No. 706,058. Patented Aug. 5, 1902.

C. L. HORACK.

CYCLE.

(Application filed Apr. 26, 1900.)

(No Model.) 4 Sheets—Sheet 1.

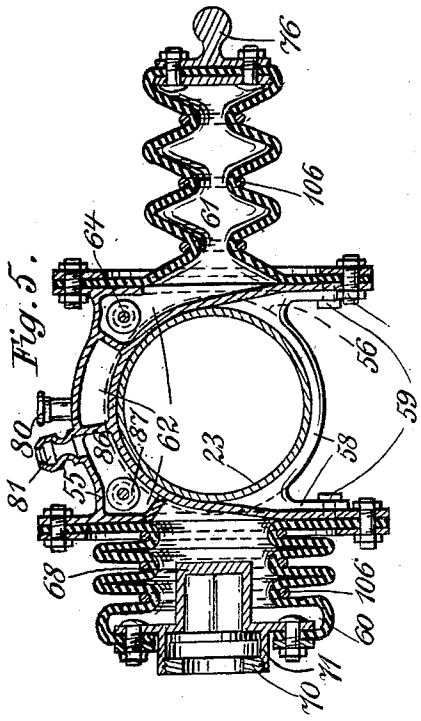


Fig. 5.

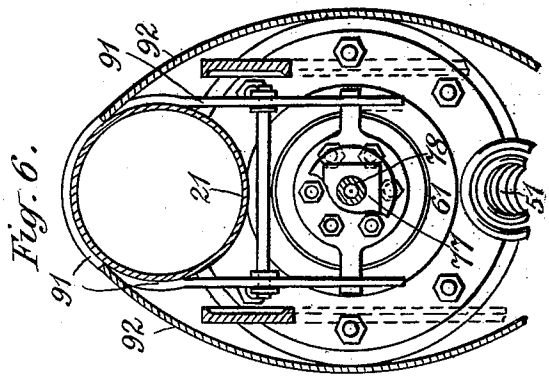


Fig. 6.

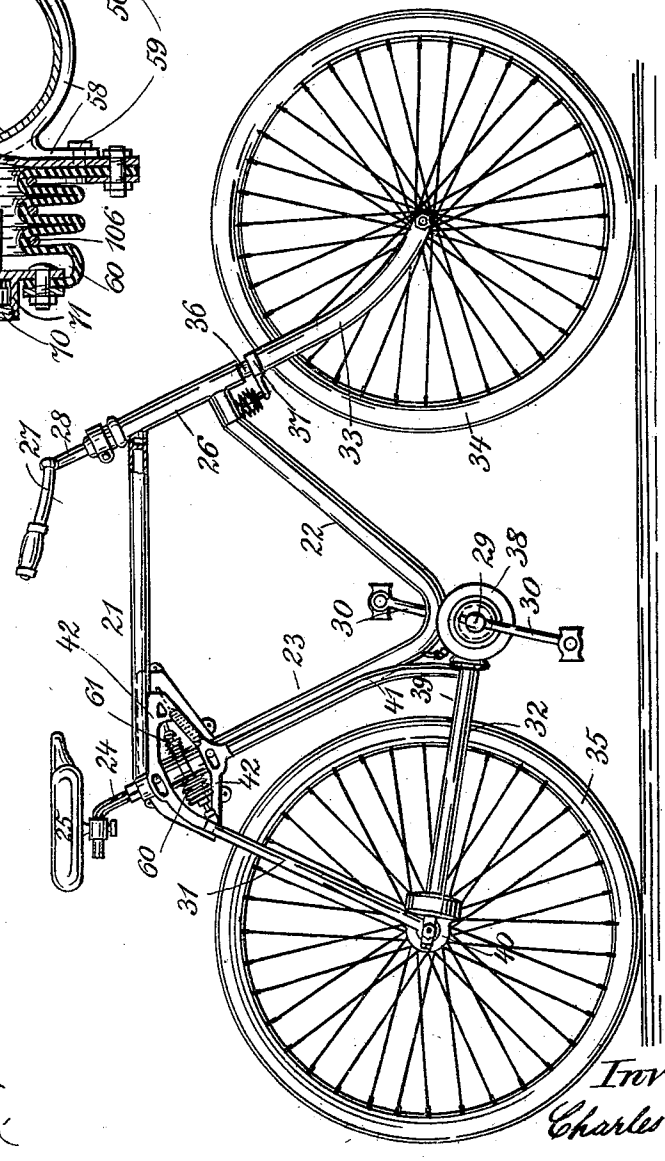


Fig. 1.

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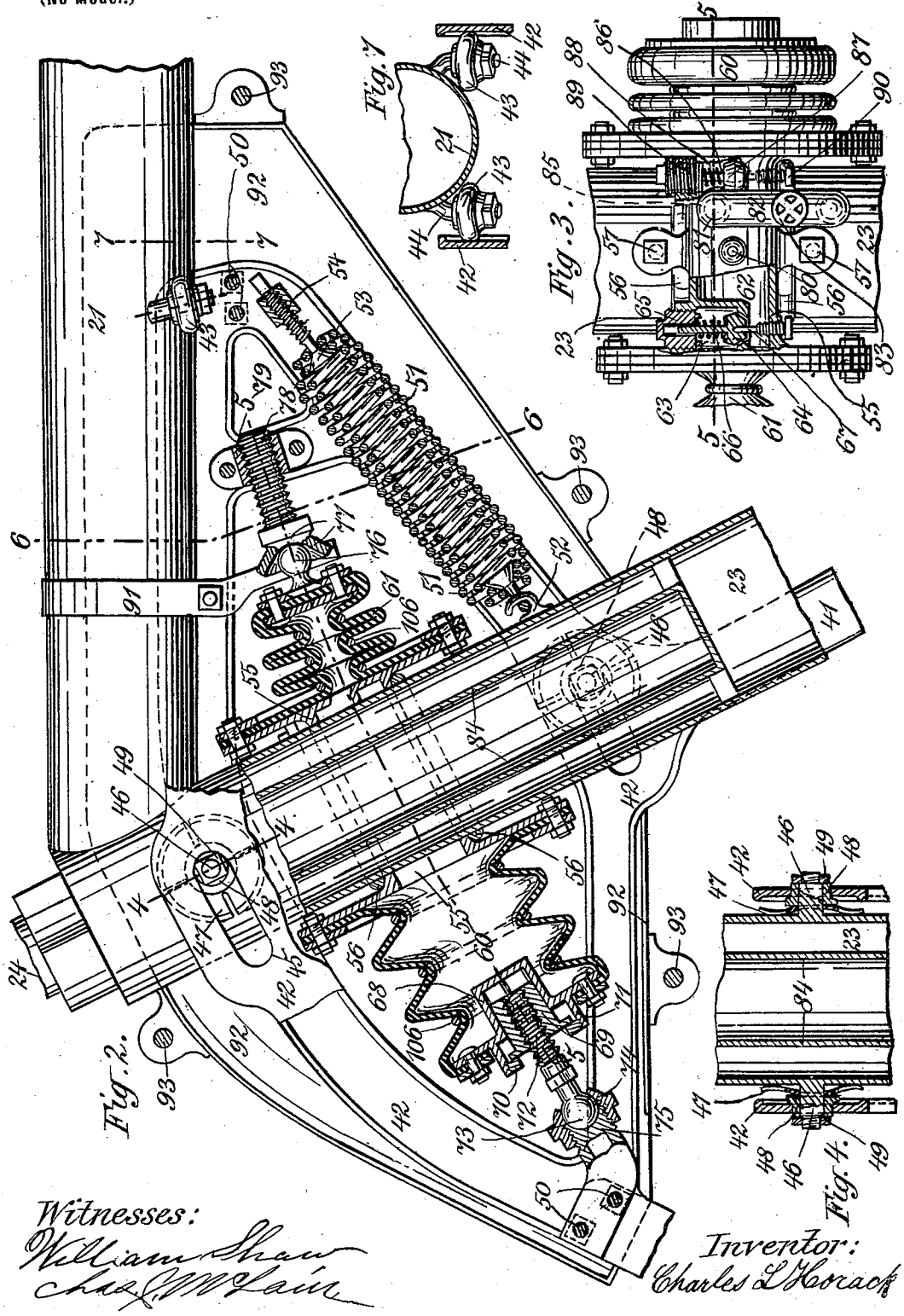


Fig. 2.

