purpose of the arrangement is such as to minimize slipping of the foot 29 at the point where slipping is most likely to occur,—in other words, at the point of initial contact of the foot 29 with the ground. It will be realized that, with a leg pivoted in the ordinary manner, the angle of lift is greatest at the point of initial contact of the foot with the ground, and therefore there is more tendency for the foot to slip at this point.

It will be seen that the cam 25 is provided with similar cam surfaces 55 and a center depression 56. Their function will be apparent from the following discussion. The theory of operation will be more readily apparent from an inspection of the diagrammatic showing in Figure 6.

The diagram, Figure 6, which though of reduced size is drawn accurately to scale and represents dimensional relations used in practice, shows schematically the leg or compression element 27 having at its upper end the slots 35 which are adapted to slide over the fixed pin or rivet construction 36. At some point along the leg is pivoted for free rotation the roller 33 which serves as follower for the cam surfaces on the cam plate 26. At the lower end of the leg or compression element 27 is pivoted the foot 29 which when the compression element is in operative position rests upon the pavement.

It is apparent that if the compression element 27 be moved so that roller 33 is held in contact with the working face on the cam plate 26, the point marking the center of the foot-pivot, which I have designated as X, will describe the curve as shown at Y. This curve is of course identical with the curve (not shown) which will be described by the bottom of the foot, and may be used in its place for the analytic treatment.

As before explained, the smaller the angle of lift, the less likelihood of slipping of the foot near its point of initial contact with the roadway. Assume that it is desired to raise the car through a height H. The foot 29 contacts the pavement at the point Z on the curve Y. The angle which the curve Y bears to the horizontal at this point Z, which angle, as before stated, defines the magnitude of the horizontal force acting on the foot, is (as indicated in the diagram) 10°. This angle of 10° remains the same over a considerable vertical distance h by reason of the shape of the cam surface 55. Therefore, if the pavement should vary by reason of irregularity in its surface above or below its normal level through the distance h, the horizontal force acting on the foot would still be at the minimum corresponding to an angle of lift of 10°.

It will be noted that a further angular movement of the leg away from the central position and beyond the 10° segment of the curve rapidly brings it to a considerable height above the normal level of the pavement, as shown in dotted lines. This raising movement is of value as allowing accommodation to abnormal unevenness in the pavement.

To demonstrate the advantage obtained by this method of working over the usual method, there is also shown in the diagram in dotted lines the circular curve Y' generated by a leg 27', of the same type as the improved leg, but of the usual type, pivoted at X for simple arcuate movement. In this case the foot normally makes contact with the pavement at the point Z' in the curve Y', where the angle of lift as shown is 20°, or twice that secured with the improved arrangement. At the two extremes of the allowed variation in level of the pavement, the angles are respectively 15.5° and 23.5°. The very great advantage in gripping power at the point needed, i.e. adjacent the point of initial contact of the foot with the roadway, secured by means of the new arrangement is thus immediately apparent.

Referring again to the cam diagram, Figure 6, it will be noted that the depressed portion 56 in the center of the cam acts to cause the roller 36 to fall as it reaches the vertical position. It is held in this place by a considerable force, as indicated by the height h through which the car drops when the roller falls into the depression. The leg is thus in stable equilibrium as respects forward and backward movement, or in other words, it tends to hold its central position until displaced by the application of considerable force. Thus the steering wheel may be turned with less likelihood of the car "running over" or accidentally moving off its support than would be the case where a leg swinging in the arc of a circle was used.

As in the other forms of our device shown in our other pending applications, the operation is such that the car may either be backed on to the compression element, or driven forward on to it, depending upon which side of the vertical the element is located in the various operations of parking or turning in confined spaces.

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not confine ourselves to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

We claim:

1. A device of the character described comprising a compression element adapted to exert lift on a vehicle from which it is suspended by driving the vehicle on the element, a cam cooperating with the element through movement of the element and guiding its motion during said driving of the element on the vehicle so that the lift near the point of initial contact of the element with the roadway shall be at a maximum.

2. A device of the character described comprising a compression element adapted to exert lift on a vehicle from which it is suspended by driving the vehicle on the element, a cam cooperating with the element through movement of the element and guiding its motion during said driving of the vehicle on the element when it is operating near its point of initial contact with the roadway to give an action similar to increasing its effective length, thereby minimizing slipping.

3. A device of the character described comprising a compression element adapted to exert lift on a vehicle from which it is suspended by driving the vehicle on the element, a cam cooperating with the element through movement of the element and guiding its motion during said driving of the vehicle on the element when it is operating near its point of initial contact with the roadway to give an action similar to increasing its effective length, thereby minimizing slipping, and means tending to bind the compression element in vertical position.

4. A device of the character described compris-
ing a compression element adapted to exert lift on a vehicle from which it is suspended by driving the vehicle on the element, a cam cooperating with the element through movement of the element and guiding its motion during said driving of the vehicle on the element so that the lift near the point of initial contact of the element with the roadway shall be relatively small, and means causing the lift to be relatively small at the first portion of the movement of the compression element after contact with the roadway.

11. A lifting device to raise a vehicle comprising a compression element supported on the vehicle and adapted to contact the roadway, pivotal supports for said element near its top comprising means having axes at right angles to each other to permit pivoting in more than one plane, and means giving an action similar to increasing the effective length of the element when it is operating near its point of initial contact with the roadway.

12. A lifting device to raise a vehicle comprising a compression element supported on the vehicle and adapted to contact the roadway, pivotal supports for said element near its top comprising means having axes at right angles to each other to permit pivoting in more than one plane, means giving an action similar to increasing the effective length of the element when it is operating near its point of initial contact with the roadway, and spring operated centering means tending to restore the element to a defined position with respect to one axis.

13. A device of the character described comprising a compression element, a slidable pivot for one end thereof, a pivot support for mounting the slidable pivot on an axis at right angles to said slidable pivot, a cam guiding the movement of the element to cause the slidable pivot to move upwardly near the point of initial contact of the element with the roadway to minimize slipping.

14. A device of the character described comprising a compression element, a slidable pivot for one end thereof, a pivot support for mounting the slidable pivot on an axis at right angles to said slidable pivot, a cam guiding the movement of the element to cause the slidable pivot to move upwardly near the point of initial contact of the element with the roadway to minimize slipping, and a centering depression in the cam to tend to hold the element in the vertical position.

15. A device of the character described, a compression element adapted to a vehicle and pivotal supports for said element near its top comprising means having axes at right angles to each other to permit pivoting in more than one plane to give a universal movement, said element being free to absorb side wise motion of the portion of the vehicle to which the element is attached.

16. A device of the character described comprising a compression element, a slidable pivot for one end thereof, a pivot support for mounting the slidable pivot on an axis at right angles to said slidable pivot, a cam guiding the movement of the element to cause the slidable pivot to move upwardly near the point of initial contact of the element with the roadway to minimize slipping, and a centering depression in the cam to tend to hold the element in the vertical position.
10. A lifting device to raise a vehicle comprising a compression element supported on the vehicle adapted to contact the roadway, means giving an action similar to increasing the effective length of the element when it is operating near its point of initial contact with the roadway and a universal connection between the compression element and the vehicle.