No. 836,738. PATENTED NOV. 27, 1906.

J. S. COPELAND.

DRIVING MECHANISM FOR BICYCLES.

APPLICATION FILED JULY 3, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

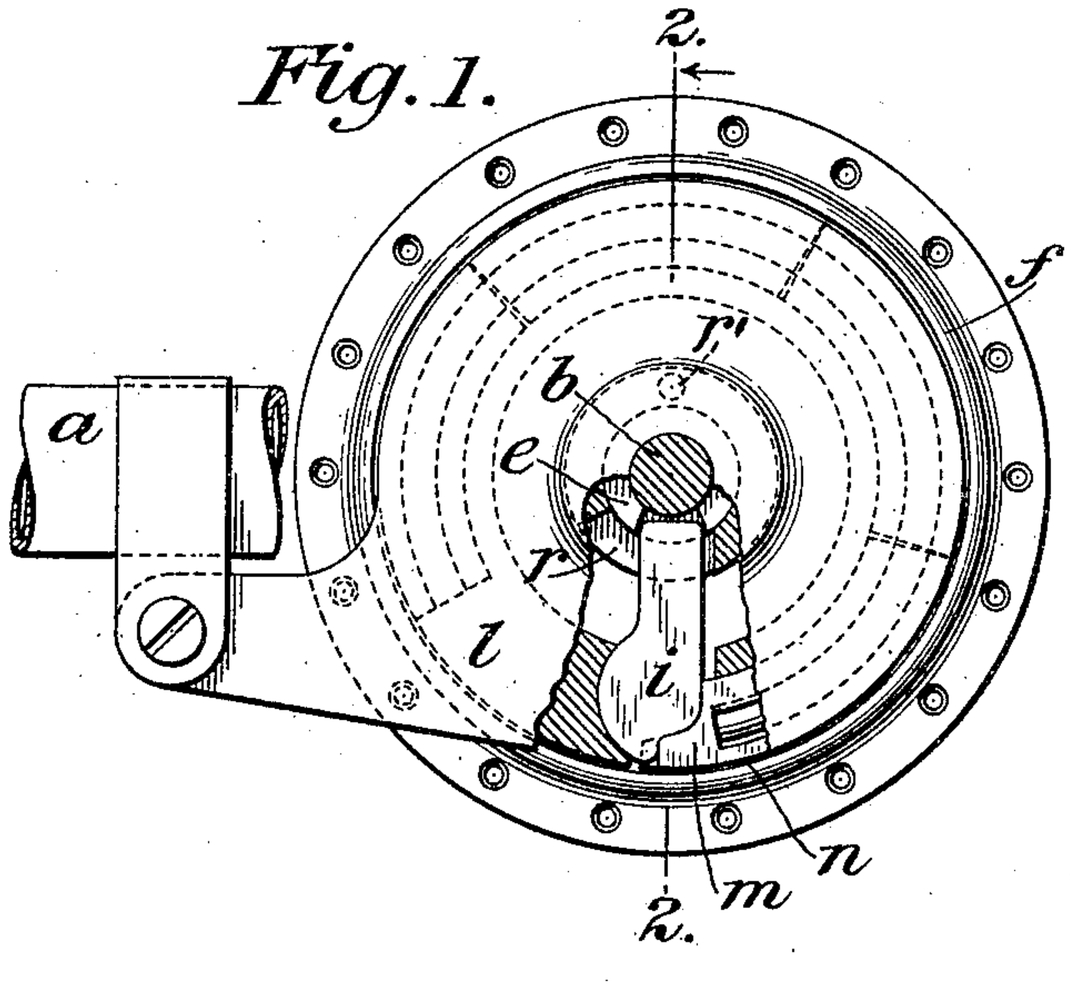
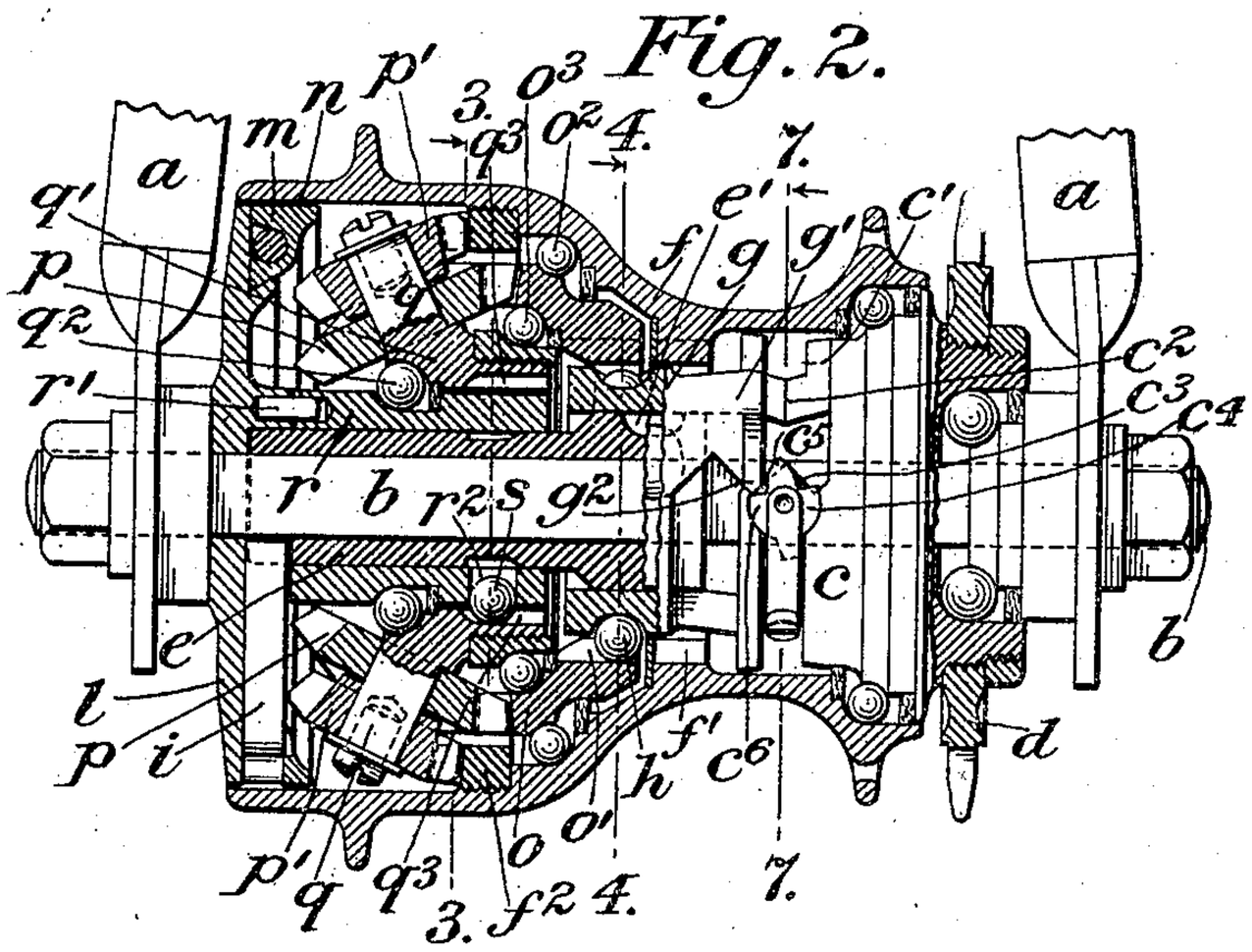


