No. 655,558. Patented Aug. 7, 1900.

M. C. JOHNSON.

VARIABLE SPEED MECHANISM.

(No Model.) (Application filed Jan. 20, 1900.) 4 Sheets—Sheet 1.

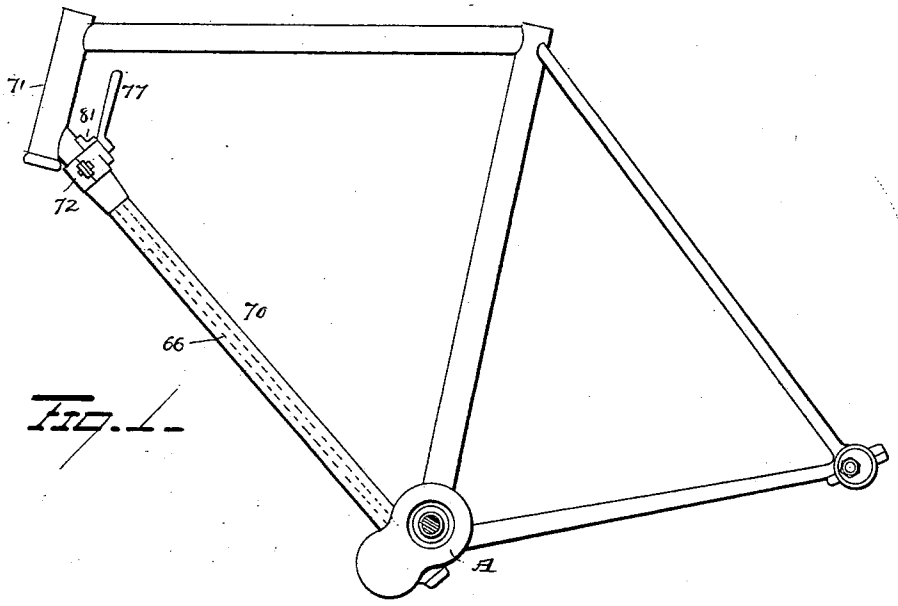


FIG. 1.

FIG. 6.

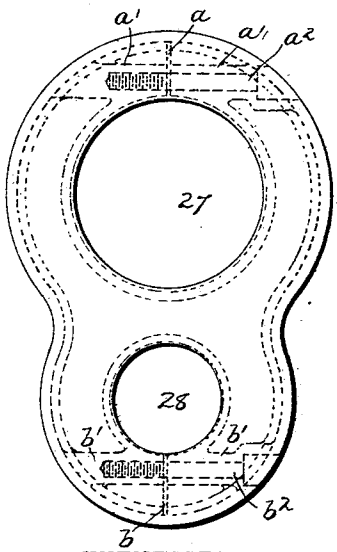


FIG. 7.

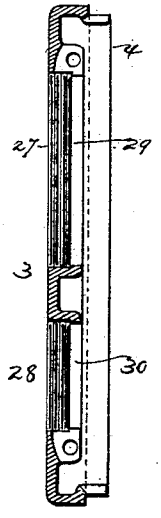


FIG. 8.

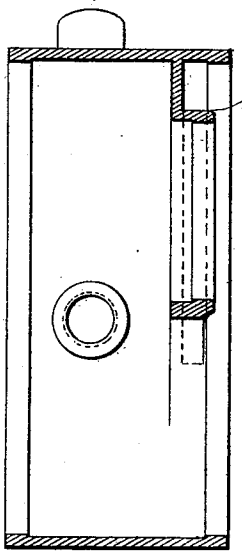
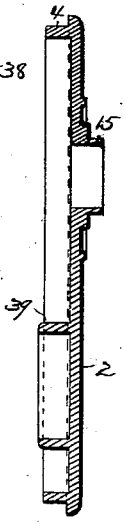


FIG. 9.



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VARIABLE SPEED MECHANISM.

(Application filed Jan. 20, 1900.)

(No Model.) 4 Sheets—Sheet 2.

