(No Model.)

F. H. RICHARDS.

VARIABLE SPEED GEARED BICYCLE.

No. 568,581. Patented Sept. 29, 1896.

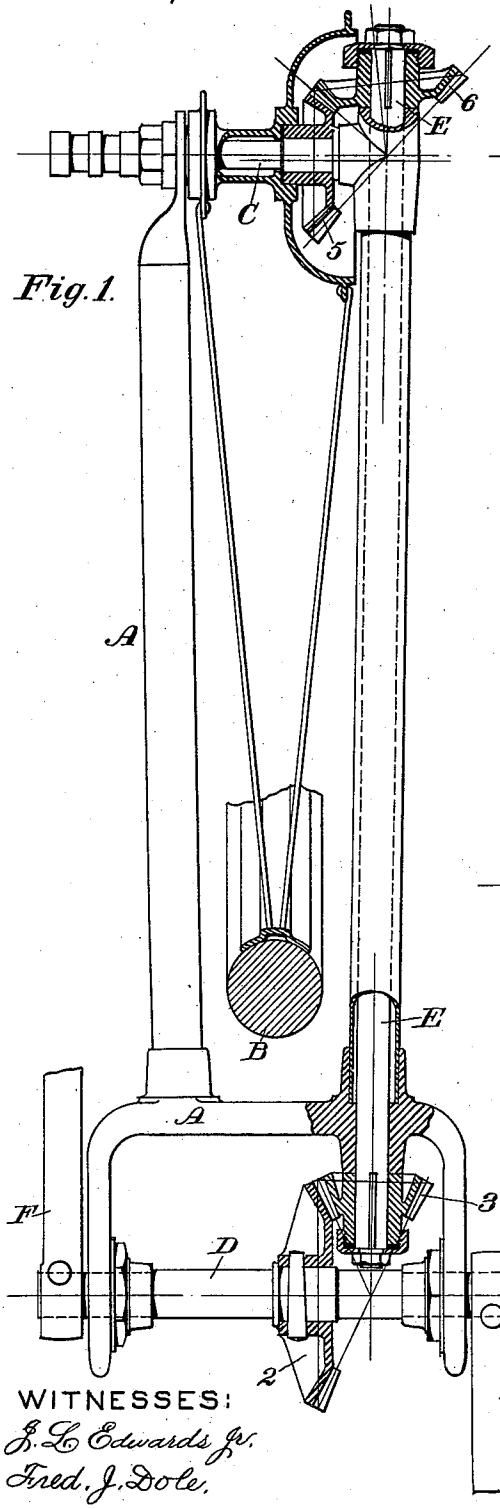


Fig. 1.

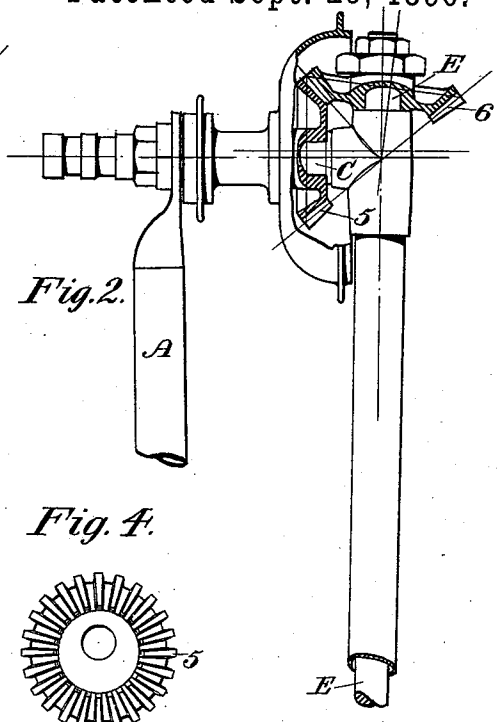
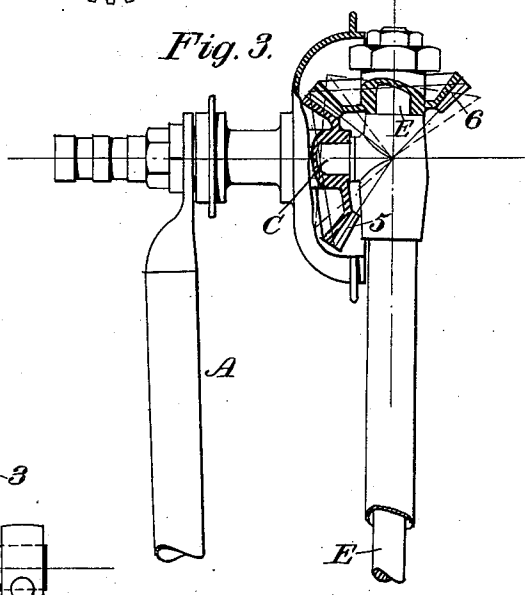


Fig. 2.

