(No Model.)

# T. B. JEFFERY.

## VELOCIPEDE.

No. 406,445. Patented July 9, 1889.

Fig. 1.

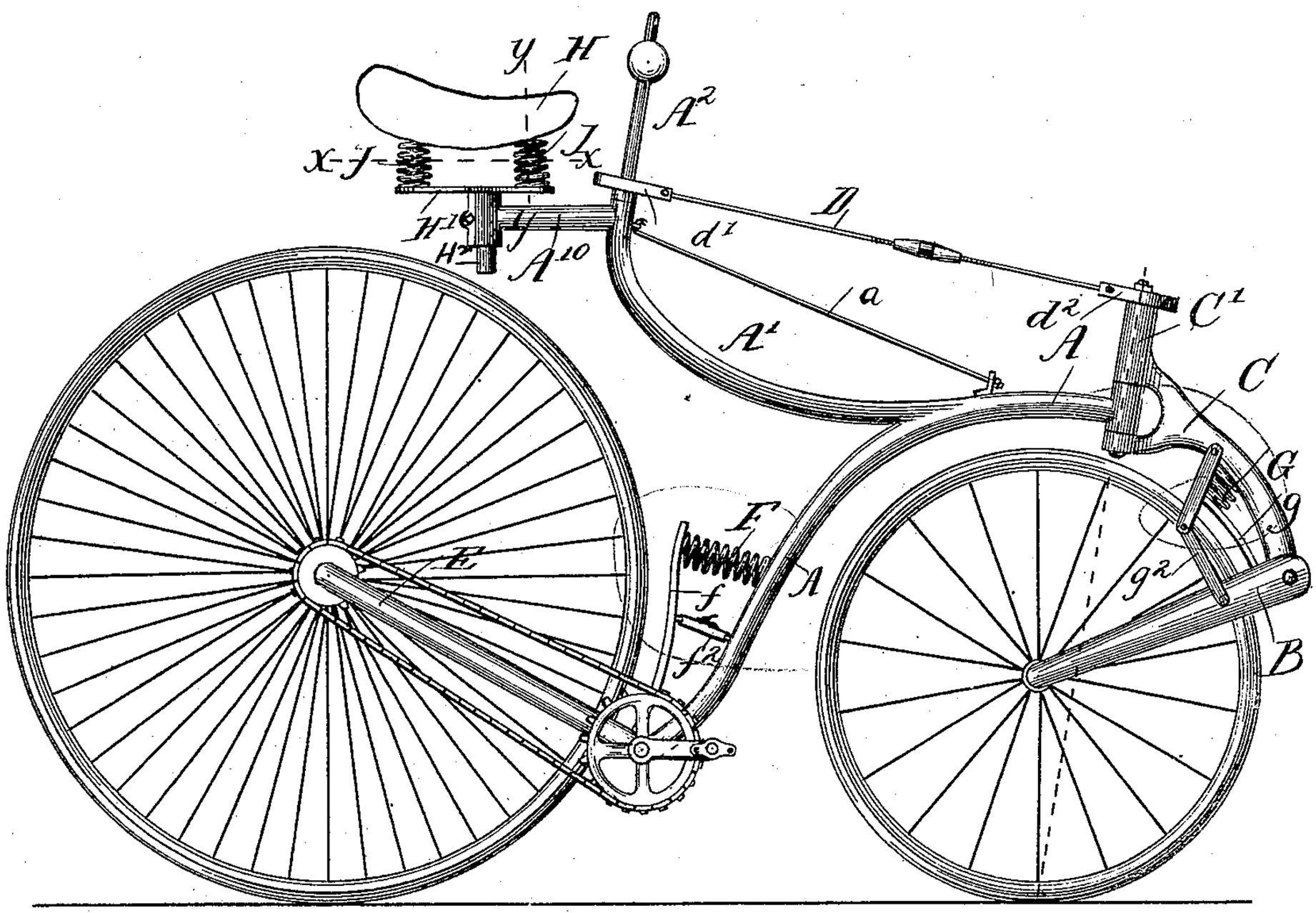



Fig. 2.

