No. 628,614. Patented July 11, 1899.

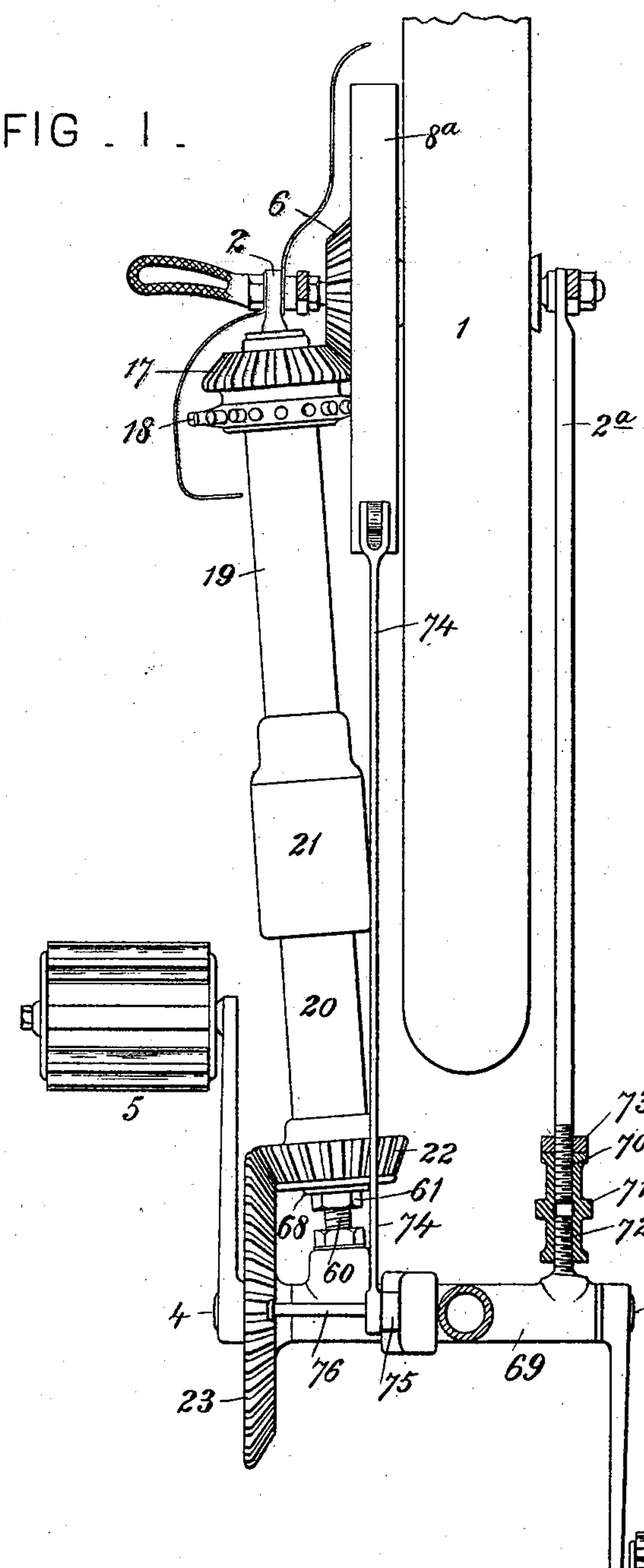
G. T. SMALLWOOD.

VELOCIPEDE.

(Application filed Oct. 10, 1892.)

(No Model.) 4 Sheets—Sheet 1.

FIG. 1.



Attest:
Arthur A. Erb.
Reuel Lewis.

Inventor:
Geo. T. Smallwood,
By Geo. L. Wheelock
atty.

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(No Model.) 4 Sheets—Sheet 2.

FIG. 3.

