

No. 675,067.

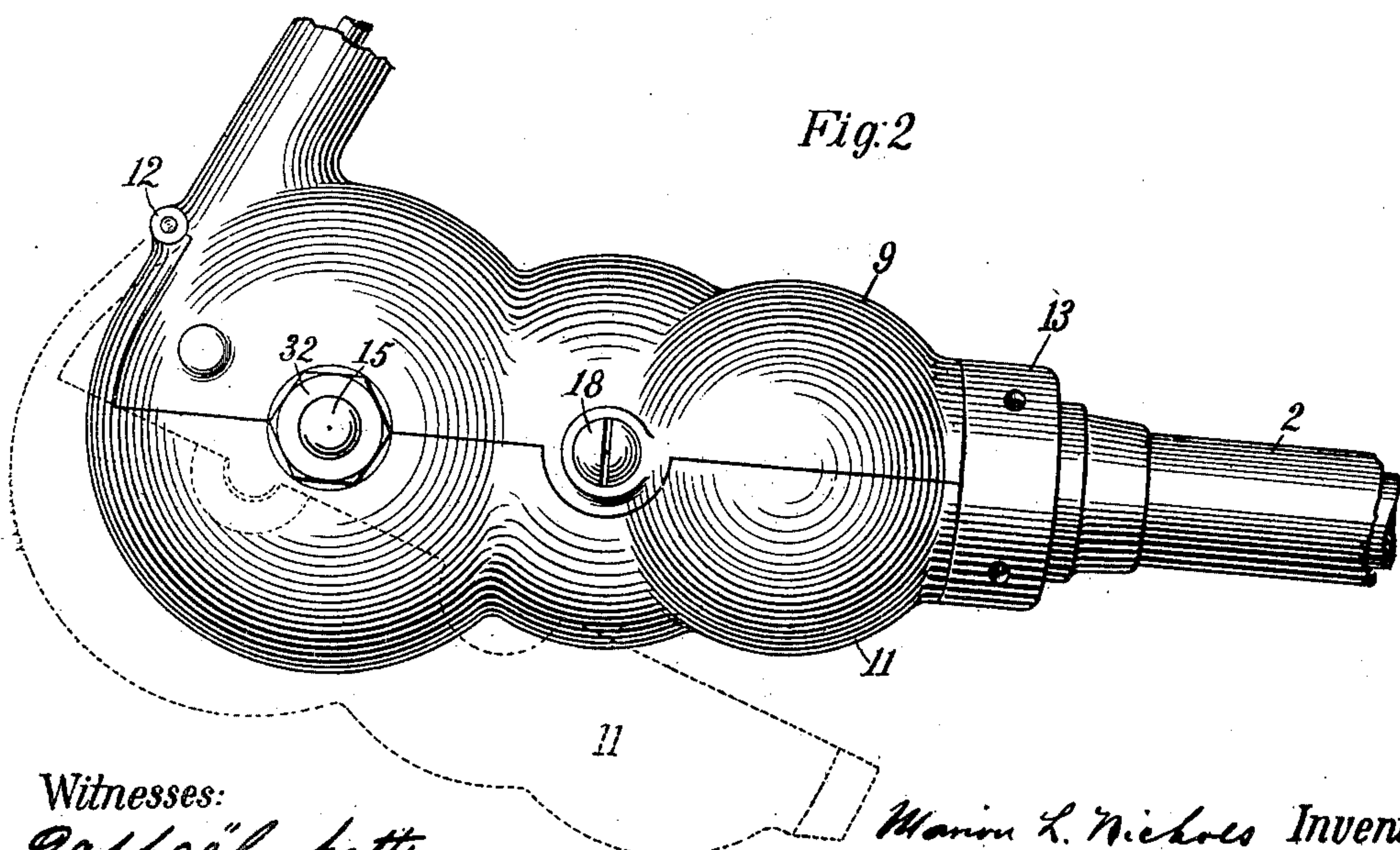