Fig. 1.

Fig. 3.

Fig. 4.

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(No Model.) 4 Sheets—Sheet 3.

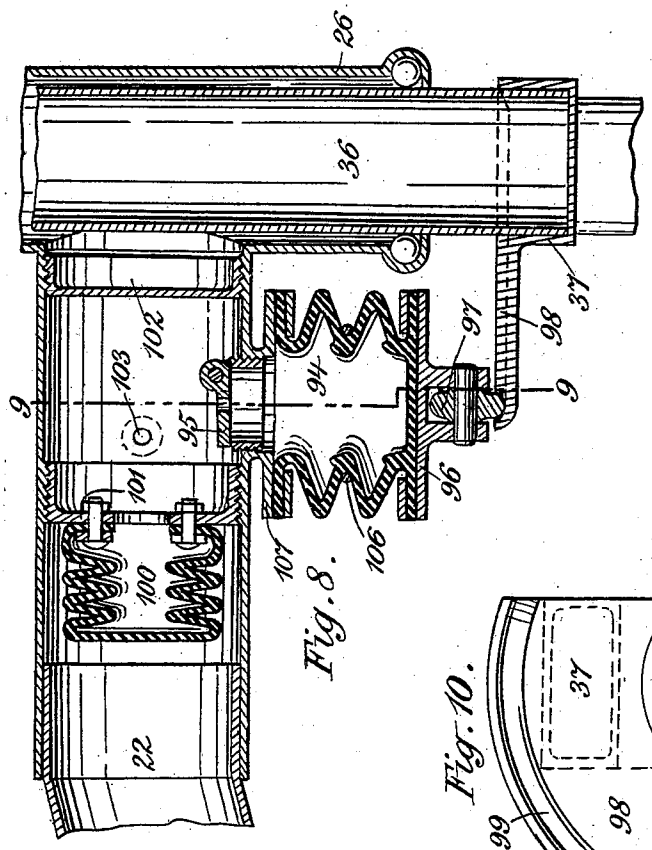


Fig. 8.

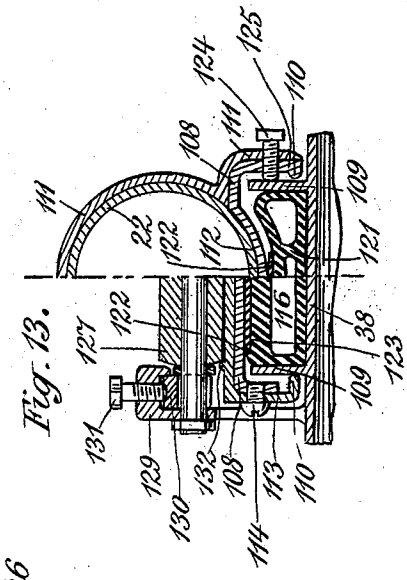


Fig. 13.

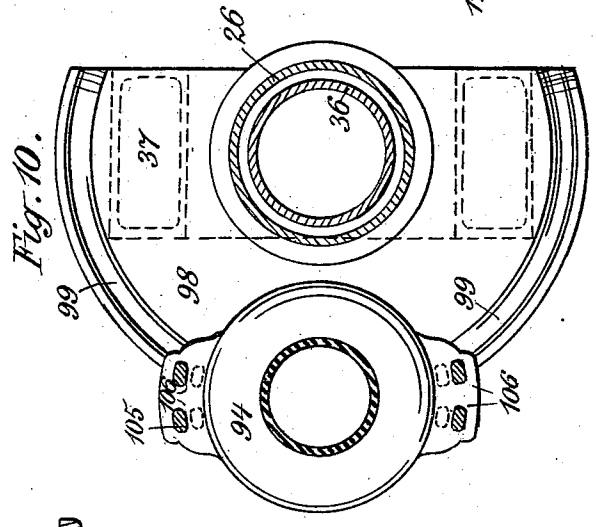


Fig. 10.

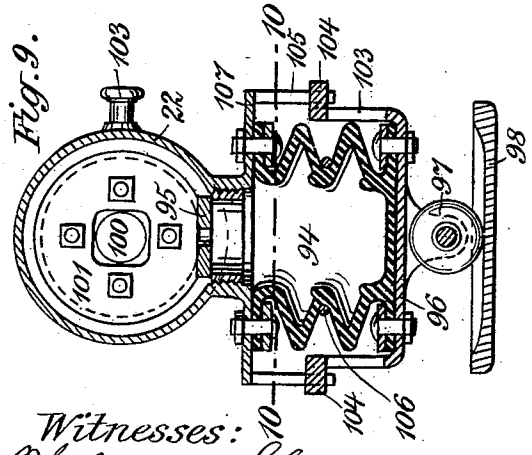


Fig. 9.

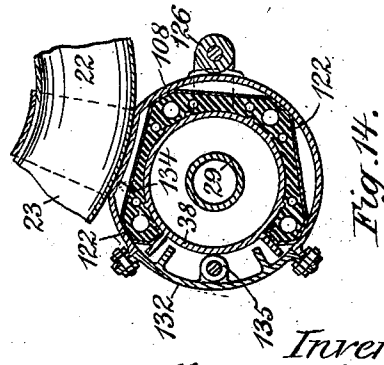


Fig. 14.

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No. 706,058. Patented Aug. 5, 1902.

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CYCLE.

(Application filed Apr. 26, 1900.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 11.

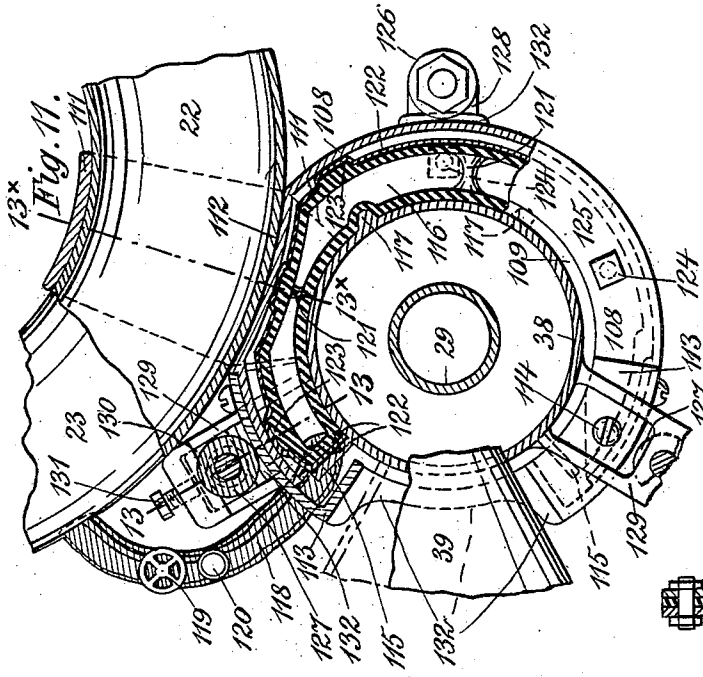


Fig. 16.