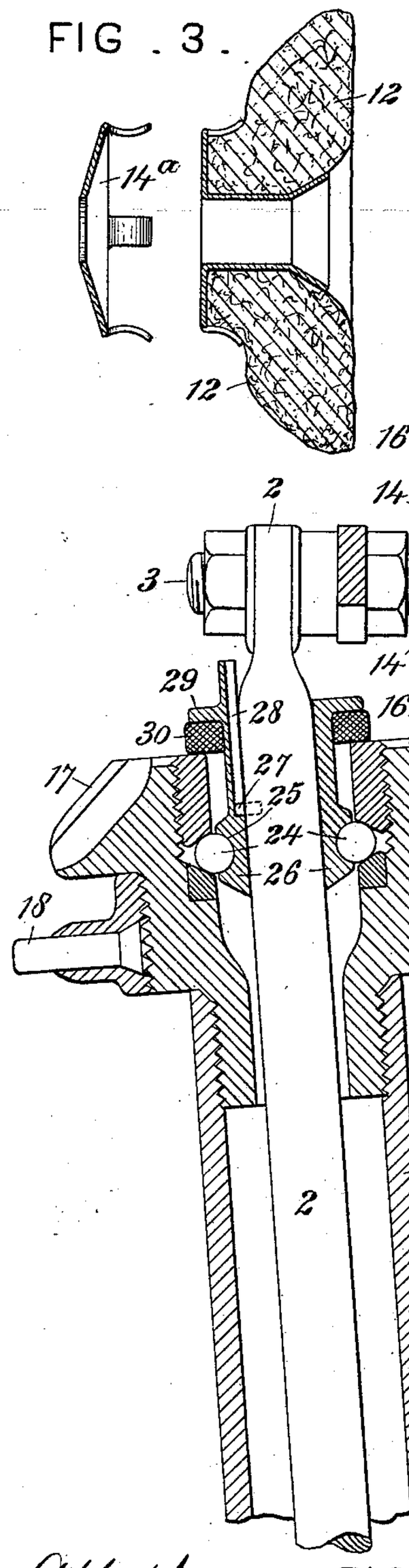

FIG. 2.

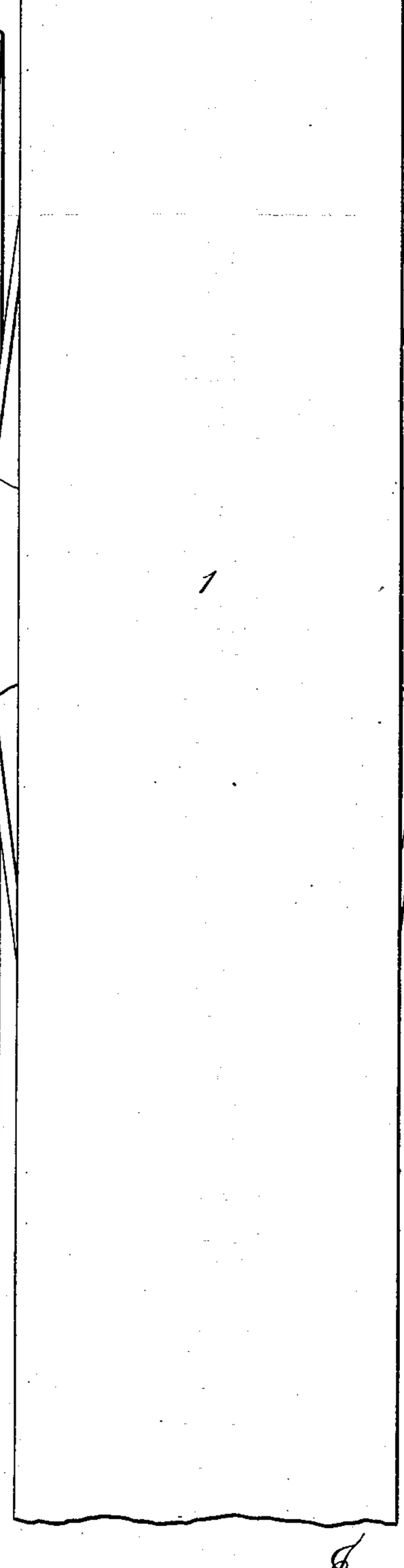

FIG. 2a.

Attest;
Arthur A. Crb.
Rewe Lewis.

Inventor:
Geo. T. Smallwood
By Geo. L. Wheelock.
Atty.

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(No Model.) 4 Sheets—Sheet 3.

FIG. 4.

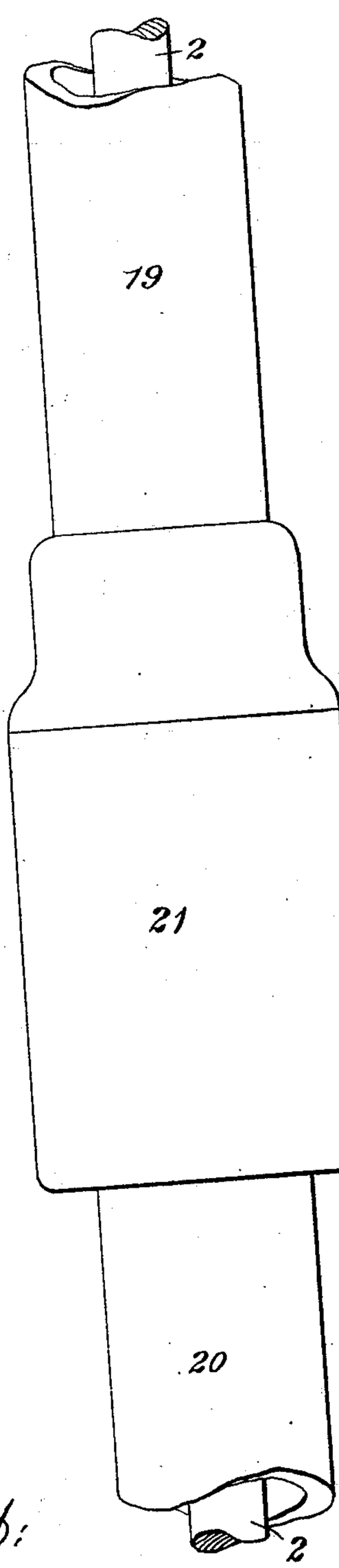


FIG. 5.