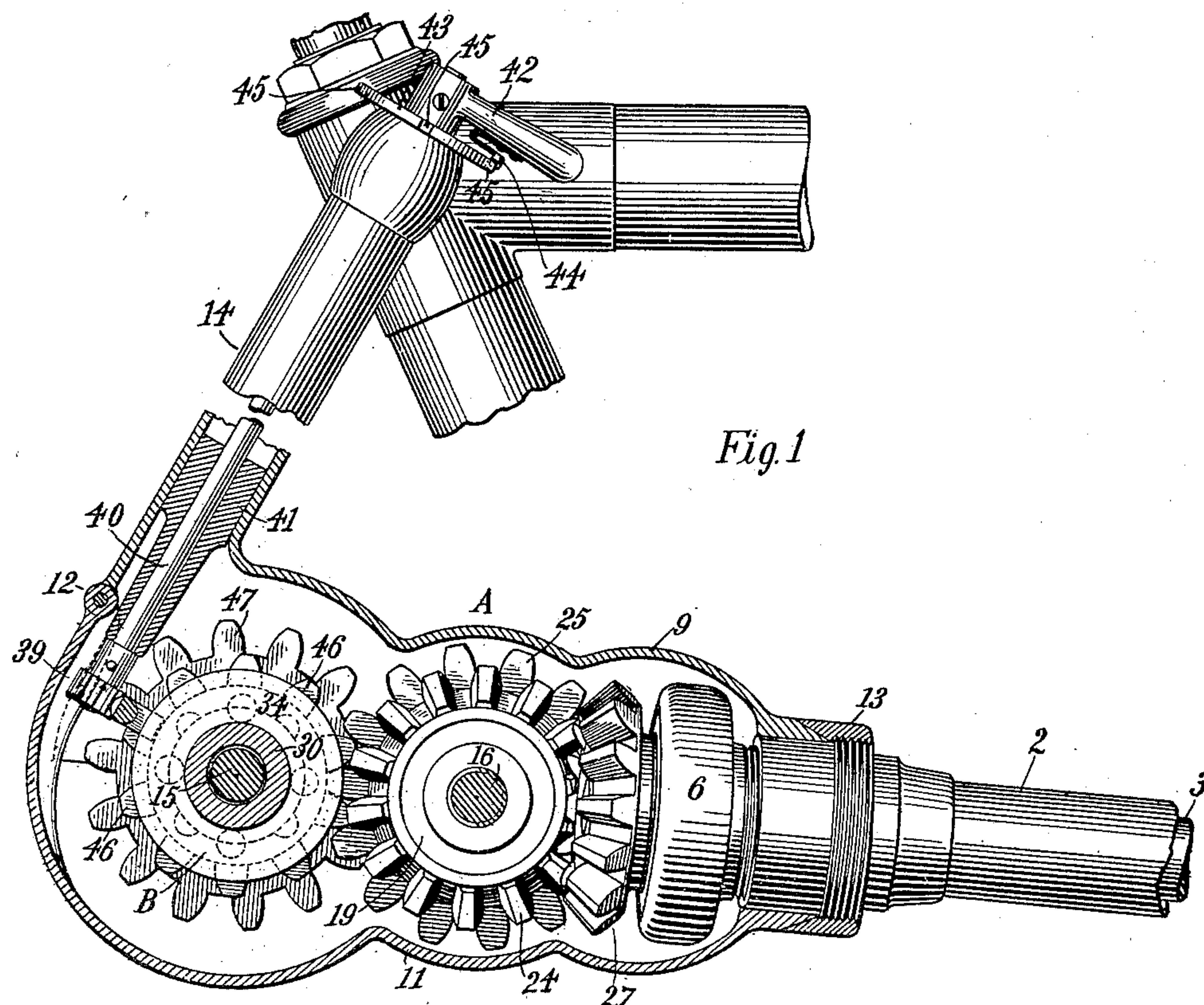
Patented May 28, 1901.

