(No Model.) 4 Sheets—Sheet 1.

J. HARRISON.

BICYCLE.

No. 578,013. Patented Mar. 2, 1897.

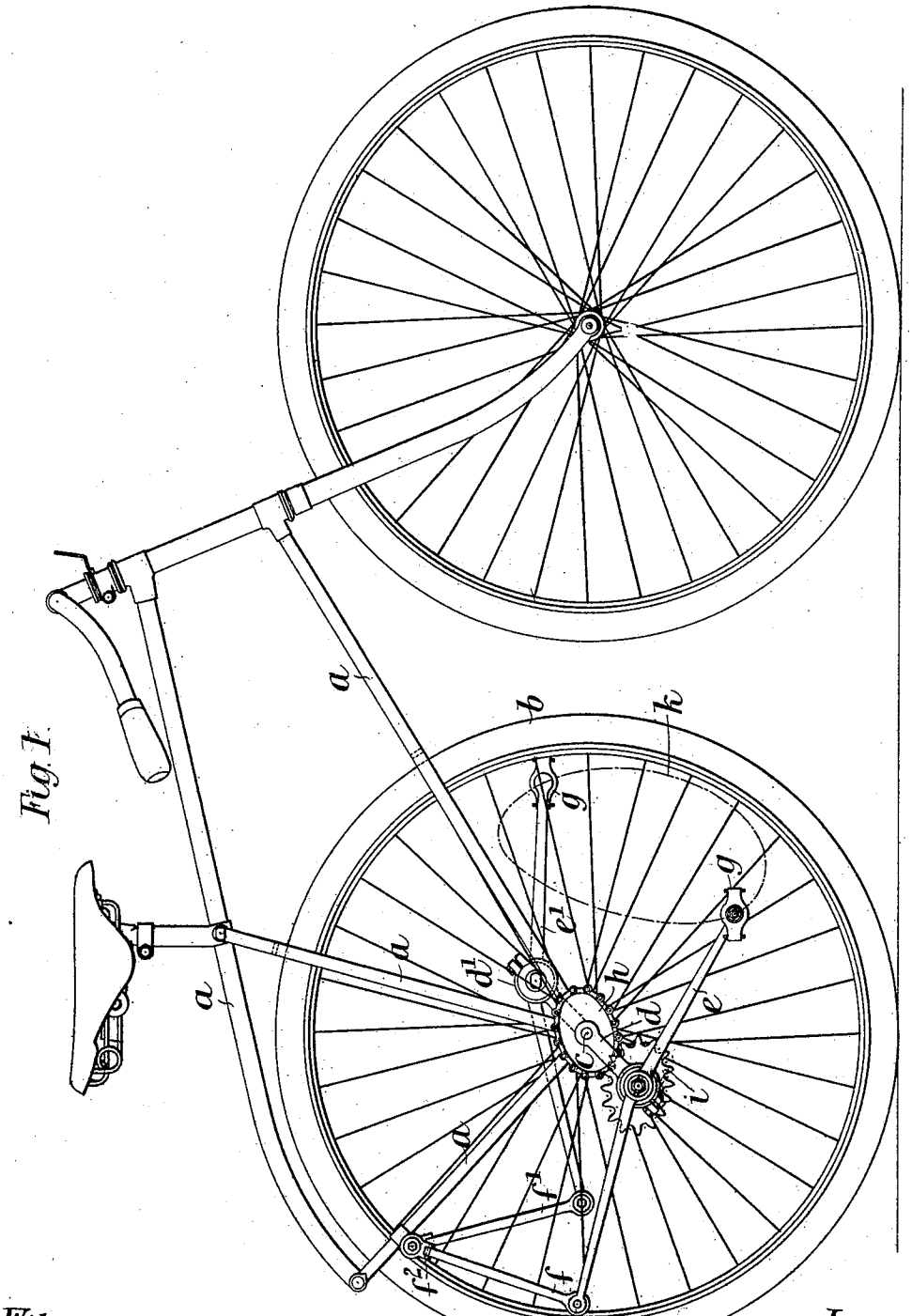

Fig. 1.

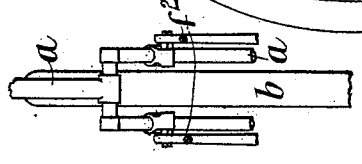

Fig. 2.