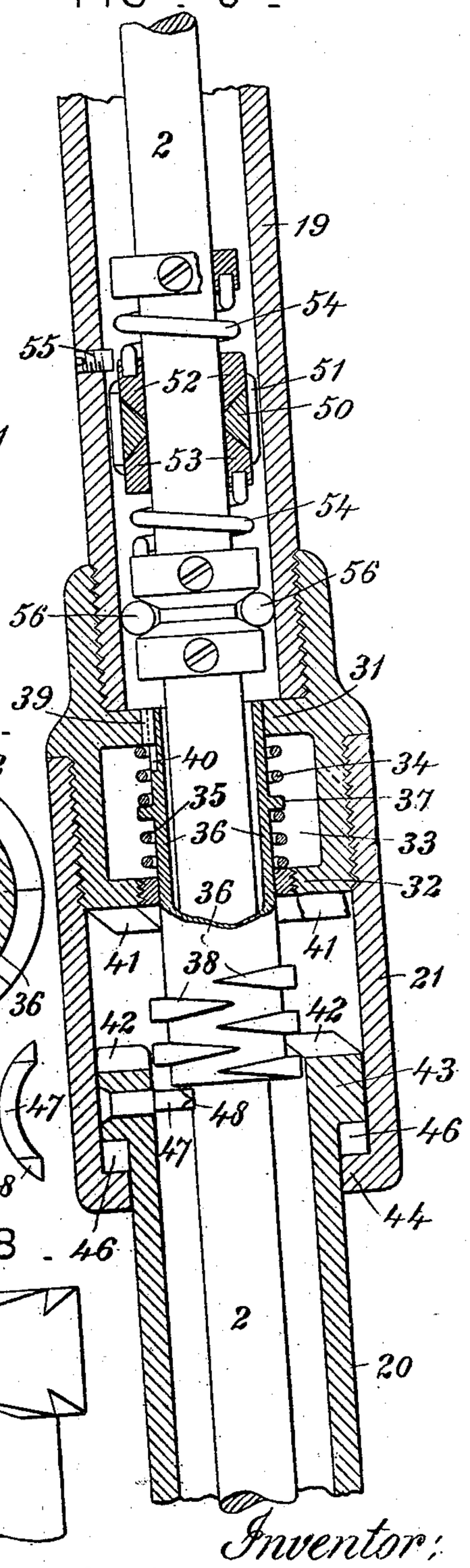


FIG. 6.

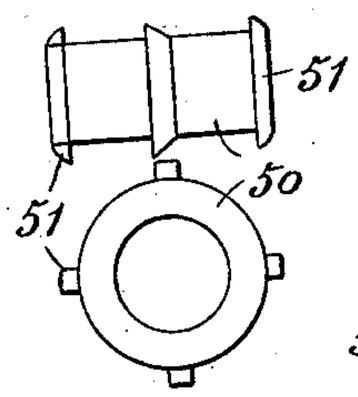
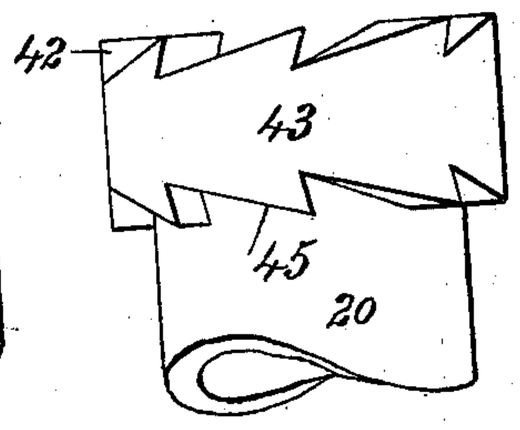


FIG. 7.

FIG. 8.



Attest:

Arthur P. Eab.
Reuel Lewis.

Inventor:

Geo. T. Smallwood.
By Geo. L. Wheelock,
Atty.

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VELOCIPEDE.

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(No Model.) 4 Sheets—Sheet 4.

FIG. 10.