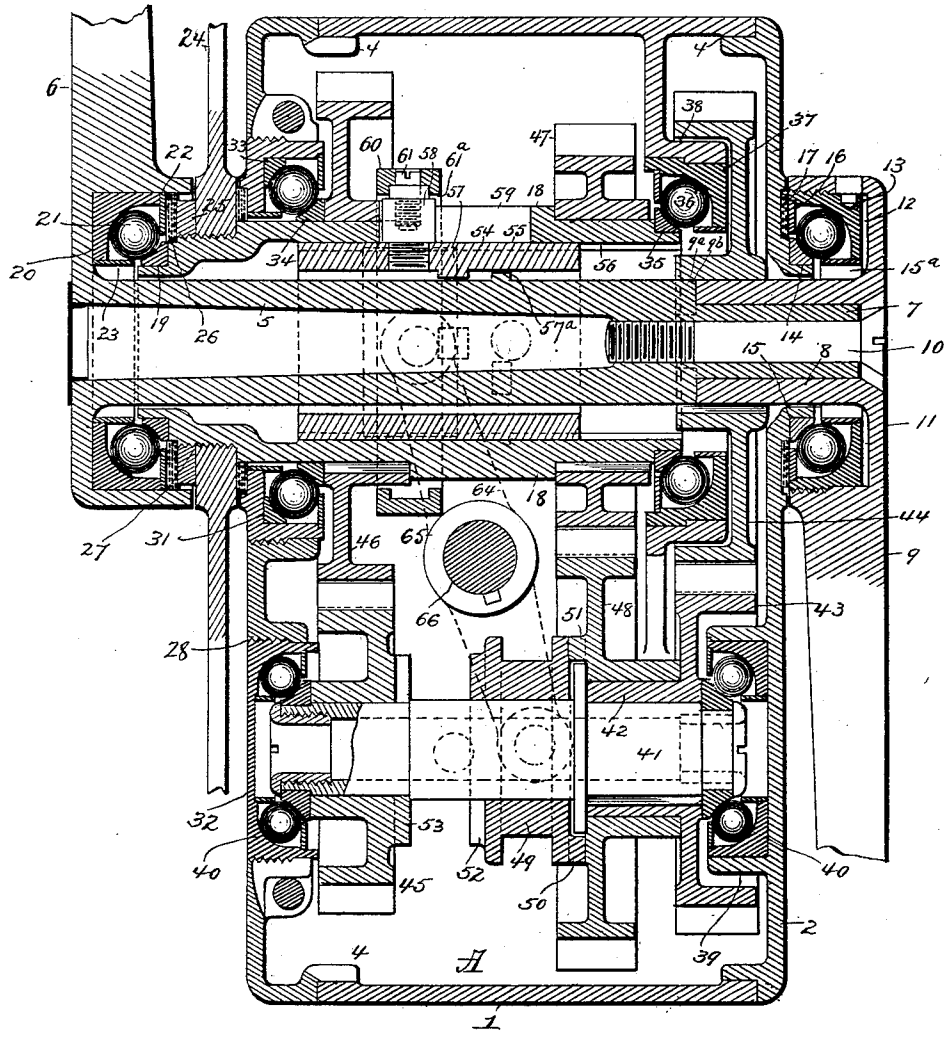

Fig. 2.

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VARIABLE SPEED MECHANISM.

(Application filed Jan. 20, 1900.)

(No Model.) 4 Sheets—Sheet 3.