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

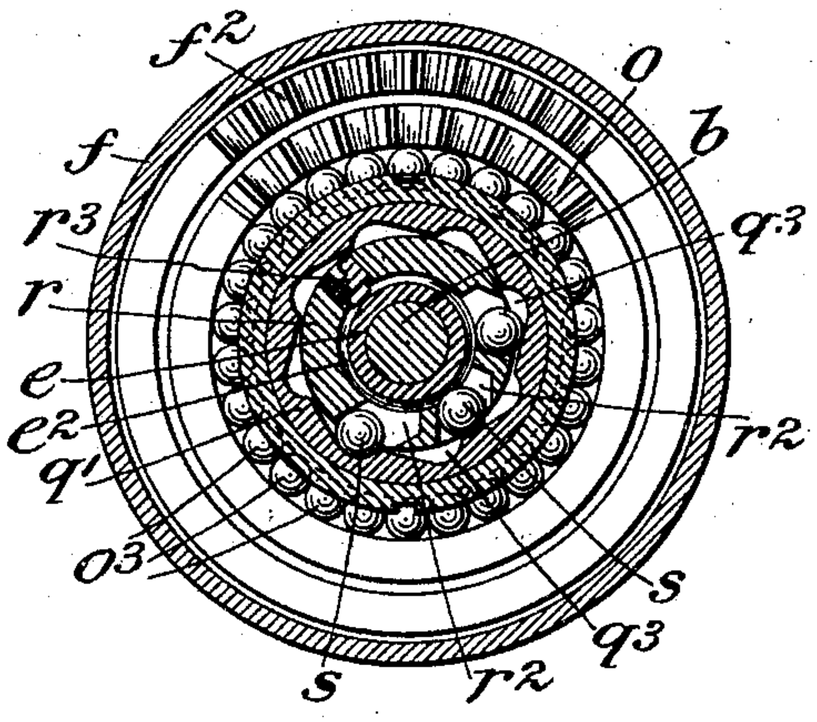


Fig. 4.

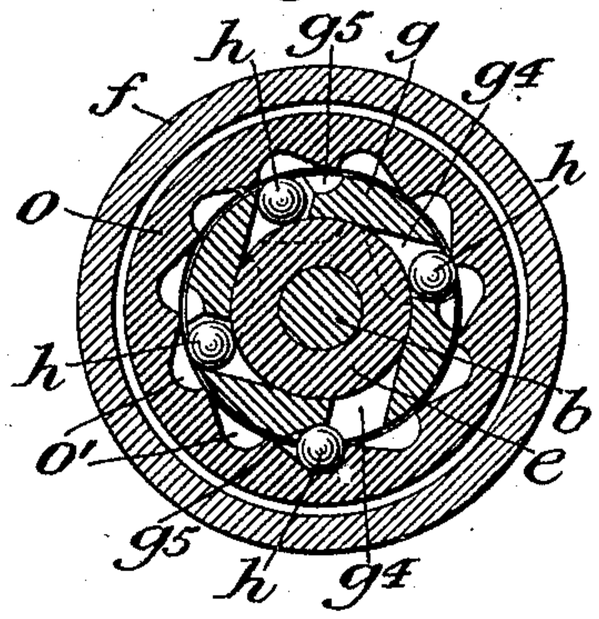


Fig. 5.

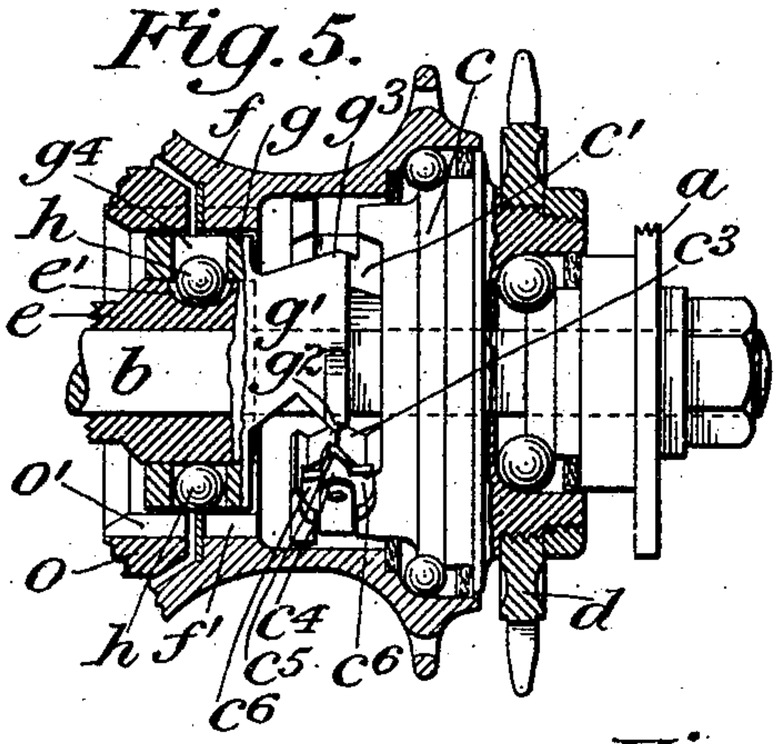


Fig. 6.