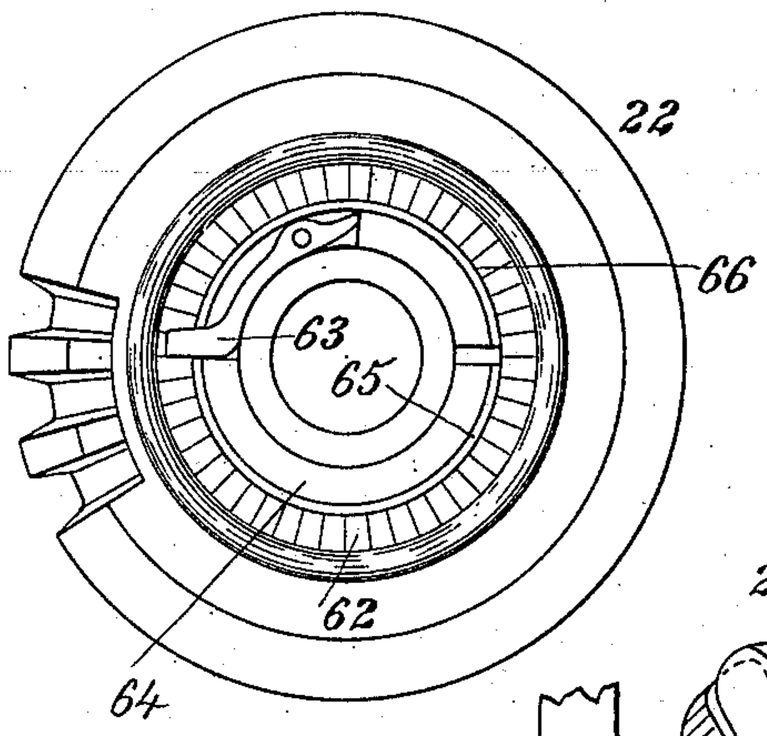


FIG. 11.

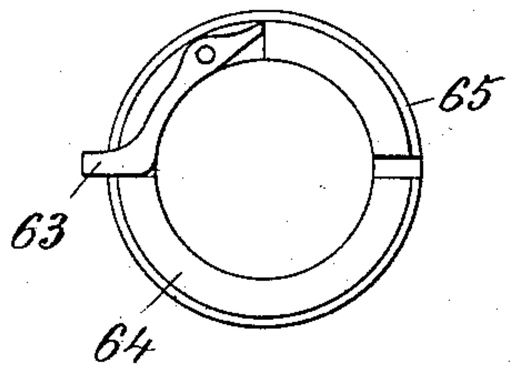
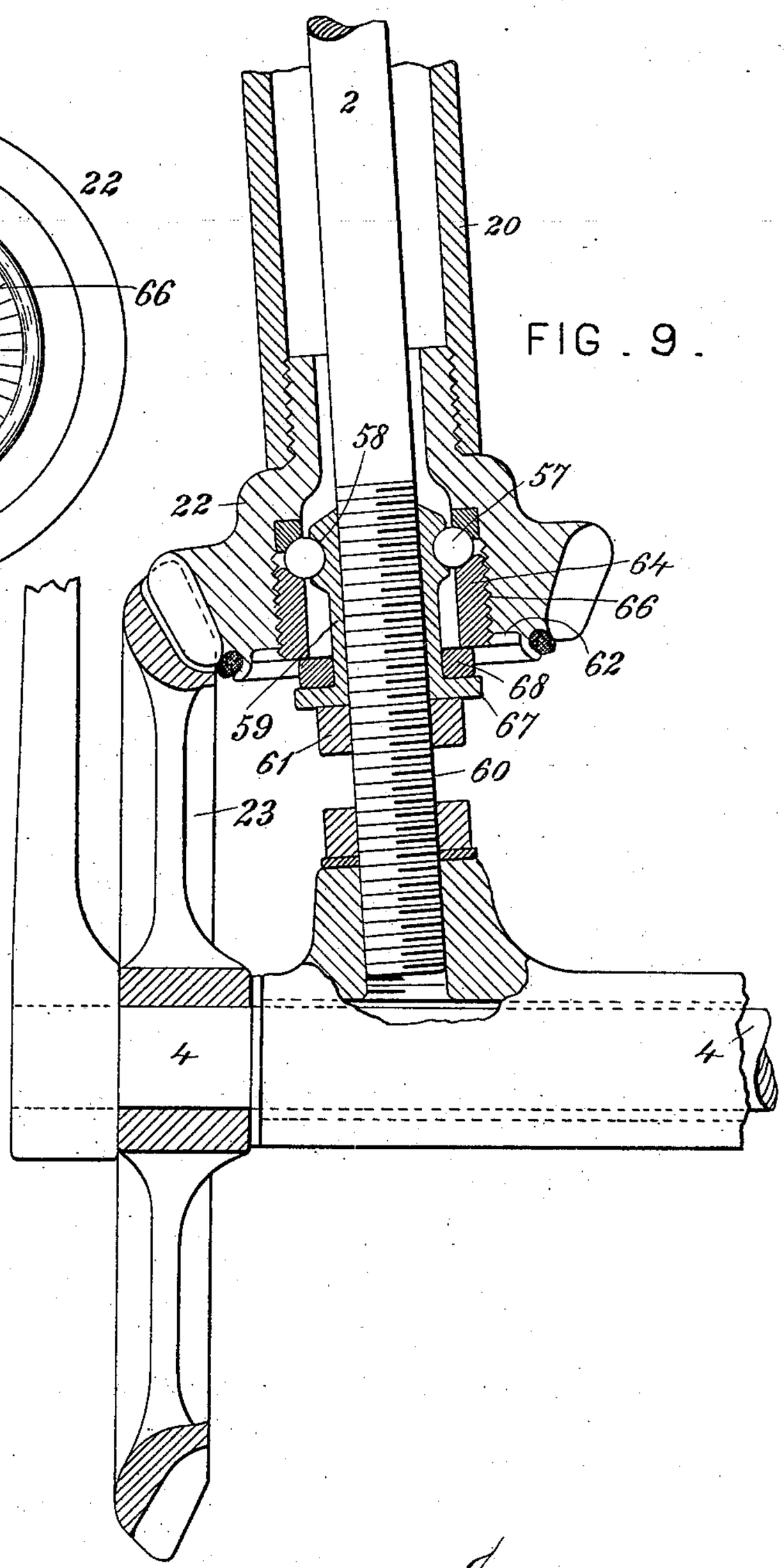


