(No Model.) 3 Sheets—Sheet 1.

J. REDDING.

DEVICE FOR CHANGING GEAR OF BICYCLES.

No. 572,828. Patented Dec. 8, 1896.

Fig. 1.

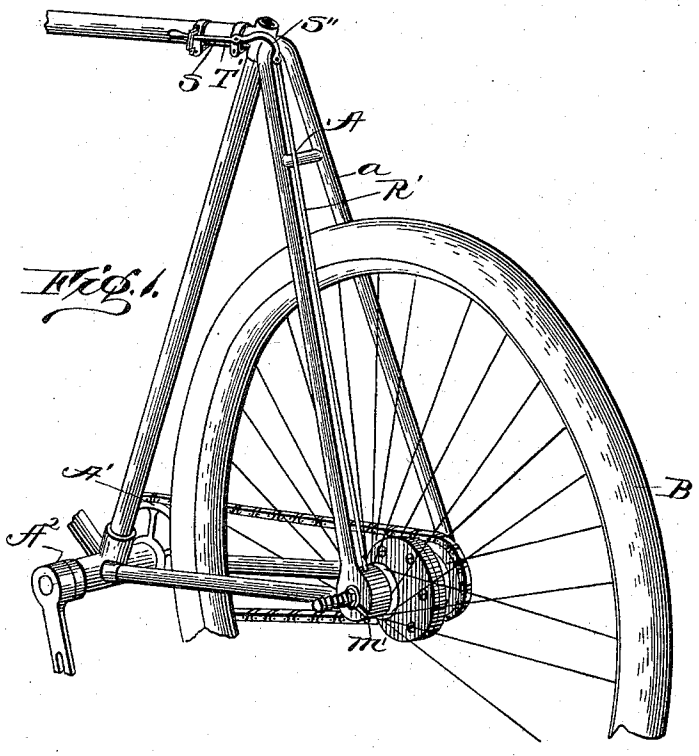
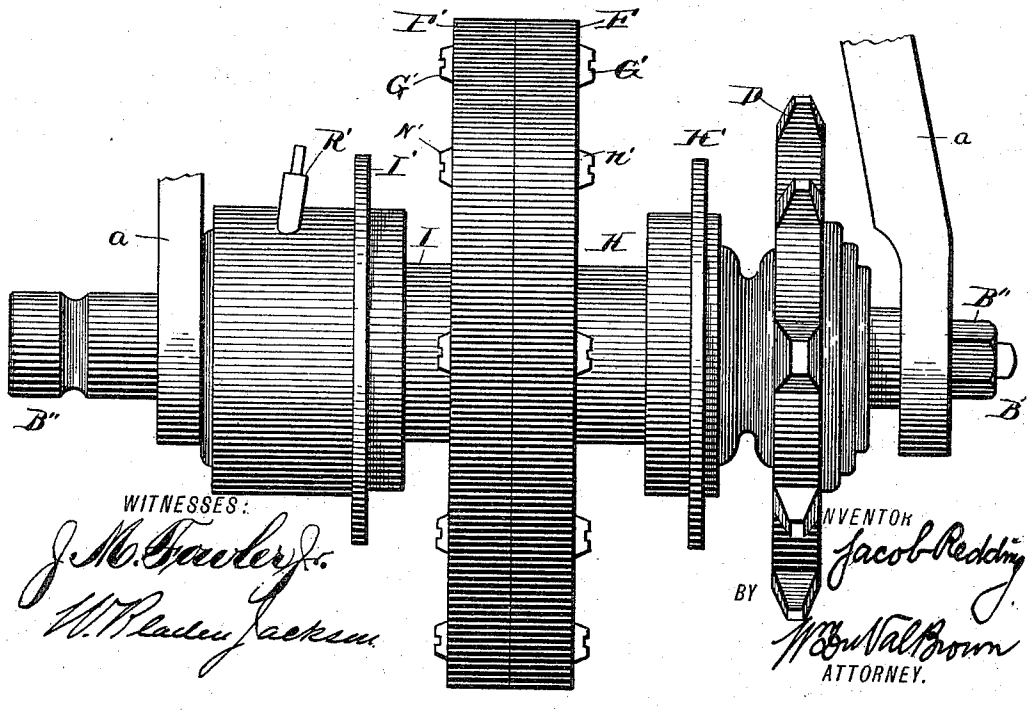


Fig. 2.