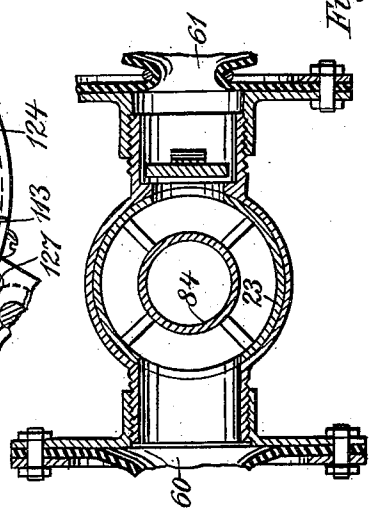


Fig. 15.

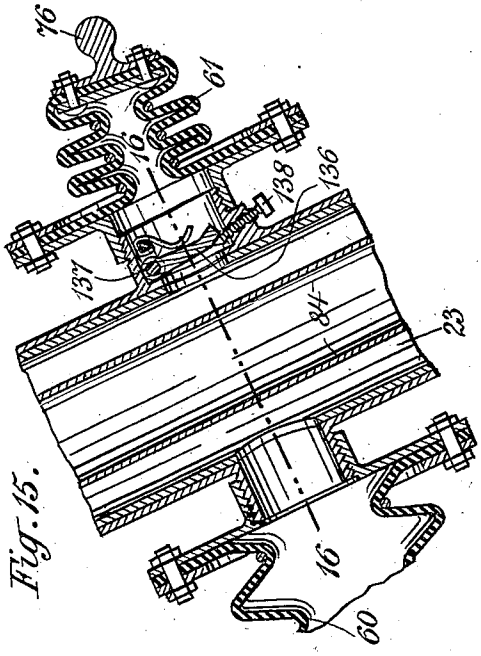
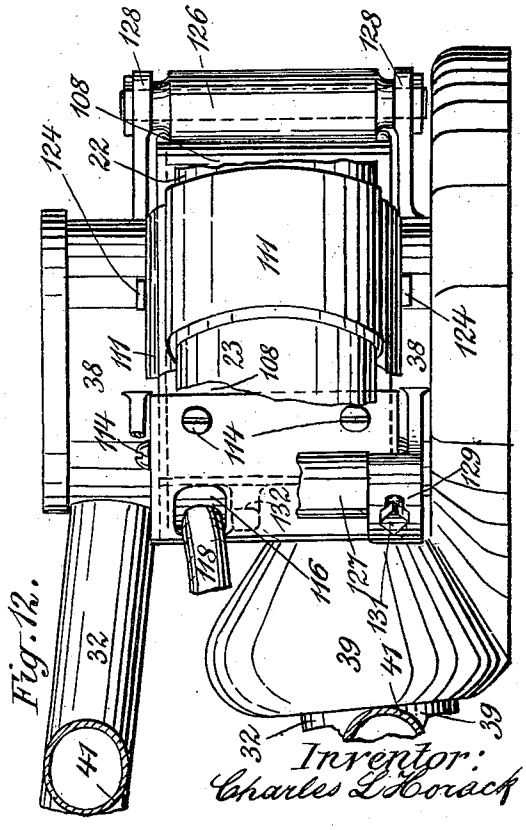


Fig. 12.



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UNITED STATES PATENT OFFICE.

CHARLES L. HORACK, OF NEW YORK, N. Y., ASSIGNOR TO RUFUS M. WILLIAMS, OF NEW YORK, N. Y.

CYCLE.

SPECIFICATION forming part of Letters Patent No. 706,058, dated August 5, 1902.

Application filed April 26, 1900. Serial No. 14,378. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. HORACK, a citizen of the United States, and a resident of New York, in the county of Kings and State of New York, have invented certain new and useful Improvements in Cycles, of which the following is a specification.

My invention refers to vehicles of various kinds, and more particularly such as bicycles and tricycles, which may be propelled by the person seated or mounted thereon or by any suitable agency, thus including automobiles, carriages, &c.

As all the improvements invented by me are especially applicable to cycles and as their construction and operation can be illustrated and explained in connection with cycles, I will in the following specification and in the drawings accompanying the same make reference particularly to cycles.

The objects of my invention are to provide means for neutralizing or reducing the shocks imparted to a cycle owing to the roughness of roads and its meeting with obstructions in general and to protect the rider against such shocks and the reactions therefrom, also to provide suitable appliances for regulating and adjusting the action of cushioning means employed for such purpose, and also for protecting such cushioning means against displacements and accidents.

Further objects are to provide suitable means for articulating two of the frame-sections to each other and for guiding sections so joined together along each other.

I accomplish these and other useful objects by the means hereinafter described, and set forth more particularly in the claims.

In the accompanying drawings, forming part of this specification, and wherein like figures of reference throughout the different views refer to corresponding parts, Figure 1 is a side elevation, partly in section, of a cycle constructed according to my invention. Fig. 2 is a longitudinal vertical section, partly in elevation, of the principal portions of my cushioning means as attached to the rear frame-sections. Fig. 3 is a rear view, partly in elevation, of such cushioning means, while Fig. 4 is a vertical cross-section along line 4 4 in Fig. 2. Fig. 5 is a horizontal cross-section along line 5 5 in Fig. 2; Fig. 6, a vertical cross-section along line 6 6 in Fig. 2, and Fig. 7 is a vertical cross-section along line 7 7 in Fig. 2. Figs. 8, 9, and 10 refer to the cushioning means for the pilot-wheel, Fig. 8 being a longitudinal vertical section of such cushioning means and adjoining parts, Fig. 9 a vertical cross-section along line 9 9 in Fig. 8 looking toward the left, and Fig. 10 a horizontal section along line 10 10 in Fig. 9. Fig. 11 is a side elevation, partly in section, of the joint between the seat-section and the rear-wheel section; and Fig. 12, a ground plan thereof. Fig. 13 represents cross-sections of said section, the left-hand portion being a section along line 13 13 in Fig. 11 and the right-hand portion a section along line $13^{\times}$ $13^{\times}$ in Fig. 11. Fig. 14 shows a longitudinal vertical section of a modified form of a hinge-joint between seat-frame and rear-wheel frame with proper cushioning means. Fig. 15 is a sectional view corresponding with the central part of Fig. 2 and showing a modification as far as the attaching of the pneumatic cushioning means to the diagonal tube of the cycle-frame is concerned, while Fig. 16 is a section along line 16 16 in Fig. 15. Fig. 1 is drawn to about one-eighth and Fig. 14 to about one-half of the scale of the remaining figures.

Referring first to Figs. 1 to 13, inclusive, 21 is the upper main tube of the cycle-frame; 22, the lower main tube; 23, the diagonal or down tube, preferably made continuous with tube 22; 24, the saddle-pillar; 25, the saddle; 26, the steering-head; 27, the handle-bars; 28, the handle-bar stem; 29, the crank-axle; 30, the pedal-bars with their pedals; 31, the upper rear fork; 32, the lower rear fork; 33, the front fork; 34, the pilot-wheel; 35, the driving-wheel; 36, the steering-post, and 37 the crown-head.