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(No Model.) 4 Sheets—Sheet 2.

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Fig. 3.

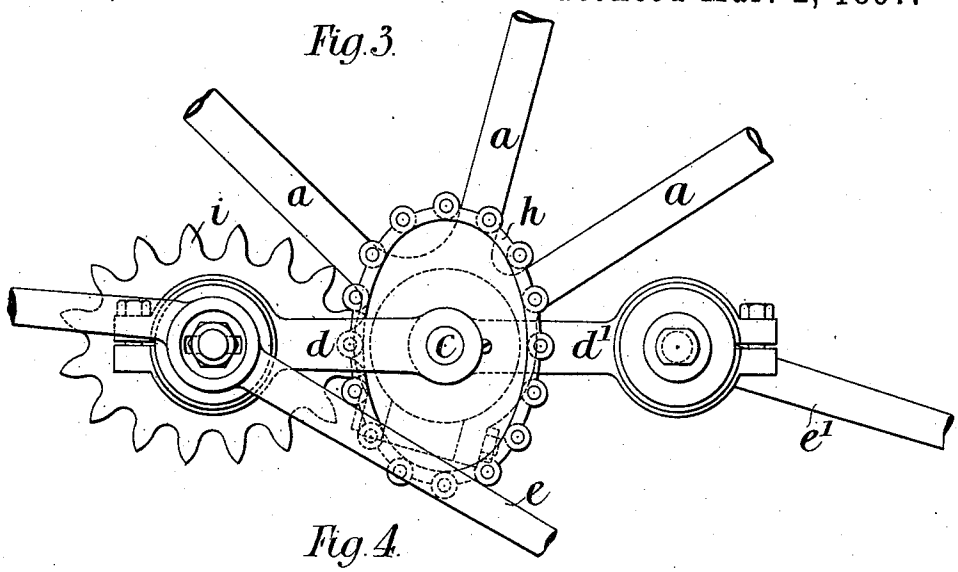

Fig. 4.

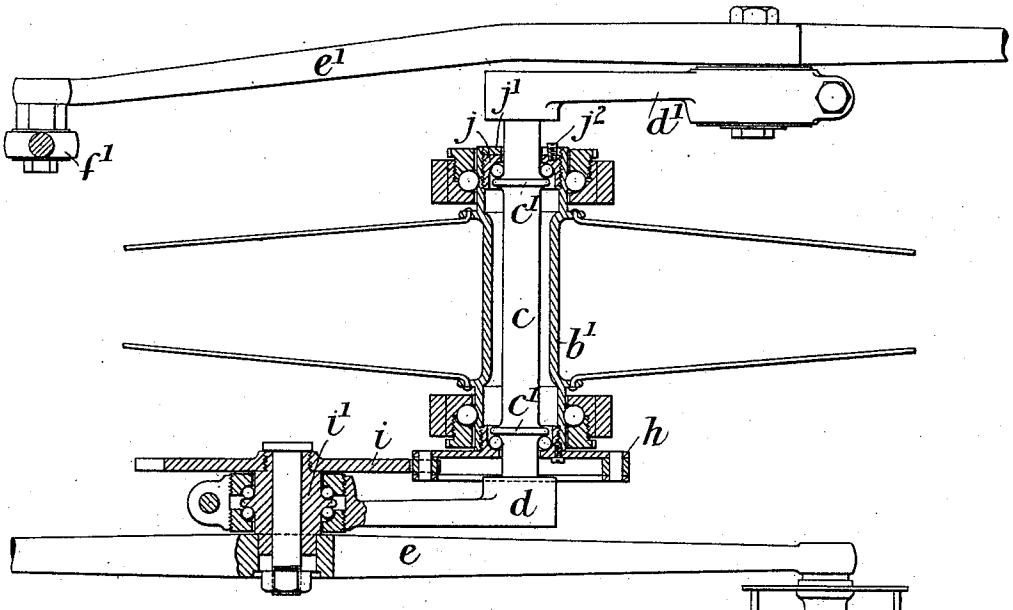

Fig. 5.

