(No Model.)

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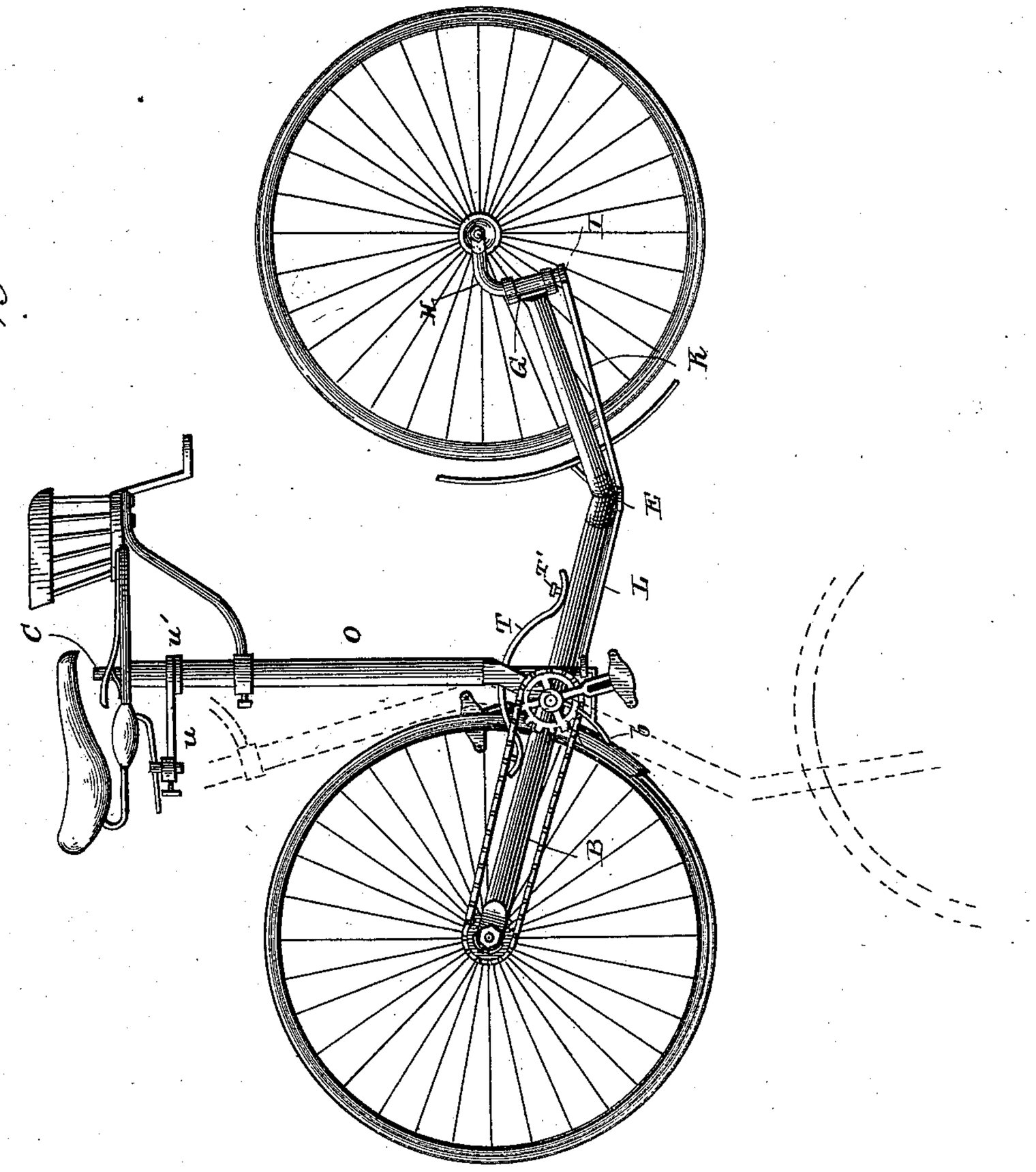
C. E. DURYEA.

VELOCIPEDE.

No. 402,313. Patented Apr. 30, 1889.

Fig. 1.