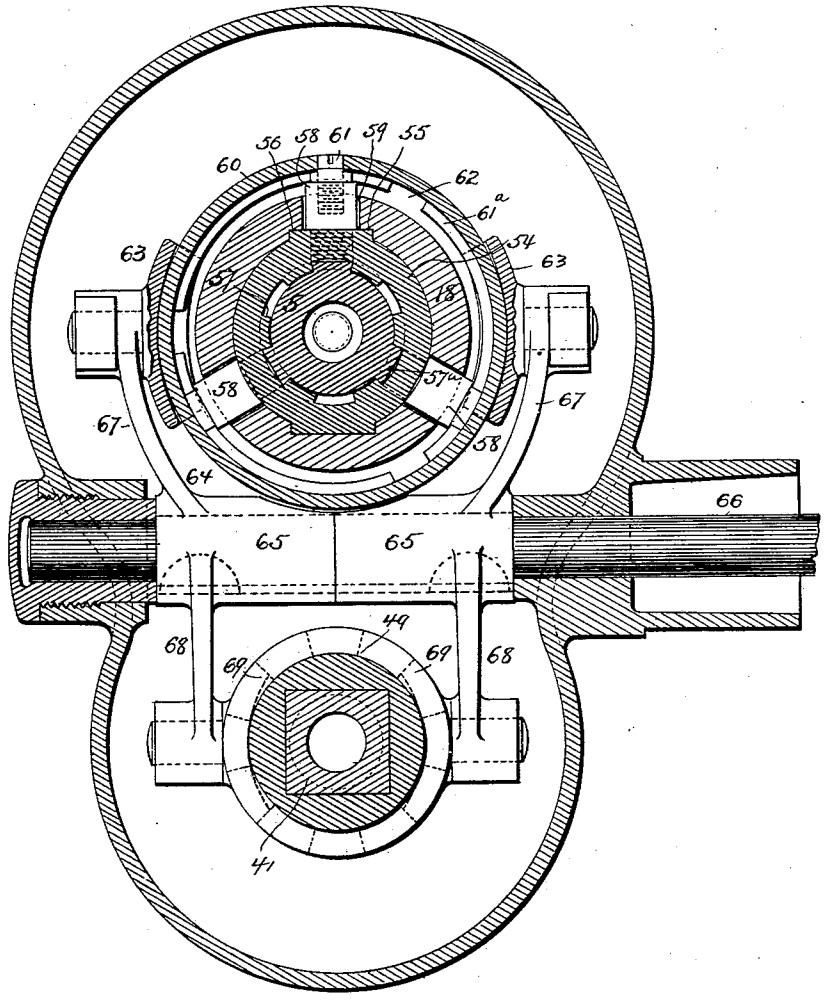

FIG. 3.

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VARIABLE SPEED MECHANISM.

(Application filed Jan. 20, 1900.)

(No Model.) 4 Sheets—Sheet 4.

