(No Model.) 3 Sheets—Sheet 1.

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BICYCLE.

No. 342,878. Patented June 1, 1886.

Fig. 1

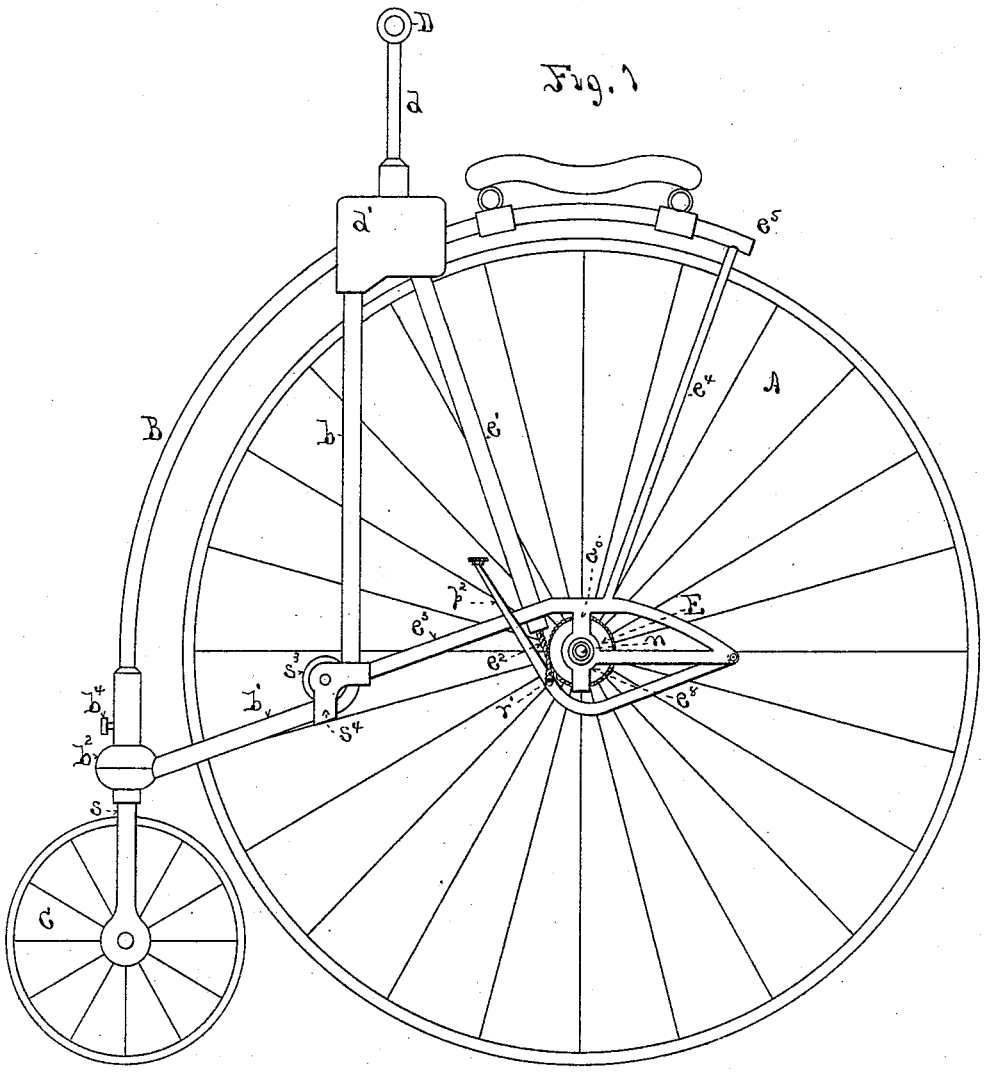

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Fig. 2

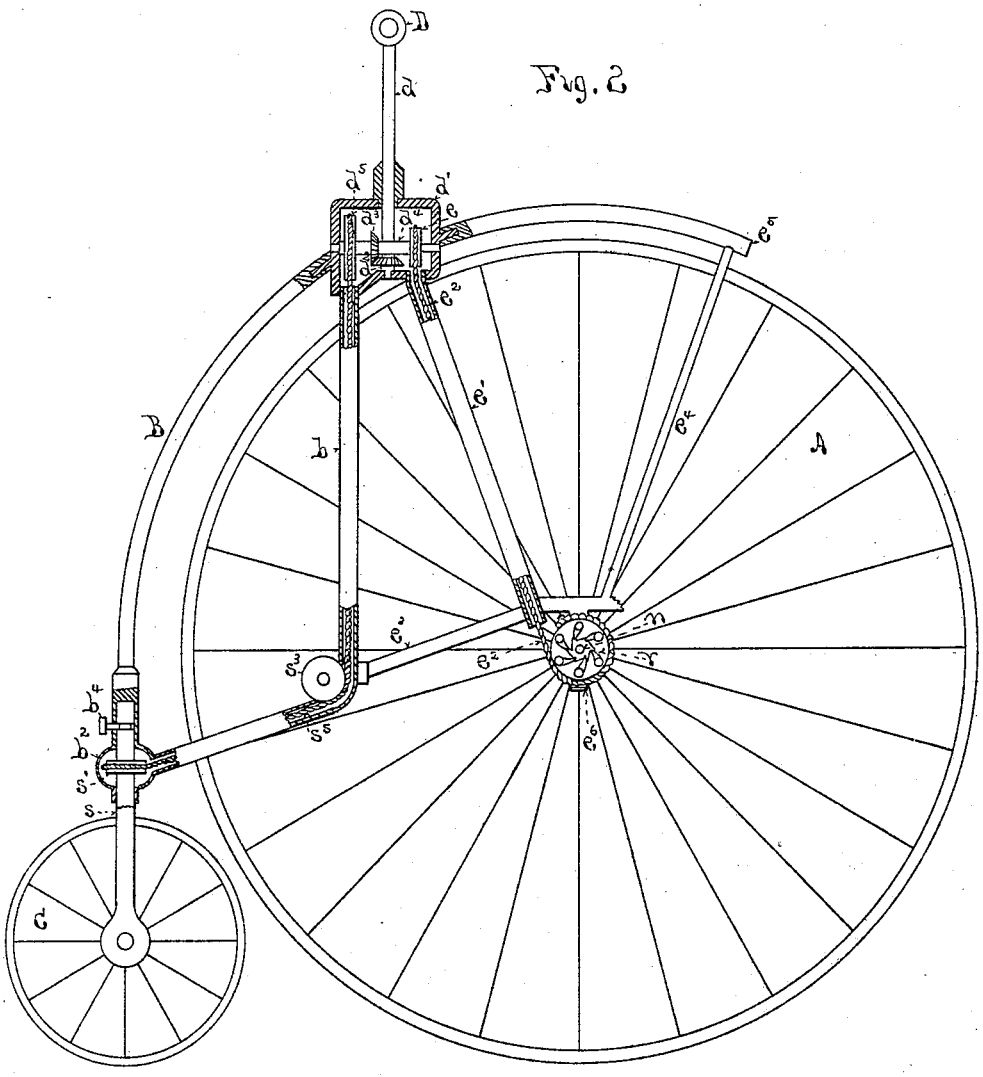

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Fig. 4

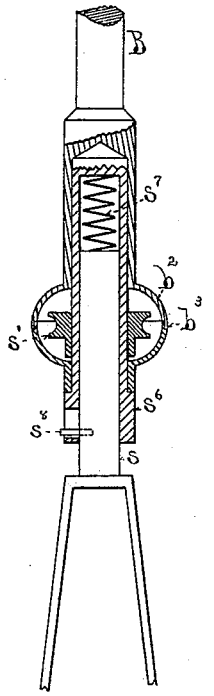


Fig. 3

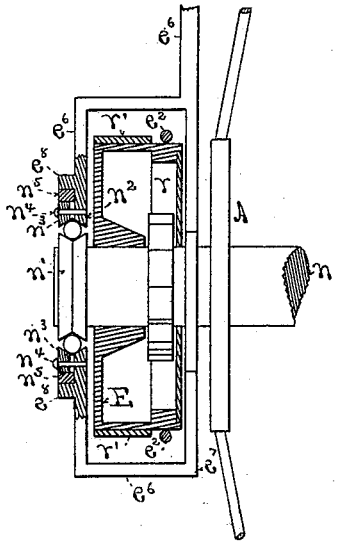


Fig. 5

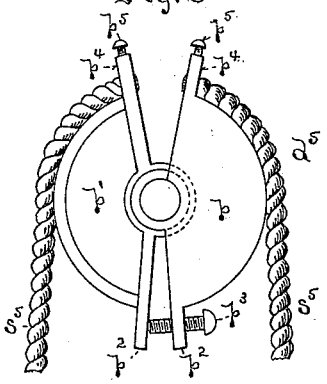
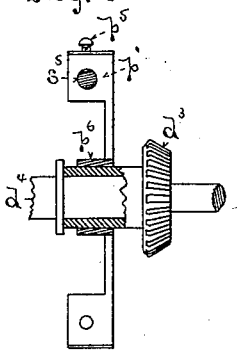


Fig. 6



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UNITED STATES PATENT OFFICE.

DAVID HALL RICE, OF BROOKLINE, MASSACHUSETTS.

BICYCLE.

SPECIFICATION forming part of Letters Patent No. 342,878, dated June 1, 1886.

Application filed November 23, 1885. Serial No. 183,638. (No model.)

To all whom it may concern:

Be it known that I, DAVID HALL RICE, of Brookline, in the county of Norfolk and State of Massachusetts, have invented a certain new and useful Improvement in Bicycles, of which the following is a specification.

My invention relates to bicycles; and it consists in certain improvements in the steering and driving mechanisms of the same, substantially as hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of a bicycle provided