(No Model.) 2 Sheets—Sheet 1.

W. J. & E. FREEMAN.

DRIVING GEAR FOR VELOCIPEDES, &c.

No. 599,445. Patented Feb. 22, 1898.

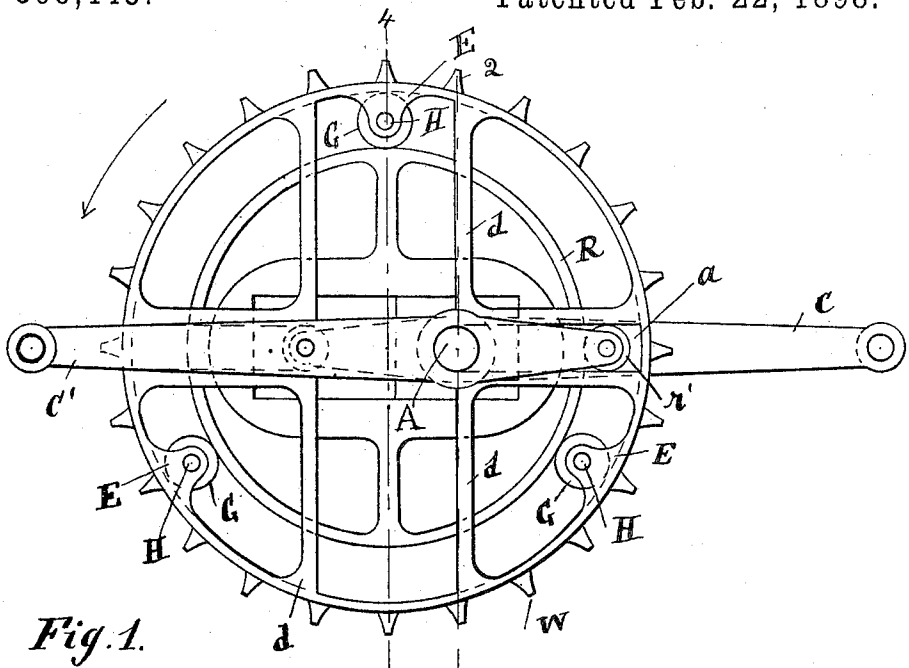


Fig. 1.

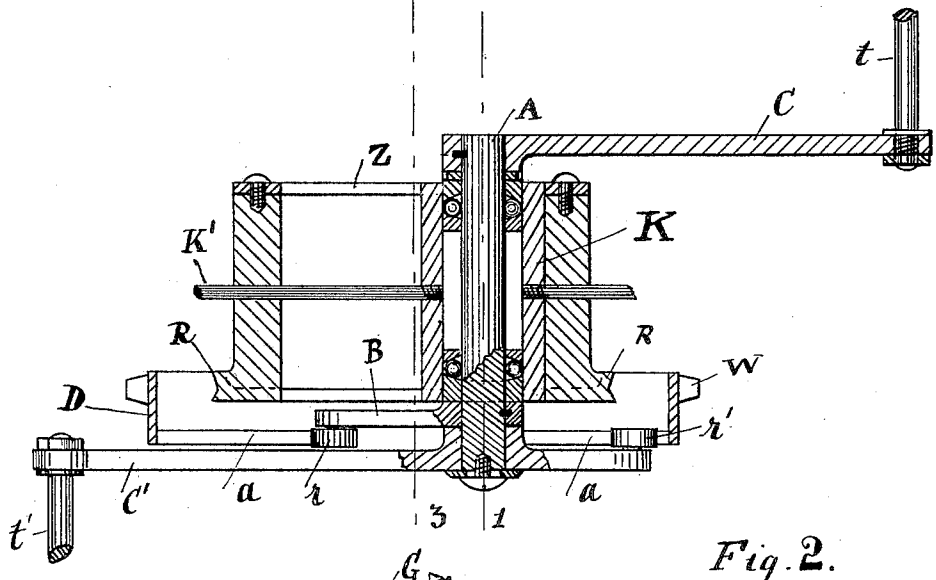


Fig. 2.

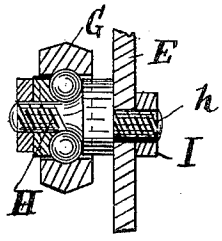


Fig. 3.

