(No Model.) 3 Sheets—Sheet 1.

W. F. HEALY.

BICYCLE.

No. 301,234. Patented July 1, 1884.

Fig. 1

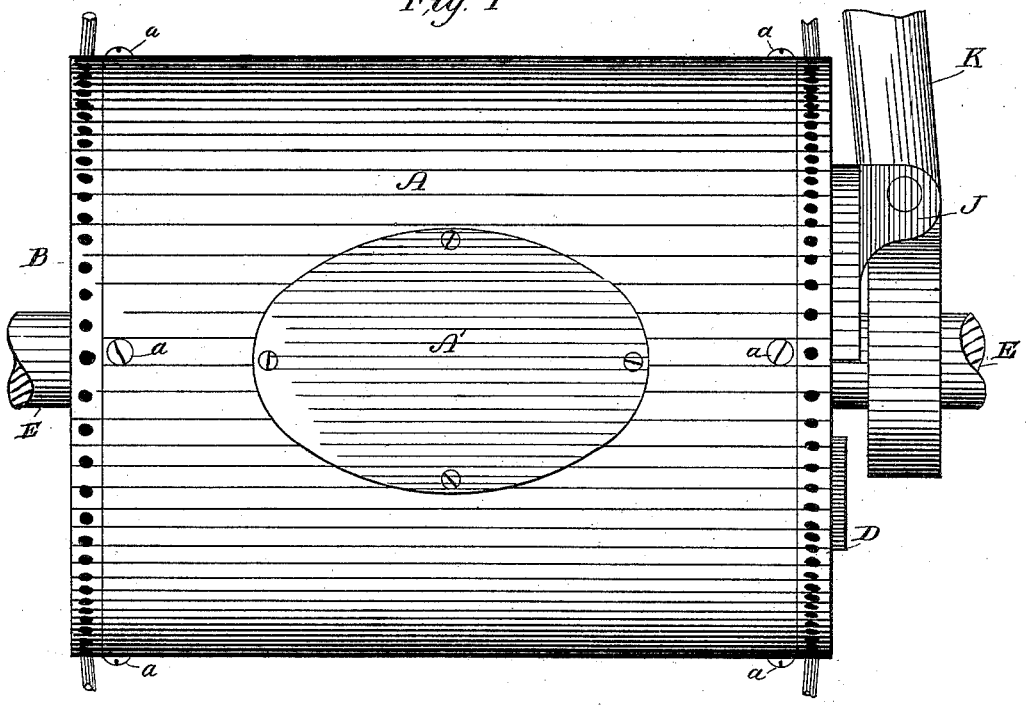

Fig. 2