The running-gear not forming part of this invention is not illustrated here. The same is assumed to be of the usual chainless type and to be inclosed within casings 38, 39, and 40, all forming part of the rear-wheel frame, 38 containing the crank-shaft and usual cog-wheel, 39 containing the longitudinal power-transmitting shaft, with cog-wheels forward

and rearward and forming part of the lower rear fork, and 40 containing the hub of the driving-wheel with its cog-wheel.

The rear-wheel frame in addition to forks 31 and 32 and casings 38, 39, and 40 also comprises two members 41, fixedly secured to rear fork 39 and extending upward one on each side of and along diagonal tube 23, and two yokes 42, placed on each side of said tube 23 and connecting the upper ends of the two members of the rear fork with said member 41 in such manner that the rear-wheel frame is a double frame substantially throughout, except where its members are joined to casings 38 and 40, one half of said double frame being located to the right and the other half to the left of wheel 35 and diagonal tube 23. The rear-wheel frame is secured to the seat-frame by means of a hinge between casings 38 and that portion of the seat-frame where tubes 22 and 23 join, as more fully described hereinafter.

The forward end of each of the yokes 42 moves in contact with a friction-roller 43, mounted upon a stud 44, placed parallel with the central longitudinal plane of the cycle where it carries such roller and fixedly attached to tube 21, while at the two points where each of said yokes travels across tube 23 it is provided with an elongated eye 45, curved with the axis of the hinge between the seat-section and rear-wheel section as a center. 46 46 are studs on said tube, around which there are placed spring-washers 47 and guide-rollers 48, engaging with said slots and held in position by nuts 49, screwed onto said studs, whereby the upper portion of the rear-wheel frame is guided upon the seat-frame and lateral displacement of the two frames is yieldingly resisted by washers 47. Studs 46 extend at right angles to the central longitudinal plane of the cycle. Said guide-rollers, and particularly those indicated by 43, should preferably be made of rubber, so as to slightly yield during relative movements of the frame-sections, so as to guard againt catching of one section upon the other. The two halves of the rear-wheel frame are connected at suitable points, as 50 50, by detachable stud-bolts secured thereto. By placing the axles of some of the guide-rollers parallel with the plane in which the frame-sections swing, while placing the axles of other such rollers at right angles to said plane, vertical as well as lateral relative displacements of the frame-sections are guarded against. Cushioning of said frame-sections while they swing with reference to each other is effected by the following means: 51 is a spiral spring, (shown here in the form of a nest-spring.) Its rear end is attached to a hook 52 on tube 23 and its forward end is adjustably secured to the forward ends of the yoke 42 by a shoe 53, adapted to be screwed along a socket 54, which is fixedly attached to said ends of yokes. By placing said spring between the lower branches of said yokes I protect it and at the same time conceal it from view. In place of one such spring a series of independent springs might be employed side by side or one within the other. 55 is a rigid casing, U-shaped in ground plan and placed sidewise around tube 23 between two horizontal cleats 56 and attached to one side of said tube by screws 57 and held in position on the other side thereof by a brace 58, inserted between said cleats and attached to casing 55 by screws 59. 60 is a flexible pneumatic cushion attached to the rear portion of said casing, and 61 such a cushion attached to its front end. Cushion 60 is of much larger diameter than 61, so that compression or expansion of the former to a certain extent will cause a displacement of a much greater body of air than compression or expansion to the same extent of cushion 61. Both cushions are constructed in the form of bellows, and their interiors are connected by a passase 62 within the body of casing 55. 63 is a chamber in and forming part of said passage. Upon its lower wall there is seated a check-valve 64 in such manner that it will move away from its seat when the pressure in cushion 60 exceeds that in cushion 61 and toward its seat when said pressures are equal or that in 61 is greater than that in 60. 65 is a screw-plug for closing up the opening through which said valve is introduced. Said plug also serves as a guide for the stem of the valve and also as a support for a spiral spring 66. By screwing plug 65 upward or downward such tension may be given to said spring as will so control valve 64 that the same will not move upward until a certain desired difference in pneumatic pressures has been reached on both sides of said valve. 67 is a pin loosely extending into the bottom of valve 64 and provided with screw-thread in engagement with the lower wall of passage 62 in such manner that by screwing said pin inward sufficiently valve 64 will be held by it at all times in partly-opened condition to such extent as may be desired, so that after a body of air has been forced upward past said valve a corresponding amount of air may return gradually after the valve has assumed its lowest position until air-pressures on both sides of the valve are again equalized.

The rear end of cushion 61 is closed by a metallic cap 68, and into said cap fits a plug 69, so as to slide, but not revolve, therein. This plug is limited in such movement by a collar 70, screw-threaded to a projection 71, which in the form of a sleeve is attached to the base of cap 68, and it will be seen that by screwing collar 70 inward or outward the extent of the play of plug 69 may be limited or increased. Said plug forms a nut for the screw-threaded shank 72 of the ball 73 of a universal joint, which joint contains the socket-pieces 74 and 75, the latter attached to the rear portions of yokes 42 by bolts 50.

Cushion 61 at its forward end carries a button or part of a sphere 76, which rests against the inner surface of a shoe 77, made flaring,

so as at all times to secure contact between button and shoe. Shoe 77 is attached to a screw-threaded shank 78, which engages with a nut 79, secured to the forward portions of yokes 42.

80 is an inflating-valve attached to casing 55. 81 is an outlet, with suitable nozzle on said casing between cushion 60 and valve 64, to which a preferably-flexible coupling 82, with a stop-cock 83, is attached, which connects with the interior of tube 23, and as tubes 22 and 23 are continuous and the interior of tube 23 also connects with tube 21 and around a socket 84, into which is inserted the saddle-pillar 24, and as said tubes are closed to the atmosphere there is thus a large pneumatic cushion provided directly communicating with the interior of casing 55. Nozzle 81 leads out of a chamber 86 in casing 55, and in said chamber there is placed a check-valve 87, opening toward said nozzle, and therefore toward the interior of the tubing of the cycle-frame, and forced toward its closing position by a spiral spring 88, the tension of which is so adjusted by means of a screw-plug 89 that such valve will open only after partial compression of cushion 60. Said check-valve is prevented from seating itself entirely by means of a screw-threaded pin 90, the construction, adjustment, and functions of parts 86, 87, 88, 89, and 90 corresponding substantially with those of parts 63, 64, 65, 66, and 67, and the flow of air from cushion 60 to cushion 61 taking place underneath the chamber 86, within which valve 87 is seated.

The proper compression of the air within the cushioning means having been produced in usual manner prior to the rider mounting the cycle, the air within the cycle-frame will afterward at the time of the opening of valve 87 have less pressure than the air in casing 55, and the important advantage will thus be gained that the sensitiveness of the pneumatic cushioning means will be increased after compression of cushion 60 has commenced, while otherwise the opposite condition would prevail.

91 is a fork the prongs of which extend downward and are adapted to engage with the outer end of cushion 61 and to arrest its expansion outward. Said fork is adjustably and detachably secured along tube 21, so that such outward expansion may be limited to a greater or less degree.