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(No Model.) 2 Sheets—Sheet 2.

W. J. & E. FREEMAN.

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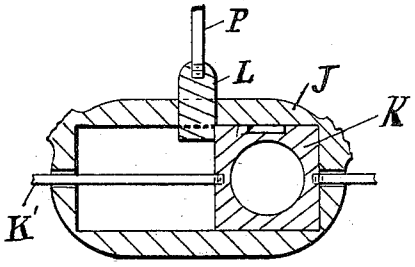


Fig. 5.

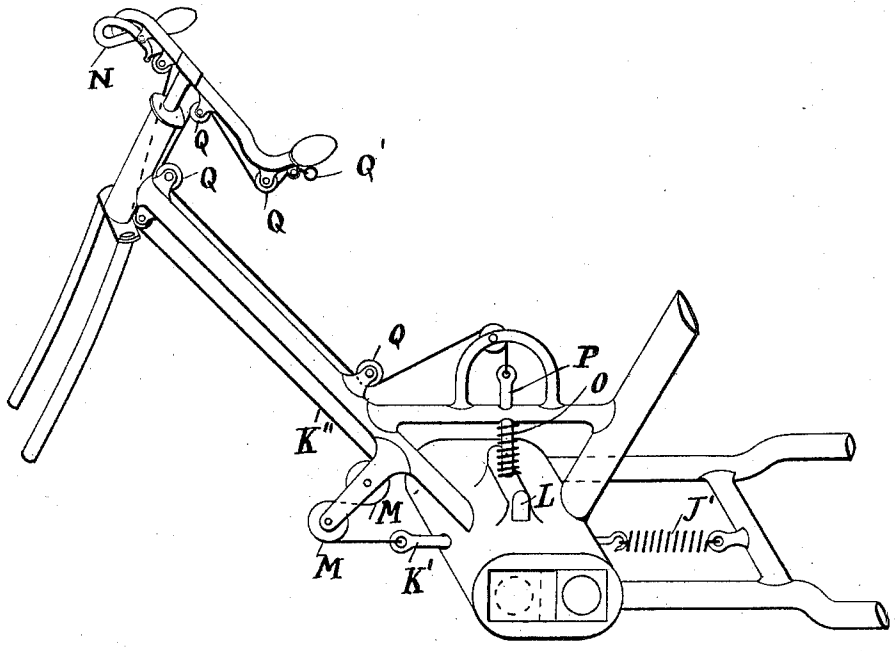


Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM JAMES FREEMAN AND EDWIN FREEMAN, OF LONDON, ENGLAND.

DRIVING-GEAR FOR VELOCIPEDES, &c.

SPECIFICATION forming part of Letters Patent No. 599,445, dated February 22, 1898.

Application filed December 7, 1895. Serial No. 571,370. (No model.) Patented in England October 15, 1895, No. 19,327.

To all whom it may concern:

Be it known that we, WILLIAM JAMES FREEMAN and EDWIN FREEMAN, subjects of the Queen of Great Britain, residing at 99 York Road, Battersea, London, England, have invented certain new and useful Improvements in Driving-Gear for Velocipedes and other Machines Driven by the Feet or Hands, (for which we have obtained a patent in Great Britain, No. 19,327, bearing date October 15, 1895,) of which the following is a specification.

This invention relates to driving-gear for velocipedes and other machines driven by the feet or hands, the said gear being of the pin-and-slot type, in which the motion of the pedal or other cranks is transmitted to the chain or driving wheel or wheels by means of pins in the said cranks or in cranks secured to the crank-axle, which pins engage with slots in the face of the said wheel or wheels; and the objects of our invention are, first, to construct the driving-gear in such a manner as to cause the power applied to the pedals or other cranks or levers to be transmitted to the driving wheel or wheels during the descent of the pedal or crank at the greatest possible mechanical advantage and to insure the least possible resistance to the upward motion of the pedals or cranks; secondly, to enable the action of the mechanism to be easily reversed, so as to form a powerful arresting apparatus, and, thirdly, to enable our improved driving mechanism to be readily affixed to existing machines without entailing much alteration of the frames.