FIG. 9.



Attest:

Arthur A. Erb

Reeve Lewis.

Inventor:

Geo. T. Smallwood,

By Geo. Lilleheelock,

Atty.

UNITED STATES PATENT OFFICE.

GEORGE T. SMALLWOOD, OF WASHINGTON, DISTRICT OF COLUMBIA.

VELOCIPEDE.

SPECIFICATION forming part of Letters Patent No. 628,614, dated July 11, 1899.

Application filed October 10, 1892. Serial No. 448,377. (No model.)

To all whom it may concern:

Be it known that I, GEORGE T. SMALLWOOD, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Velocipedes, of which the following is a specification.

This invention relates more particularly to variable-gear driving mechanism for velocipedes, although it has also reference to improvements useful in other connections than such driving mechanism, and it will be understood that each of the improvements constituting the invention is intended to be secured for all the uses to which it may be adapted.

In order to propel velocipedes, (as well as to drive other machines,) arrangements have been devised in which variable gear has been employed—that is to say, gear whose rate of transmission of the power can be varied. In the case of velocipedes such gear has been designed to provide, according to the adjustment, a low gear for hill-climbing and a higher gear for riding on a level. Heretofore, so far as I am aware, the rate of transmission of such variable gear, as well in driving mechanisms in general as in those of velocipedes in particular, has been controlled by some means independent of the rotary movement of the driving-shaft, usually through a handle or other manipulating appliance, whose sole function is exercised in controlling such rate, or else the gear has been arranged to transmit the power of the driving-shaft at one speed when said shaft is turned in one direction and at a different speed when this is turned in the opposite direction. Thus in the case of a velocipede the rider would either have to shift some part of the gear otherwise than by the torsional manipulation of the pedal-shaft or he would have to back pedal himself uphill, (or whenever he wished to avail himself of a change of gear.)

In accordance with the present invention a variable gear is used which is adjustable to vary the rate of transmission from a shaft turning in the same direction and means are provided for controlling the adjustment of such gear through the torsional manipulation of a rotary driving-shaft by the aid of a relatively backward rotation of said shaft. Such relatively backward rotation may be produced not only by a backward rotation of the driving-shaft about its own axis, but also by a partial check of the forward rotation or a complete arrest of the rotation of said driving-shaft about its own axis. In the case of a velocipede back pedaling, as well as a holding back of the pedals, (whether sufficient to stop the rotation of the pedal-shaft or only enough to check its forward rotation to a suitable extent,) may produce a relatively backward rotation of the driving-shaft. The rider of a velocipede provided with this improvement can therefore manipulate the crank or pedal shaft with his feet, so as to control the adjustment of the variable gear, as well as to propel the vehicle by front pedaling at whichever speed he may desire. Also in accordance with the present invention a driving mechanism is made in which devices are so connected as to move together in one direction, while movable relatively to each other in the opposite direction, and the movement of the so-connected devices relatively to each other is utilized to control the adjustment of the variable gear of the driving mechanism. What is considered the best means for effecting such control (its use being a special improvement) is a screw and its traveler connected with said devices, respectively, and arranged to adjust the gear through the longitudinal motion imparted by the action of the screw-threads and traveler upon each other when differentially rotated.

A further improvement consists in providing means for disengaging the connection between the aforesaid devices during the adjustment of the variable gear, the two devices being free during the disengagement to move relatively to each other in the direction in which they normally move together. In this way a direct rotation of the crank or driving shaft can be availed of in controlling the adjustment of the variable gear.

Other improvements and combinations also form part of the invention, as hereinafter set forth.

In the accompanying drawings, which form part of the specification, what is considered the best mode of carrying out the principle of the invention is illustrated.

Figure 1 is a plan view showing only such portions of a bicycle as are necessary to illustrate my improvements. Fig. 2 is a sectional view showing the rear end of the drive-shaft and the gear-wheel with which its pinion intermeshes. A portion of the driving-wheel is shown in elevation. Fig. 2ª is a modification showing the outer series of teeth formed on the friction-rim. Fig. 3 is a detail view of the shutter of the hollow gear-wheel and the pad which is received by the chamber within said gear-wheel. Fig. 4 is an elevation of a portion of the drive-shaft. Fig. 5 is a longitudinal section thereof. Figs. 6, 7, and 8 are detail views of some of the parts shown in Fig. 5. Fig. 9 is a sectional view showing the front end of the drive-shaft and the gear-wheel with which the forward pinion intermeshes. Fig. 10 is an elevation of the forward pinion. Fig. 11 is an elevation of the bushing received by the forward pinion.