M. L. NICHOLS.
CHANGEABLE SPEED GEAR.

(No Model.)

(Application filed May 28, 1900.)

3 Sheets—Sheet 1.



Witnesses:

Rapphaël Ketter
Augustus Lee Jr

Marion L. Nichols Inventor

by *T. D. Morrison*

ADP

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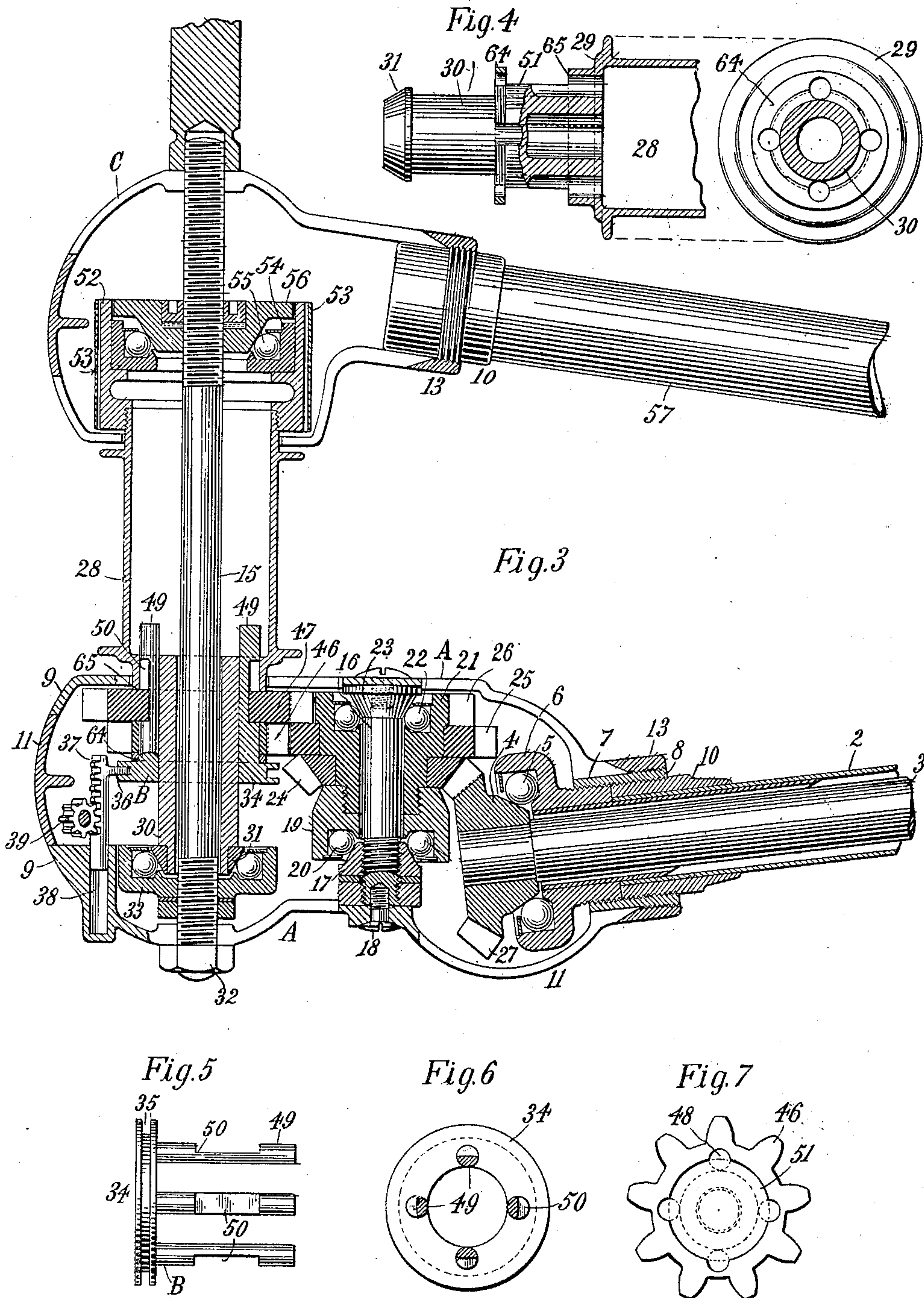
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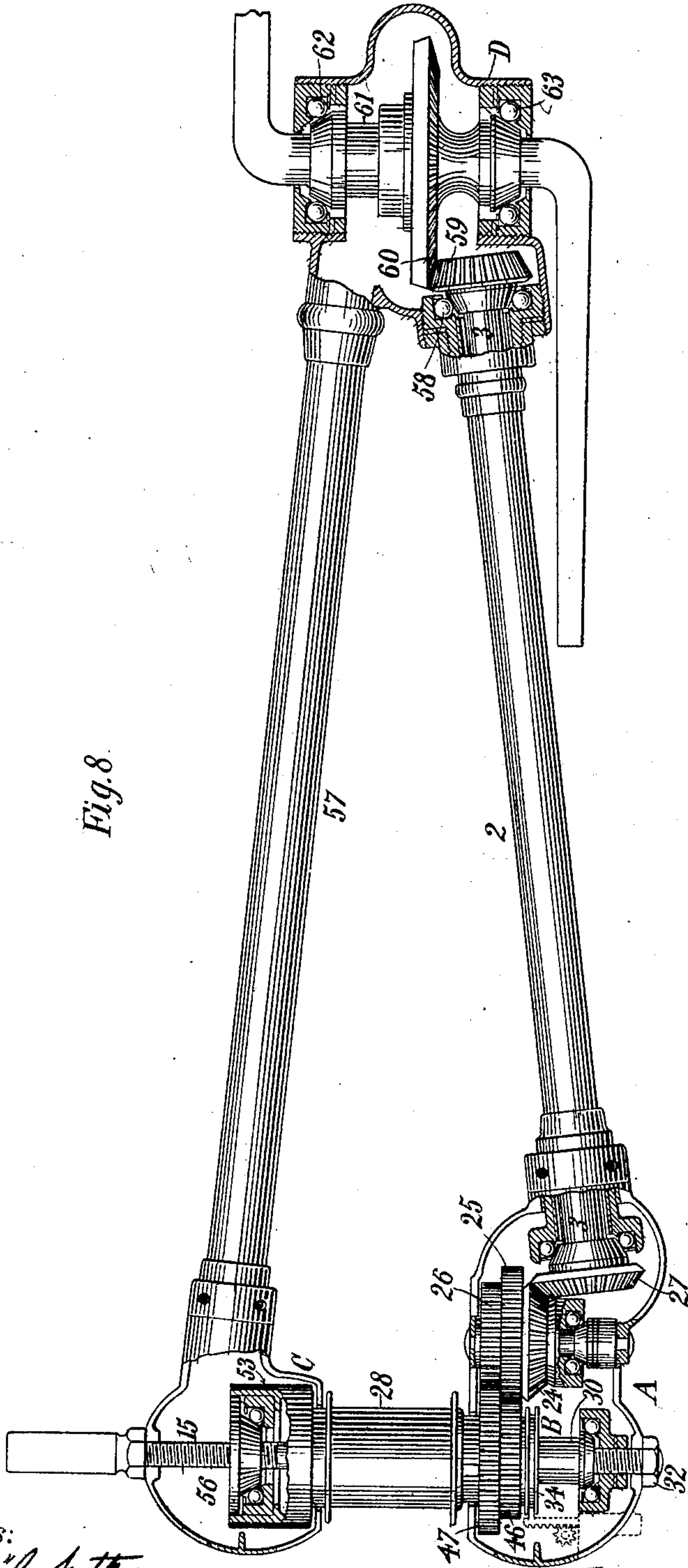
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3 Sheets—Sheet 3.