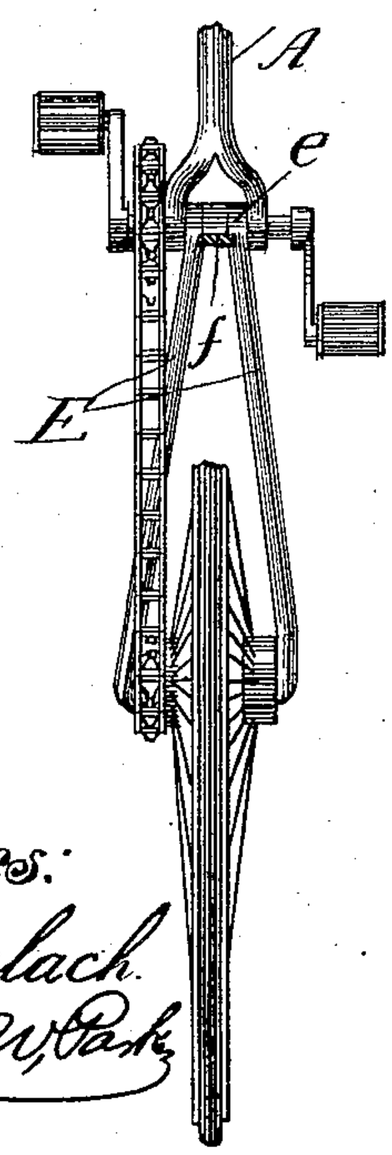



Fig. 3.

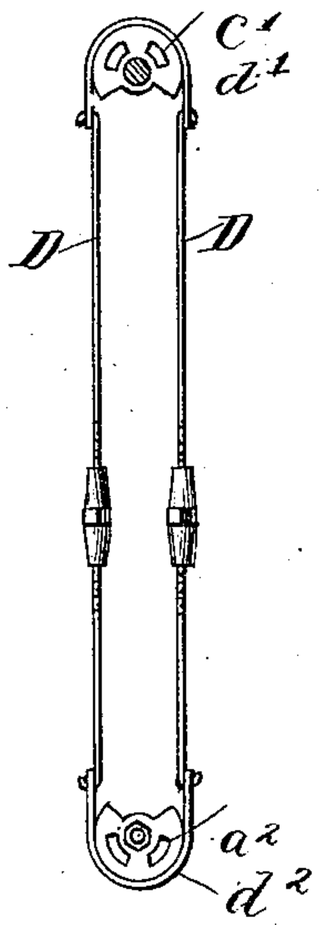



Fig. 4.

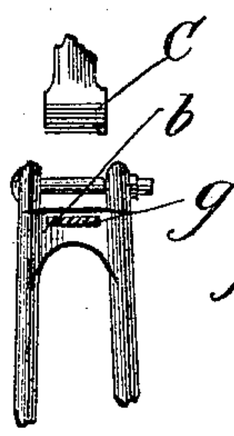



Fig. 5.

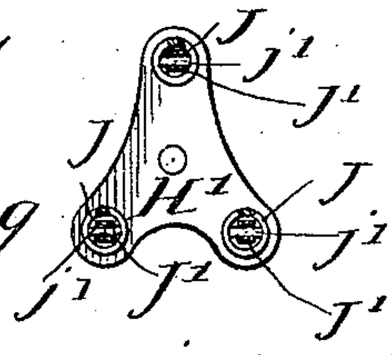
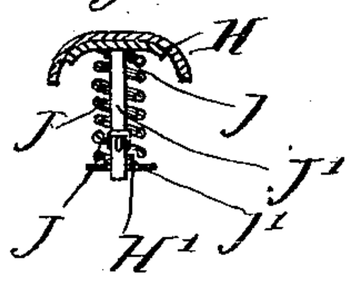



Fig. 6.

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# UNITED STATES PATENT OFFICE.

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## VELOCIPEDE.

SPECIFICATION forming part of Letters Patent No. 406,445, dated July 9, 1889.

Application filed June 6, 1887. Serial No. 240,386. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS B. JEFFERY, a citizen of the United States, residing at Ravenswood, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Velocipedes, of which the following specification contains a full and exact description, reference being had to the accompanying drawings, forming part thereof.

Figure 1 is a side elevation of a velocipede embodying my invention. Fig. 2 is a plan showing the rear fork and driving-gear and the driving-wheel and backbone partly broken away. Fig. 3 is a detail plan of the steering-apparatus connections. Fig. 4 is a detail of the forward end of the front fork and its joint with the front bone. Fig. 5 is a section through *x x*, Fig. 1. Fig. 6 is a section through *y y*, Fig. 1.

A is the backbone.

B is the front fork, which strides the steering-wheel, and has its two branches made integral by the neck *b* outside the circumference of said wheel.

C is the front bone.

C′ is the steering-head at its rear end.

D D are tiller-rods communicating motion from the handle-bar shaft to the steering-head C′.