with my improvements. Fig. 2 is a similar view of the same with the driving-levers and straps removed, and portions of the frame broken away to show the working parts. Fig. 3 is an enlarged view of a portion of the frame, showing the arrangement of the driving-clutches and main-shaft bearings. Fig. 4 is an enlarged view of the pivotal support of the steering-wheel. Figs. 5 and 6 are detail views of a portion of the steering mechanism.

The bicycle shown is of the pattern having the small steering-wheel in front and the larger driving-wheel behind.

A is the driving-wheel, and C the steering-wheel. B is the backbone, curved in form, as shown, to follow the contour of the larger wheel. D is the steering-head, mounted on a vertical shaft, d, which is journaled in the rectangular frame d', attached to the upper end of the backbone. This steering-head receives the handles, constructed in the usual manner, and its shaft is sustained by bearings in the upper and lower sides of the frame d', which may be ball-bearings, if desired. Within this frame is mounted rigidly on the shaft d a gear-pinion, d^2, which meshes into a pinion, d^3, revolving loosely upon the horizontal shaft or bar d^4. Attached to pinion d^3, and revolving on the same shaft with it is the pulley-wheel d^5. The shaft d passes downward through a hole in an enlarged part of bar d^4, as shown, and when it is turned by the steering-handles it will revolve the pulley d^5 in a vertical plane. A hollow rod or brace, b, of the frame of the machine is secured at its upper end to the bottom plate of the frame d', so as to come opposite the pulley d^5, and extends downward nearly vertically until it meets the hollow brace b', crossing its path from the rear frame-work to the backbone just above the steering-wheel, where brace b opens into brace b'. The lower end of the backbone B is formed tubular, and with a socket in it containing a hollow enlargement, b^2. Attached to the upper end of the fork f of the wheel C is a spindle, s, which projects upward into the socket of the backbone and turns therein. Where this spindle passes through the enlargement b^2 of the backbone it has attached to it a pulley, s'. The lower end of the hollow brace b' opens into the enlargement, to which it is attached, opposite this pulley on its side of the machine. At the junction of the braces b and b' a small pulley, s^3, is pivoted between side plates, s^4, attached to the braces, and so that its edge shall project into the interior of the braces at that place, they being cut away sufficiently for the purpose.