The preferred adjustment and the operation of the cushioning means above described are as follows: The tension of spring 51 is so adjusted that when the weight of the rider is upon the cycle plug 69 will occupy the position shown in Fig. 2, so that when a slight shock only is imparted to the driving-wheel, and thereby the driving-wheel frame is forced forward, spring 51 alone will take up and neutralize this first shock up to the point where plug 69 has been pushed inward within cap 68 as far as possible and begins to compress cushion 60. As spiral spring 51 can be made very elastic and sensitive, it will be seen that slight shocks may thus be taken up by it in quick succession and without straining the pneumatic cushion at all or to any great extent, in that respect imitating in a measure the quick action of a pneumatic tire not too strongly inflated. When the shock imparted to the rear wheel is so great as to compress cushion 60, and thereby increase the air-pressure within casing 55, this will start the flow of air into cushion 61, due to the air-passage being normally left open around valve 64, and will soon after and as the pressure further increases lift valve 64 from its seat and cause further flow of air into cushion 61, thereby forcing the same outward until either the general limit of possible expansion of said cushion is reached or else until the outer end of said cushion comes in contact with the prongs of fork 91, the tension of spiral spring 51 being further increased during such expansion of cushion 61. When reaction sets in, valve 64 will be forced toward its closing position by its own weight and by the action of spring 66, and thus return flow of the air into cushion 60 will be greatly retarded, and in consequence through the instrumentality of parts 76 77 78 the relative return movement of the rear-wheel frame will be correspondingly checked and retarded by cushion 61 remaining partly inflated until equalization of air-pressure on both sides of valve 64 has taken place. As the free flow of air into cushion 61 will not occur immediately after compression of cushion 60 begins to take place, owing to the action of spring 66 and the weight of said valve, the free return movement at this stage of yokes 42 and reëxpansion of cushion 60 will be permitted and to that extent the pneumatic cushioning means will then act in similar manner as spring 51, and besides, spring 51 being made more sensitive than the pneumatic cushioning means, plug 69 during such early reaction will be forced outward and into the position shown in Fig. 2, due to the prompt action of spring 51, and thus the cushioning means will be again in a position to respond promptly to successive light shocks. As spring 66 is made adjustable, as described, it will be seen that the extent of the initial free play of pneumatic cushion 60 may thereby be adjusted. Screw-threaded shank 72 serves to fix the distance between plug 69 and sphere 73, and thereby the play of said plug may be limited within cap 68. Screw 78 may be utilized to regulate the extreme compression of cushion 61, while it is the function of fork 91 to arrest the expansion of said cushion, when it is desired to do so, while the compression of cushion 60 is still progressing, thereby upon reaction allowing free return movement of the rear-wheel frame until shoe 77 strikes button 76 and until retarding action is thereupon produced by said cushion.

In varying the relative adjustments of

valves 64 and 87 by adjusting the springs which force the same toward their seats and the positions of the pins which regulate the minimum return flow of air through these valves the sensitiveness of the cushioning means during varying relative movements of the frame-sections toward each other and away from each other can be regulated at will.

If cushion 60 were omitted entirely, cushion 61 and the connecting parts could be utilized, as described above, as a check for retarding the recontraction of spring 51 upon reaction from a shock imparted to the rear wheel.

By placing the means for regulating flow of air between the chambers of the pneumatic cushioning means, which regulating means are shown to comprise an automatic valve permitting comparatively free flow of air in one direction and allowing a restricted return flow in a passage between said chambers, the most reliable and prompt action of such regulating means is secured.

By making casing 55, which carries diaphragms 60 and 61, detachable from the cycle-frame I am enabled to have all necessary adjustments or repairs made with reference to said diaphragms and to the valves adjusting the flow of air without even necessitating the placing out of operation of the cycle.

By having a multiplicity of guide-rollers between the seat-section and the rear-wheel section and at different distances from the hinge and by arranging the same substantially as described and preferably out of line with each other where three rollers are used I secure the necessary lateral rigidity of the frame without interfering with the proper relative movements of said frame-sections. The guide-rollers having their axles placed parallel with that of the hinge will secure proper relative guidance of the sections in a vertical plane, while those having their axles at right angles thereto will secure proper lateral guidance.

The yoke-shaped connection between parts 31 and 41 not only provides a very strong form for the rear-wheel section, but also offers special facilities for arranging within the same the cushioning means between said sections.

92 is a casing for protecting the cushioning means above described. The same is preferably constructed of sheet metal in two halves secured to the seat-frame and connected together and held in position by bolts 93, the interior of said casing being sufficiently large to permit of the swinging within the same of the upper portion of the driving-wheel frame and to provide for the expansion of the cushioning means therein and the sections of the casing being made to shut up tight against each other and against the seat-frame except where the movement of the rear-wheel frame requires the leaving open of suitable spaces.

Cushioning between the steering-post and front fork and the seat-frame is accomplished by the following means: 94 is a bellows-shaped flexible cushion opening into tube 22. At the connection with said tube a perforated check-valve 95, opening upward, is provided. The lower end of said cushion rests against a metallic plate 96, carrying the bearings for a roller 97, the axis of the axle of said roller being made to intersect the axis of the steering-post. 98 is a shelf or platform having its upper surface flush with the upper surface of crown-fork 37 and preferably carrying a semicircular groove 99, which also extends to the top of said crown-head or of extensions thereon, in which groove-roller 97 travels, said groove having for its center a point in the axis of the steering-fork. At its ends said groove slopes upward, so as to guard against roller 97 too readily leaving the groove when the steering-fork has been turned somewhat over ninety degrees. 100 is a bellows-shaped flexible diaphragm mounted upon a screw-threaded casing 101, screwed into tube 22 in such manner that said diaphragm is adapted to expand within said tube toward the rear of the cycle-frame. The forward end of tube 22 is closed in an air-tight manner by a screw-plug 102. 103 is an inflation-valve between diaphragms 94 and 100, whereby proper air-pressure may be produced in said cushioning means. The desired upward play being provided between steering-post 36 and steering-head 26, cushion 94 is designed to yieldingly resist such relative displacement, and as compression of cushion 94 takes place valve 95 will be forced open and air will pass upward into the compartment above, and in case of great pressure therein will have a tendency to expand diaphragm 100 against the air-pressure within the rear portion of tube 22. As reaction takes place valve 95 will close and gradual equalization of the air-pressure on both sides thereof will take place through the perforation in said valve. The advantage offered by inserting diaphragm 100 between diaphragms 60 and 94 and providing an inflation-valve on each side thereof consists in permitting of maintaining air-pressures within the cushioning means for the rear-wheel frame different from those within the cushioning means for the pilot-wheel frame and still producing coaction of the two cushioning means in case excessive pressure is reached in one of said cushioning means. Generally speaking, heavier air-pressure will be carried in the portion of the cycle-frame in the rear of diaphragm 100 than in front of the same on account of the greater weight generally supported by the rear wheel, and it is this greater pressure which would thus be utilized to counteract excessive pressures in the cushioning means of the steering-post. The insertion of diaphragm 100 also offers the advantage that in case of leakage of the cushioning means on one side of the same those on the other side of it will not be interfered

with. However, it will readily be seen that all the other cushioning means described might be utilized if diaphragm 100 were omitted.

Roller 97 is employed so as to permit of revoluble displacement of the seat-frame with reference to the pilot-wheel frame while diaphragm 94 is under tension, the grooved track 98 serving to prevent lateral displacement of the lower portion 94 lateral with reference to the steering-post, and to prevent lateral displacement thereof in direction in which said diaphragm travels around the steering-post there are attached to plate 96 upright standards 103 with eyes 104 on their upper extremities, into which fit and wherein slide studs 105, depending from and fixedly secured to a flange 107 on tube 22, whereby such lateral displacement of said diaphragm is prevented. 106 106 are rings made of wire and placed around the inner creased portions of the various flexible diaphragms above referred to.

108 are projections on the inner surfaces of diaphragm 94, which when the latter is compressed will prevent the greater portions of the surfaces of said walls facing each other from meeting and permanently adhering to each other in case such compression should continue for a long period.