WITNESSES:

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(No Model.) 3 Sheets—Sheet 2

J. REDDING.

DEVICE FOR CHANGING GEAR OF BICYCLES.

No. 572,828 Patented Dec. 8, 1896.

Fig. 3.

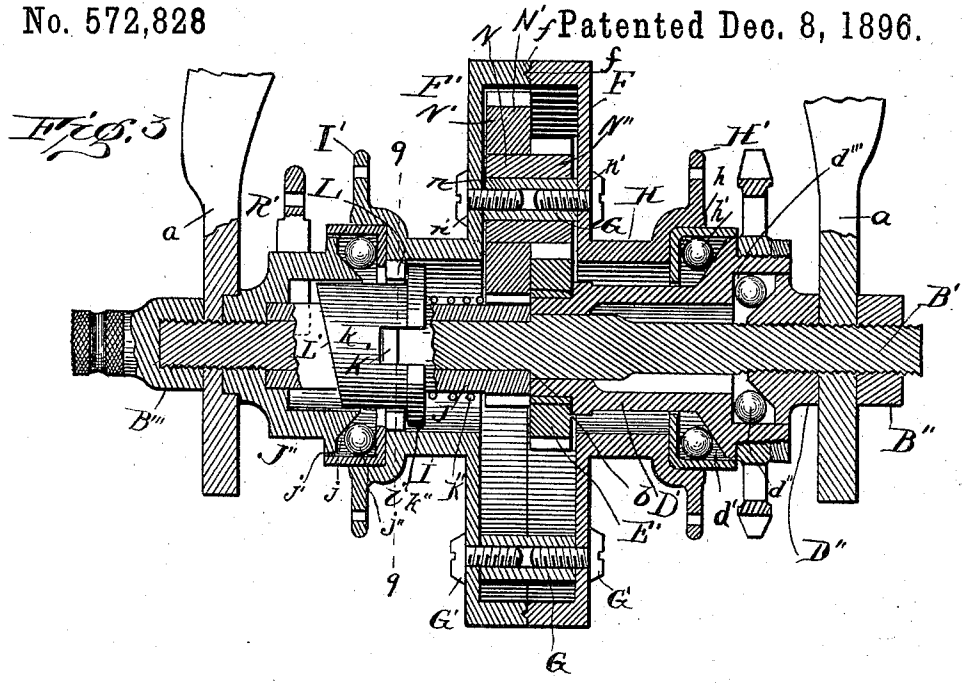


Fig. 6.

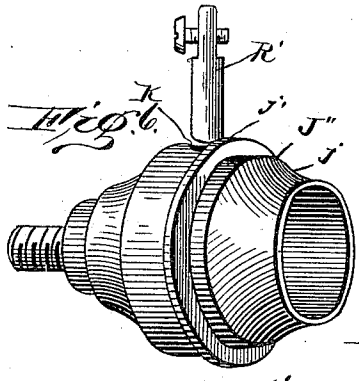


Fig. 5.

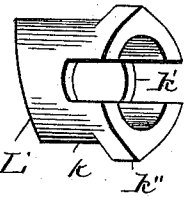


Fig. 14.

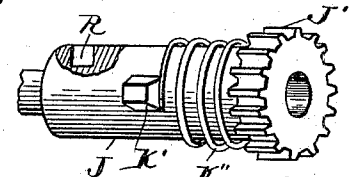


Fig. 11.

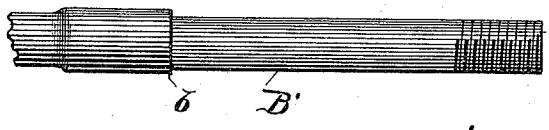


Fig. 13.