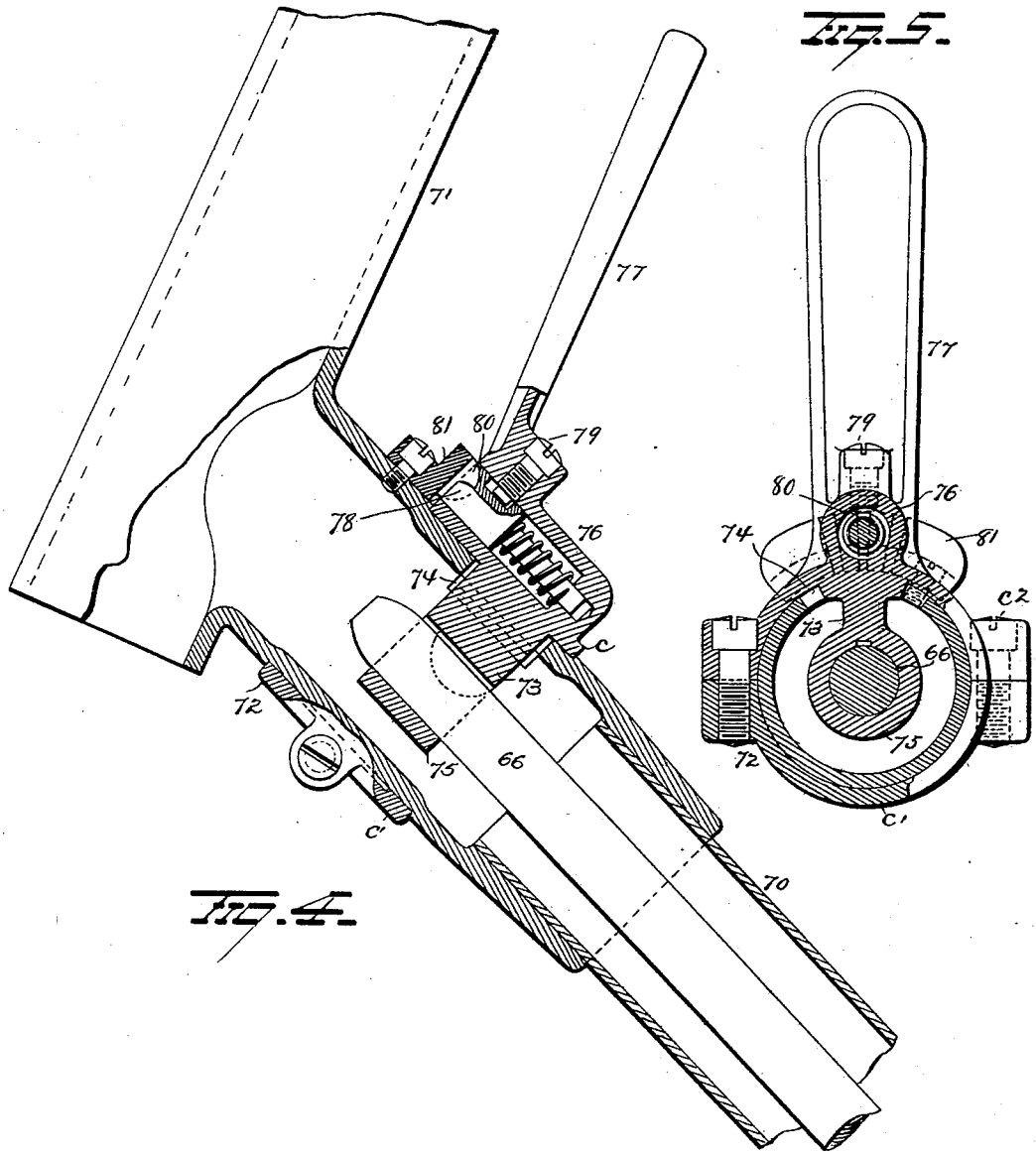

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

MOSES C. JOHNSON, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE HELIX GEAR COMPANY, OF SAME PLACE.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 655,558, dated August 7, 1900.

Application filed January 20, 1900. Serial No. 2,149. (No model.)

To all whom it may concern:

Be it known that I, MOSES C. JOHNSON, a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Variable-Speed Mechanism; 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 an improvement in driving mechanism, and more particularly to appliances adaptable for use in the propulsion of vehicles at different speeds, the object of the invention being to provide simple and efficient means for changing the speed of a driven shaft, wheel, or device while the same is in motion and causing it to rotate at one of three different speeds.

With this object in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of a bicycle having my improvements applied thereto. Fig. 2 is a sectional view through the gearing and its casing. Fig. 3 is a section taken at right angles to Fig. 2, with some of the parts removed. Figs. 4 and 5 are views showing the details of the controlling devices. Figs. 6, 7, 8, and 9 are views illustrating details of the casing.

A represents a casing, which may, as shown in the drawings, be the crank-hanger of a bicycle-frame and which comprises a body portion 1, of a size and shape to accommodate the gearing, and face-plates 2 3, inclosing the gearing within said body portion, said face-plates being provided at their outer edges with flanges or lugs 4, which enter the body portion 1 and are secured thereto by means of screws or in any other suitable manner.

When my improvements are employed for propelling a bicycle or other machine to which power is applied by means of crank-arms, I may adopt the construction shown in Fig. 2, although this same arrangement of driving-shaft may be used with other means of applying power by substituting gear wheels or pulleys for the crank-arms and providing any suitable gearing or belting for driving said gear wheels or pulleys.

In the drawings I have shown a tubular driving-shaft 5, one end of which is made integral with the crank or pedal arm 6, and the other end of said tubular shaft is made with a shank 7 for the reception of a sleeve or elongated boss 8, made integral with the other crank or pedal arm 9, the end of said sleeve or boss having lugs 9^a to enter sockets 9^b in the shaft 5 to prevent these parts from turning relatively to each other. A screw 10 passes through the enlarged end 11 of the crank-arm 9 and through the shank 7 and is screwed into a threaded portion of the tubular shaft 5. The enlarged end 11 of the arm 9 is made with an annular recess 12 for the reception of a bearing-ring 13, and a bearing-cone 14 is supported by a flange 15 on the face-plate 2. Balls are disposed between the rings or cones 13 14, thus forming ball-bearings for one end of the driving-shafts. Rings 15^a and 16 may be employed to retain the balls properly in place, and a felt washer 17 will preferably be located between the ring 16 and the face-plate 2. A sleeve 18, (which constitutes the driven shaft,) appreciably larger in diameter than the external diameter of the driving-shaft 5, is disposed within the casing and incloses the major portion of said shaft. One end of the sleeve 18 is contracted in size and carries a bearing ring or cone 19. Another bearing ring or cone is secured in the enlarged end 20 of the crank-arm 6, and between said bearing rings or cones balls 21 are disposed, said balls being retained properly in place by means of rings 22 23. From the above description it will be observed that the driving-shaft has a bearing at one end on one of the face-plates of the casing and at the other end on the end of sleeve 18. The contracted portion of the sleeve 18 is threaded for the reception of the threaded hub of a sprocket-wheel 24 (or other motion-transmitting device,) and a collar 25 is screwed on said sleeve and made to bear against the sprocket-wheel. Between the collar 25 and the retaining-ring 23 a felt washer 26 is disposed.