On the opposite side of the machine from that shown in Figs. 1 and 2 braces precisely similar to b b' connect the frame d' with enlargement b^2, provided with a pulley like s^3, and in relation to pulleys d^5 and s' similarly on that side. A steel-wire cord, s^6, is passed over pulley d^5, down through braces b b', against pulley s^3, and around pulley s', thence back through the similar braces on the opposite side of the machine to the pulley d^5, where its ends are united together. For additional security it is pinned to pulleys d^5 s' at the center, where it passes around them.

By turning the steering-head D, the wheel C will be turned to the right or left, thus steering the machine. By passing the steering-cord in this manner through the frame all liability of its dragging or chafing upon the interior of the frame—the pulleys s^3 carrying it around the corners—and the consequent strain and friction are avoided.

Fig. 4 shows a modification of the pivot for the steering-wheel, which allows the jar of the wheel when passing over rough ground to be taken up by a spring-buffer. The spindle s in this case is made to enter a hollow spindle, s^6, in the upper end of which is placed a spiral spring, s^7, against which spindle s bears. A pin, s^8, extending through a slot in the side of s^6, is fixed in spindle s, allowing the latter to play up and down, while it compels it to turn with the former. The spindle s^6 carries the pulley s', and turns in the socket of the back-

bone B. The hollow enlargement b^2 is formed in two halves, divided at the horizontal line b^3, where one half laps over and screws upon the other, thus enabling the spindle s or s^6, with its pulley s', to be inserted within it.

As shown in Fig. 2, the spindle s is held in place in its socket in the backbone by a set-screw, b^4, having its point entering a groove around the spindle, and in Fig. 4 it is held in place by a sleeve extending downward from pulley s'.

In order to guard against the steel-wire rope s^5 becoming stretched so as to interfere with the steering, I have provided a take-up mechanism by which the stretch of the rope may be taken up. In Figs. 5 and 6 is shown this mechanism, being a modification of the pulley d^5. The pulley is made in two parts, p and p'. The part p is attached to the sleeve of the bevel-pinion d^3, and turns with it. An ear, p^2, at its lower side carries the set-screw p^3, and another ear, p^4, on its upper side receives the end of the rope s^5 into a hole in it, where it is secured by the set-screw p^5. The part p' of the pulley has a sleeve, p^6, which turns around the sleeve of the pinion d^3, and the two parts p and p' of the pulley are offset on their sleeves, so as to come opposite to each other in a plane at right angles to their axis of rotation, as shown. The part p' of the pulley is also provided with an ear, p^2, on its lower side, against which the end of set-screw p^3 bears, and with an ear, p^4, and set-screw p^5 on its upper side, to receive and secure the other end of the rope s^5. The tightening or taking up of the rope is accomplished by simply turning the set-screw p^3, which draws the ears p^4 p^4 of the parts p p' of the pulley nearer together, while the parts are both turned so as to draw on either end of the rope by the revolution of the pinion d^3.

My improvement in the driving mechanism of the bicycle consists in dispensing with the spiral or other springs to draw up the pedals after they are pressed down by the foot, and substituting a mechanism therefor which causes the downward movement of the pedal to raise the other, as follows:

E is the drum containing the ratchet mechanism r, which drives the main wheel. This drum has wound around it the strap or cord r', attached to the pedal-lever r^2 and the drum in the usual manner. The wheel is fixed to and revolves with its shaft n, to which the ratchet is attached, while the pawls are carried around on the interior of drum E, as shown in Fig. 2. On the opposite side of the machine a similar pedal-lever, drum, ratchet mechanism, and strap or cord are applied to the shaft or wheel. The drums revolve around shaft n, and it is evident that at each downward movement of the levers the drums and pawls engaging with the ratchets on each side will drive the machine forward. To return the levers and ratchets, so as to continue the downward strokes, I first hang upon the shaft d^4 in the frame d' a pulley, e, which revolves freely on the shaft. Opposite to and leading downward and toward drum E from this pulley I attach to the lower plate of frame d' a tubular brace, e', which is attached to the frame-work of the machine near its lower end, as shown. The bore of this brace continued would be tangent to drum E. The latter is made wider transversely on its periphery than the space required for the winding on of the cord or strap r' of the pedal-lever. On the opposite side of the machine I attach to frame d' a precisely similar tubular brace to e', and in similar relation to pulley e and the drum corresponding to E on that side. Through the brace e' and over the pulley e and down through the corresponding brace on the opposite side I pass the steel-wire cord e^2. Then with the lever r^2 raised and its cord or strap r' wound upon the ratchet-drum E, and with the corresponding lever on the opposite side of the machine pressed down and its strap unwound, I wind the opposite ends of rope e^2 around the opposite drums, as shown, and attach them to said drums, respectively, so that practically they form a continuation on each side of the straps of the pedal-lever over the pulley e. By this adjustment when pedal-lever r^2 is pressed down and unwinds its cord or strap r' from its drum it winds up its end of rope e^2 an equal amount upon the drum, which draws the rope through its hollow braces on each side and unwinds it from the opposite ratchet-drum, which in turn winds upon that drum its pedal-lever strap and raises the lever at the same speed at which the lever r^2 is depressed. The next stroke downward on the opposite pedal-lever reverses the motion of rope e^2 and winds up lever cord or strap r' and raises lever r^2. The advantages of this arrangement are that the mechanism is simple and not likely to get out of order; that it drives the machine at high speed, because the return-stroke of the levers is as quick as the downstroke; and, lastly, that it affords a perfect rest for the feet without removing them from the pedals by simply equalizing the pressure upon them on each side of the machine, thus enabling the rider to rest more or less of his weight upon the pedals or saddle, as he may desire.

A brace, e^3, connects the tubular braces b and e' and the brace e^4 together and to the parts of the frame which carry the main-wheel bearings and the pivots of the pedal-levers. An arched brace, e^5, connects the frame d' with the upper end of brace e^4 and supports the saddle. The braces on each side forming the frame correspond to those on the other, and the frame d' is cased in, as shown in Fig. 1, to exclude dust and dirt.

By my mechanism for operating the pedal-levers I am enabled, as before described, to construct the shaft n and wheel A to turn together, and thus to bring the wheel-bearings outside of the frame, and the drums E where they can be readily fitted with adjustable ball-bearings, as shown in Figs. 1 and 3. Attached

to brace e^3 is a downwardly-projecting brace, e^6, which is carried outward around the drum E, and thence inward below the same, where it unites to a back brace, e^7, which passes straight down behind the drum E and forms a rectangular frame with e^6, to sustain and brace the latter. This back brace has a hole in it, where the shaft n passes through it, larger than the shaft, to avoid the latter touching it. On its outer portion, where the brace e^6 receives the shaft through it, there is a circular enlargement, e^8, formed upon it, projecting outward in the form of a sleeve. On the exterior of shaft n is fixed a grooved collar, n', to form the inner ball-bearing. The hole through brace e^6 is beveled out in a circle at n^2, to form one member of the outer ball-bearing, and the ring n^3, similarly beveled out, forms the other member, the two members being clamped together and upon the balls by screw-bolts n^4 n^4. n^5 is a gage-ring screwed upon the periphery of ring n^3, and it is used to gage the distance which the bolts n^4 n^4 draw the ring n^3 toward ring-bevel n^2. This ball-bearing is the one patented to me July 21, 1885, in Letters Patent No. 322,482, and it only differs from the one there shown in having gage-ring n^5 and bearing-ring n^3 inclosed in the flange or sleeve e^8, which is attached to the opposite ring-bevel n^2, thus supporting the parts firmly, and enabling access to be had to the gage-ring and screw-bolts n^4 n^4 from the side without disturbing other parts in adjusting the bearings.