The portions of an ordinary bicycle (shown in the drawings) are driving-wheel 1, forks 2 2ª, axle 3, crank-shaft 4, and the pedals 5.

The driving-wheel 1 has attached to one side so as to turn therewith on the axle 3 a double-faced gear-wheel 6 7, upon the periphery of which is a band or ring 8, which constitutes a friction-rim adapted to receive the pressure of any suitable brake 8ª for controlling the momentum of the machine. This double-faced gear-wheel is provided with a series of bevel-teeth 6 and a concentric series of cogs 7. These outer cogs 7 may be formed on the gear 6 7, as shown in Fig. 2, or they may be formed integral with the rim or band 8, which is a separate piece from the body of the wheel. In either case the rim or band 8 surrounds the outer ends of the teeth and the slots between said teeth, the teeth occupying a position on the face of the wheel, at the periphery thereof, and being integral with one of said parts—that is to say, with the body of the wheel or with the rim or band 8. The teeth 6 are formed on the hollow hub 9 of said gear-wheel.

The chamber 10 within the hub 9 is for the reception of a lubricant for the teeth 6 and the teeth that intermesh therewith, the lubricant being conducted thereto by a passage or passages 11. Within the chamber 10 is preferably placed an absorbent pad or holder 12, Fig. 3, which is saturated with the lubricant. In this way the intermeshing teeth will be lubricated for a long time and frequent oiling will be obviated. Should the pad or holder 12 not be in use, the opening 13 of the chamber 10 is closed either by a shutter or cover 14, as shown in Fig. 2, or 14ª, (shown in Fig. 3,) and foreign matter will thus be excluded.

Confined within a groove 15 in the hub 9 is a noise-deadening ring 16, which is preferably made of absorbent material, so as to assist in lubricating the intermeshing gear-teeth.

Mounted on the side bar or fork 2 is a double-faced pinion 17 18, of which the bevel-teeth 17 are adapted to intermesh with the bevel-teeth 6 and the cogs 18 with the cogs 7. The pinion 17 18 is fixed to the rear end of the shiftable section 19 of the tubular drive-shaft, through which the aforesaid side bar or fork 2 passes. The section 19 is connected with the front section 20 of the drive-shaft by a coupling-sleeve 21. The forward end of section 20 is provided with a pinion 22, which intermeshes with a gear-wheel 23 on the crank-shaft 4, whereby the drive-shaft and the driving-wheel are driven.

Mechanism will be presently described whereby the pinion 17 18 is automatically shifted back and forth, bringing teeth 17 and 18 alternately into engagement with teeth 6 and 7, respectively, for obtaining either power or speed. When the teeth 6 and 17 intermesh, speed is obtained, and when cogs 7 and 18 intermesh power is gained and speed sacrificed.

A ball-bearing 24 is received by a groove 25 in a sliding piece or sleeve 26 on the side bar 2. The pinion 17 18 is mounted on said ball-bearing 24, and the sliding sleeve 26 moves with the pinion as it is shifted. The sleeve 26 is prevented from revolving with the pinion by means of a pin 27, projecting from the side bar 2 and entering a longitudinal groove 28 in said sleeve. Between the pinion 17 18 and flange 29 on the sleeve 26 is confined a washer 30 for excluding dust and dirt.

The mechanism for automatically controlling and changing the position of the pinion 17 18 will now be described.

Within the housing or coupling 21 the contiguous ends of the sections of the tubular drive-shaft are confined, the housing or coupling being secured to the section 19, but the section 20 is free to move within it. Annular flanges 31 32 within the housing or coupling form a chamber 33, in which springs 34 35 are confined upon a tube 36. The inner ends of the springs bear against a flange or ring 37 on said tube and the outer ends against flanges 31 32. The end of the tube 36 extends through the opening formed by flange 32 and has a double thread 38 formed thereon. By means of the springs 34 35 and the flange 37 the tube 36 is held in normal position, and said springs at the same time permit the tube to have a yielding longitudinal movement independent of the housing or coupling. A spline 39, projecting from the internal flange 31, is received by a longitudinal groove 40 in the tube 36, thus causing the latter to partake of the revolution of the drive-shaft 19 20 21, while it permits said independent longitudinal movement.

The tube 36 is made longitudinally movable to prevent binding between it and the traveler 47, hereinafter described, in case the latter should not happen to be in a position to immediately take into the thread 38 when the clutch-teeth separate; also, to give a yielding action to section 19 as its pinion 17 18 is being connected with gear 6 7.