The face-plate 3 is made with two openings 27 28, coincident with the walls of which

threaded flanges 29 30 project inwardly. The upper end of the face-plate 3 is split, as shown at a, and provided with bosses a' a' for the passage of a bolt a^2 for the purpose of clamping a threaded bearing-cup 31 in the opening 27 when said cup shall have been properly adjusted. The lower end of the face-plate 3 is also split, as at b, and provided with bosses b' for the accommodation of a bolt b^2 for clamping a threaded bearing-cup 32 in the opening 28 in said face-plate. A bearing cone or ring 33 is located in the bearing-cup 31, and a similar bearing cone or ring 34 is disposed on the sleeve 18. Balls are arranged between these rings or cones to form a bearing for one end of the sleeve 18. The other end of the sleeve 18 is provided with a cone or ring 35 for the accommodation of balls 36, and the latter also bear against a ring 37, supported in a holder 38, cast in the casing.

The lower portion of the face-plate 2 is provided on its inner face with an annular flange, which constitutes a bearing-cup 39 in line with the bearing-cup 32 in the opposite face-plate 3. The bearing-cups 32 and 39 are made with bearings for balls 40, which constitute the bearings for the respective ends of a shaft 41. The hub 42 of a gear-wheel 43 is keyed to the shaft 41, near one end thereof, said wheel being provided with, say, twenty-five teeth, and it receives motion from a larger gear-wheel 44, having, say, thirty-five teeth, keyed to the driving-shaft 5. A gear-wheel 45 is mounted loosely near the other end of the shaft 41 and is of a smaller size than the gear 43, preferably having twenty-two teeth. The gear 45 meshes with a large gear-wheel 46, having, say, thirty-eight teeth, keyed to the large sleeve 18, near the end thereof, to which the sprocket-wheel 24 is secured. A gear-wheel 47, having, say, thirty teeth, is keyed to the other end of the large sleeve 18 and meshes with a gear-wheel 48, having the same number of teeth, mounted loosely on the hub 42 of the gear-wheel 43.

The intermediate portion of the shaft 41 may be made angular for the accommodation of a sliding clutch-collar 49, having teeth or lugs 50 on one face to engage similar teeth or lugs 51 on the loose gear 48, and having teeth or lugs 52 on its other face to engage teeth or lugs 53 on the loose gear 45, and thus lock one or the other of said loose gears to the shaft 41 when the clutch-collar is shifted in one direction or the other.

A clutch-sleeve 54 is disposed between the driving-shaft 5 and the large sleeve 18 and is made with angular portions 55, which enter grooves 56 in the inner face of the sleeve 18, so that said clutch-sleeve 54 will rotate with the sleeve 18 and also be capable of being shifted longitudinally therein. The clutch-sleeve 54 is provided internally with teeth or lugs 57, which when said sleeve is shifted in one direction will interlock with similar teeth or lugs 57^a on the driving-shaft, and thus connect the latter with the sleeve 18, carrying the sprocket-wheel 24. The clutch-sleeve has a series of radiating arms or lugs 58 screwed thereto, and these project freely through slots 59 (appreciably larger in diameter than said arms or lugs) in the sleeve 18. The arms or lugs 58 project beyond the peripheral face of the sleeve 18 and are secured to a ring 60 by means of screws 61. The ring 60 is provided at each edge with an inwardly-projecting flange 61^a, and these flanges are notched at intervals, as at 62, to permit the ready assembling of the parts. The ring 60 is embraced at diametrically-opposite points by jaws 63, through which it freely rotates. The jaws 63 are carried by a lever 64, by means of which the clutch-sleeve 54 is shifted to lock the driving-shaft with the sleeve 18 or unlock it therefrom. The lever 64 may conveniently comprise two sleeves 65, keyed to a common shaft 66, two upwardly-projecting arms 67, carrying the jaws 63, and two depending arms 68, which latter carry jaws 69, loosely embracing the clutch-collar 49 for the purpose of shifting the same, as will be readily understood. When my improvements are used for propelling a bicycle, the shaft 66 will be extended up through the front reach-bar 70 of the frame and provided with means for operating it near the head 71 of the frame. These operating devices will now be explained.