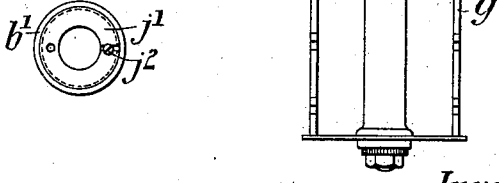

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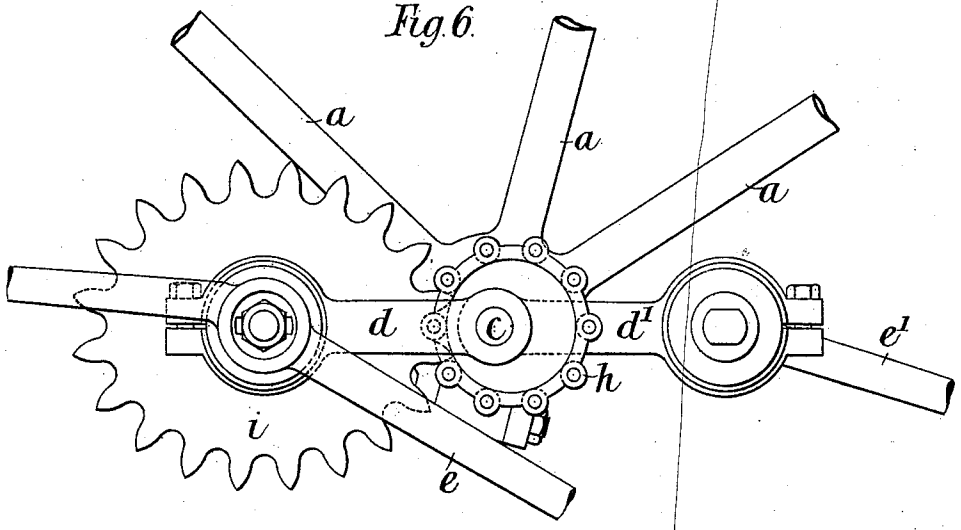
Fig. 6.



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(No Model.) 4 Sheets—Sheet 4.

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No. 578,013. Patented Mar. 2, 1897.

Fig. 7.

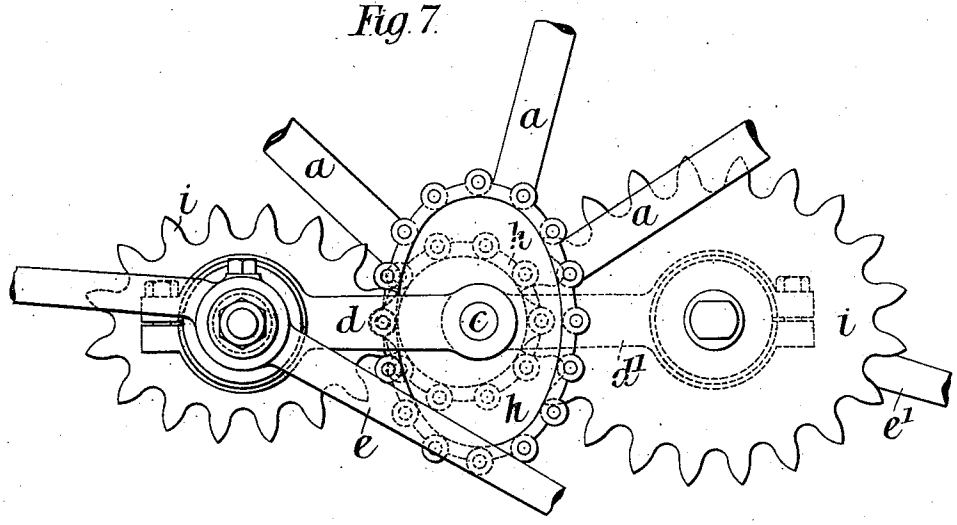

Fig. 8.