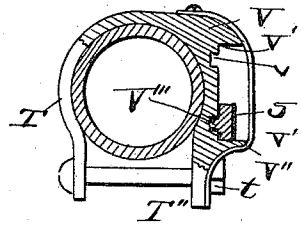
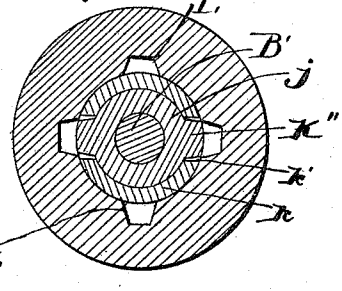


Fig. 9.



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(No Model.) 3 Sheets—Sheet 3.

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DEVICE FOR CHANGING GEAR OF BICYCLES.

No. 572,828. Patented Dec. 8, 1896.

Fig. 7.

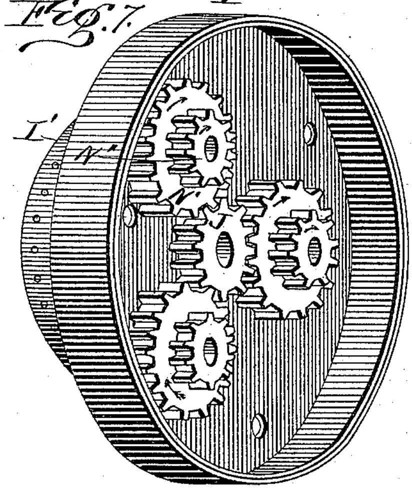


Fig. 8.

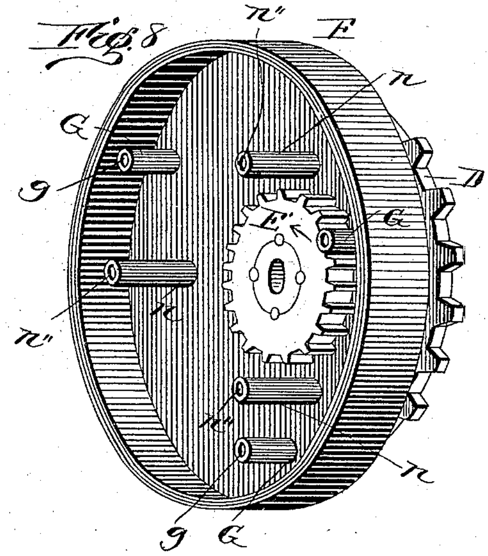
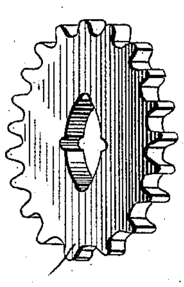


Fig. 10.



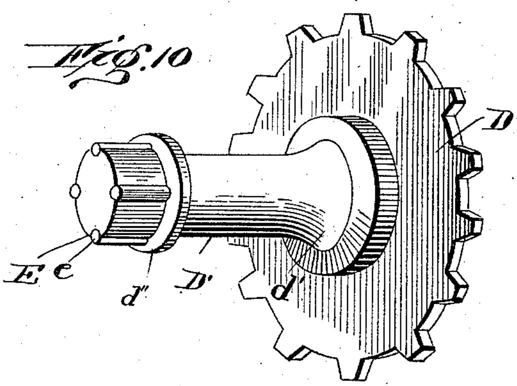
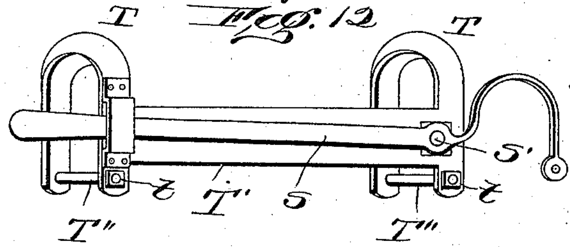


Fig. 12.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JACOB REDDING, OF NEW CASTLE, INDIANA.