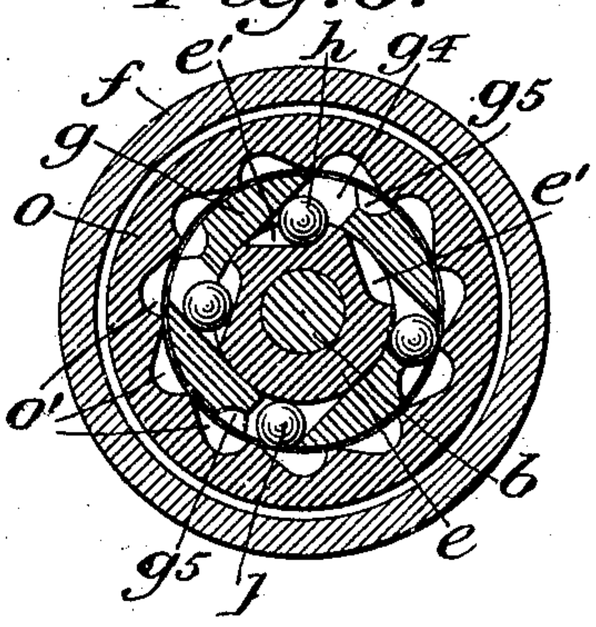
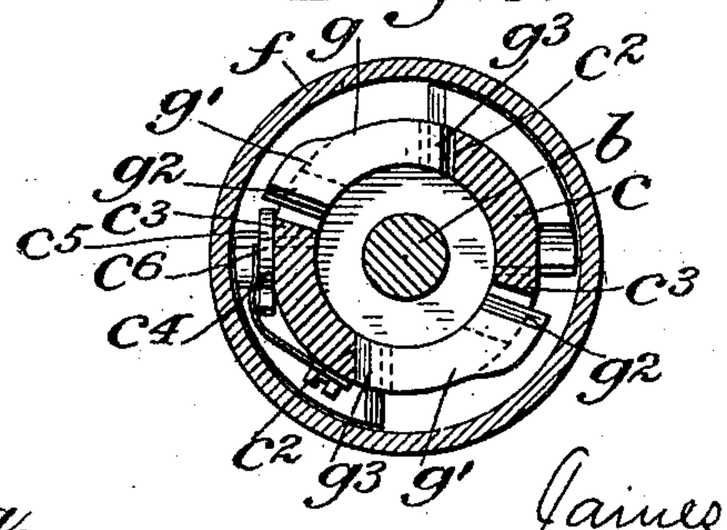


Fig. 7.



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UNITED STATES PATENT OFFICE.

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DRIVING MECHANISM FOR BICYCLES.

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To all whom it may concern:

Be it known that I, JAMES S. COPELAND, a citizen of the United States, residing at Hartford, county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Driving Mechanism for Bicycles, &c., of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates particularly to driving mechanism for the propulsion of bicycles and other purposes in which provision is made for different speeds, and also it may be for permitting the driven part to run freely—that is, to coast—and also for the application of a brake through a backward movement of the driving part.

In such mechanisms as heretofore constructed it is usual to provide a direct connection for the lowest speed and to require the interposition of multiplying gears between the driving part and the driven part for the production of the high speed.

One object of the present invention accordingly is to provide such a construction of the mechanism as will permit the driving part to be coupled directly to the driven part for high speed and to be geared down through reducing-gear for driving at the low speed, whereby the friction of the mechanism, as it ought to be, is least when driving at the high speed.

It is also an object of the invention to enable the driving at high speed or at low speed or the application of the brake to be determined by the shifting of a single part or driving-clutch member, whereby the construction of the mechanism is made as simple as possible and the operation thereof becomes direct and certain.

It is also the object of the invention to improve generally the construction and operation of mechanism of the class referred to, and various features of improvement will be more particularly pointed out hereinafter with reference to the accompanying drawings, in which the invention is illustrated as embodied in a convenient and desirable form of mechanism specially adapted for the propulsion of bicycles.