The upper end of the front reach-bar 70 is countersunk to form a bearing for a collar 72, which is loosely mounted, so as to turn thereon. The collar 72 comprises two parts c c', held together by means of bolts c^2. The part c of the collar 72 is made with an arm 73, which projects through an elongated slot 74 in the reach-bar 70, and is provided at its end with a perforated boss 75 for the reception of the upper end of the shaft 66, to which it is keyed. The part c of the collar has cast with its outer face a box or hollow enlargement 76, and integral with this box or enlargement is an operating arm or lever 77, which projects therefrom at such an angle as to be normally disposed parallel with the head 71 of the frame, or approximately so. A spring-pressed dog 78 is disposed in the box or enlargement 76 and prevented from escape therefrom by means of a screw 79. The end of the head of the dog 78 is made with two beveled faces 80 to ride from one notch to another in segment 81, secured to the reach-bar 70, and adapted to be retained in one or another of said notches. From this construction and arrangement of parts it will be seen that when the arm or lever 77 is moved from one notch of the segment to another the shaft 66 will be turned and the shifting-lever 64 moved to shift the clutch-collar 49 and clutch-sleeve 54. The segment 81 is made with three notches. When the dog 78 of lever 77 is in the central notch, the gearing will be so disposed that the speed of the sprocket-wheel will be that of the crank arms by

means of which motion is imparted to the driving-shaft 5. When the lever 77 is shifted to cause the dog to engage one of the side notches, the gearing will be so disposed as to reduce the speed of the sprocket-wheel, and when the lever is shifted to the other side notch the speed of the sprocket-wheel will be increased. It will be readily seen that when the operating-lever is in its central position the lever 77 will also be in its central position and the clutch-collar will be out of engagement with both gears 45 and 48, but the clutch-sleeve will be in locked engagement with the driving-shaft 5. With this adjustment of the gearing motion imparted to the driving-shaft 5 by the operation of the pedal or crank arms will be transmitted directly to the sleeve 18 and by it to the sprocket-wheel, so that the latter will rotate at the same rate of speed as the driving-shaft and pedal or crank arms attached thereto. This may be termed the "normal" speed of the sprocket-wheel. Should it be desired that the sprocket-wheel shall rotate at a faster rate of speed than the driving-shaft and pedal-arms, the levers will be operated to shift the clutch-collar 49 and clutch-sleeve 54 to the position shown in Fig. 2. In this condition of the gearing motion will be transmitted from the driving-shaft through the large gear 44 to the small gear 43, and this latter gear being keyed to the shaft 41 motion will be transmitted to this shaft at a greater rate of speed than the shaft 5, to which the gear 44 is secured. Motion will be transmitted from the shaft 41, through the clutch-collar 49, to the gear 48 and from the latter to the gear 47, (said gears 48 and 47 being of equal size,) keyed to the sleeve 18, to which the driven or sprocket wheel 24 is secured. Should the operating-lever be now moved to the other end of its throw, the sprocket-wheel would be first reduced to normal speed by the disengagement of the clutch-collar 49 from its gear 48 and the engagement of the clutch-collar 49 with the driving-shaft 5, and then as the complete throw of the operating-lever 77 is reached the clutch-collar 49 will engage the small gear 45 and the clutch-sleeve will release the driving-shaft. Motion imparted to the driving-shaft 5 will now be transmitted to the shaft 41 by means of the gears 44 and 43, and from the shaft 41 motion will be transmitted by the small gear 45 to the large gear 46. The large gear 46 being secured to the sleeve 18, this sleeve and the sprocket-wheel secured to it will be rotated at a speed below the normal.