DEVICE FOR CHANGING GEAR OF BICYCLES.

SPECIFICATION forming part of Letters Patent No. 572,828, dated December 8, 1896.

Application filed March 9, 1896. Serial No. 582,461. (No model.)

To all whom it may concern:

Be it known that I, JACOB REDDING, a citizen of the United States, residing at New Castle, in the county of Henry and State of Indiana, have invented certain new and useful Improvements in Devices for Changing the Gear of 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.

This invention relates to a new and useful improvement in a device for changing the gear of bicycles; and it consists in the construction and arrangement of parts hereinafter described, and definitely pointed out in the claims.

The aim and purpose of this invention are to provide a changeable gear for bicycles which is adapted to be applied to the hub of a bicycle-wheel, so that the rider can readily change the gear without dismounting and while the machine is in motion.

With these objects in view I construct a changeable gear which can be applied to the hub of any bicycle-wheel and which fits within the forks of the frame and which is compactly assembled, so as to use but little room and not detract from the appearance of the machine.

It is also the purpose of this invention to construct a clutch in connection with the gearing which can be unlocked by the rider when the wheel is moving at any rate of speed, and a clutch which after being unlocked is actuated automatically by the movement of the wheel proper and the various gear-wheels constituting the mechanism.

It is further the object of this invention to construct the device of but few parts, so as not to add weight when placed on the wheel, and one which can be cheaply manufactured.

These and other objects not hereinbefore specified are accomplished by the construction illustrated in the accompanying drawings, wherein like letters of reference indicate corresponding parts in the several views, and in which—

Figure 1 is an elevation of the rear portion of a safety-bicycle frame and rear wheel, showing my improved device for changing the gear applied thereto. Fig. 2 is a side elevation of my device applied to the bicycle-frame between the forks. Fig. 3 is a vertical central longitudinal section of Fig. 2. Fig. 4 is a perspective view of the cog-sleeve. Fig. 5 is a perspective view of the clutch-sleeve. Fig. 6 is a perspective of the cone-nut, showing the aperture for the clutch-lever and the lower portion of the clutch-lever. Fig. 7 is a view of the interior of one portion of the casing, showing the pinions in position. Fig. 8 is a view of the interior of the adjacent portion of the casing. Fig. 9 is a section on the line 9 9, Fig. 3. Fig. 10 is a perspective view of the sprocket and sleeve. Fig. 11 is an elevation of the axle, and Figs. 12 and 13 are detail views of the hand-lever.

In the drawings, A represents the rear portion of a safety-bicycle frame, and A′ the front sprocket-wheel, which is operated by the usual cranks A″. *a* represents the rear forks of the frame. The rear ends of the frame are bifurcated, forming slots *m*′.

B represents the rear wheel, supported on the frame by the shaft B′, which extends from fork to fork and is placed in the slots *m*′ and is secured in place by the nut B″ on one end and the nut B‴ on the opposite end, which latter nut is so shaped as to be used as a step. This shaft is provided with a shoulder *b* for a purpose hereinafter described and as plainly shown in Fig. 11.

D designates the rear sprocket, which is rigidly secured on the sleeve D′, as shown in Fig. 10, and is adapted to be placed on the shaft B′, but out of contact with the same. The sprocket and sleeve are prevented from moving longitudinally on the shaft in an outward direction by the cone-nut D″, which is screwed on the shaft on the inner side of the rear fork, as shown in Fig. 3. The sleeve is hollowed out, as shown at *d*‴, in which are placed balls *d*, which bear against the nut, making a ball-bearing between the parts. The sleeve D′ is provided near its longitudinal center with a cone-surface *d*′, for a purpose hereinafter described. Near the opposite end of this sleeve from the sprocket is formed a collar *d*″, and extending from this collar to the end of the sleeve are a series of longitudinal grooves E.

E′ is a gear-wheel having a series of grooves on the inner face of its hub. This gear-wheel is adapted to be placed on the end of the

sleeve, and when so placed the grooves on the sleeve will register with the grooves on the gear-wheel. *e* represents keys which pass into these grooves to rigidly secure the wheel to the sleeve.