In the drawings, Figure 1 is a view in elevation as seen from the right-hand side of a bicycle, showing the hub of the rear driving-wheel, a portion of the rear fork, and the brake-disk and arm, the latter being partly broken out to show details of construction. Fig. 2 is a view in section on the plane indicated by the line 2 2 of Fig. 1, the extremities of the rear forks being shown in plan view. Fig. 3 is a transverse section on the irregular plane indicated by the line 3 3 of Fig. 2, the direction of sight being indicated by the arrow near said line. Fig. 4 is a section on the plane indicated by the line 4 4 of Fig. 2, the direction of sight being indicated by the arrow near said line. Fig. 5 is a detail view similar to Fig. 2, but showing some of the parts in different positions. Fig. 6 is a view similar to Fig. 4, but with the plane of section through the clutch-pockets in the brake-actuator. Fig. 7 is a view in transverse section on the plane indicated by the line 7 7 of Fig. 2, the direction of sight being indicated by the arrow near said line.

In the particular form of mechanism which for convenience is illustrated in the drawings as an embodiment of the invention the rear-fork members *a a* of a bicycle-frame of ordinary construction are shown as supporting in usual manner a rear-wheel shaft *b*, upon which is mounted a driver *c*, which may have secured thereto the driving-sprocket *d* and a brake-actuator *e*. The rear-wheel hub *f*, substantially of usual construction, is mounted for rotation and is supported in the present instance upon suitable ball-bearings on the driver *c* and indirectly, as will appear hereinafter, upon a non-rotating sleeve encircling the brake-actuator.

The driver *c* in the construction shown is made to determine the forward driving of the wheel at either of two speeds or the application of a brake, coöperating to this end with a movable clutch member arranged to engage either the high-speed mechanism or the low-speed mechanism or the brake-actuator, such clutch member *g* being shown herein as a sleeve movable longitudinally and carrying pawls, preferably balls *h*, in pockets g^4, which open through the sleeve exteriorly and interiorly, being preferably inclined with respect to the radii of the sleeve and provided at the outer end each with a driving-abutment g^5. The pawls are adapted to engage one of three different parts, as hereinafter described, according to the longitudinal

position of the sleeve g, and this is determined in the present instance by devices which will now be described.

The sleeve g is provided at its end nearest the driver c with one or more longitudinally-projecting heads g', each of which is tapered rearwardly to a knife-edge, as at g^2, and is also tapered forwardly to a knife-edge, as at g^3. The driver c, forming a sleeve of substantially the same diameter as the sleeve g, is recessed longitudinally, as at c', to coöperate with each head g', and at its forward end the recess c' has a tapered notch c^2 to coöperate with the tapered edge g^3 of the head g' for the purpose of centering the sleeve g longitudinally when through relative rotation of the sleeve and driver the edge g^3 is brought into contact with the notch c^2, the coöperation of the inclined sides effecting a longitudinal movement of the sleeve from either direction toward the center. In the middle of the rear end of the recess c' in line with the tapered notch c^2 is a wedge-shaped cam c^3 for coöperation with the rearward edge g^2 of the head g' to throw the sleeve g in one direction or in the other, as determined by a shifting-cam or switch c^4, which, as shown in Figs. 2, 5, and 7, is pivotally mounted upon the driver c, being held upon its pivot by a flat spring c^7, bearing on the switch in line with the point of the wedge-shaped cam c^3, such shifting-cam or switch having a point c^5, which extends slightly beyond the extremity of the wedge-shaped cam c^3, and lateral shoulders c^6, which overlap the sides of the wedge-shaped cam c^3.

It will be seen that when the head g' has been centered by a relative backward movement of the driver c and the driver is then given a relative forward movement the point or edge g^2 of the head g' will strike the point c^5 of the switch or shifting-cam c^4 and will be deflected by it to one side and that in the continued relative forward movement of the driver c the edge g' striking, for example, the right-hand wing c^6 of the switch will rock the switch upon its pivot, so that the switch will throw the head, and with it the sleeve g, to the right, for example. When the head has been centered again by a relative backward movement and such movement is succeeded by a relative forward movement, the head striking the other side of the point of the switch which was left in its deflected position will be deflected in the opposite direction, also rocking the switch in the opposite direction and throwing the sleeve g to the left.