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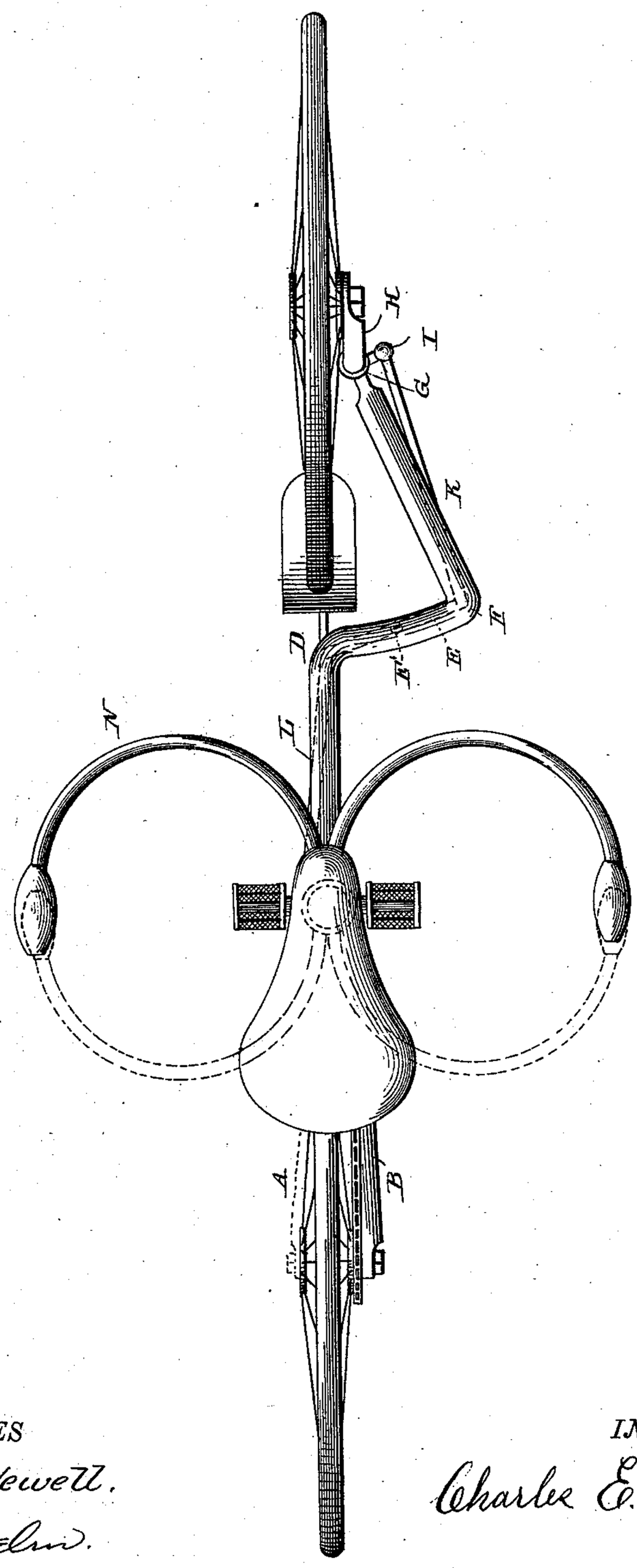

Fig. 2.

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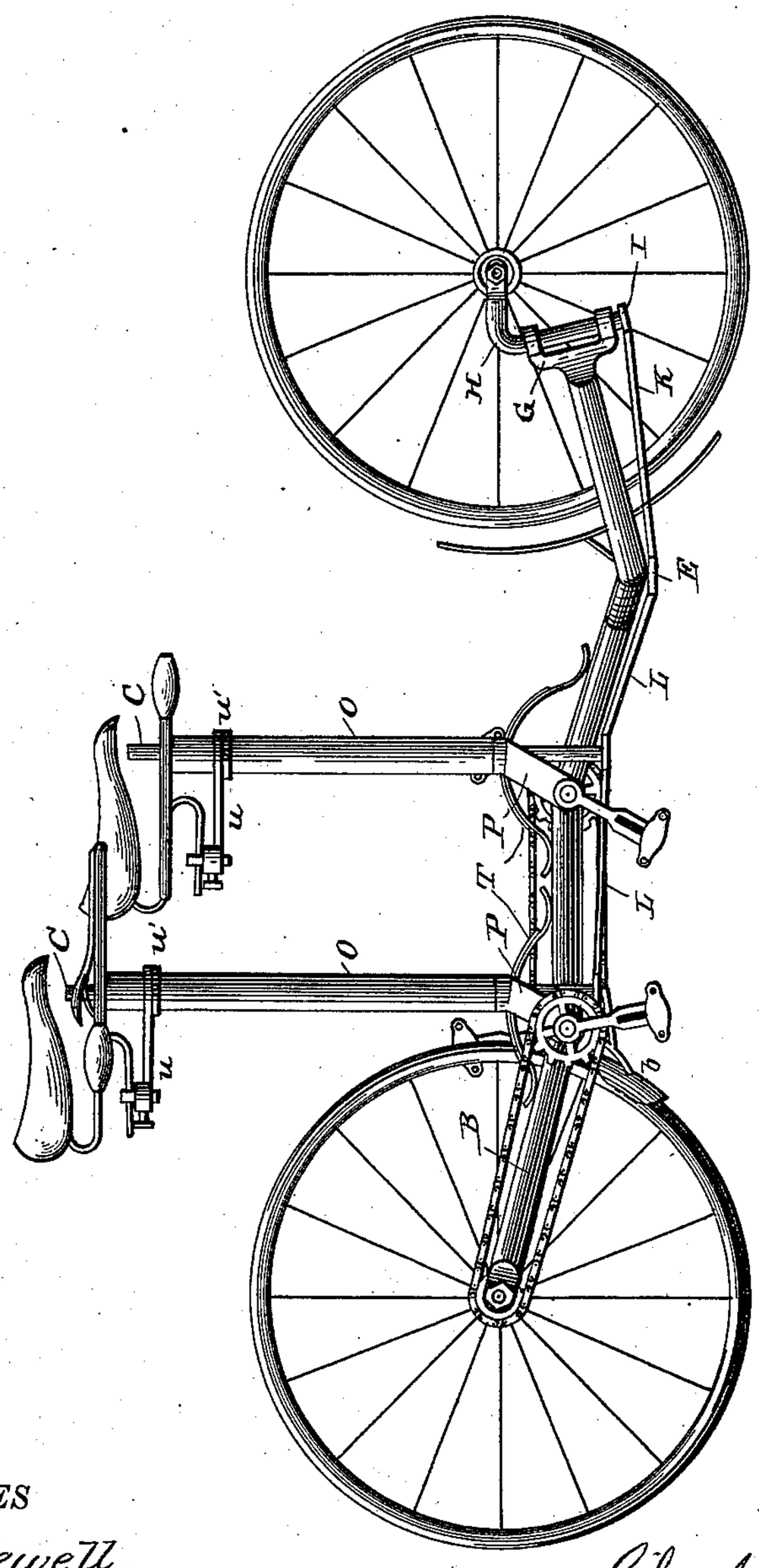
Fig. 3.