F designates one half of the casing, and F′ the adjacent half. This casing is circular in form, and the rim of the part F is provided with an annular tongue *f*, adapted to fit in an annular groove *f′* in the adjacent part. These two parts of the casing are secured together by means of the bolts G, which are made of separate pieces from the casing and have their opposite ends secured to the two parts of the casing by screws G′, which pass through apertures in the casing into apertures *g* in the bolts. It will thus be seen that the casing can be readily taken apart on either side, if desired for any purpose. I show three of these bolts in the drawings, although it is evident that any convenient number could be used.

The part F of the casing has a circular extension H, which extends out and surrounds the sprocket-sleeve D′ and is then bent up to form the spoke-disk H′. This extension has a cut-out portion *h* on its interior, in which are placed balls *h′*, which bear against the cone-surface *d′* on the sleeve D′ when the parts are assembled. It will thus be seen from the above that the sprocket and sleeve have a ball-bearing connection with the shaft and the casing and extension have a ball-bearing connection with the sprocket-sleeve and that the sprocket-sleeve and casing can revolve independent of each other.

The part F′ of the casing has a circular extension I, which has its end turned up, forming the other spoke-disk, I′. The interior of this extension I has a cut-out portion *i*, for a purpose hereinafter described.

J designates the cog-sleeve, supported on the shaft B′. This cog-wheel surrounds the shaft B′ and is rotatably supported thereon. The inner end of the sleeve is slightly enlarged and is formed with a series of cog-teeth J′, cut out of the surface of the sleeve. This cog-sleeve is retained on the shaft by means of the cone-nut J″. This nut is screwed on the shaft B′ and is provided with the cone-surface *j* and the annular rib *j′*, which rests within the circular extension I of the casing.

j″ designates balls interposed between the cone-surfaces *j* and *i*, so that the casing will have a ball-bearing connection with the nut. The upper face of the cone-nut is provided with an aperture K, for a purpose hereinafter described.

The cog-sleeve is provided with oppositely-arranged shoulders K′, and between the shoulders is interposed a coiled spring K″.

k designates the clutch-sleeve, which is adapted to slide on the cog-sleeve. This sleeve is provided with oppositely-arranged notches *k′*, in which the shoulders K′ on the cog-sleeve are adapted to engage. It will thus be seen that the clutch-sleeve is keyed to the cog-sleeve and will rotate with the cog-sleeve. The clutch-sleeve is provided with the oppositely-arranged shoulders *k″*, which are adapted to engage notches L on the inner face of the circular extension I. When the clutch-sleeve is in position, the coiled spring will bear against the sleeve and normally press it outward, and the shoulders on the clutch-sleeve will engage the notches on the extension and lock the same to the sleeve. The outer face of the sleeve is provided with a beveled or inclined cam-face L′, for a purpose hereinafter described.

The inner end of the cog-sleeve extends within the casing to its substantially transverse center. The inner end of the sprocket-sleeve also extends within the casing to substantially the same distance, and the gear-wheel E′ is surrounded by the casing. The inner ends of the cog-sleeve and sprocket-sleeve are entirely disconnected and the cog and sprocket sleeves can revolve independent of each other, as well as of the casing.

N designates double pinions journaled within the casing. These pinions, as plainly shown in Figs. 3 and 7, consist of two pinions N′ and N″ of different diameters rigidly secured together. I show three sets of these double pinions, although I might vary the number and still be within the spirit of my invention. These double pinions are rotatably secured in the casing by the bolts *n*, which extend across the casing to the opposite sides. These bolts are rigidly secured in place by the screws *n′*, which pass through apertures in the sides of the casing into apertures *n″* in the ends of the bolt. The large pinion N′ meshes with the cog-teeth on the cog-sleeve, and the smaller pinion N″ meshes with the gear-wheel E′ on the sprocket-sleeve.