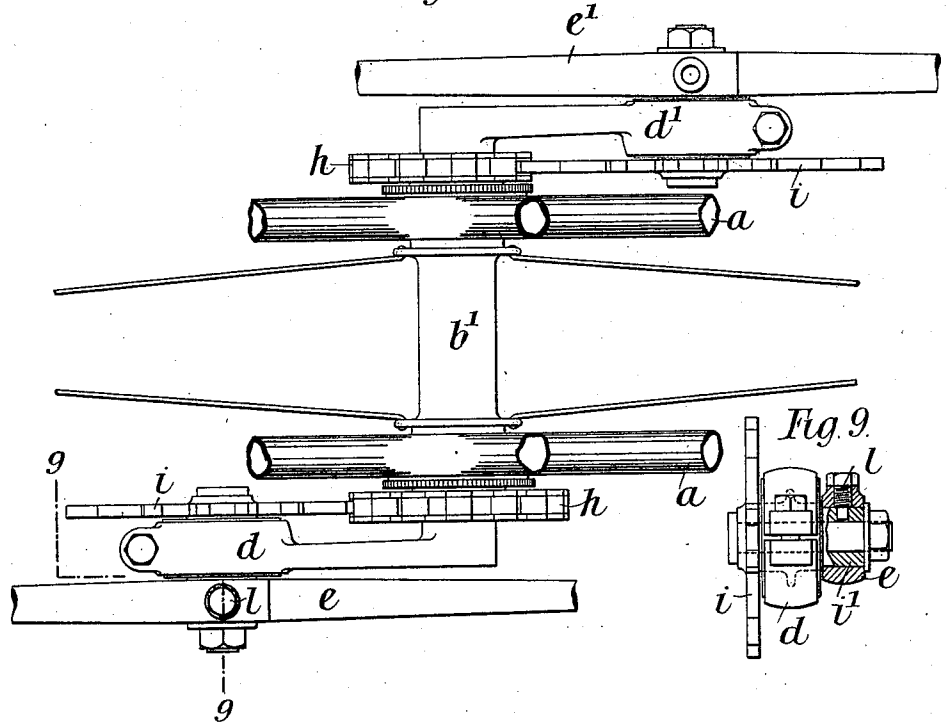

Fig. 9.

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UNITED STATES PATENT OFFICE.

JOHN HARRISON, OF STAMFORD, ENGLAND.

BICYCLE.

SPECIFICATION forming part of Letters Patent No. 578,013, dated March 2, 1897.

Application filed February 11, 1895. Serial No. 537,962. (No model.)

To all whom it may concern:

Be it known that I, JOHN HARRISON, a subject of the Queen of Great Britain, residing at Stamford, England, have invented new and useful Improvements in and Relating to Bicycles, of which the following is a specification.

My invention relates to velocipedes; and it consists, chiefly, in a novel arrangement of the driving mechanism whereby the power of the rider can be applied more continuously and effectively than heretofore.

According to my invention I make use of gearing, and preferably of elliptical gearing, which may be arranged to work as sun and planet gearing or as ordinary gearing, and, in combination with the gearing, I employ pedal-bars connected at or near their centers to the cranks and at their front ends carrying the pedals and at their rear ends connected to oscillating links depending from the frame of the velocipede.

To enable my invention to be fully understood, I will describe the same by reference to the accomyanying drawings, in which—

Figure 1 is a side elevation of a bicycle having my improvements applied thereto. Fig. 2 is a view of part of the same, looking from the rear end. Fig. 3 is a side elevation, drawn to an enlarged scale, showing the driving-gear; and Fig. 4 is a sectional plan of the same. Fig. 5 is a view of a nut for locking one of the ball-bearing cones in position. Fig. 6 is a side elevation showing the driving-gear adapted for high speed. Figs. 7 and 8 are respectively a side elevation and a plan showing the two driving-gears illustrated, respectively, in Figs. 1, 3, and 4, and in Fig. 6 both applied to one machine to form a variable-speed gear. Fig. 9 is an end elevation, partly in section, on the line 9 9, Fig. 8.

Similar letters of reference indicate corresponding parts in the several figures.

a indicates the frame of the machine; *b*, the driving-wheel; *c*, the crank-axle; *d d'*, the cranks; *e e'*, the pedal-bars; *f f'*, the links connecting the rear ends of the same with the framing; *g g*, the pedals or treadles, and *h i* the sun and planet wheels, respectively.