E is the rear fork, which has its two branches made integral by the connecting-neck *e*.

F is a spring which is stopped against the bracket *f* and acts against the backbone.

G is a similar spring stopped against the bracket *g* and acting against the front bone C.

My invention, which is above described in general, is an improvement in velocipedes, relating particularly to that form of bicycle called a "Safety;" but it embodies some features which are applicable to a tricycle, and I do not limit myself to their use in a two-wheeled machine.

The main features of this invention are specially applicable to a machine in which the steering-wheel is the forward wheel, and the driving is done by driving-chain connecting sprocket-wheel on a pedal-crank shaft located as low as possible with sprocket-wheel on the rear-wheel axle, the seat being located usually forward of the vertical plane of the drive-wheel axle. Hitherto such machines have had the steering or front fork and steering-head made rigid and extended back and up to the handle-bar, so that the steering-axis or axis of the steering-head is in a line which would pass through the axis of the steering-wheel and meet the ground forward of the point of contact of the wheel with the ground. In all so-constructed machines it will be apparent that the fact that the wheel's contact with the ground is not in line with the steering-axis will cause that when the wheel is turned about that axis in steering it must necessarily either slide laterally somewhat on the ground or roll an equal amount and swing the machine sidewise. The latter is the result which actually occurs, and hence the steering is made more difficult than it should be, because the operator in turning the steering-head also by that movement propels the machine, or at least the forward part of it, sideward in the direction in which he is about to turn, thus doing by the hand part of the work which belongs to the foot; but, furthermore, when the axis of the steering-head is inclined rearward, the slight lateral rolling of the steering-wheel tends to set the fork, and so the steering-head and neck, at an inclination which tips the seat and rear wheel slightly in the opposite direction from that to which the machine is being turned, which is especially undesirable when the machine is under headway, and at all times renders turning less easy and more likely to result in overbalancing. Both these defects are remedied by a construction in which the axis of the steering-head is in a line which includes the point of the wheel's contact with the ground, (so that the wheel turns about the steering-axis without necessarily rolling on the ground,) and in which said axial line is inclined forward and not rearward. Since the wheel's contact with the ground is vertically below its center, (on level ground,) this construction brings the steering-head forward of the vertical line of the steering-wheel axle, all of which appears in the structure illustrated in the drawings and hereinabove described in detail.

Another peculiarity should be noticed concerning the action of a swiveled wheel (such as a steering-wheel) in meeting an obstruc-

tion lying obliquely to its course, in order to understand the reason and advantage of my construction. When the swivel-axis is behind the axis of the wheel, the tendency of all resistance encountered by the wheel, even the rolling friction or a smooth surface, is to cause the wheel, if once deflected in the slightest degree, to swing entirely around and place itself behind the swivel-axis. The familiar action of common caster-wheels is an example of this. This tendency is of course intensified when the wheel meets an obstacle which it strikes obliquely, and if the headway is considerable a very firm hold on the handle is necessary to prevent swerving and losing the course; but if the wheel is hung behind the swivel-axis, so that it trails instead of pilots, its tendency is to keep its course, and, even if deflected for an instant, to resume that course the instant the deflecting obstruction is passed. Thus a wheelbarrow which is being pushed must be guided by being firmly held by the handles, while one which is being pulled may be held loosely and will follow the course by merely trailing after the walker who holds it up. For this reason my machine is much more easily held to its course and much less easily turned aside by obstacles—such as stones and unevenness in the ground—than such as have the steering-axis rearward of the wheel-axis.

Another feature of my construction relates to the passage of obstacles. It will be observed that the head C′ is not directly a part of the front fork B, but is a part of the front bone C, which is hinged to the fork B, the two parts being held in their proper relation and enabled to act together, so far as necessary, by the spring G and jointed link $g^2$. The hinge-joint between these two parts C and B, I locate at a point as far forward and at the same time as far above the axle as possible—that is, at a position chosen with reference to both these desiderata, not sacrificing either wholly for the other. The reason for this is that when an obstacle is encountered two results are caused—first, the onward movement of the machine is checked, and, second, an upward movement of the machine is caused as the wheel rises over the obstacle. It is desirable to prevent the rider from experiencing either of these shocks or to diminish as far as possible the extent to which he shall experience them. These shocks are first received by the steering-wheel. The spring G, interposed between the fork B and the front bone, tends to absorb the shock and prevent its reaching the backbone and rider. By hanging the wheel far rearward of the pivot between the fork and front bone it gets a long leverage for its upward yielding, and by hanging it far below said pivot it gets long leverage for its rearward yielding. The position shown, the fork extending forward and upward from the axle at an inclination of from thirty degrees to forty-five degrees from the horizontal, I find to yield the best average result in respect to these two particulars; and in order to get as great length as possible for the fork, as well as to diminish the number of joints to the lowest number, I join the fork by the neck *b* outside the circumference of the wheel and make the pivot just outside that neck, as seen in Fig. 4.