Fig. 8.



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UNITED STATES PATENT OFFICE.

MARION L. NICHOLS, OF WESTFIELD, NEW JERSEY.

CHANGEABLE-SPEED GEAR.

SPECIFICATION forming part of Letters Patent No. 675,067, dated May 28, 1901.

Application filed May 28, 1900. Serial No. 18,226. (No model.)

To all whom it may concern:

Be it known that I, MARION L. NICHOLS, of Westfield, county of Union, State of New Jersey, have invented a new and useful Changeable-Speed Gear, of which the following is a specification.

My invention relates to improvements in changeable-speed gears as the same are adapted for bicycles, its object being to provide an improved construction thereof; and it consists in the features hereinafter particularly described and claimed.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of my improved gear as applied to the rear or driving wheel of a bicycle, shown detached therefrom and with the inclosing case and some of the included parts in section and also showing part of the connected rear arm of the frame and of the rear side standard, disclosing the manner in which the shifting device of the gears is operated by an arm or lever underneath the saddle. Fig. 2 is a side elevation of the gear-case, the dotted lines indicating the partially-open position of the same. Fig. 3 is a horizontal section of the rear-wheel hub and the connected gears, showing also the band-brake drum, the brake being indicated in dotted lines. Fig. 4 is a detail of part of the wheel-hub and cone-stem, which extend through the gears and are connected with the bearing outside of the gears. Figs. 5 and 6 are details of the clutch device. Fig. 7 is a detail of one of the gears, and Fig. 8 is an outline plan of the entire driving and brake mechanism.

In the drawings, 2 represents one of the rear arms of the frame of a bicycle, and 3 the counter-shaft which rotates within the same. The rear end of the counter-shaft carries a cone 4, which runs upon the balls 5 in the cup 6, which has rigid support by being screw-threaded into the collar 7 of the housing or case A. This collar is secured to the arm 2 by means of the screw-threaded sleeve 8, to which the upper part or member 9 of the housing is brazed or of which it is an integral part, the collar receiving the enlargement 10 of the rear arm and also the hub or extension of the bearing-cup 6, as shown best in Fig. 3. The lower member or part 11 of the housing is hinged at 12 to the upper portion and is held

in closed position, as indicated by full lines in Fig. 2, by means of the collar-nut 13, which is threaded upon the sleeve 8, as shown in Figs. 1 and 3. The upper or stationary part 9 of the casing A is made integral with or permanently connected to the rear standard 14 of the frame. Intermediate of the rear end of the counter-shaft 3 and the axle 15 of the driving-wheel is arranged the spindle or pin 16, which is threaded into the bearing-cone 17 and is itself held rigidly in place and supported by the casing A by means of the screw 18, tapped into the end of the spindle. The bearing-cup 19 is mounted loosely on the spindle 16, carries the balls 20, and is screw-threaded to the cup 21, which incloses the balls 22, running upon the cone 23 at the other end of the spindle. Mounted rigidly upon the body of the cup 24 are the bevel-gear 21, the large spur-gear 25, and the small gear 26, the bevel-gear 24 meshing with the bevel-gear 27, which is shown as an integral part of the cone 4 upon the counter-shaft 3, whereby the gears 24, 25, and 26 are driven by the counter-shaft. The wheel-hub 28 terminates at the end adjacent the gears in the head 29 and a hollow spindle 30, the end of which is formed into a cone 31. The axle 15 extends through the spindle 30 and has rigid support in the casing A, being secured in place by means of the nut 32. It also carries the bearing-cup 33, the balls of which ride upon the cone 31. Mounted to slide, but not to turn, on spindle 30 is the disk or head 34 of the clutch B. The edge of this head or disk is provided with the circumferential groove 35, in which rests the stud 36 of the slidable rack 37, which is mounted in a guide 38 in the case A and is actuated by means of the pinion 39. This is carried by the rod 40, supported in a bearing-block 41 and extending upward through the standard 14 to the top of the frame, where it is provided with a crank 42, by means of which it can be rotated, so as to shift the rack 37. A notched plate or quadrant 43 receives the spring-catch 44 in notches 45, so as to set the arm 42 in any one of three adjusted positions for the purposes hereinafter described. Turning loosely upon the enlarged part 51 of the spindle 30, between the flange 64 and shoulder 65, are the small gear 46 and the large gear 47, meshing, respectively, with the