In order that our said invention may be fully understood, we will proceed to explain the same with reference to the accompanying sheets of drawings, in which—

Figure 1 represents a side elevation of our improved driving-gear as applied to velocipedes and other machines driven by the feet. Fig. 2 is a section of same. Fig. 3 is a section through one of the rollers supporting the chain-wheel. Fig. 4 is a perspective view of the reversing-gear attached to a bicycle. Fig. 5 is a section through the crank-shaft bearing.

The same letters denote the same parts in all the figures.

In Figs. 1 and 2, A is the crank-shaft; B, a short crank keyed or otherwise secured thereto between the face of the wheel D and the ring R.

C C′ are pedal-cranks; *t t′*, the crank or pedal pins.

D is the chain-wheel; W, the teeth or sprockets thereon.

The wheel D is annular and provided with lugs E E E, in which are inserted studs H H H, on which rotate antifriction-rollers G G G, the peripheries of which are either curved or shaped as shown at Fig. 3. These rollers bear on a circular ring R, the edge of which is shaped to fit the rollers G G G. The rollers and the ring are preferably made of hardened steel. The rollers are preferably furnished with ball-bearings, as shown at Fig. 3, and in order to insure contact between the rollers and the ring R the portion *h* of the studs H which fits into the lugs E is eccentric to the bearings on which the rollers rotate, so that by revolving the studs in the lugs the rollers will be brought into contact with the ring R. The nut I secures the stud in its proper position.

The wheel D is provided with a slotted face or skeleton frame *d d* in the front thereof. The skeleton frame *d* forms slots *a a*, in which work rollers *r r′*, whereof *r* is free to rotate on the pin of the crank B, while *r′* rotates on a stud in the crank C′.

As will be seen from the drawings, the centers of the crank-shaft and chain-wheel do not coincide, line 1 2 being drawn through the center of the crank-shaft and line 3 4 through the center of the chain-wheel. As an example, with driving-gear of the ordinary construction having the radius of the pedal-crank equal to the diameter of the chain-wheel the maximum mechanical advantage is two to one; but with our improved gear with the same length of crank and diameter of chain-wheel by making the distance of the center of the rollers *r r′* from the center of crank-shaft one-third the length of the pedal-crank, the eccentricity of pedal-crank being one-sixth of the crank length, the maximum mechanical advantage is three to one.

As increasing the mechanical advantage of the pedal over the chain-wheel during the downward motion of the pedal decreases to

the same extent the mechanical advantage on its upward movement, it is necessary in order to give the rider control over the machine when "back pedaling" to reverse the action of the gear that is to give him the benefit of the increased mechanical advantage during the ascent of the pedals, the reversal being effected as follows: In Figs. 1 and 2 the pedal-shaft is shown passing through a slotted bracket carrying the ring R. When the crank-shaft is in the position shown, the mechanism is in the driving position; but by moving the crank-shaft to the opposite end of the slot the action of the gear will be reversed so as to obtain the maximum advantage when back pedaling, thus enabling the gear to be used as a powerful brake. The action of the gear may be reversed by any suitable means which will move the crank-shaft from one end of the slot to the other and hold it securely in either position. One device which we have found very suitable for this purpose is shown at Figs. 4 and 5.

Fig. 4 shows the reversing-gear attached to a bicycle-frame, J being the bottom bracket, in which slides the block K. The said block is provided with the usual ball-bearings to receive the crank-shaft. L is a bolt to hold the block K at either end of the bracket J, as desired. The block K is normally held in the driving position by means of the spring J′ and the bolt L, to which is attached the rod P. A rod K′ is attached to the block K at the opposite side to the spring, and to this rod is attached one end of a chain or cord K″, passing over guide-pulleys M M and secured at its other end to a hand-lever N, attached to the handle-bar in the same manner as the ordinary brake-lever. The bolt L is normally forced downward by the spring O, and a cord or chain fastened to the rod P, and which, after passing over guide-pulleys Q Q, terminates in a ring or loop Q′, enables the bolt to be lifted against the pressure of the spring O. When it is desired to use the gear as a brake—for example, when descending a hill on a bicycle—the bolt L is lifted by pulling the cord attached thereto with the left hand. The right hand then pulls the block K forward by means of the lever N. The bolt L is then released and falls behind the block K, holding the gear in position for back pedaling until the bottom of the hill is reached, when the bolt L is lifted and the lever N released. The spring J′ pulls the block K to its normal position. On releasing the bolt the gear will be locked in the driving position. If, however, it is desired to use the gear as a substitute for a two-speed gear for hill-climbing, advantage may be taken of the maximum mechanical advantage for climbing, and when riding on level ground the gear may be locked in the mid-position by allowing the lock L to drop into a slot in the block K, when the machine will be to all intents and purposes an ordinary safety-bicycle.