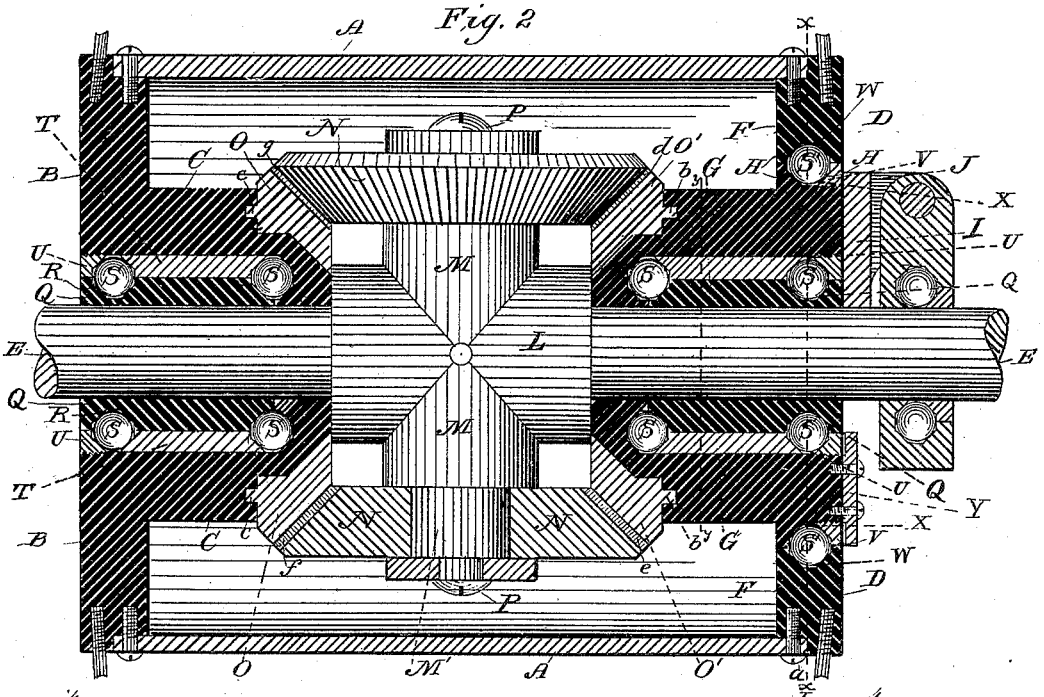

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Fig. 3

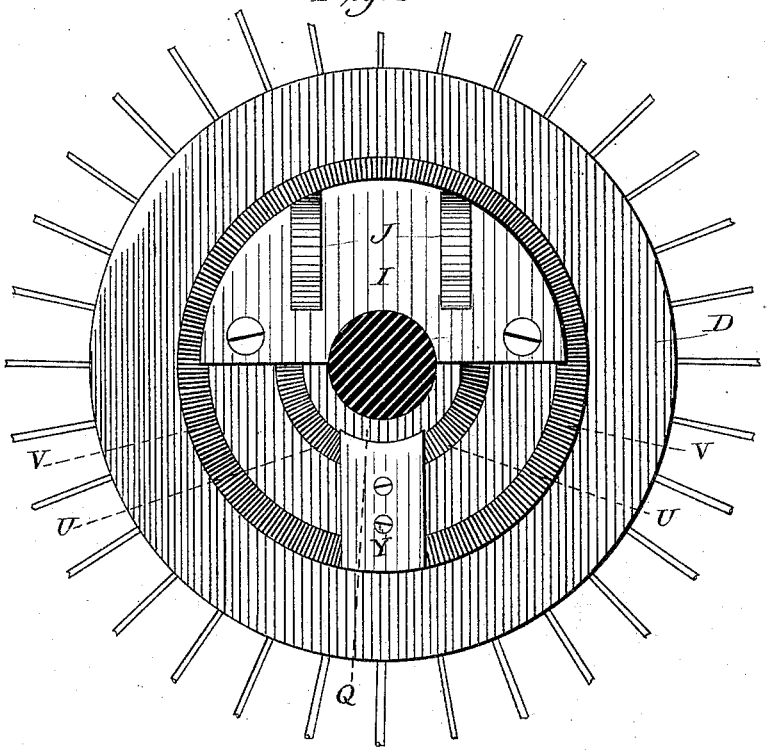
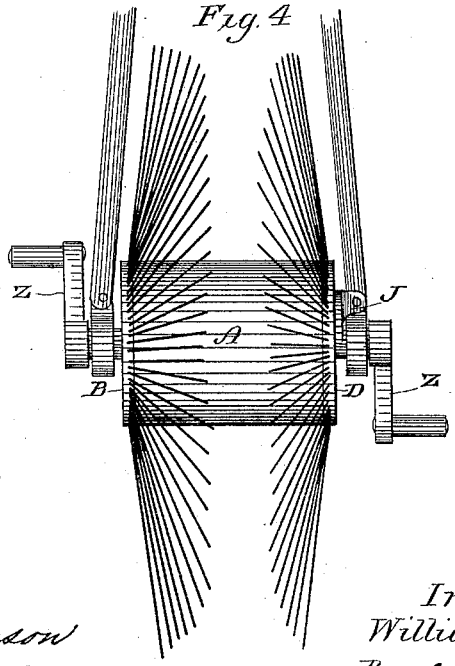