Referring now to Figs. 11, 12, and 13, articulation of the seat-frame to the rear-wheel frame is accomplished as follows: 108 is a crescent-shaped casing, U-shaped in cross-section, and mounted upon the central portion of casing 38 outside of two vertical walls 109 which extend around about three-quarters of the circumference of said shell. The inner edges of said casing are adjusted to be in approximately close contact with said walls, as shown at 110. 111 is a shoe extending around and rigidly attached to the greater portion of tube 22 where it adjoins casing 108 and likewise attached to the outer portions of said casing at that point, a depression, as at 112, being provided on the outer surface of said casing for the purpose of receiving and seating therein the under side of tube 22. Casing 108 has the inner portions of its rear ends made so sloping that it can be readily slipped over casing 38 in a direction at right angles to the axis of the same, shoes 113 being afterward attached to said ends by screws 114. 115 115 are walls of the same height as walls 109, but placed along casing 38 in a radial direction thereto and parallel therewith, so as to form with walls 109 a convex crescent-shaped trough, around which the concave-shaped trough formed by casing 108 and end shoes 113 is so placed that the latter trough can play or revolve around the former without permitting the detachment of the frame-sections from each other. 116 is a pneumatic cushion interposed between casings 38 and 108, so as to fit into the troughs referred to above. 117 117 are projections on casing 38 engaging with the recessed inner surface of said cushion to prevent creeping of the latter around said casing while the frame-sections move with reference to each other. 118 is a flexible connection between cushion 116 and the interior of tube 23 and extending through a suitable opening in casing 108. Said connection is provided with a stop-cock 119 and valve 120, through which the cushion can be inflated in case said stop-cock be closed. 121 121 are pillars or stays between the exterior and the interior walls of the cushion to preserve its shape during inflation and compression, and 122 a metallic band so fitted to said cushion that it will extend from underneath its ends outward along such ends and along its outer surface 123, being outward-projecting points on the cushion where said band contacts with casing 108. By so employing a metal band I not only reduce friction, but also preserve the rubber cushion.

To secure perfect lateral adjustment of casing 108 with reference to flanges 109, I provide adjustable set-screws, as 124, passing through flanges 125 of such casing and resting against flanges 109.

For the purpose of guarding against excessive relative displacements of casings 38 and 108 and of guiding casing 108 I provide guide-rollers, as 126 and 127, in contact with its outer surface. Roller 126 is shown to be mounted in fixed bearings on lugs 128, secured to casing 38, while rollers 127 are adapted to move toward and away from axle 29, according to the varying compressions of cushion 116.

129 129 represent lugs in which bearings 130, movable radially with reference to shaft 29, for the axles of rollers 127 are inserted. 131 represents set-screws passing through the outer portions of said lugs and so resting upon said bearings that thereby their outward movement may be limited, and in case that for any reason cushion 116 should not be inserted in its usual position screws 131 could be screwed inward sufficiently to guide casing 108 concentrically with reference to shaft 29.

132 are cleats between which rollers 126 and 127 are confined while traveling upon the outer surface of casing 108.

The employment of a cushion, and particularly of a pneumatic cushion, at the hinge between the frame-sections, as described, will guard against excessive strains upon said sections at that point and will ease their relative movement, and by connecting such pneumatic cushion with the pneumatic cushioning means interposed between other portions of the frame-sections and placing valves in such connection, as described, I am enabled to operate these two cushioning means separately or conjointly, as may be required, gaining in the latter case the advantages incident to a greater body of air-resisting compression, and thereby making the cushioning means more sensitive. By placing an elastic cushion between the casing carrying the pedal-shaft and the seat-section of the frame, even where such casing forms part of said frame, an im-

portant advantage is gained, because, particularly where riders rest their weights principally upon the pedals and the handle-bars, the cushion above referred to will relieve the feet of the rider to a considerable extent from the effects of jars imparted to the cycle-frame.

While rollers 126 and 127 have the tendency to confine casing 108 in its proper position, I prefer to employ as a further safeguard against extreme relative displacements of casings 38 and 108 a connecting-piece 133, rigidly attached to both shoes 113 in such manner that said part 113, together with casing 108, entirely surrounds casing 38 without interfering with the free movement of the latter.

In the cushioning means for the hinge between the seat-frame and the rear-wheel frame, as illustrated in vertical longitudinal section in Fig. 14, a rubber block 134, preferably perforated at intervals, is interposed between casings 38 and 108, a metallic band 122 being also employed in manner as described above, a roller 135, having its bearings upon connecting-piece 132 and traveling upon casing 38, being also provided, rollers 127, however, being omitted.

In Figs. 15 and 16 the diaphragms 60 and 61 are shown to be attached to suitable flanges directly attached to tube 23, the passage of air between said diaphragms taking place around tube 84. In this case a swinging check-valve 136, adapted to open toward diaphragm 61, is forced toward its seat by a leaf-spring 137, and a screw 138 serving to adjust the extent to which said valve is to be kept open at all times for the return flow of air.

I do not wish to confine myself to the details herein described, as it will readily be seen that the same might be modified in many respects without departing from the spirit of my invention. Thus the particular forms and relative proportions of cushions 60 and 61 and the means for actuating the same may be varied materially, providing the construction be such that during certain relative movements of the sections of the cycle-frame a greater body of air may be displaced within cushion 60 than is simultaneously displaced within cushion 61.

Yokes 42 instead of being constructed of thin flat metal, as illustrated, might be constructed of tubing, which might form the combinations of parts 31 or 41.

If only a small capacity be required for the cushioning means within the cycle-frame, the same might be confined to the interiors of tube 22 and of tube 23 opposite to and underneath its connection with diaphragms 60 and 61, as shown in Fig. 15, and in that case an air-tight connection would have to be made between socket 84 and tube 23 directly above such connection, and the portion of said socket above said connection could then be omitted, while the diameter of the part of tube 23 above said point might be reduced to substantially the diameter of said socket.

Having described and claimed, broadly, in other applications now pending before the United States Patent Office cushioning means described herein, I do not submit such broad claims in connection with this specification.

I claim—

1. In a cycle, pneumatic cushioning means adapted to resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising a spring and two chambers, each chamber having a movable wall, one of said walls being adapted to yieldingly resist such relative displacement in one direction, and the other wall being adapted to resist such displacement in the opposite direction, means interposed between said chambers for permitting the flow of air between said chambers in one direction, and for permitting and regulating the flow of air in the opposite direction, and means for alternately actuating said spring and producing reaction of the same by alternate movements of said walls.

2. In a cycle, pneumatic cushioning means adapted to resist relative displacement of the seating-surface of the saddle and one of the wheels, and comprising a chamber having a movable wall adapted to be actuated upon such relative displacement and two additional chambers communicating therewith, and two check-valves, one of said valves being placed at the entrance to each of said chambers, suitable return-passages being provided between the chambers between which check-valves are so inserted.

3. In a cycle, pneumatic cushioning means containing three chambers and adapted to resist relative displacement of the seating-surface of the saddle and one of the wheels, and comprising a movable wall forming part of one of said chambers and adapted to be actuated upon such relative displacement, the additional two chambers being connected with the chamber having said movable wall, two automatic valves, one of said valves being interposed between aforesaid chamber and one of the additional chambers, and the other valve being interposed between aforesaid chamber and the other additional chamber, and means for forcing one of said valves toward its seat with greater pressure than that applied to the other valve, suitable return-passages being provided between the chambers between which check-valves are so inserted.