Fig. 4.

Fig. 3.



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FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

VARIABLE-SPEED GEARED BICYCLE.

SPECIFICATION forming part of Letters Patent No. 568,581, dated September 29, 1896.

Application filed June 18, 1894. Serial No. 514,898. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Variable-Speed Geared Bicycles, of which the following is a specification.

This invention relates to geared bicycles, the object of the invention being to provide, in connection with the pedal-shaft and driving-wheel of a bicycle, improved gearing whereby the driving-wheel will have a speed of varying velocity relatively to the speed of the pedal-shaft, and also to so construct and organize said gearing that during operation a reduction in the speed of the pedals relatively to the speed of the driving-wheel will take place during the mid-stroke portion of the ascending and descending movements of said pedals, and an acceleration in the rotary movements of said pedals will take place as the pedals approach the dead-centers of their movements, thereby diminishing the variation in power caused by the retarding effect due to dead-centers, as in geared machines of this class of ordinary construction.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional plan view of a portion of the framework of a bicycle of the class specified embodying one form of my present improvements, said figure showing the side shaft operatively connected with the pedal-shaft by a two-to-one train of gearing and showing said side shaft connected with the driving-wheel by means of an obliquely-disposed bevel-gear upon said shaft meshing with an eccentric bevel-gear upon the driving-wheel hub and illustrating one portion of said gear. Fig. 2 is a sectional plan view of that portion of the frame of the bicycle adjacent to the driving-wheel, showing the same gear connection with the driving-wheel illustrated in Fig. 1, but showing the same in a different position from the position shown in said figure. Fig. 3 is a sectional plan view of that portion of the frame of the bicycle adjacent to the driving-wheel, showing the driving-wheel hub and the side shaft each provided with an obliquely-disposed eccentric gear in mesh one with the other. Fig. 4 is a face view of one of the eccentric gears detached.

Similar characters designate like parts in all of the figures.

My present invention in part resides in the combination, with the pedal-shaft and pedal-cranks and with the driving-wheel, of a side shaft, a two-to-one train of bevel-gears connecting the pedal-shaft and the side shaft, and a one-to-one train of eccentric bevel-gears connecting the side shaft and the driving-wheel, one or both of these gears being obliquely disposed, so that the side shaft will have an alternately reduced and accelerated speed of rotation, the driving-wheel gear of this eccentric train having its long radius disposed substantially in parallelism with the pedal-cranks when said cranks are in horizontal alinement, so that the radius of the driving-wheel gear will come into horizontal parallelism with the two pedal-cranks and forward of its axis of rotation at each complete revolution of such driving-wheel gear, whereby the speed of revolution of said pedal-cranks will be accelerated as the cranks approach the dead-centers of their movements and will be reduced during the mid-stroke portions of the ascending and descending movements of the cranks, as will be hereinafter more fully set forth.

In the drawings I have shown only so much of the framework of a bicycle as is necessary to fully illustrate the application of my improvements thereto.

The general construction and organization of the framework A, driving-wheel B, driving-wheel carrier or axle C, pedal-shaft D, and intermediate or side shaft E are or may be the same as the construction and organization of like parts in geared bicycles of ordinary construction, the shafts D and E, respectively, being revolubly supported in suitable bearings in the usual manner and the pedal-shaft D being provided with the usual oppositely-disposed pedals F and F′.

Fixed upon the pedal-shaft D, approximately midway of its length, is a bevel-gear 2, which meshes with a bevel-gear 3 of smaller diameter carried at the end of the intermediate or side shaft E. These two gears in the preferred construction and organization

thereof herein shown constitute a two-to-one train of gearing for rotating the said shaft E from the pedal-shaft D, the two gear-wheels being of such construction relative to each other that one complete revolution of one will impart two complete revolutions to the other, the larger gear-wheel 2 being secured to the pedal-shaft.