Fig. 4



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5

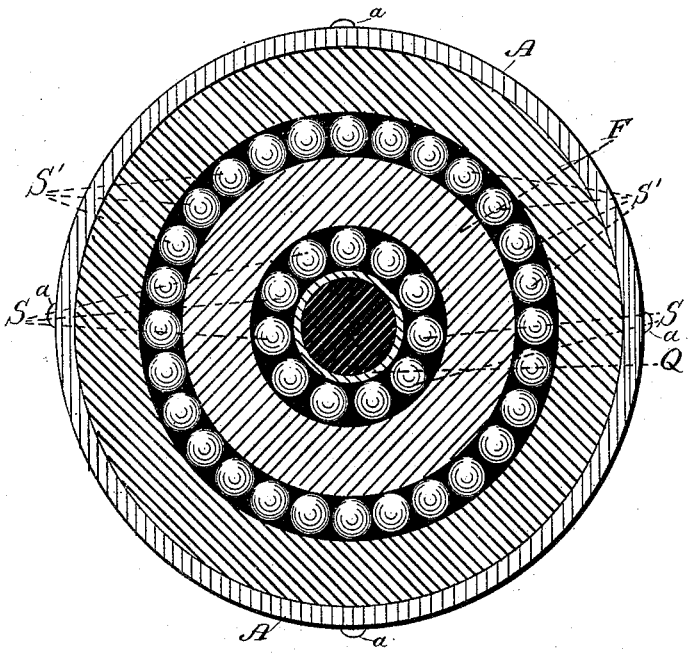
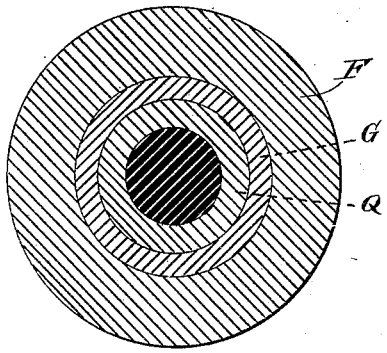


Fig. 6



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UNITED STATES PATENT OFFICE.

WILLIAM F. HEALY, OF BRIDGEPORT, CONNECTICUT.

BICYCLE.

SPECIFICATION forming part of Letters Patent No. 301,234, dated July 1, 1884.

Application filed January 23, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. HEALY, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Bicycles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain novel and useful improvements in bicycles, and has for its object to provide a simple and compact device for increasing the speed of bicycles, whereby for every complete revolution of the cranks two revolutions of the wheel will have been performed, but without an increase of friction proportionate to the increased speed; and with these ends in view my invention consists in the details of construction and combination of elements hereinafter fully and in detail explained, and then specifically designated by the claims.

In order that those skilled in the art to which my invention appertains may more fully understand how to make and use my improvement, I will proceed to describe the same, referring by letter to the accompanying drawings, in which—

Figure 1 is an elevation of the hub of a bicycle containing my improvement, and showing portion of a fork attached to one side; Fig. 2, a longitudinal section of my improved bicycle-hub, showing the gears in operative position, partly in section and partly in elevation, the bearings and balls therein contained, and a vertical section of an outside bearing, showing its means of attachment to the fork of the bicycle; Fig. 3, an end elevation of the hub, showing the plate provided with lugs for the attachment of the fork, and a view of the outer surface of the ring-nuts, showing the serrations by which, in connection with the check-block, they are securely held; Fig. 4, a front elevation of a bicycle provided with my improvement, and showing the respective attachments of the forks upon either side of the wheel and of the cranks upon either end of the driving-shaft; Fig. 5, a section of the hub, taken through the line *x x*, (see Fig. 2,) and showing the arrangement of the balls in the inner and outer bearings; and Fig. 6, a section taken through the hub at the line *y y*, and showing the arrangement of the tight and loose collars whose ends form part of the track for the balls which form the bearings.

Similar letters denote like parts in the several figures of the drawings.

A is a cylindrical shell adapted to contain the mechanism of my improvement, and B D are heads closing the ends of said shell, and having upon their peripheries holes (see Fig. 1) adapted to receive the spokes of the wheel. In the face of the shell A is an opening, and the plate A′ is attached to the shell A by screws and serves as a cover for the opening. The two heads B D differ in their construction. The head B is constructed in one piece, having as a part thereof the inward projection C. The head D is constructed from two concentric collars, F G, the outer of which, F, is firmly secured to the shell by screws *a*, and turns with the wheel upon the bearings H, as will be presently explained. The inner collar, G, is rigidly attached to the fork K by means of the plate I, having upon its face the lugs J, which embrace the fork upon either side, and are securely attached thereto by a screw or bolt.