large gear 25 and the small gear 26 on the spindle 16. These gears are provided with series of holes 48, through which extend the fingers 49 of the clutch. These fingers are cylindrical in form, but have an intermediate portion 50 cut away on their exteriors to about their diameters, the exterior surface of the cut-away portion being coincident with the periphery of the part 51. In the shifting of the clutch the cylindrical portion of the fingers 49 next the head 34 is carried into the gear 46, whereby the gear is caused to turn with the clutch. The gear 47, being adjacent to the cut-away portion 50, is free to turn loosely as driven by its intermeshing gear 26, this position of parts being shown in Fig. 3. If the lever 42 is thrown to its next adjustable or intermediate position, the cut-away portion 50 of the fingers 49 is adjacent both gears, and consequently both are free to turn freely on the spindle. When the clutch is thrown to the extreme reverse position by the further operation of the handle 42, the fingers 49 are brought into engagement with the gear 47, so as to lock it thereto. Thus it will be seen that in the extreme adjusted positions of the clutch either the small gear 46 or the large gear 47 is engaged, and therefore the relative speed of the wheel-hub 28 varied with reference to that of the counter-shaft 3. The other end of the hub 28 carries the brake-drum 52, around which is arranged the brake 53. In the outer end of the drum is arranged the bearing-cup 54, carrying balls 55, which bear upon the cone 56, mounted upon the axle 15, these parts being inclosed by the housing or casing C, which is connected to the rear end of the arm 57 in a similar manner to the connection between the casing A and the other arm 2 of the frame.

The forward end of the counter-shaft is supported in the bearings 58 of the crank-hanger D and carries a bevel-pinion 59, meshing with the bevel-gear 60, mounted upon the crank-shaft 61 intermediate of its bearings 62 and 63. It will thus be seen that the entire gear and brake mechanism of the machine is within or between the supporting-bearings of the crank-shaft and driving-wheel, so as to prevent undue lateral strains or torsions, as would be the case if any of these parts were carried outside said bearings.

The operation of the mechanism is obvious from the foregoing description. It may, however, be briefly stated as follows: As the crank-shaft is rotated by means of the bevel-gear 60 and pinion 59 the counter-shaft 3 is rotated, driving the gears 24, 25, and 26, which carry with them the gears 46 and 47, either or neither of which is clutched upon

the spindle 30 of the rear-wheel hub, as may be desired by the rider and according to the position in which the arm 42 of the shaft 40 is placed, thereby enabling the rider at will to throw either high or low speed gear into operative connection or to disconnect them, as for the purpose of coasting.

For convenience the crank-shaft 61 may be designated the "driving-shaft," the counter-shaft 3 as the "transmitting-shaft," the hub 28 as the "driven shaft," and the part 21 as the "cross-shaft" of the mechanism.

I claim—

1. A vehicle train of gear, comprising driving, transmitting, cross and driven shafts, bevel-gears interconnecting the driving, transmitting and cross shafts, and spur-gears connecting the cross and driven shafts, the gear upon the driven shaft being disposed intermediate its bearings.

2. In a vehicle, the combination with the driving, transmitting, cross and driven shafts, and bevel-gears interconnecting the driving, transmitting and cross shafts, of changeable-speed spur-gears connecting the cross and driven shafts, said gears upon the driven shaft being arranged intermediate its bearings, a gear-shifter, and a rack and pinion for operating said gear-shifter.

3. In a gear-driven bicycle, in combination, changeable-speed gears upon the driven shaft arranged intermediate its bearings and coöperating with the train from the driving-shaft, a gear-shifter for said changeable-speed gears, and means for operating said gear-shifter contained within a rear standard of the frame.

4. In a gear-driven bicycle, spur-gears loosely mounted upon the driven-wheel axle intermediate its bearings, a gear-shifter for engaging and driving either or neither of said gears, a rack for actuating said gear-shifter, a pinion engaging said rack, a shaft upon which said pinion is mounted arranged within a rear frame-standard, a crank for rotating said shaft, and means for locking said shaft in adjusted positions.

5. In a bicycle, in combination, changeable-speed gears upon the driven shaft, a gear-shifter therefor, a rack and pinion for actuating said gear-shifter, a shaft for operating said rack and pinion inclosed within one of the rear standards of the bicycle-frame, a crank upon said shaft, and a quadrant for holding said crank in adjusted positions.

Signed at New York city this 15th day of May, 1900.

MARION L. NICHOLS.

Witnesses:

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T. D. MERWIN.