The construction described, with the steering-axis so far forward, necessitates provision for operating it from the seat, which is necessarily located near the rear wheel. I support the seat and the handle-bar on the bracket-like branch A′ of the backbone, which is stayed by the straining-rod *a*, the handle-bar shaft being supported directly in said bracket and the seat on a secondary bracket or extension $A^{10}$. The handle-bar shaft has secured to it a sheave or tiller-wheel *c′*, and the steering-head has a similar sheave $a^2$, and the flexible straps *d′* and $d^2$, passing around said sheaves, respectively, are connected by the adjustable rods D, whereby the motion of the handle-bar shaft is communicated to the steering-head. The adjustment of the tiller-rods D is effected by the use of a common reverse-threaded coupling-nut D, the action of which is familiar and obvious.

The seat H is supported upon three spiral springs J J J, two at the rear and one at the front, resting upon a base plate or frame H′, which has a spindle H″, by which it is clamped and vertically adjusted in the bracket $A^{10}$. The upward reaction of the springs J, and their consequent initial stiffness, is limited and regulated by the buckled straps J′ J′ J′, located within the said spiral springs and reeved into the staples *j j j* on the upper side of the base-plate and the staples *j′ j′ j′* on the under side of the seat.

The rear fork E, I make extending forward and downward from the hub of the rear wheel and terminating in the neck *e*, to which is attached the rear end of the backbone, and through which passes the pedal-crank axle.

In order to give as much elasticity as possible to the whole frame and to cause the movement of the seat when the machine is jarred to be easiest for the rider, I attach the backbone to the fork at this point by a pivotal connection similar to that by which the front fork B and front bone C are joined, and I provide the spring F, stopped against the bracket *f*, (which is rigid at its lower end in the neck *e*,) and acting against the backbone A, and the spring G, stopped against the bracket *g*, (which is rigid at its lower end in the neck *b*,) and acting against the front bone C. The operation of these pivotal junctions and springs can be understood by supposing the weight of the rider to be upon the seat tending to press the frame downward. The spring G on the stop *g*, acting against the front bone C, tends to throw the frame forward and upward, and the spring F on the stop *f*, acting against the backbone A, prevents the backbone and rear fork from dropping or sagging too far, but at the same time allows enough

play to counterbalance the unevenness of the ground and give to the whole frame an easy elasticity. These springs F and G are necessarily quite stiff to support the weight of the entire frame and rider, and to prevent them from reacting so far as to throw the machine out of form when the weight of the rider is removed, and also to prevent them from reacting too far after any violent jar occasioned in travel, I provide the checks $f^2$ and $g^2$, the former tying the bracket $f$ to the backbone, and the other tying the front fork B to the front bone C, the former being a simple buckled strap reeved through suitable staples, and the latter being a jointed link, and these two devices may be used interchangeably—either at either place.

I claim—

1. In a bicycle, in combination with the front steering-wheel, a steering-head having its axis in line with the wheel's contact with the ground and forward of the steering-wheel's axle, substantially as set forth.

2. In a bicycle, in combination with the front steering-wheel and the rear driving-wheel, the steering-head having its axis in a line forward of the steering-wheel's axis and leaning forward, substantially as set forth.

3. In a velocipede, in combination with the front steering-wheel and the rear driving-wheel, the backbone and the front bone pivoted together, the axis of the pivot being in a line which leans forward, the rider's seat secured to the backbone, and the tiller-rods connecting the handle-bar shaft to the steering-head on the front bone, substantially as set forth.

4. In a velocipede, in combination with the rear driving-wheel and the front steering-wheel, the backbone situated over the steering-wheel and extending between the steering and driving wheels and pivoted to the front bone in a steering-head axle, the steering-wheel, the front fork hinged to the front bone, and a spring reacting between said hinged parts to spread them, substantially as set forth.

5. In a bicycle, in combination with the rear driving-wheel and the front steering-wheel, the backbone and the front bone pivoted together in a steering-head whose axis is inclined forward and is in a line passing in front of the steering-wheel's axle, and a front fork in which the steering-wheel is journaled, hinged to the front bone forward of the steering-head, substantially as set forth.