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VELOCIPEDE.

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Fig. 4.

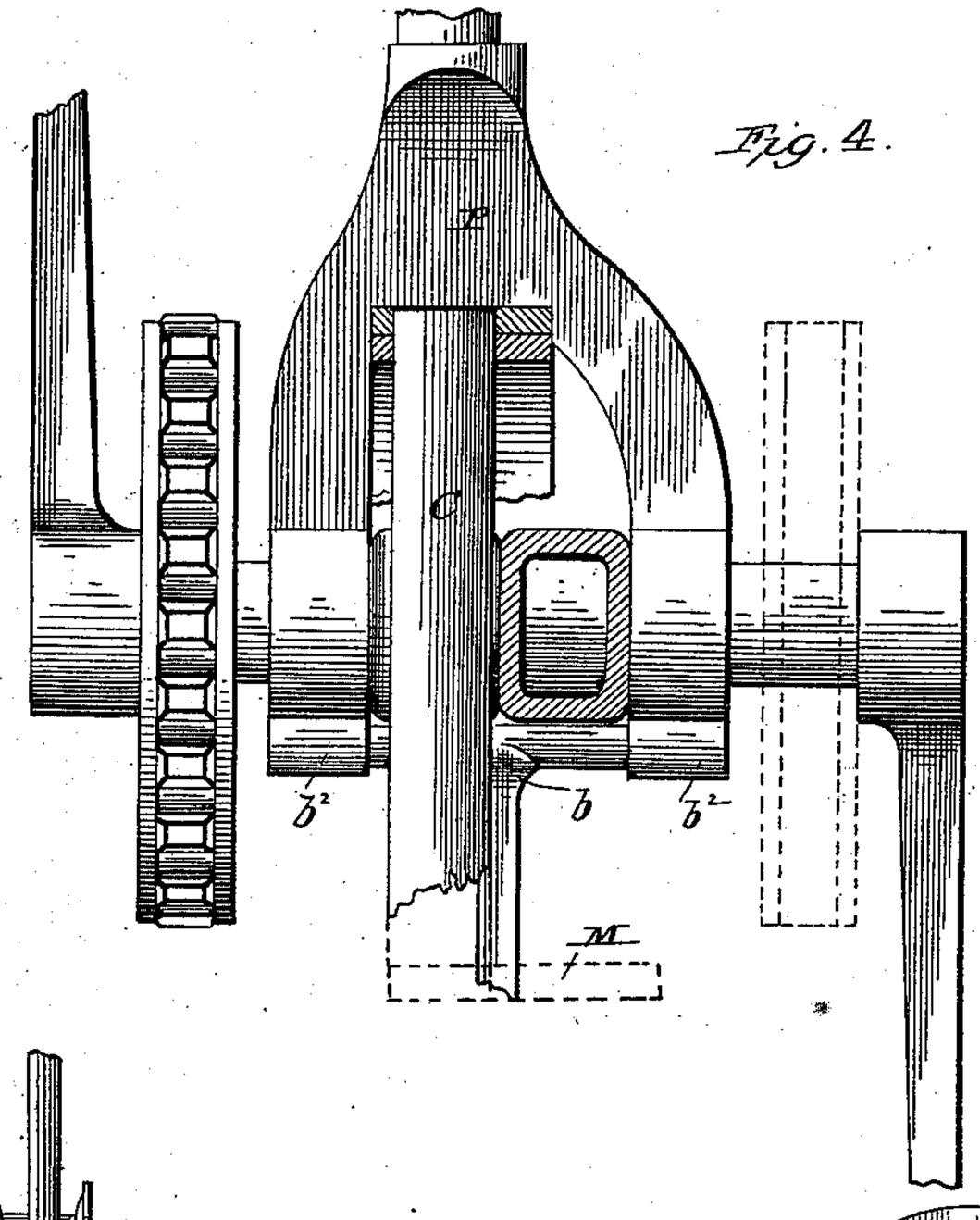

Fig. 5.