As hereinbefore stated, the sleeve g forms a clutch member common to the high-speed mechanism, the low-speed mechanism, and the brake-actuator, the pawls h carried thereby being shifted into engagement with one or the other of these parts.

The construction herein described makes it possible to engage the driver directly with the hub f or whatever the driven part may be instead of engaging it indirectly through multiplying-gears, as is usual, by which power is consumed in friction when in order to attain the highest speed the friction to be overcome ought to be a minimum. This improved arrangement of course implies the interposition of reducing-gears between the driver and the driven part for slow speed; but the friction of such gears is then least objectionable, and, moreover, in the described construction it is reduced to a minimum. Accordingly when the pawl-carrier or clutch member g is in its extreme right-hand position the pawls h carried thereby will be in position to engage driving-pockets f', formed interiorly in the hub f. When the pawl-carrier or clutch member is in its intermediate position, the pawls or balls h carried thereby will be in line with the pockets e', formed in the brake-actuator e, so that upon a backward relative movement of the driver c the brake-actuator will receive a partial backward rotation to apply the brake. Any suitable brake mechanism may be employed.

As shown in the drawings, the brake-actuator e is slotted at its extremity to engage a brake-actuating lever i, (shown in Figs. 1 and 2,) the same being pivotally mounted on a fixed cap l, its rounded head engaging a corresponding socket, as shown in Fig. 1, so that by its movement the segmental anchored brake-ring m is expanded against the internal brake-surface n on the wheel-hub f, checking the rotation of the wheel.

In the extreme left-hand position of the pawl-carrier or clutch member g its pawls or balls h are in line with the pawl-pockets o' of a slow-driving gear o, between which and the wheel-hub f or other driven part is interposed a suitable reducing-gear.

As shown in the drawings, the slow-driving gear o is an annular or crown gear mounted between ball-bearings o^2 on the wheel-hub f and o^3 on an inner hub or sleeve. The gear o meshes with the larger of a pair of pinions p p', the smaller of which engages a gear f^2, formed on or secured to the wheel-hub or driven part f. The pinions p and p', of which there may be several pairs, are mounted so as to revolve bodily with the hub f when it is being driven at high speed in order that no power shall be wasted in overcoming the friction of these gears. They are also mounted so as to be held from bodily revolution when the wheel-hub or driven part is being driven through said pinions at the slow speed. Accordingly the pinions of each pair are mounted to rotate together upon a stud q, which is secured on or forms a part of a sleeve q', the latter being mounted between the bearings o^3 above mentioned and bearings q^2 on a sleeve r, which encircles the brake-actuator e. The sleeve r is held from

rotation as by a pin r', which engages the fixed cap l, and it is provided with a series of pawl-pockets r^2, carrying pawls or balls s, which are adapted to engage pockets q^3, formed interiorly in the sleeve q', the pockets being disposed, as shown in Fig. 3, in such manner as to permit forward rotation of the sleeve q' and to prevent backward rotation thereof. A screw-stud r^3, carried by the sleeve r, engages an annular slot e^2 in the brake-actuator e to prevent relative longitudinal displacement of the parts.

The operation of the mechanism will now be understood. If the parts are in the position shown in Fig. 2 and the driver c is rotating in a forward direction with the pawl-carrier or clutch member g in its left-hand position, the pawls h will then engage the slow driving-gear o, and the latter, acting through the reducing-gears p and p', will drive the hub or driven part f at the slow speed, any stress tending to revolve the reducing-pinions backward being resisted by the pawls s, carried by the fixed sleeve r and engaging the pawl-pockets q^3 in the pinion-carrying sleeve q'. If now a slight backward movement is imparted to the driver c, as by back pedaling the bicycle, the V-shaped notch c^2 of the driver, contacting with the forward edge g^3 of the head g', will center the head g', drawing the sleeve g into its intermediate position, in which the pawls h will engage the pawl-pockets e' of the brake-actuator e, so that the latter will be oscillated to actuate the brake. The switch or shifting cam c^4 being frictionally held is left at each operation in the position to which it was moved by the action of the edge g^2 of the head g' against the corresponding wing of the switch. Consequently if the slight backward movement of the driver c which was necessary to center the head g' be followed immediately by a forward movement of the driver the point c^5 of the switch being then at the left of the central line, and therefore at the left of the edge g^2 of the head g', will deflect the head g' slightly to the right, so that it will be engaged by the right-hand side of the wedge-cam c^3, whereby the head will be carried to the right, and in the continued relative forward movement of the driver c the switch or shifting cam will be thrown to the right. When the head g' is drawn to the right, as thus described, the pawls h carried thereby will engage pockets f' of the hub f, and the wheel or other driven part will be rotated at its highest speed. Under these conditions through the engagement of the gear f^2 with the smaller pinion p' both pinions and the slow driving-gear o will be caused to revolve together, whereby the consumption of power in rotating the pinions upon their own axis and also in rotating the gear o will be avoided.