6. In combination with the rear driving-wheel and the front steering-wheel, the backbone and the front bone pivoted together in a steering-head over the front wheel, the driving-wheel fork hinged to the backbone and the steering-wheel fork hinged to the front bone, and springs reacting between said hinged parts, respectively, to uphold the joints, substantially as set forth.

7. In combination with the rear driving-wheel and the front steering-wheel, the backbone and the front bone pivoted together in a steering-head, and the rear driving-wheel frame or fork hinged to the backbone, and the front-wheel frame or fork hinged to the front bone, and springs reacting between the hinged parts, respectively, and checks to limit the action of the springs, substantially as set forth.

8. In a velocipede, in combination with a front steering-wheel and the rear driving-wheel, the seat-support between the wheels hinged to the rear driving-wheel frame or fork, and a spring reacting between the seat-support and said rear driving-wheel frame to spread them apart, substantially as set forth.

9. A velocipede having a frame elastic at two joints, one elastic joint being forward of each wheel, substantially as set forth.

10. In a velocipede, a single front steering-wheel, the front-wheel frame comprising the steering-head and the bearings for the steering-wheel and jointed between said head and bearings, and a spring reacting between said jointed parts, and a rigid frame pivoted to said front-wheel frame at the steering-head, and the handle-bar secured to and turning said rigid frame, substantially as set forth.

11. In a velocipede, a single front steering-wheel, the front-wheel frame comprising the steering-head and the bearings for the steering-wheel and jointed between said head and bearings, a spring reacting between said jointed parts, a rigid frame pivoted to said front-wheel frame at the steering-head, and the seat and handle-bar both supported on said rigid frame.

12. In a velocipede, in combination, front and rear forks, front and rear bones, a spring reacting between the front fork and front bone, and a spring reacting between the rear fork and rear bone, substantially as set forth.

13. In a velocipede, in combination, front and rear wheels, front and rear forks, and front and rear bones, a spring reacting between the front fork and front bone, and a spring reacting between the rear fork and rear bone, and a seat secured to one of the bones, substantially as set forth.

14. In a velocipede, in combination with the rear driving-wheel and the frame in which it is journaled, a forward frame which is joined to said driving-wheel frame by a horizontal pivot, and a spring which contacts with and reacts between said frames, and the rider's seat supported on said forward frame, substantially as set forth.

15. In a velocipede, in combination with the rear driving-wheel and the frame in which it is journaled, a forward frame joined to the rear driving-wheel frame by a horizontal pivot located lower than the axle of said driving-wheel, a spring reacting between said frames, and the rider's seat secured to the forward frame, substantially as set forth.

16. In combination with a rear driving-wheel and a front steering-wheel and the frame in which said rear driving-wheel is jour-

naled, the backbone joined to said rear driving-wheel frame upon a horizontal pivot, and a spring which contacts with and reacts between said frame and backbone, the backbone extending from said pivot to a point above the steering-wheel, and the steering-wheel frame pivoted to said backbone in a steering-head, and the seat secured to the backbone, substantially as set forth.

17. In a velocipede, in combination with a rear driving-wheel and the front steering-wheel, and the frame in which said rear driving-wheel is journaled, a frame pivoted to the driving-wheel frame on a horizontal pivot, and a spring which contacts with and reacts between said frames, the latter frame extending from said pivot to the steering-head and having the bearings for the pedal-crank shaft, substantially as set forth.

18. In a velocipede, in combination with the rear driving and the front steering wheel, and the frame in which said rear driving-wheel is journaled, a frame pivoted thereto on a horizontal pivot, and a spring which contacts with and reacts between said frames, the latter frame extending thence to the steering-head and supporting both the seat and the handle-bar, substantially as set forth.

19. In a velocipede, in combination with the rear driving-wheel and the front steering-wheel, and the frame in which said rear driving-wheel is journaled, a frame pivoted thereto on a horizontal pivot, and a spring which contacts with and reacts between said frames, the latter frame extending from said pivot to the steering-head and having the bearings for the pedal-crank shaft and affording support for both the handle-bar and the seat, substantially as set forth.

20. In combination, substantially as set forth, the rear driving-wheel and its frame, the pedal-crank shaft journaled in said frame, a forward frame pivoted to said driving-wheel frame near the pedal-crank-shaft axis, the rider's seat secured to the forward frame, and a spring which contacts with and reacts between said frames to resist the approach of the seat to the driving-wheel.

Chicago, May 27, 1887.

THOS. B. JEFFERY.

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