In the arrangement of my invention shown in Figs. 1 to 4 I make use of two elliptical gear-wheels arranged to work as sun and planet wheels, the sun-wheel *h* being fixed to the hub *b'* of the driving-wheel *b* and having the crank-axle *c* rotating within it, while the sun-wheel *i* is fixed to the pedal-bar *e*. The said sun-wheel, as shown most clearly in Fig. 4, is provided with a boss *i'*, which passes through the crank *d* into an aperture in the said pedal-bar and forms the crank-pin. In practice I have found it advantageous to make the sun-wheel as a lantern-wheel, the teeth of which are pins having friction-rollers, while the planet-wheel has ordinary spur-teeth.

By referring to Fig. 4 it will be noticed that I have represented ball-bearings as being placed around the crank-axle *c*, the balls at one end of the said crank-axle being carried in a ball-race formed in a hollow boss upon the sun-wheel *h*, while at the other end the ball-race is formed in a cylindrical block *j*, screwed into the hub *b'* of the driving-wheel *b*. By screwing in this cylindrical block more or less the adjustment of the balls relatively with the collars *c' c'* upon the crank-axle *c* can be effected. In order to lock the said block in any position into which it may be adjusted, I provide a split nut or collar *j'*, (shown clearly in Fig. 5,) so arranged that when a taper-screw j^2 is inserted through the split into a hole in the block *j* the said nut will be expanded to clamp it in the hub *b'*.

As shown in Figs. 1 to 4, the sun and planet wheels are represented as being of the same size, in which case the driving-wheel only makes two rotations to one of the crank. If a higher speed is required, I advantageously employ the arrangement shown in Fig. 6, that is to say, instead of using an elliptical wheel for the sun-wheel I use an eccentric wheel having half the number of teeth of the planet-wheel, whereby the driving-wheel makes three revolutions to one of the cranks.

The links *f f* are pivoted as close together as possible to a rearward extension of the framing *a*, as shown in Fig. 2, so as to prevent their having an unsightly appearance upon the machine, and the pedal-bars *e e'* are bent inward, as shown in Fig. 4, in order to meet the lower ends of the said links. In order to allow the cranks to have lateral control of the pedals and to prevent any wringing of the links *f f'* in case either of the

treadle-bars *e e'* should be accidentally bent laterally, the said links *f f'* are formed in two pieces at their upper ends, connected together by knuckle-joints f^2, which permit of the necessary movement of the links. Instead of forming knuckle-joints in the links knuckle-joints may be formed in the treadle-bars adjacent to the crank-pins.

With the arrangement of driving mechanism hereinbefore described the pedals move in the path indicated by the dotted line *k* in Fig. 1, that is to say, in an approximately elliptical path in which the vertical movement is very much greater than the horizontal movement, thus giving a more effective path for the applied power, whereby the dead-points of the cranks are more quickly passed than when the pedals move in a circle, a very uniform and regular movement being at the same time obtained, which was not the case when elliptical gear was used with ordinary pedal-cranks.

In Figs. 7 and 8 I show an arrangement for driving at two different speeds, the gearing on one side of the machine being of the construction shown in Figs. 1 to 4 and that on the other side of the machine of the construction shown in Fig. 6. In order to permit of working either set of gearing, in which case the other set of gearing is out of action, I provide for locking either planet-wheel to its pedal-bar, as may be desired. For this purpose I advantageously employ a set-screw *l*, (shown most clearly in Fig. 9,) the said set-screw extending through the pedal-bar into a hole or aperture formed in the hub or boss *i'* on the planet-wheel. It will be understood that when one planet-wheel is fixed the boss *i'* of the other planet-wheel rotates in the pedal-bar connected to it.

Although I have shown my invention applied to the rear wheel of a bicycle, it is to be understood that it is also applicable to the front wheel or to a chain or gear wheel geared with the driving-wheel of the machine.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

In a velocipede having cranks actuated by pedal-bars mounted upon said cranks and severally connected at their ends to links depending from the frame, the combination with the pedal-bars and with a sun-wheel having its periphery eccentric to the axis of rotation, and located on a driving shaft or hub, of an elliptical planet-wheel fixed on one of said pedal-bars and having its axis at the center of the ellipse and gearing into said sun-wheel, the combination serving to insure an approximately elliptical pedal-path, all substantially as set forth.

JOHN HARRISON.

Witnesses:
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