It will be understood that a change from high speed to low speed, or vice versa, is secured by a slight backward movement of the driver, followed immediately by a continued forward movement, and that the application of the brake is secured by a continued backward pressure upon the driver.

It is obvious that various features of the invention can be embodied in other forms of mechanism than that shown and described herein and that the invention is not necessarily limited in its application to the propulsion of bicycles. Hence the invention is not to be limited to the particular form and arrangement shown and described herein.

I claim as my invention—

1. The combination of a driver, a driven part, a brake-actuator, change-speed gearing in operative relation with said driven part and a movable clutch member in operative relation with said driver adapted to engage said driven part, said change-speed gearing or said brake-actuator.

2. The combination of a driver, a driven part, a brake-actuator, change-speed gearing in operative relation with said driven part, a movable loose pawl-carrier in operative relation with said driver, and means to shift said carrier to place its pawls in operative relation with said driven part, said change-speed gearing or said brake-actuator.

3. The combination of a driver, a driven part, a brake-actuator, change-speed gearing in operative relation with said driven part, and a movable ball-clutch carrier in operative relation with said driver and means to shift said carrier to place its balls in operation with said driven part, said change-speed gearing or brake-actuator.

4. The combination of a driver, a driven part, a brake-actuator, change-speed gearing in operative relation with said driven part, said driven part, actuator and gearing having clutch-engaging devices in different longitudinal planes, a movable clutch-carrier in operative relation with said driver, and means to shift said carrier to place its clutch devices in operative relation with the clutch-engaging devices of the driven part, actuator and gearing.

5. The combination of a driver, a hub having interior clutch-engaging devices, change-speed gearing in operative relation with said hub and having interior clutch-engaging devices, a brake-actuator having exterior clutch-engaging devices, a clutch-carrying sleeve interposed between said hub and change-speed gearing and said brake-actuator, and means to shift said carrier to place its clutch devices in operative relation with said clutch-engaging devices of said hub, gearing and actuator.

6. The combination of a driver, a hub having interior pawl-pockets, a slow-speed gear mounted within the hub and having interior pawl-pockets, reducing-gear interposed be-

tween said slow-speed gear and said hub, a loose pawl-carrier in operative relation with said driver, and means to shift said carrier to place its pawls in position to engage the pawl-pockets of said hub or said gear.

7. The combination of a driver, a hub having interior pawl-pockets, a slow-speed gear having interior pawl-pockets, reducing-gearing between said slow-speed gear and said hub, a brake-actuator having external pawl-pockets, a movable sleeve-like loose pawl-carrier disposed between said hub and slow-speed gear and said brake-actuator and in operative relation with said driver and means to shift said carrier to place its pawls in operative relation with the pawl-pockets of said hub, said slow-speed gear or said brake-actuator.

8. The combination of a driver, a hub having interior ball-pockets, a slow-speed gear having interior ball-pockets, reducing-gear between said slow-speed gear and said hub, a movable sleeve-like carrier having ball-pockets and balls therein and in operative relation with said driver and means to shift said carrier to place the balls carried in its pockets in operative relation with the ball-pockets of said hub, or said slow-speed gear.

9. The combination of a driver, a hub having interior ball-pockets, a slow-speed gear having interior ball-pockets, reducing-gearing between said slow-speed gear and said hub, a brake-actuator having exterior ball-pockets, a movable sleeve-like carrier having ball-pockets and balls therein and in operative relation with said driver, said carrier being interposed between said hub and said slow-speed gear and said brake-actuator, and means to shift said carrier to place its balls in operative relation with the ball-pockets of said hub, gear or actuator.