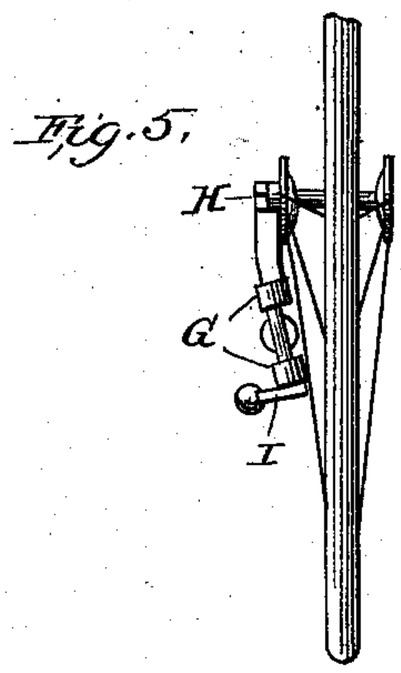

Fig. 6.

Fig. 7.

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(No Model.) 5 Sheets—Sheet 5.

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Fig. 8.

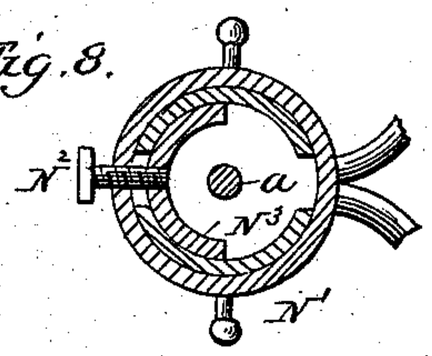


Fig. 9.

Fig. 11.

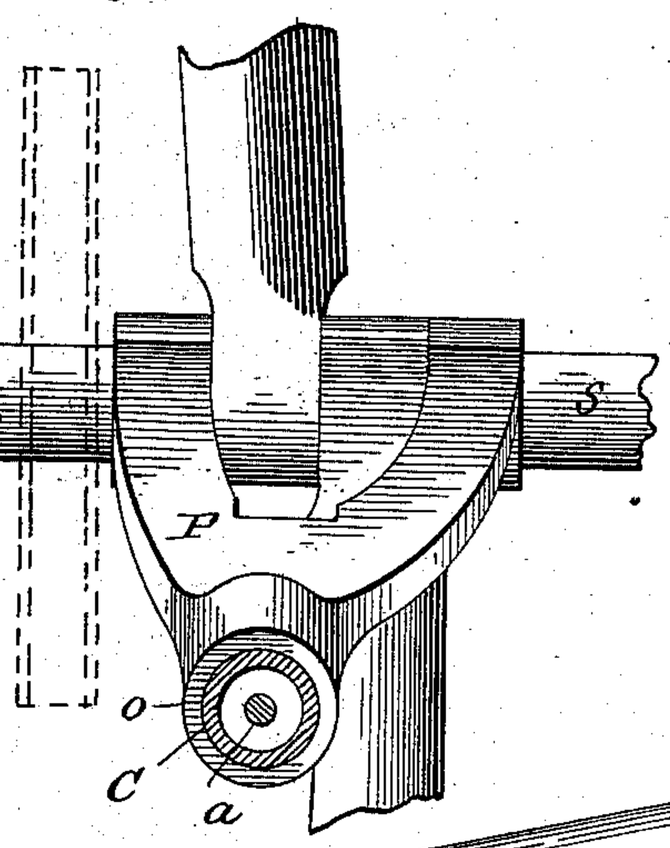


Fig. 10.

Fig. 12.