Clutch-teeth 41 are formed upon the outer side of the internal flange 32 of the housing, which are adapted to engage with clutch-teeth 42 of the head 43 on the inner end of drive-shaft section 20. Flange 44 on the housing 21 prevents the withdrawal of the head 43. This head is also formed with clutch-teeth 45, which engage with the clutch-teeth 46 on the inner side of the flange 44. Projecting within the head 43 and swiveled thereto is a traveler 47, having pointed or beveled ends 48 and a stem 49. Said traveler 47 operates on the double thread 38 and shifts the section 21 19 and pinion 17 18 backward or forward.

A suitable friction device is employed to hold the drive-shaft section 19 when the pinion 17 18 is shifted to intermediate position between the teeth of gear-wheel 6 7. I therefore confine a toothed friction-ring 50 between collars 52 53. These collars and ring 50 are placed on side bar 2, and the collars are pressed tightly against the sides of the ring by suitably-fixed springs 54. The ring 50 is thus held from free rotation by frictional contact with the collars 52 53. Carried by the drive-shaft section 19 is a pin 55, which when the pinion 17 18 is shifted comes to a position to act upon a tooth or projection 51 of ring 50.

56 is a ball-bearing which supports the central portion of the drive-shaft 19 20 21.

The pedal or crank shaft gearing comprises the gear-wheel 23 and the pinon 22, which is mounted on a ball-bearing 57. This ball-bearing is received by a groove 58 in an adjustable piece or sleeve 59, provided with an internal thread to engage the thread 60 on the side bar 2. The adjustable piece 59 is locked in position by a nut 61.

The pinion 22 is formed on its face with an annular series of ratchet-teeth 62, which are engaged by a spring-pawl 63, carried by the bushing 64. The bushing 64 has an external screw-thread 65, received by an internal screw-thread 66 in the pinion 22. This bushing is for the purpose of taking up wear of the ball-bearing 57, and as it is tightened the pawl 63 will catch in the teeth 62 and prevent its loosening. Confined between the pinion 22 and a flange 67 on the adjustable piece 59 is a washer 68 for keeping dust and dirt from the ball-bearing 57.

By means of the adjustable piece 59 it is evident that the pinion 22 can be accurately adjusted with relation to gear-wheel 23; also, that the entire drive-shaft is adjusted thereby.

By reference to Fig. 1 it will be seen that the side-bar portion 2^a is shorter than is necessary to reach the crank-shaft bearing 69 and is provided with a screw-thread 70 at its forward end. This screw-thread 70 receives a turnbuckle 71, which is also received by a screw-threaded portion 72, projecting from the crank-shaft bearing. The turnbuckle is locked in position by a nut 73, screwed onto thread 70. By means of this construction it will be seen that the side bar 2^a is adjusted and the driving-wheel 1 thereby accurately set to place.

The brake mechanism (not fully shown, but which may be of any preferred form) may be operated by rod 74, lever 75, and foot-piece 76.

The parts being in the position as represented in the drawings, the rider has the machine geared for speed. The operation is as follows: Gear-wheel 23 drives pinion 22 and drive-shaft section 20, while the latter, through clutch-teeth 45 46, imparts rotation to housing 21 and drive-shaft section 19, thus rotating the driving-wheel 1 through the teeth 17 6. The rider now comes to a hill which he is to climb. He stops the motion of his feet and instantly gear-wheel 23, pinion 22, and drive-shaft section 20 are held stationary. The momentum of the machine causes driving-wheel 1, through gear-teeth 6, to drive pinion 17 18, and consequently drive-shaft section 19 will be driven. The slightest movement of section 19 independently of section 20 causes the oblique teeth 45 46 to separate and bring traveler 47 into position to act upon the thread 38. As the ground-wheel 1 continues to drive section 19 the traveler 47 will draw housing or coupling 21, section 19, and pinion 17 18 forward until the teeth 6 17 have become disengaged and pin 55 rests in the space between the projections 51 of friction-ring 50. The time taken to accomplish this movement would be about one revolution of the driving-wheel 1. The rider now again drives the pedals, and gear-wheel 23, pinion 22, and section 20 again rotate; but the traveler 47 is in the center of thread 38 and pin 55 is holding the section 19 from rotation by contact with the friction device 50 51 52 53. Consequently the traveler will continue to draw housing or coupling 21, section 19, and pinion 17 18 forward until cogs or teeth 18 come into engagement with cogs or teeth 7. At this point clutch-teeth 41 42 come into engagement and the traveler 47 leaves the thread 38. Pin 55 is also withdrawn from operation, and the drive-shaft is in a position for applying power for climbing the hill.

Upon reaching the top of the hill should the rider desire to gear for speed again he simply stops the motion of his feet for a second, and the machine will automatically change to speed.

In coasting the feet remain stationary and the pinion 17 18 is automatically thrown from engagement. The speed of the machine is then controlled by the brake.

In my application as originally filed special claims were made to the gear-wheel, with lubricating or noise-deadening and lubricating provisions, as hereinbefore set forth; but this subject-matter has been held by the Patent Office to constitute an independent invention, to be patented only by a separate application.