It is evident that any other braces besides e' may be used to carry rope e^2 around the wheel, or that it may be carried around the latter without braces to cover it, so long as it is connected to the ratchet-drums and pedal-levers around the bearing-pulley e, as described; or a series of jointed links or rods may be employed in making the connection. It is also evident that the pulley e serves the purpose of a bearing around which to transmit the reciprocating motion of the connecting device which unites the pedal-lever on one side of the machine to that on the other side, which is shown as the rope e^2, and that other forms of such bearing may be used in place of the pulley—as, for instance, a smooth rounded surface, or a rocking lever to the ends of which the rope e^2 may be attached on each side; but I prefer the pulley form of such bearing as neater and more compact. Two pulleys may be used side by side in place of one pulley e, provided they constitute in effect the same bearing-surface to carry the rope around free from the wheel. It is also evident that the pulleys s' and d^5, when the latter is made in two parts, p and p', may be made to change places and the latter perform its functions of taking up the slack of rope s^5 upon the spindle of steering-wheel C, without departing from the spirit of my invention.

What I claim as new and of my invention is—

1. In a velocipede having its smaller and steering wheel forward of the rider, the combination of steering-handle D and its stem d, pulley d^5, connected therewith by gear mechanism, straight tubular braces b on each side of wheel A, having their axes in the plane of said pulley, the straight tubular braces d' d' on each side, internally connected therewith forward of the hub of wheel A and extending forward to the steering-wheel, the pulleys s^3 at the junction of said tubular braces, the pulley s', in line with braces b' upon the spindle of steering-wheel C, the braces e^3 on each side, extending from the junction of braces b b' backward to the axis of the steering-wheel, and the flexible rope s^5, carried through said braces b b' and around said pulleys, substantially as described.

2. The combination, in a bicycle-frame, of the pulley d^5, constructed in two parts, p p', sleeved together and adapted to be adjusted to take up the slack of rope s^5, the pulley s', attached to the spindle of steering-wheel C, and the flexible rope s^5, passing around said pulleys and adapted to transmit motion from one to the other, substantially as described.

3. The combination, in a bicycle, of wheel A, the opposite independent drums E, provided with ratchets r, adapted to drive said wheel, pedal-levers r^2, working on pivots in the rear of the hub of wheel A, and having the pedals forward of the same and connected with and adapted to operate said drums, pulley e, attached to the frame outside the rim of the wheel, and the tubular frame-braces e' on each side of wheel A, having their bores substantially tangential to pulley e and drums E E, and serving as supports for the rider's seat, substantially as described.

4. The combination, in a bicycle, of the wheel A, fixed upon its shaft n and revolving therewith, the opposite independent drums E, revolving upon said shaft on each side of said wheel and provided with ratchet r, adapted to act thereon, the frame-braces e^6, passing outside of said drums, and the ball-bearings supporting said shaft in said braces at each end and provided with adjusting-ring n^3, screws n^4, and ring n^5 on their outer faces and outside of said drums, substantially as described.

5. In a bicycle, the combination of the wheel A, the shaft n, fixed therein and revolving therewith, the drum E, mounted on said shaft and provided with ratchet r, adapted to act thereon, the frame-brace e^6, passing around and outside of said drum and supporting said shaft-bearing, and the inner brace, e^7, passing down behind said drum and connected at each end to brace e^6, substantially as described.

6. The combination, in a bicycle, of backbone B, carrying a socket at its lower end, the hollow spindle s^6, seated and capable of revolving in said socket, the spindle s, attached to the fork of wheel C and entering the bore of spindle s^6, the spring s^7, located in said bore above spindle s, and the pin s^8, passing

through a slot in spindle *s*, substantially as described.

7. The combination of the bicycle-wheel, shaft *n*, grooved bearing-collar *n'*, beveled outer bearing, n^2, having sleeve e^8 attached thereto, gage-ring n^5, fitting within said sleeve, beveled outer bearing-collar, n^3, united with said gage-ring by a screw-thread, and clamping-bolts n^4 n^4, all arranged with said gage-ring, and bolts exposed laterally for adjustment, substantially as described.

DAVID HALL RICE.

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