10. The combination of a driver, a driven part, change-speed gearing in operative relation with said driven part, said change-speed gearing being mounted to revolve idly with said driven part, a clutch member in operative relation with said driver and means actuated by the relative rotation of the parts to place said clutch member in operative relation with said driven part or said change-speed gearing.

11. The combination of a driver, a driven part, change-speed gearing in operative relation with said driven part, said change-speed gearing being mounted to revolve idly with said driven part in one direction, means to prevent revolution of said gearing in the opposite direction, a clutch member in operative relation with driver and means to place said clutch member in operative relation with the driven part or said reducing-gearing.

12. The combination of a driver, a driven part, a clutch member in operative relation with said driver, an independent annular or crown gear adapted to be engaged by said clutch member, an independent rotatable gear-carrier and change-speed gears mounted on said carrier and engaging said annular or crown gear and said driven part.

13. The combination of a driver, a driven part, a clutch member in operative relation with said driver, an independent annular or crown gear adapted to be engaged by said clutch member, a loosely-mounted independent rotatable gear-carrier and change-speed gears mounted on said carrier and engaging said annular or crown gear and said driven part.

14. The combination of a driver, a driven part, a clutch member in operative relation with said driver, an annular or crown gear adapted to be engaged by said clutch member, a gear-carrier mounted to rotate freely in one direction, means to prevent rotation thereof in the opposite direction, change-speed gears mounted on said carrier and engaging said annular or crown gear and said driven part.

15. The combination of a driver, a driven part, a clutch member in operative relation with said driver, an annular or crown gear adapted to be engaged by said clutch member, a fixed loose pawl-carrier, a gear-carrying sleeve mounted to rotate about said pawl-carrier and adapted to be engaged by said pawl to permit rotation in one direction and change-speed gears mounted on said gear-carrying sleeve and engaging said annular or crown gear and said driven part.

16. The combination of a driver, a driven part, a longitudinally-movable clutch member, independent connections whereby said driven part may be driven at different speeds from said clutch member, and a shifting cam or switch mounted on the driver part and adapted to engage said clutch member to shift the same alternately in different directions.

17. The combination of a driver, a longitudinally-movable clutch member having a loose connection with said driver, and a shifting cam or switch mounted movable on the driver to rotate therewith and adapted to engage said clutch member and through its own movement to shift the same alternately in opposite directions.

18. The combination of a driver, a longitudinally-movable clutch member having a loose connection with said driver, means coöperating with said driver, and clutch member to center the clutch member upon relative movement of the driver in one direction and a shifting cam or switch mounted on the driver and adapted to engage said clutch member to shift the same in one direction or the other upon relative forward movement of the driver.

19. The combination of a driver, a longitudinally-movable clutch member, the driver

and the clutch member having the one a recess and the other a head loosely engaging the recess, a cam-notch at one end of said recess to determine the position of the clutch member upon relative movement of the driver in one direction, and means at the other end of said recess to shift said clutch member longitudinally in one direction upon relative movement of the driver in the opposite direction.

20. The combination of a driver, a longitudinally-movable clutch member, said driver and said clutch member having the one a recess and the other a head loosely engaging the recess, said recess having at one end a cam-notch to determine the position of the clutch member upon relative rotation of the driver in one direction, a shifting cam or switch at the other end of said recess and engaged by said head alternately on opposite sides at successive operations to shift the clutch member longitudinally in one direction or the other.

21. The combination of a driver, a longitudinally-movable clutch member, said driver and said clutch member having the one a recess and the other a head loosely engaging said recess, one end of said recess having a cam-notch to center the clutch member and the other end of said recess having a wedged cam and a cam-switch to engage said head and shift the clutch member in one direction or the other.

22. The combination of a driver, a clutch member, said driver and said clutch member having the one a recess and the other a head loosely engaging said recess, and a switch-cam pivoted at one end of said recess and having a central point to be engaged and deflected by the head and lateral members to be engaged by said head to throw the switch-point in one direction or the other.

This specification signed and witnessed this 30th day of June, 1905.

JAMES S. COPELAND.

In presence of—

GEORGE POPE,

F. N. WEGNER.