The parts being arranged as shown and described, the device is intended to be operated as follows: When it is desired to have a low gear, the clutch-sleeve will be forced outward by the spring engaging the extension of the casing, as hereinbefore described. Now when power is exerted on the sprocket, the gear-wheel E′, meshing with the pinion N″ and the pinion N′ meshing with the cog-teeth and these cog-teeth being locked to the casing, none of the various pinions, gear-wheel, or cog-teeth will revolve independent of each other, but will all revolve as one wheel, and the casing will revolve at the same speed as the sprocket. Now when it is desired to increase the speed of the wheel more than that of the sprocket the clutch-sleeve is moved to the right, disengaging it from the casing, and the cog-wheel locked from rotation, as hereinafter described. When the sprocket is put in motion, the gear-wheel E′, meshing with the pinion N″, will cause that pinion and the pinion N′ to revolve, and the cog being stationary the pinions will revolve around this cog in a forward direction—that is, in the same direction as the sprocket is moving and the gear-wheel E′, as shown by the arrows in

Figs. 7 and 8, and in so revolving they will carry the casing and spoke-disks at an increased speed.

The increase in speed is regulated in proportion to the total difference in the number of teeth on the larger and smaller wheels entering into the combination, taking one set only of peripheral wheels into the calculation, and the change in speed will be less in proportion as the total difference in number of teeth is increased, and vice versa.

The pinions N′ and N″ being rigidly secured together and motion being imparted to the small pinion N″ by the larger gear-wheel E′ will cause the pinion to revolve faster, which will also cause the large pinion N′ to revolve faster, that is, the same speed as the pinion N″, and the pinion N′, revolving around the now stationary cog at this increased speed, will cause the casing to revolve faster, as above described. It will thus be seen that this difference in speed can be readily regulated by simply using a different-sized gear-wheel and pinion with a different number of teeth.

The clutch-lever is moved longitudinally on the cog-sleeve as follows:

R′ designates a rod which passes through the aperture K in the cone-nut J″, and R designates an aperture in the cog-sleeve directly under the aperture K in the nut. The upper end of the connecting-rod is pivoted to the hand-lever S. The connecting end of the lever is thinned and formed in a curve, as shown at S″, forming an inverted-**U**-shaped spring connection between the rod R′ and the lever.

T represents collars, as shown in Figs. 12 and 13, secured to the rear portion of the top horizontal bar of a safety-frame adjacent the seat. These collars are connected by the rod T′, which extends parallel with the horizontal bar. The collars are split rings and are detachably secured to the bar by the bolts T″, which pass through suitable apertures in the collars and are clamped in position by the nuts *t*. The collars T and rod T′ form a rigid supporting-frame for the lever. The hand-lever S is pivoted to this supporting-frame at S′, as shown in Fig. 12.

Assuming that the parts are arranged as in a low gear and it is desired to change the gear, the connecting end of the lever is moved downward, moving down the rod R′. When the parts are in low gear, the cog-sleeve and clutch-sleeve will be revolving with the casing, and when the rod is forced down its lower end will bear against the inclined side of the revolving clutch-sleeve, gradually forcing it to the right until the shoulders on the clutch-sleeve will become disengaged from the notches in the casing. This will be accomplished with one revolution of the clutch-sleeve, and when the aperture in the cog-sleeve registers with the aperture in the nut the rod will be forced down into the aperture in the cog-sleeve by the tension of the now contracted spring portion of the lever and the cog-sleeve will be locked from rotation and the gear changed, as before described. When it is desired to again change the gear, the rod is moved upward out of engagement with the aperture in the cog-sleeve and the coiled spring on the cog-sleeve will force the clutch-sleeve to the left until it becomes locked in the casing.

The natural tendency of the cog-sleeve is to revolve in the same direction that the sprocket-wheel is moving, and hence the clutch-sleeve may be forced inward to the right and out of clutch with the casing before the end of the rod stops bearing against the cam-face of the clutch-sleeve and enters the aperture in the cog-sleeve, thus obviating any danger of locking the gear device from moving at all. It will thus be seen that I provide a clutch which is automatic in its action and therefore easy to actuate, at all times reliable, and can be used to change the gear when the wheel is moving at any speed, and can be operated by the rider from his seat.