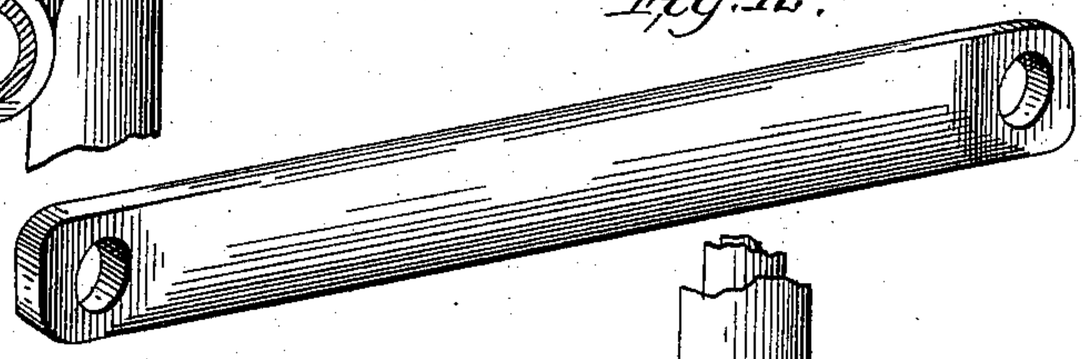
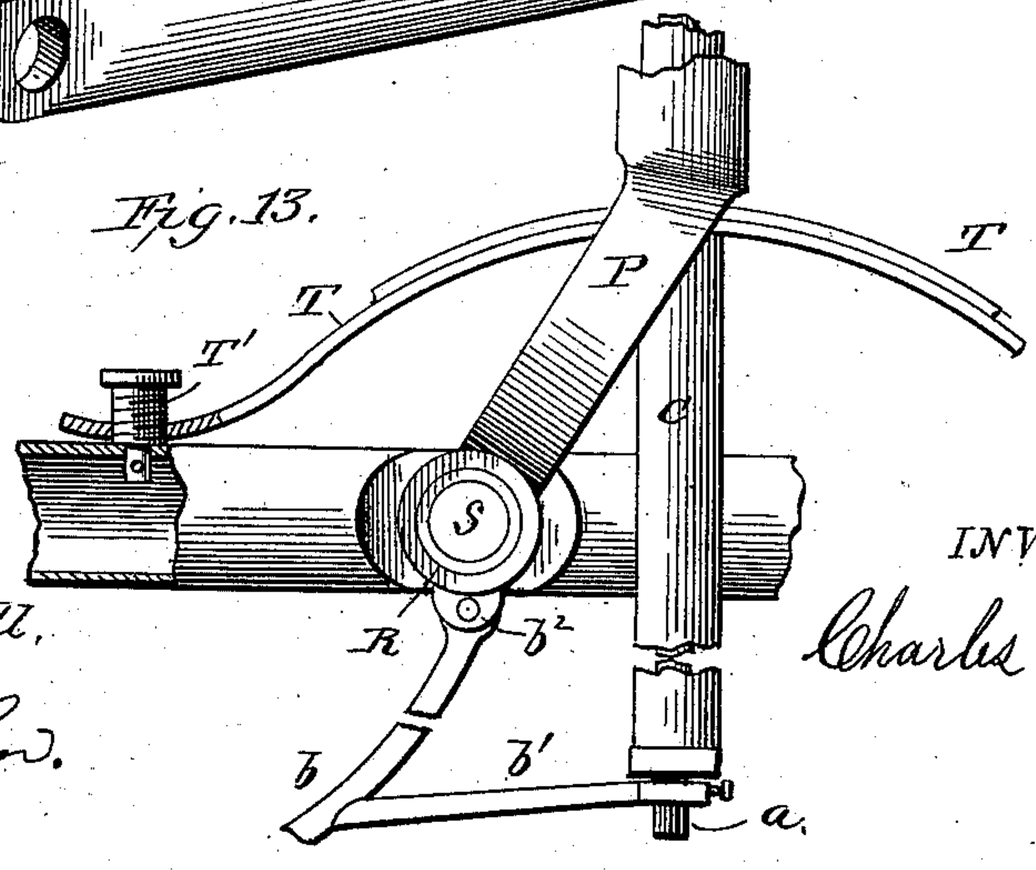


Fig. 13.



WITNESSES,

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Chas Helm.

INVENTOR,

Charles E. Duryea

UNITED STATES PATENT OFFICE.

CHARLES E. DURYEA, OF WASHINGTON, DISTRICT OF COLUMBIA.

VELOCIPEDE.

SPECIFICATION forming part of Letters Patent No. 402,313, dated April 30, 1889.

Application filed June 13, 1888. Serial No. 277,015. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. DURYEA, of Washington, District of Columbia, have invented certain new and useful Improvements in Velocipedes, of which the following is a full and clear description, reference being had to the accompanying drawings, of which—

Figure 1 is a side elevation. Fig. 2 is a plan. Fig. 3 is a side elevation of the machine when converted into a tandem double; and Figs. 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 are details showing the construction of such parts as differ from the ordinary method of construction, and which will be described below.

This velocipede is of that class known as "rear-driving safety-bicycles," which have two wheels, usually of the same size, with the saddle placed over the forward part of the rear or driving wheel, and a handle-bar attached to the forward wheel for the purpose of effecting the steering, and differs from the common form in the shape of the frame which connects the wheels, the method of supporting the handles and saddle, and the method of effecting the steering.

The main objects of my improvements are, first, to provide a frame-work that shall be strong, light, and cheap, and of such shape that it may be used by ladies; second, to get the handles in such position that they may be reached and used without causing the rider to assume a stooping, round-shouldered position; third, to enable the rider to steer without the use of the hands when they may be otherwise engaged, and, fourth, to reduce jars and vibrations to a minimum before they reach either the handles, pedals, or saddle. These objects I accomplish in great part by the shape of the frame, which consists of three parts so joined at or near the crank-axle that they may move freely in a vertical plane. The rear part extends backward directly to the axle of the driving-wheel, to which it is connected. If desired, the rear part may be double or what is known as a "fork," with its second prong extending along the opposite side of the wheel, as shown by dotted line at A in Fig. 2. The forward part extends forward in the plane of the wheels till near the rear part of the forward wheel, where it turns outward far enough to allow the wheel space in which to turn, and then passes inward and forward toward the center of the wheel, ending behind and below the axle, where it carries the steering centers. From these steering centers a neck, H, passes upward and forward to the axle of the front wheel. This neck is so shaped and the steering centers G are so placed that the axis around which the wheel turns is inclined backward and outward to such an extent as, if continued, to cause its lower end to pass into the ground in the line of the wheel-bases, and at a point preferably not behind the point of contact of the front wheel. The backward inclination is shown in Figs. 1, 3, and 6 and the outward inclination in Fig. 5. By causing the line of the axis to fall in the line of the wheels there is no tendency to deflect the wheel out of its plane in either direction, and by causing it to fall at or in front of the forward point of contact the steering is rendered steadier than if it fell elsewhere.