In the drawings I have shown two forms or modifications of variable-speed gearing in connection with the intermediate or side shaft E and the driving-wheel, both of which modifications are deemed to be within the scope and limits of my present invention.

The variable-speed gearing shown in Figs. 1 and 2, in connection with the driving-wheel and intermediate shaft E, consists of a bevel-gear 5, which is fixed to and is concentrically mounted with relation to the axis of the driving-wheel hub, (which gear will be hereinafter termed the "eccentric" gear,) and an intermeshing gear 6, concentrically mounted upon the intermediate shaft E in such manner that its plane of movement will be sufficiently oblique with relation to the axis of the shaft by which it is carried and with relation to the axis of the eccentric gear 5 that it will have a lateral movement of sufficient magnitude to cause its intermeshing portion at all times to conform to the eccentric arc described by the toothed periphery of the eccentric gear 5 during rotation thereof. In other words, the bevel-gear 6 will be so constructed and so disposed with relation to its carrying-shaft and the eccentric gear of the driving-wheel that it will have such a uniform wabbling movement laterally as will insure a positive intermeshing engagement between the two gears at all times during the rotation of the same.

In the form thereof shown in Fig. 3 both of the gears 5 and 6 are eccentrically mounted upon their respective carriers and are also obliquely disposed with relation to the axes of said carriers and to each other.

Where two eccentric gears 5 and 6 are employed, as shown in Fig. 3, the longer radius of one will be contiguous to the shorter radius of the other gear, and both gears will have a uniform wabbling lateral movement to adapt each to the variations in the arc described by the other. This will be readily understood by reference to Fig. 3 of the drawings, in which figure two opposite positions of the intermeshing gears are shown in full and dotted lines, respectively.

In operation power is applied to the pedal-shaft D through the pedals F and thence through the "two-to-one" train of gearing to the side shaft or intermediate shaft E, whence it is transmitted, through the medium of the "one-to-one" train of eccentric gearing, to the driving-wheel B, the movement thus imparted to the driving-wheel being of varying velocity relatively to the speed of the pedal-shaft, which result will be evident by a comparison of the several figures of the drawings with the preceding description.

By reference to Figs. 1, 2, and 3 of the drawings it will be seen that the side shaft E intersects the axis of the driving-wheel B, said shaft extending to and past said axis and being revolubly connected with the bevel-wheel 5 of said driving-wheel by a bevel-wheel 6, which is located in the rear of the axis of said driving-wheel, and which gear 6 is constantly in mesh with the gear 5, as hereinbefore stated. By connecting the gear 6 with the driving-wheel gear 5, in the rear of the axis of said driving-wheel, I secure a greater rigidity of the parts than is possible with the gear 6, located in advance of said axis, as a slight springing of the frame will not tend to throw the two gears out of working engagement. This is a matter of considerable importance, especially with eccentric gears constructed and arranged as hereinbefore described, as any slight variations in their relative positions, which might be caused by bending or springing of the frame, would tend to impair the true working thereof. By this construction and organization of driving mechanism for bicycles I obtain all the advantages inherent to elliptical sprocket wheel and chain connections well known in the art to which this invention appertains, in addition to the advantages of the geared bicycle over the chain-driven bicycles.

Having thus described my invention, I claim—

In a variable-geared bicycle, the combination of a driving-wheel, a pedal-shaft, and a side shaft having its ends adjacent to said driving-wheel and pedal-shaft; a two-to-one train of gears disposed on said pedal-shaft and the end of said side shaft adjacent to said pedal-shaft; a one-to-one train of gears comprising an eccentrically-disposed gear on the driving-wheel having its diameter at right angles to the rotating axis of said wheel and an obliquely-disposed gear on that end of the side shaft adjacent to the driving-wheel, said gears meshing with each other; and cranks, one at each end of the crank-shaft, having their longitudinal axes in horizontal planes coinciding with the plane of the longer radii of the gears of the one-to-one train at each complete rotation of said one-to-one train, whereby the speed of the pedal-cranks is accelerated as they approach the dead-centers of their movements and is reduced at the mid-stroke portions of their ascending and descending movements.

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