The gear may be put in one extreme position for climbing and in the other for descending inclines.

Z is a loose plate attached to the bracket J to allow the block K to be inserted in the slot and to retain it when in place.

We are aware that prior to our invention driving mechanism for velocipedes has been made in which the motion of the cranks is transmitted to the chain-wheel by means of pins and slots. We therefore do not claim such a combination broadly; but

What we do claim as our invention, and desire to secure by Letters Patent, is—

1. In a pedal-actuated or manumotive driving-gear, the combination of a crank-axle A and sliding bearings K therefor, a crank C at one end of the said axle, a crank C′ having a rearward extension and carrying a roller r' at the other end of said axle, an inside crank B with roller r, a bracket J having a rectangular slot for the reception of said sliding bearings, and a driving-wheel D mounted concentrically on said bracket and rotatable thereon by cranks B and C′, substantially as and for the purpose specified and shown by the drawings.

2. In a pedal-actuated or manumotive driving-gear, the combination of a crank-axle A and sliding bearings K therefor, a slotted bracket-support J for said bearings, rod K′ and spring J′ for moving said sliding bearings, a crank C at one end of said axle, a crank C′ having a rearward extension and carrying a roller r' at the other end of said axle, an inside crank B with roller r, and a driving-wheel D mounted concentrically on said bracket-support and rotatable thereon by cranks B and C′, substantially as and for the purpose specified and shown by the drawings.

3. In a pedal-actuated or manumotive driving-gear, the combination of a crank-axle A and sliding bearings therefor; a slotted bracket J for said bearings; rod K′ and spring J′ for moving, and bolt L for securing, said sliding bearings in a predetermined position; a crank C at one end of said axle; a crank C′ having a rearward extension and carrying a roller r' at the other end of said axle; an inside crank B with roller r; and a driving-wheel D, mounted concentrically on said bracket-support, and rotatable thereon by cranks B and C′, substantially as and for the purpose specified and shown by the drawings.

4. In a pedal-actuated or manumotive driving-gear the combination of a chain-wheel D having a slotted face d, a crank-axle A eccentric to the center of the wheel D, a crank C, cranks B and C′ having rollers r r' engaging with slots a in the face d of the wheel D, a slotted bracket J for supporting the crank-axle and chain-wheel and a means for varying the eccentricity of the axle A all substantially as described and for the purpose stated.

5. In a driving-gear for velocipedes and

other machines the combination of a sprocket-wheel D having a slotted face and supported on rollers G revolving around a ring R secured to a slotted crank-bracket J a block K provided with bearings to receive the crank-axle A sliding freely in the said bracket a bolt L capable of vertical movement in the said bracket and a means for moving the said block backward and forward in the bracket and raising and lowering the said bolt for the purpose stated.

6. In a driving-gear for velocipedes and other machines the combination of a slotted crank-bracket J a block K sliding freely therein in which rotates a crank-axle A a ring R secured to the said bracket carrying a chain-wheel D having a slotted face engaging with rollers attached to cranks secured to the crank-axle a spring and rod K′ attached to the block, and a movable bolt L with a cord K″ attached at one end to a hand-lever N and at the other end to the rod K′ and a cord attached at one end to the rod P and at the other end to a ring Q′ all substantially as specified and for the purpose stated.

7. In a pedal-actuated or manumotive driving-gear, the combination of a crank-axle and sliding bearings therefor, a driving-wheel having a central space for the free movement of said bearings therein, slots on its face adapted to form roller-paths, teeth on the exterior and three or more lugs on the interior of its peripherical rim, a roller pivoted in each of said lugs and adapted to travel upon a fixed interior concentric pathway, rollers pivoted to cranks adapted to work on said roller-paths, and a pedal-actuated crank on each end of said crank-axle, substantially as and for the purpose specified and shown by the drawings.

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Witnesses:
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PERCY E. MATTOCKS.