4. In a cycle, pneumatic cushioning means comprising three chambers and adapted to resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising a movable wall forming part of one of said chambers and adapted to be actuated upon such relative displacement, each of the additional two chambers being in direct communication with aforesaid chamber, and two valves, one of said valves being placed in the connecting-passage between aforesaid chamber and one of the additional

chambers, and the other being placed in the connecting-passage between aforesaid chamber and the other additional chamber, suitable return-passages being provided between the chambers between which check-valves are so inserted.

5. In a cycle, pneumatic cushioning means adapted to be compressed upon relative displacements of the seating-surface of the saddle and one of the wheels, said cushioning means comprising a chamber communicating with two other chambers, an automatic valve at the inlet to each of said other chambers, said valves being adapted to open successively, suitable return-passages being provided for permitting return flow of air while said valves are in their restricted positions.

6. In a cycle, pneumatic cushioning means adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising two movable walls maintained during their movements in close contact or connection with the adjoining portions of said cushioning means, and an automatic valve in a passage between said walls for restricting flow of air in one direction and permitting freer flow in the opposite direction whereby two chambers are formed within said cushioning means, one of said walls being adapted to be forced inward and the other being adapted to be forced outward simultaneously during such a displacement, a proper passage being provided for permitting flow of air between said chambers while said valve is in its restricting position, and means for arresting such movement of one of said walls while permitting movement of the other wall.

7. In a cycle, pneumatic cushioning means adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising two movable walls maintained during their movements in close contact or connection with the adjoining portions of said cushioning means, and an automatic valve in a passage between said walls for restricting flow of air in one direction and permitting freer flow in the opposite direction whereby two chambers are formed within said cushioning means, a proper passage being provided for permitting flow of air between said chambers when said valve is in its restricting position, and means for arresting such movement of one of said walls while permitting movement of the other wall.

8. In a cycle, pneumatic cushioning means adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising two chambers each provided with a movable wall, and means interposed between said chambers for permitting the flow of air between said chambers in one direction while one of said walls is moving inward and the other is moving outward and to regulate the flow of air while said walls are moving in the opposite directions, whereby smaller quantities of air are caused to flow backward during such opposite movements of said walls than during corresponding movements in the other direction, and means for arresting such movement of one of said walls while permitting movement of the other wall.

9. In a cycle, pneumatic cushioning means adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising two chambers each provided with a movable wall, and means interposed between said chambers for permitting the flow of air between said chambers in one direction while one of said walls is moving inward and the other is moving outward and to regulate the flow of air while said walls are moving in the opposite directions, whereby smaller quantities of air are caused to flow backward during such opposite movements of said walls than during corresponding movements in the other direction, and adjustable means for arresting such movement of one of said walls while permitting movement of the other wall.

10. In a cycle, pneumatic cushioning means adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels and comprising two chambers each provided with a movable wall, and means interposed between said chambers for permitting the flow of air between said chambers in one direction while one of said walls is moving inward and the other is moving outward and to regulate the flow of air while said walls are moving in opposite directions, whereby smaller quantities of air are caused to flow backward during such opposite movements of said walls than during corresponding movements in the other direction, and means for adjusting the extent of the movement of one of said walls prior to the movement of the other wall.

11. In a cycle, pneumatic cushioning means closed to the atmosphere and having an outer movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, and a continuous movable wall inclosed by said cushioning means and having its edges fixedly secured to the walls of said cushioning means, whereby the same are divided into two non-communicating chambers.

12. In a cycle, pneumatic cushioning means closed to the atmosphere and having an outer flexible wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, and a flexible wall inclosed in said cushioning means, whereby the same are divided into two non-communicating chambers.

13. In a cycle, the combination with the frame, of pneumatic cushioning means having an outer movable wall, adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, a continuous, movable wall inclosed by said cushioning means and having its

edges in continuous contact with the walls of said cushioning means, whereby the same are divided into two chambers, and an inflation-valve for each of said chambers.

14. In a cycle, pneumatic cushioning means comprising a rigid casing and a movable wall adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels, and a movable wall within said cushioning means and having its edges in fixed contact with such rigid portion, whereby the cushioning means are divided into two chambers.

15. In a cycle, pneumatic cushioning means closed to the atmosphere and having a rigid casing and a movable wall adapted to yieldingly resist relative displacement of the seating-surface of the saddle and one of the wheels, and a flexible wall inclosed within and fixedly attached to the walls of said cushioning means, whereby the same are divided into two chambers.

16. In a cycle, the combination with the frame, of a pneumatic cushion having a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, another pneumatic cushion having a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and another wheel and a continuous, movable wall between said cushions having its edges in continuous contact therewith and adapted to be actuated upon relative changes of pressures within said cushions.

17. In a cycle, the combination with the frame, of a pneumatic cushion having a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, another pneumatic cushion having a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and another wheel, and a flexible wall forming part of each of said cushions adapted to be deflected upon relative changes of pressures within said cushions.

18. In a cycle, the combination with the frame, of a pneumatic cushion having a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, another pneumatic cushion having a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and another wheel, a continuous, movable wall between said cushions and having its edges in continuous contact therewith and adapted to be actuated upon relative changes of pressures within said cushions, and an inflation-valve for each of said cushions.

19. In a cycle, the combination with a sectional frame, of a pneumatic cushion having a rigid casing and a movable wall adapted to be actuated upon relative displacement of the seating-surface of the saddle and one of the wheels, another pneumatic cushion having a rigid casing and a movable wall adapted to be actuated upon relative displacement of said seating-surface and another wheel, and a continuous, movable wall between said cushions having its edges in continuous contact with rigid portions of both said cushions and adapted to be actuated upon relative changes of pressures within said cushions.

20. In a cycle, the combination with a tubular sectional frame and the running-gear, of pneumatic cushioning means adapted to be compressed upon relative displacement of two of the frame-sections, tubing of one of the frame-sections forming portion of said cushion, and a continuous flexible wall within said tubing and fixedly attached thereto whereby said cushioning means are divided into two compartments.

21. In a cycle, the combination with a sectional frame, of cushioning means interposed between said sections and comprising a flexible diaphragm constructed in the form of a cup and having a flange protruding outside of its walls, a base in contact with the outer surface of said flange and provided with a suitable contact portion adapted to engage with one of the frame-sections, and means for securing said flange to said protruding portion of the diaphragm.

22. In a cycle, the combination with a sectional frame, of cushioning means interposed between said sections and comprising a flexible diaphragm constructed in the form of a cup and having a flange protruding outside of its walls, a base in contact with the outer surface of said flange and provided with a suitable contact portion adapted to engage with one of the frame-sections, an annular disk on the other side of said flange, and means for attaching said disk to said base outside of said diaphragm.

23. In a cycle, the combination with a sectional frame, comprising a seat-section, and a wheel-section articulated thereto, of cushioning means interposed between said sections, the wheel-section extending forward beyond and rearward of the diagonal or down tube of the seat-section, the forward extension being in the form of a yoke 42 in a substantially vertical plane, said yoke being placed laterally and at the same elevation with reference to such portion of the seat-section, and cushioning means interposed between said diagonal tube and the branches of said yoke.

24. In a cycle, the combination with a sectional frame having the seat-section comprising a diagonal or down tube and the upper main tube articulated to the rear-wheel section, the latter comprising the lower and the upper rear fork and a brace extending upward from the lower forward portion of said wheel-section, and a connecting device 42 between the upper portions of said brace and said upper fork extending forward beyond the diagonal or down tube, said connecting device being placed laterally with reference to the seat-section, and means for guiding said con-

necting device along said diagonal tube and said upper main tube.