By providing the shaft with the shoulder *b* the cog-sleeve is prevented from bearing against the sprocket-sleeve, as it would have a tendency to do when the clutch-sleeve is moved to the right against the tension of the coiled spring.

Upon the front collar T is formed an enlargement V, which has a cut-out portion V′. In this cut-out portion are formed two apertures *v v′*.

V″ is a cover-plate adapted to fit over the cut-out portion. The free end of the hand-lever is passed through this portion and is limited in its upward and downward motion by the shoulders of the cut-out portion.

V‴ is a projection adapted to fit into the apertures. The lever is formed of resilient material, and when it is desired to move the lever the same is moved out to disengage the projection or pin from one of the apertures, and after the lever is moved a sufficient distance the pin will register with one of the other apertures and the lever will spring back in position and become firmly locked. The outward movement of the lever is limited by the cover-plate V″, as shown in Fig. 13.

It will be noticed from the above description that the parts of the device for changing the gear are compactly assembled and snugly fit within an ordinary bicycle-wheel and all of the various pinions and bearings are housed within the casing, making the device dust-proof and not detracting from the appearance of the wheel.

I am aware that many minor changes can be made in the construction and arrangement of parts, as hereinbefore described and shown, without in the least departing from the nature and principles of my invention.

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

1. In a changeable gear for bicycles, the combination with a supporting-shaft, of a

sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a spoke-disk rotatably supported on the sprocket-sleeve, a gear-wheel rigid on the sprocket-sleeve, a cog-sleeve rotatably supported on the supporting-shaft having cogs thereon, differential pinions journaled on the spoke-disk and rigidly secured together, the smaller pinion meshing with the gear-wheel and the larger pinion meshing with the cogs on the cog-sleeve, a clutch-sleeve slidingly secured on the cog-sleeve normally clutching the cog-sleeve to the spoke-disk, a cam-face on one end of the clutch-sleeve, and means engaging the cam-face for sliding the clutch-sleeve out of engagement with the spoke-disk for releasing the cog-sleeve from the disk and locking the cog-sleeve from rotation, substantially as described.

2. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a spoke-disk rotatably supported on the sprocket-sleeve, a gear-wheel rigid on the sprocket-sleeve, a cog-sleeve rotatably supported on the supporting-shaft having cogs thereon and provided with an aperture, differential pinions journaled on the spoke-disk and rigidly secured together, one pinion meshing with the gear-wheel and the other pinion meshing with the cogs on the cog-sleeve, a clutch-sleeve slidingly secured on the cog-sleeve normally clutching the cog-sleeve to the spoke-disk, a cam-face on one end of the clutch-sleeve, and means engaging the cam-face for sliding the clutch-sleeve out of engagement with the spoke-disk and engaging the aperture in the cog-sleeve for locking the said sleeve from rotation, substantially as described.

3. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a spoke-disk rotatably supported on the sprocket-sleeve, a cog-sleeve rotatably supported on the shaft, gearing connecting the cog-sleeve to the spoke-disk and the spoke-disk to the sprocket-sleeve, a clutch-sleeve slidingly secured on the cog-sleeve normally clutching the cog-sleeve to the spoke-disk and means for sliding the clutch-sleeve out of engagement with the spoke-disk for releasing the cog-sleeve from the disk and locking the cog-sleeve from rotation, substantially as described.

4. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a spoke-disk rotatably supported on the sprocket-sleeve, a gear-wheel rigid on the sprocket-sleeve, a cog-sleeve rotatably supported on the supporting-shaft having cogs thereon and provided with an aperture, differential pinions journaled on the spoke-disk and rigidly secured together, one pinion meshing with the gear-wheel and the other pinion meshing with the cogs on the cog-sleeve, a clutch-sleeve slidingly secured on the cog-sleeve normally clutching the cog-sleeve to the spoke-disk, a cam-face on one end of the clutch-sleeve, a rod engaging the cam-face for sliding the clutch-sleeve out of engagement with the spoke-disk for releasing the cog-sleeve from the disk, a lever for operating the rod and a spring extension formed integral with the lever and interposed between the lever and rod for forcing the rod into the aperture in the cog-sleeve after the clutch-sleeve has been moved the required distance, substantially as described.

5. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a spoke-disk rotatably supported on the sprocket-sleeve, a gear-wheel rigid on the sprocket-sleeve, a cog-sleeve rotatably supported on the supporting-shaft having cogs thereon, differential pinions journaled on the spoke-disk and rigidly secured together, one pinion meshing with the gear-wheel and the other pinion meshing with the cog-sleeve, a clutch-sleeve slidingly secured on the cog-sleeve, a coiled spring surrounding the cog-sleeve and bearing against the clutch-sleeve for normally clutching the clutch-sleeve to the spoke-disk, and means for sliding the clutch-sleeve out of engagement with the spoke-disk against the tension of the spring for releasing the cog-sleeve from the disk and locking the cog-sleeve from rotation, substantially as described.

6. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying a sprocket rotatably supported on the shaft, a casing and spoke-disk rotatably supported on the shaft, the casing and spoke-disk being formed integral, a gear-wheel rigid on the sprocket-sleeve and within the casing, a cog-sleeve rotatably supported on the shaft having cogs on its inner end and extending within the casing, a cone-nut on the shaft for holding the cog-sleeve in position extending within the casing and provided with an aperture, the cog-sleeve and sprocket-sleeve arranged to revolve independent of each other, differential pinions journaled within the casing and rigidly secured together, one pinion meshing with the gear-wheel and the other pinion meshing with the cogs on the cog-sleeve, means for clutching the cog-sleeve to the spoke-disk and means extending through the aperture in the cone-nut for unclutching the cog-sleeve from the spoke-disk and locking it from rotation, substantially as described.

7. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a cone-nut rigidly secured to the opposite end of the shaft, a spoke-disk rotatably supported on the sprocket-sleeve and cone-nut, a gear-wheel rigid on the sprocket-sleeve, a cog-sleeve rotatably supported on the supporting-shaft

and prevented from longitudinal outward movement by the cone-nut, differential pinions journaled on the spoke-disk and rigidly secured together, one pinion meshing with the gear-wheel and the other pinion meshing with the cogs on the cog-sleeve, means for clutching the cog-sleeve to the spoke-disk, and means for unclutching the cog-sleeve from the spoke-disk and locking the said sleeve from rotation, substantially as described.

8. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying the sprocket rotatably supported on the shaft, a spoke-disk rotatably supported on the sprocket-sleeve, a cog-sleeve rotatably supported on the shaft, gearing connecting the cog-sleeve to the spoke-disk and the spoke-disk to the sprocket-sleeve, means for clutching the cog-sleeve to the spoke-disk and means for unclutching the cog-sleeve from the spoke-disk and locking it from rotation, substantially as described.

9. In a changeable gear for bicycles, the combination with a supporting-shaft, of a sprocket-sleeve carrying a sprocket rotatably supported on the shaft, a casing and spoke-disk rotatably supported on the sprocket-sleeve, the casing and spoke-disk being formed integral, a gear-wheel rigid on the sprocket-sleeve and within the casing, a cog-sleeve rotatably supported on the shaft having cogs on its inner end and extending within the casing, the cog-sleeve and sprocket-sleeve arranged to revolve independent of each other, differential pinions journaled within the casing and rigidly secured together, one pinion meshing with the gear-wheel and the other pinion meshing with the cogs on the cog-sleeve, means for clutching the cog-sleeve to the spoke-disk, and means for unclutching the cog-sleeve from the spoke-disk and locking it from rotation, substantially as described.

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

JACOB REDDING.

Witnesses:

IREDEL FRAZIER,

FOSTER G. HUDDLESTON.