As shown at I in Figs. 6 and 2, a short crank is attached to the neck and projects nearly perpendicular to the plane of the wheel. To its outer end is joined one end of the bridle-rod K, which at its other end connects with the outward end of a lever, E, placed under that portion of the frame extending from D to F in Fig. 2, and pivoted at E′, as indicated by dotted lines. The inner end of this lever is attached to a second bridle-rod, L, Fig. 1, which extends backward under the rear part of the forward frame and connects with a crank, M, Fig. 4, attached to the lower end of the steering-tube C. This steering-tube passes upward inside the upper part of the frame, and to its upper end the handle-bars N are attached. Thus it will be seen that any motion imparted to the handle-bars is transmitted to the forward wheel by means of the steering-tube C, crank M, rod L, lever E, rod K, crank I, and neck H.

The upper part of the frame consists of the tube O, which surrounds the steering-tube C, and terminates at its lower end in the bracket P, which carries the tube R, Fig. 13. This tube serves as the pivot which joins the front and rear portions of the machine, and also serves as a journal in which the crank-axle S is placed. Under the arch of the bracket P

is placed a stiff spring, T, which is held in position by the steering-tube C passing through it, and of which one end bears on the rear part and the other on the front part of the frame. The action of the spring is to keep the parts in their proper positions, and yet allow enough motion to reduce vibrations and jars to a minimum. Thus on striking a stone the first result is to retard the motion, which is scarcely felt by the rider, because the upper part swings forward upon the common pivot. Next the forward wheel rises over the obstacle and is down again before the inertia of the rider is sensibly overcome or an appreciable jar felt. Very nearly the same result obtains when the rear wheel reaches the obstacle. Therefore it is evident that this machine may be ridden with greater comfort and less exertion than others of its class not furnished with springs to both wheels, or the swinging support for the saddle and handles.

At T′ T′, Figs. 1 and 13, are shown screws, whereby the spring T may be stiffened by raising the ends thereof in case the load is heavier than it will support in the normal position of the frame. As shown in Fig. 13, the screw T′ is threaded into the spring T, and has its point made smaller and passed through a slot in the tube, inside of which it is provided with a key, T^2, Fig. 13, which prevents the machine from folding in case an attempt be made to lift it by the handles. Of course there are other methods of accomplishing this result.

Near the upper end of the tube O a collar is placed, upon which rests a bracket which supports the spring and saddle. These are so placed that the point of the saddle is near to and above the tubes O and C, and in order that the handle-bars may not be in the way of the legs of the rider they are curved so as to pass quite well to the front and then back again to the most natural position for the hands—*i. e.*, at the sides of the rider. Such placing of saddle and steering-tube and shape of the handle-bars permit the handle-bars to be reversed, as shown by dotted lines in Fig. 2. When thus reversed, the machine is suitable for lady riders.

The forward part of the frame is so low that it does not interfere with the skirts, nor is it difficult to step over in mounting or dismounting. Further, there are no handle-bars to interfere with the mount or trip the rider in the case of a fall, and, finally, the hands are at the side in a natural healthful position, instead of being excessively far forward, as in other ladies' machines of this class.

Ladies are in the habit of carrying a parasol, purse, or such an article with them, and often have both hands engaged at once, and therefore a machine to meet their needs should be arranged to guide easily and safely "hands off." In order to do this it is necessary that the saddle be arranged to move laterally in respect to the pedals, and that such motion effect the steering. This I accomplish by attaching a ball or knob, V, Fig. 7, to the encircling portion N′ of the handle-bars, and another, V′, directly below to the corresponding portion, U′, of the saddle-bracket. About midway between these two a pivot, W, is placed, which serves to attach the tube X to the tube O. This tube is slotted to receive the stem of the balls, as shown in Fig. 7, and so placed that one ball will be below the pivot W and the other above. The tube X being free to turn upon the pivot, it is evident that any motion of the handle-bars will be transmitted to the saddle-bracket in a reverse direction, causing the saddle to swing toward the handle that is moving backward. This motion is approximately the same as is found in the form of bicycle which has cranks attached to the steering-wheel axle, but has an advantage over that in that when the machine leans the weight of the rider slightly tends to swing the saddle toward the lower side, and this swinging guides the steering-wheel to that side correcting the leaning position. Thus the machine is an automatic steerer, as well as a machine suitable for steering "hands off"—both valuable features in a machine adapted to general use by both sexes.