It is evident that the high and low speeds of the sprocket-wheel relatively to the normal can be readily regulated by properly proportioning the various gears. The high speed may be made many times greater than the normal speed or only a trifle greater, and the low speed may be made decidedly slower than the normal or only slightly lower, by altering the relative sizes of the various intermeshing gears.

When my improvements are used with a bicycle, the rider will have under his control the adjustment of the gearing for three speeds, and these three speeds can be increased or diminished proportionately by merely changing the relative sizes of the wheels of the sprocket-gearing. For example, suppose that the sprocket-gearing is arranged for a "seventy gear" and a slower speed (say fifty-six) is desired. This can be accomplished by operating the lever 77 to lock the gear 45 with the shaft 41; but should a speed higher than seventy be desired (say ninety-eight) the operating-lever 77 would be operated in the reverse direction to effect the locking of the gear 43 with the shaft 41.

I prefer to so arrange the gearing as to make the low speed twenty per cent. below normal and the high speed forty per cent. above normal. Thus if the normal speed be eighty the high speed will be one hundred and twelve and the low speed sixty-four; but these relative proportions may be altered indefinitely, as above explained.

Various slight changes might be made in the details of construction of my invention without departing from the spirit thereof or limiting its scope, and hence I do not wish to limit myself to the precise details herein set forth.

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

1. The combination with a driving-shaft and a driven shaft, of a clutch between the driving and driven shafts, gearing between the driving and driven shafts, a portion of said gearing arranged to increase the speed of the driven shaft and a portion of said gearing arranged to diminish the speed of the driven shaft and means for throwing one or the other portion into action and simultaneously operating the clutch between the driving and driven shafts.

2. The combination with a tubular driven shaft and a driving-shaft passing through the same, of a clutch disposed between said shafts, gearing between said shafts for increasing the speed of the driven shaft, gearing for diminishing the speed of the driven shaft, a clutch for rendering one or the other of said gearings active and means for operating said clutches simultaneously.

3. The combination with a tubular driven shaft and a driving-shaft appreciably smaller in diameter than the driven shaft and passing through it, a clutch-sleeve disposed within the driven shaft and adapted to rotate therewith and have a longitudinal movement relatively thereto, means for connecting said clutch-sleeve with the driving-shaft, a high-speed gearing and a low-speed gearing connecting said shafts, a clutch for making one gearing or the other active and operating devices connected both to said clutch and clutch-sleeve for operating them simultaneously.

4. The combination with a driving-shaft, a driven shaft and a third shaft, of a clutch be-

tween the driving and driven shafts, a gear keyed to the driving-shaft, a smaller gear keyed to the third shaft and meshing with said first-mentioned gear, a large gear keyed to the driven shaft, a smaller gear loose on the third shaft and meshing with the large gear on the driven shaft, intermeshing gears of equal sizes keyed to the driven shaft and loose on the third shaft respectively and a clutch on the third shaft for locking one or the other of the loose gears mounted on said third shaft to the same.

5. The combination with a casing, of a tubular driven shaft mounted therein, of a driving-shaft mounted at one end in the casing and mounted at the other end on the tubular driven shaft, a clutch between said shafts, high and low speed gearings connecting said shafts, a clutch between said gearings and operating means connected with said clutches for operating them simultaneously.

6. The combination with a driving-shaft, of a tubular driven shaft through which the driving-shaft passes, said driven shaft having a series of longitudinal slots, a clutch-sleeve within the tubular driven shaft and adapted to engage the driving-shaft, lugs projecting from said clutch-sleeve and passing through the slots in the driven shaft, a ring secured to said lugs, a lever, jaws carried by said lever and loosely embracing said ring, means for operating said lever, high and low speed gearings between said shafts, a clutch between said high and low speed gearings and connection with said lever and means for operating said lever.

7. The combination with a driving-shaft a driven shaft, low-speed gearing and high-speed gearing between said shafts and a clutch between said low and high speed gearings, of a lever for operating said clutch, an operating-shaft secured to said lever, an oscillatory collar or bracket, an arm projecting from said collar or bracket and secured to said operating-shaft, an operating-handle projecting from said collar or bracket, a notched segment, and a spring-pressed dog carried by the lever and adapted to engage said notched segment.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

MOSES C. JOHNSON.

Witnesses:
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