E is the driving-shaft, passing entirely through the hub, and at whose center is rigidly secured the tight collar L, projecting from the opposite sides of which, at right angles, are the cross-heads M. Upon either side of the collar L are the tight collars Q, forming a part of the shaft, and beveled at their inner ends. Near their outer ends these collars are provided with grooves cut in their peripheries, and in shape half-octagonal in cross-section, for the purpose of forming a track for the balls S.

T are loose collars surrounding the fast collars Q, and are beveled at either end, so as to present a bearing-surface against the balls S, which travel in the track formed at the inner end of the collars by the surfaces of the tight collars Q, the loose collars T, and the inner face of the projection C, and at the outer ends of the collars by the hemi-octagonal grooves R, the beveled surfaces of the loose collars T,

and the beveled surfaces of the ring-nuts next described. U are ring-nuts threaded externally, beveled at their forward ends to form a part of the track for the balls S, and designed to engage with threads upon the inner circumference of the heads B G, for the purpose of tightening or easing the bearings just described.

Cut in the inner circumference of the collar F is a groove, W, half-octagonal in shape, and parallel to the cross-section of the collar, and in the periphery of the collar G is cut a groove, X, similar to the groove W, save that one side is cut down and threaded to engage with the threads upon the ring-nut V, so that when the collars are in position and the ring-nut V in place, as shown in Fig. 2, a track is formed octagonal in shape and adapted to contain the balls S′, which run in the bearing H. The ring-nut V is in all respects similar to the nuts U, save in size. The outer surface of the nuts U V is serrated, as shown at Fig. 3, and the check-block Y is provided upon its inner surface with teeth adapted to engage with the serrations on the nuts U V. This block is screwed to the outer face of the inner collar, G, and its ends hold the nuts firmly in position by the engagement of the teeth upon the block with the serrations on the nuts U V.

Rigidly attached by lugs *c* to the projection C of the head B is a beveled gear, O, (shown in section at Fig. 2,) and rigidly attached by lugs *b* to the inner end of the inner collar, G, of the head D is another beveled gear, O′. Both these gears are uniform in size, pitch, and number of teeth. Upon the ends of the cross-heads M are short shafts M′, carrying transverse gears N, attached to said shafts by means of screws P, in such manner as to leave the gears free to turn upon the short shaft. The gears N are identical in size, pitch, and teeth with the gears O O′. The teeth of the transverse gears N engage with the teeth of the gears O O′ at the points of contact *d e f g*, Fig. 2, for the purpose presently explained.

Z are cranks attached to the ends of the shaft E, for the purpose of revolving it.

The operation of my invention is as follows: By one revolution of the driving-shaft E one entire revolution will be imparted to the cross-heads M, which are fixedly attached thereto, and consequently to the transverse gears N. As has been previously noted, the inner collar, G, of the head D is rigidly attached to the fork K, so that it is held secure as against any rotary movement. The gear O′ therefore always remains stationary. The gear O is also immovably attached to the inner face of the projection C by lugs *c;* but the head B is in no way attached to the forks; consequently any motion transmitted to the gear O is applied directly to the head B, of which said gear forms a part, and which is free to revolve independent of the shaft E. By a revolution of the shaft E the transverse gears N describe not only a revolution around the axis of the driving-shaft, but also by their engagement with the teeth of the stationary gear O′ a complete revolution around the short shafts M′—their axes. This, as will be readily understood, imparts the twofold speed thus acquired to the movable gear O, thereby causing it and the head B, to which it is rigidly attached, to describe two revolutions to each entire revolution of the driving-shaft E. To explain somewhat more in detail: If the head B were rigidly attached to the driving-shaft E, if the collar Q, carrying the cross-heads and transverse gears, were loose upon the shaft and the gear O′ free to turn, it is obvious that the cross-heads and transverse gears would perform no function whatever, and that the head B would revolve once, and once only, to each revolution of the shaft. They would be mere useless generators of friction, instead of valuable parts, as when combined and operated in my invention. By the motion of the cranks Z, the shaft E and the tight collar L and cross-heads M, thereto attached, acquire a rotary motion in the direction shown by the arrow seen upon the collar L in Fig. 2. As the transverse gears revolve around the shaft E upon the ends of the cross-heads, they acquire by the engagement of their teeth with the teeth of the stationary gear O′ an independent rotary motion around the short shafts M′ in the direction shown by the arrow seen upon the transverse gear N, Fig. 2. As the gears N and O′ are all provided with the same number of teeth, this independent motion must be equal to one revolution of the gears N upon their axes—the short shafts—for every revolution of the driving-shaft E. The driven gear O, whose sole function is to receive the motion from the transverse gears, and which is in no way dependent directly upon the shaft for its motion, must therefore receive from the gears N not only the speed derived from the motions of the gears N around the shaft, but also the speed imparted by the revolution of the transverse gears upon their axes—the short shafts. In short, the motion of the gears N around the shaft E furnishes motion which causes the gear O to revolve once at every revolution of the shaft. The motion of the gears N around their independent axes M′ furnishes another revolution of the gear O to each turn of the shaft E, and these two sources of power furnish motion which causes the gear O to make two complete revolutions to each turn of the shaft E, and in the direction shown by the arrow seen upon the gear O. As the gear O is rigidly attached to the head B, and as the head B, shell A, and outer collar, F, of the head D are firmly secured one to the other, and as the heads B D carry in their peripheries the spokes of the wheel, it will be readily seen that the double revolution just described will cause the wheel of the bicycle to revolve twice to each revolution of the cranks.