Attached to the handle-bars is an ordinary brake-lever, so arranged that pressure applied by the hands will depress that portion that enters the steering-tube C through the slot in the upper end thereof. Inside the tube C the brake-lever connects with the rod *a*, which passes downward until below the lever M on the lower end of the steering-tube C, where it attaches to the arm *b′* of the brake *b*. (See Figs. 8 and 13.) The brake *b* is attached to lugs on the bracket P by a pivot, b^2, Fig. 13. The saddle may be adjusted by means of the post which supports the spring; but I prefer to adjust it by means of the collar U′, Fig. 1. The handle-bars adjust upon the tube C by means of the block N^3 and set-screw N^2, which clamps the tube C between the block N^3 and the collar N′. The chain is arranged as is usual in this class of machines. Being jointed at the crank-axle, the frame is easily separable into the three parts which form it, and it is an easy matter to add a duplicate of the upper part with a bar, (shown in Fig. 12,) and thus produce a double machine suitable for two riders, as shown in Fig. 3. Duplicate cranks, chain, supporting-spring, and extra chain-wheel would of course have to be provided, but once provided no machine-work would be necessary to change from a single to a double, or vice versa. The extra chain-wheel could be placed on the original axle, as indicated by dotted lines in Fig. 4, or by the side of the original wheel. With a very strong framing and special springs this method of extending could be continued so as to carry more than two riders; but it would make a very heavy single, and the steering becomes less certain as the length of the machine increases.

By removing the brake *b* from the lugs

which carry it and disconnecting the bridle-rod L from the lever M the forward part of the machine may be swung downward in the plane of the wheels till it touches the rear wheel. This releases the spring T and allows the upper part of the frame to swing backward till it also touches the rear wheel. These positions are indicated by dotted lines in Fig. 1. The great shortening effected renders the machine much easier to crate for shipment—a very valuable feature where owners wish to carry a bicycle with them when traveling.

It is evident that the forward part of the frame could be placed to one side of the plane of the wheels, and thus secure a more complete fold of the machine, or the same purpose could be effected by making the outer surface of the tube R to lie horizontally at an angle to the inner surface and having the holes in the frame so accommodated thereto that its normal position would not be changed; but when folded the two parts would diverge from each other at twice the angle described by the surfaces of the tube R. In Fig. 1 a seat for a child is shown as attached to the tube O.

Handles and pedals could be supplied, but not without more trouble than in the tandem form shown in Fig. 3. Further, such a tandem would not be suitable for two ladies, so I prefer not to use such a form.

It is evident that a continuous unjointed frame from the rear wheel to the steering centers may be used in the place of the two-part frame shown; but the great lessening of vibration makes it preferable to use a jointed frame with springs to absorb jar and hold the frame in position; or a continuous unjointed elastic frame could be used, but it is difficult to make such a frame capable of fully resisting torsional strains. I have shown the three parts of the frame pivoted together at the crank-axle and held in position by a single flat spring; but I do not wish to limit myself to this special arrangement. The upper part may be carried by a second pivot placed near the crank-axle, or the front and rear parts may be not joined together, but each joined to the upper part; or one or more springs may be used to preserve the proper positions of the front and rear portions, while other springs support the upper part of the frame. The method shown, however, is preferable. Two springs may be used instead of one, placed one each side of the upper part, and they may be coiled, flat, or other shape. It is also evident that this method of mounting a saddle or saddle and handles upon a support that is pivoted to swing in a vertical plane may be applied with fair results to tricycles.

I am aware that bicycles have been made having one of the wheels jointed to the frame which carried the pedals, saddle, and handles, and which was rigid so far as motion in a vertical plane was concerned. I am also aware that bicycles have been constructed in which a vertically-rigid frame was mounted upon a like frame attached to the wheels, springs being interposed between the two frames. My invention differs from and excels these in that the saddle and handles are fixed in respect to each other, but free to oscillate upon the crank-axle, which is the natural point of oscillation, and such oscillation is met naturally and properly by pressure upon the proper pedal. Thus on meeting an obstruction the saddle swings forward and naturally causes increased pressure upon the pedal which is forward, which causes the machine to surmount the obstruction. No other machine has this feature. Second, by supporting the weight of the rider free to move over a joint between the wheels, the motions of the rider due to the springs are vertical, and therefore pleasant, whereas were one wheel only jointed to a rigid frame which carried the saddle, handles, and pedals the motions of the rider would be in an arc of a circle of which the center was at the axle of the rigidly-attached wheel, and such arc, not being a vertical line, would necessitate a bending of the rider's body with each motion in an attempt to preserve a vertical position. In case of a rigid frame connecting the wheels either wheel in rising describes an arc of a circle whose center is at the axle of the other, and as the rider is between the wheels he must rise to some extent. In my machine either wheel in rising describes an arc of which the center is at or near the crank-axle, and therefore it may rise over an obstruction and be down again before the inertia of the rider and the other parts of the machine be overcome. I am also aware of wheels being attached to the frame by means of spring-forks. This method is much inferior to mine in that one side of the fork may operate without the other, thus straining the joints and affecting the steering. Further, the best results cannot be obtained from a spring unless it be exactly suited to the rider's weight. It is evident that the spring will give downward until its tension supports the weight of the rider; but this may bring the pedals too near the ground or may destroy the proper position of the upper part of the frame by causing it to lean too far forward, due to the rear part of the frame being the shorter and therefore varying its angle more rapidly. For this reason I provide a means of adjusting the springs to suit the rider. I have shown the handle-bars as curving forward in a horizontal plane. I do not wish to limit myself to that special curve or plane. The bars would give good satisfaction if curved upward slightly when in their forward position.