25. In a cycle, the combination with a sectional frame having the seat-section articulated to the rear-wheel section, the latter comprising the lower and the upper rear fork and a brace extending upward from the lower forward portion of said wheel-section, and a substantially O-formed connecting device 42 between the upper portions of said brace and said upper fork extending forward beyond and rearward of the diagonal or down tube, said connecting device being placed laterally with reference to the seat-section, of the seat-section, and cushioning means interposed between said two sections and inserted within said connecting device forward and backward of said down-tube.

26. In a cycle, the combination with a sectional frame having the seat-section articulated to the rear-wheel section, the latter comprising the lower and the upper rear fork and a brace extending upward from the lower forward portion of said wheel-section and connected to said upper fork, and means for guiding said sections one upon the other at three points placed in substantially the same vertical plane parallel with the longitudinal central plane of the cycle and out of line with each other.

27. In a cycle, the combination with a sectional frame having the seat-section articulated to the rear-wheel section, the latter comprising the lower and the upper rear fork and a brace attached to the lower forward portion of said wheel-section in the rear of the crank-shaft, and means for connecting it to the upper portion of said upper fork, the portion of said brace between its points of attachment being placed substantially parallel with the down-tube of the seat-frame and lateral thereto.

28. In a cycle, the combination with a sectional frame, one of the frame-sections being articulated to another section, of cushioning means interposed between said sections, and a friction-roller with suitable axle between said sections, said axle being placed parallel with the axle to which the frame-sections are articulated, a guiding-surface being provided on one of said sections along which said roller travels longitudinally, while revolving around its axis.

29. In a cycle, the combination with a sectional frame, of cushioning means interposed between relatively movable sections of the frame, a friction-roller with suitable axle between said sections, a guiding-surface being provided on one of said sections along which said roller travels longitudinally while revolving around its axis, and an elastic tension device for enforcing contact between said roller and the other frame-section.

30. In a cycle, the combination with a sectional frame, of a rigid hollow casing detachably secured to one of the frame-sections and provided with a multiplicity of outlets, different cushioning means connected with said outlets and adapted to be compressed upon relative displacements of sections of the frame, an automatic valve in each of said outlets whereby flow of air is restricted by it in one direction and freer flow is permitted in the opposite direction, and means for permitting flow between said rigid hollow casing and the cushioning means connected with said outlets while the corresponding valves are in their restricting positions.

31. In a cycle, the combination with a sectional frame comprising a seat-section and a wheel-section, of a rigid casing detachably secured to the diagonal or down tube of the seat-section and extending forward and backward of the same, pneumatic cushioning means attached to said casing forward and backward of said tube, and adjusted to contact with portions of the wheel-frame, a connecting-passage being provided between said cushioning means within said casing, an automatic valve in said passage for restricting flow of air in one direction and for permitting freer flow in the opposite direction, and means for permitting flow of air between said cushioning means while said valve is in its restricting position.

32. In a cycle, the combination with a sectional frame comprising two relatively movable sections, of a hollow rigid U-shaped casing detachably secured to one of said sections, and a pneumatic cushion mounted upon said casing and connecting with its interior and adapted to contact with the other frame-section.

33. In a cycle, the combination with a sectional frame, of a hollow rigid U-shaped casing detachably secured to one side of and partly encircling one of the tubes of one of the frame-sections, and a bracket connecting the branches of said U-shaped casing, thereby entirely surrounding said tube, and cushioning means mounted upon said casing and connecting with its interior and adapted to contact with the other frame-section.

34. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, and an arc-shaped casing forming part of another frame-section and revolubly mounted on said axle and adapted to be attached to and detached from said axle by moving it at right angles thereto, a shoe detachably secured to the end of one of the branches of said arc-shaped casing, and a projection on said axle adapted to engage with said shoe.

35. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, an arc-shaped rigid casing revolubly mounted thereon and forming part of another frame-section, and a retaining device movable with reference to said casing and held against its outer surface for retaining it in proper position with reference to said axle.

36. In a cycle, the combination with a sectional frame, of an axle on one of the frame-

sections, an arc-shaped rigid casing revolubly mounted thereon and forming part of another frame-section, and a roller with suitable axle and bearings in contact with the outer surface of said casing for the purpose of retaining it in proper position with reference to said axle, said bearings being fixedly attached to said axle.

37. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, a rigid casing revolubly mounted thereon and forming part of another frame-section, and a series of rollers around the outer periphery of said casing having their bearings rigidly attached to said axle and adapted to guide said casing.

38. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, a casing revolubly mounted thereon and forming part of another frame-section, a guide-roller interposed between said casing and the section carrying said axle, and means for adjusting the position of the axle of said guide-roller with reference to aforesaid axle.

39. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, an arc-shaped casing revolubly mounted thereon and forming part of another frame-section, and a brace between the branches of said arc-shaped casing and fixedly attached thereto, whereby a sleeve is formed around said axle.

40. In a cycle, the combination with a sectional frame, of an axle on the frame-section comprising the lower rear fork, an arc-shaped casing revolubly mounted on said axle and forming part of another frame-section, and a brace rigidly attached to both branches of said arc-shaped casing and placed between the prongs of said fork, whereby a sleeve is formed around said axle.

41. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, a casing revolubly mounted with reference to said axle, and means for adjusting and confining said casing in varying positions with reference to the longitudinal direction of said axle.

42. In a cycle, the combination with a sectional frame, of pneumatic cushioning means interposed between its sections, an axle on one of said sections, a casing revolubly mounted with reference to said axle, a pneumatic cushion between axle and casing, said casing being adapted to slide along said cushion while revolving with reference to the axle, and a connecting-passage between said cushion and aforesaid cushioning means.

43. In a cycle, the combination with a sectional frame, of pneumatic cushioning means having an inflation-valve interposed between its sections, a casing revolubly mounted with reference to said axle, a pneumatic cushion with an independent inflation-valve between axle and casing, said casing being adapted to slide along said cushion while revolving with reference to the axle, a connecting-passage between said cushioning means and said cushion, and a stop-cock in said passage between said inflation-valves.

44. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, a casing revolubly mounted thereon and forming portion of another frame-section, a rubber cushion interposed between axle and casing and seated upon one of said parts, and a series of metal contact-points attached to said cushion and adjusted to contact at intervals with the relatively movable portion of the other one of said parts, said contact-points forming portions of a continuous strip of metal.

45. In a cycle, the combination with a sectional frame, of an axle on one of the frame-sections, a casing revolubly mounted thereon and forming portion of another frame-section, an arc-shaped rubber cushion seated within a trough upon the circumference of said axle, and a continuous metallic band having its interior surface extending from the end surfaces of said cushion around the exterior surface of the same, and having its exterior surface contacting with the interior surface of said relatively movable casing.

46. In a cycle, the combination with a sectional frame, of an axle on the rear-wheel section, a casing revolubly mounted thereon and forming portion of the seat-section, the down-tube and the lower main tube of the seat-section being made continuous in a curve which is convex where they are joined to said casing, a depression in said casing for seating therein such curved portions of said tubes, and means for attaching the same to said casing.

47. In a cycle, the combination with a sectional frame, of an axle on the rear-wheel section, a casing revolubly mounted thereon and forming portion of the seat-section, the down-tube and the lower main tube of the seat-section being made a continuous tube, and a yoke for joining said continuous tube and said casing together and extending around and attached to the greater portion of the periphery of said tube and along portion of the outer surface of and along the sides of said casing.

Signed at New York, in the county of New York and State of New York, this 6th day of April, A. D. 1900.

CHARLES L. HORACK.

Witnesses:
WILLIAM SHAW,
CHAS. J. MCLAIN.