The function of the bearings formed by the

combination of the balls S, the grooves R in the tight collars Q, and the beveled ends of the loose collars T is merely to allow the shaft E to revolve within the hub with the least possible friction, and the result obtained by the use of the bearings H is that the outer collar, F, is left free to revolve around the inner collar, G, which is held fast to the fork K.

I am well aware that ball-bearings have been used in many connections for lessening friction of bearing-surfaces, and that they have been very commonly used in connection with bicycles, upon the ends of the forks, for the purpose of allowing the axle or driving-shaft to turn easily, and I do not wish to be understood as laying claim, broadly, to any such construction, the gist of my invention in this regard resting in the broad idea of ball-bearings situated within the hub of a bicycle, whereby the hub may be permitted to revolve around and independent of the axle.

The advantages gained by the use of the pattern and arrangement of the gears in my improvement are that while the two revolutions of the wheel for every one of the cranks is accomplished, as desired, the mechanism required to accomplish this result occupies so little space that a hub of ordinary size is competent to inclose it. Being situated within the wheel, the mechanism cannot be injured by the falling of the machine. It is out of reach of the feet of the rider, and by the use of the shell is fully protected from dust or dirt.

By the use of the various multiplying devices heretofore used the appearance of the bicycle was greatly damaged, they were liable to become useless from dust and dirt, and the use of oil necessary for their operation rendered the machine dirty. The appearance of a bicycle provided with my improved mechanism is in no way changed, save that by the connection of the peripheries of the hub-flanges the hub in my improvement is seen to be somewhat larger than in ordinary bicycles.

By the use of the shell in my improvement all dirt and dust is excluded from the working parts and the two heads are firmly held together.

The plate A′ is readily detachable and permits ready access to the mechanism for the purpose of cleaning and oiling or for repairs.

The outside bearing shown as attached to the fork K in Fig. 2 is merely for the purpose of showing some means of attachment of the end of the driving-shaft, and I do not wish to be understood as claiming either its construction or operation, neither of these being of the gist of my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The collar L, rigidly secured to the axle, and having projecting therefrom cross-heads M, carrying gears N, in combination with gear-wheel O′, secured to the stationary collar G, gear-wheel O, secured to the head B C, hub A, collar F, and means for rotating the axle, substantially as described.

2. In the hub of a bicycle, the combination of the tight collars Q, having grooves R, the loose collars T, and balls S, with the ring-nuts U, threaded externally and arranged around the tight collar, substantially as shown.

3. In a bicycle-hub, the nuts V, in combination with the collars F G and the balls S, substantially as shown, and for the purpose set forth.

4. The check-block Y, adapted to firmly hold the ring-nuts U V, having upon its inner face teeth or serrations, in combination with the head to which it is attached, and the nuts which it secures, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM F. HEALY.

Witnesses:
W. J. HAVILAND,
S. S. WILLIAMSON.