I claim—

1. A bicycle in which the wheels are connected by a frame that passes to one side only of each wheel and that does not rise above a line passing through their axles.

2. A bicycle in which the wheels are connected by a frame that is single throughout its length, that is joined to one end only of

each wheel-axle, and that does not rise above a line passing through the wheel-axles.

3. A bicycle having a frame of which that portion connecting the wheels does not rise above a line passing through the axles of the wheel and passes to one side only of the steering-wheel.

4. A bicycle having its steering centers located at one side of the steering-wheel.

5. A velocipede having its steering centers located at one side of the steering-wheel and inclined so that a line through the said centers would intercept the line of the wheel-bases.

6. A velocipede having its steering centers located at one side of the steering-wheel and inclined so that a line through the said centers would intercept the line of the wheel-bases at a point at or in front of the forward point of contact with the ground.

7. A bicycle having the frame that connects the wheels jointed between the wheels to swing vertically, each part being elastically connected with the saddle-support, whereby a vertical movement of either wheel out of its normal position may occur without affecting the saddle.

8. In a bicycle, an elastic frame so arranged that each wheel may swing vertically in an arc of a circle of which the center is at or near the crank-axle without affecting the saddle.

9. In a bicycle, a jointed elastic frame of which the joints are located at or near the crank-axle, the elasticity is supplied by adjustable springs, and which is elastically connected with the saddle-support, whereby either wheel may rise vertically without affecting the saddle.

10. In a bicycle of the class described, a frame connecting the wheels jointed at or near the crank-axle, and a saddle-support pivoted thereto, all being maintained in position by adjustable springs.

11. A bicycle of the class described, in which the frame connecting the wheels is jointed at or near the crank-axle to swing in a plane approximately vertical, whereby the parts may be brought into proximity for convenience in storing and shipping.

12. A bicycle of the class described, having the frame that connects the wheels jointed at or near the crank-axle to swing vertically and provided with a means to prevent accidental folding.

13. In a velocipede, a saddle-support pivoted to the supporting-frame at or near the crank-axle and supported in an upright position by springs.

14. In a velocipede, a support for handles and saddle pivoted at or near the crank-axle to swing in a vertical plane parallel to the plane of the wheels and supported in an upright position by springs.

15. In a velocipede, a support for handles and saddle pivoted at or near the crank-axle to swing in a vertical plane parallel to the plane of the wheels, and supported in an upright position by adjustable springs.

16. In a bicycle of the class described, a frame connecting the wheels jointed at or near the crank-axle and held in position by a spring which may be adjusted so as to hold the crank-axle at a greater or less distance from the ground, as desired.

17. A bicycle of the class described having a saddle-support pivoted to the frame that connects the wheels, and held upright by springs that have a means of adjustment, whereby it is possible to cause the saddle-support to lean forward or backward by adjusting one spring more than the other.

18. In a velocipede, a handle-bar removably attached to the top of the steering-post, so that it may be reversed either horizontally or vertically, as and for the purpose described.

19. A velocipede having the axis around which the handles move placed under the saddle and the bars so curved as to pass outward to the handles without interfering with the motion of the rider, and, further, having the bars so attached to the steering-post that they may be reversed, by which arrangement they may be caused to pass either before or behind the rider at will.

20. A velocipede wherein the saddle may have a lateral motion with respect to the wheels and pedals around the same center as the handles, and wherein the saddle is so connected with the steering-wheel that the said wheel is turned toward the side to which the saddle is moved.

21. A velocipede wherein the saddle may have a lateral motion with respect to the wheels and pedals around the same center as the handles, and wherein the saddle is so connected with the handles that motion of one causes the other to move around the same center in a reverse direction.

22. A bicycle of the class described having the saddle-support, forward part, and rear part separably joined together at or near the crank-axle, whereby either forward or rear part may be separated from the other two, for the purpose described.

23. In combination with the wheels of a rear-driving safety-bicycle, a frame which passes from the rear axle forward until beyond the periphery of the rear wheel, where it carries the crank-axle, thence forward till near the periphery of the front wheel, thence outward far enough to allow the front wheel to turn in steering, thence forward and inward to the steering center located near the front axle, to which the frame is connected by means of a neck.

24. The combination, with a front steering-wheel of a velocipede, a horizontal supporting-frame therefor, and a handle-bar axis approximately perpendicular thereto, of a crank or arm attached to the said axis perpendicular to the plane of the wheels, an arm similarly attached to that portion of the frame between the steering centers and the front axle, and a

lever pivoted to the frame between the said arms and connected to their projecting ends by connecting-rods and universal joints, whereby motion of the handle-bar axis is transmitted to the said steering-wheel.

25. The combination, with a velocipede having a wheel centrally located behind the rider, of a brake applied to the tire thereof and operated from the vicinity of the handles by means of a lever attached to the handle-bar, and an arm attached to the brake and connected to the said lever by a connection which passes through the axis of the handle-bar.

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