Having thus described my invention, what I claim is—

1. A driving mechanism comprising a vari-

able gear whereby the rotation of a driving-shaft in one direction is transmitted at different speeds according to the adjustment of said gear, and means whereby said adjustment is controlled through the said driving-shaft by the aid of a relatively backward rotation thereof, substantially as described.

2. In combination with the propelling-wheel of a vehicle, and its driving or pedal shaft, a variable gear whereby the rotation of the said shaft in one direction is transmitted to said wheel at different speeds according to the adjustment of said gear, and means whereby said adjustment is controlled through the said driving or pedal shaft by the aid of a relatively backward rotation thereof, substantially as described.

3. A driving mechanism comprising devices connected to move together in one direction while movable relatively to each other in the opposite direction, a variable gear adjustable to transmit at different speeds the connected movement of said devices, and gear-controlling means for controlling the adjustment through the movement of said devices relative to each other, substantially as described.

4. A driving mechanism comprising a screw and its traveler connected to rotate together in one direction while capable of rotating relatively to each other in the opposite direction, a variable gear, and means for controlling the adjustment of the said gear through the longitudinal motion imparted by the action of the screw-threads and traveler upon each other when differentially rotated, substantially as described.

5. The combination of devices connected to move together in one direction and movable relatively to each other in the opposite direction, a variable gear adjustable to transmit at different speeds the connected movement of said devices, means whereby their movement relative to each other disengages them temporarily so that they become movable relatively to each other in the first-named direction, and means whereby the adjustment of said gear is controlled through the movement of said devices relative to each other, substantially as described.

6. The combination with a screw, and its traveler, of sets of clutch-teeth arranged to engage at opposite ends of the screw's traverse and having the separable teeth in each set connected with said screw and traveler respectively, the said teeth when engaged connecting said screw and traveler in one direction while permitting them to move relatively to each other in the opposite direction, substantially as described.

7. The combination with a variable gear, and a driving-shaft whose power is transmitted through said gear, of a gear-controlling screw, a traveler for said screw, sets of clutch-teeth arranged to engage at opposite ends of the screw's traverse and having the separable teeth in each set connected with the said screw and traveler respectively, the said teeth forming part of the line through which the power of said driving-shaft is transmitted and connecting the devices on the driving and driven sides of the clutch so that they move together in one direction but are movable relatively to each other in the opposite direction, substantially as described.

8. The combination with a variable gear having separable gear-wheels, of a rotatorily and longitudinally movable screw connected with one part of said separable gears for shifting the same, a rotary traveler for engaging the said screw, and a friction device for preventing the rotation of the screw with the traveler when the said gears are separated, substantially as described.

9. The combination with a variable gear having separable gear-wheels, of a rotatorily and longitudinally movable screw connected with one part of said separable gears for shifting the same, a rotary traveler for engaging the said screw, and connected therewith so that said screw and traveler rotate together in one direction while movable relatively to each other in the opposite direction, and a friction device for preventing the rotation of the screw with the traveler when the said gears are separated, substantially as described.

10. The combination with a variable gear having separable gear-wheels, of a rotatorily and longitudinally movable screw connected with one part of said separable gears for shifting the same, a rotary traveler for engaging the said screw, a friction device for preventing the rotation of the screw with the traveler, and devices for conveying to said gear the power to be transmitted thereby, these power-conveying devices being connected to move together in one direction while movable relatively to each other in the opposite direction and being also connected with said screw and traveler respectively so that the adjustment of the gear may be controlled through the relative movement of said devices, substantially as described.

11. The combination of a rotary device or shaft-section, a rotary and longitudinally-movable device or shaft-section, sets of clutch-teeth which when engaged connect said devices or shaft-sections to rotate together in one direction while permitting them to move relatively to each other in the opposite direction, a variable gear having separable gear-wheels, a gear-controlling screw on the second mentioned of said devices or shaft-sections, a traveler connected with the first-mentioned device or shaft-section and engaging said screw, and a friction device arranged to prevent the screw from rotating with said traveler when the gear-wheels are separated, the said sets of clutch-teeth being arranged to engage at opposite ends of the screw's longitudinal motion and disengaging during an intermediate part of such motion, substantially as described.

12. In a driving mechanism, a rotary longitudinally-movable device or shaft-section,

and a variable gear arranged to transmit the rotation of said device or shaft-section and having therewith a connection for controlling the adjustment of said gear through the longitudinal movement of said device or shaft-section, in combination with a rotary device or shaft-section, connected with said rotary longitudinally-movable device or shaft-section by clutch-teeth which transmit rotation in one direction while permitting rotation in the opposite direction, and means for imparting longitudinal motion to the first-mentioned device or shaft-section through rotation permitted by said clutch-teeth, substantially as described.

13. A wheel, a rotary longitudinally-movable hollow shaft-section arranged at right angles to the axis of said wheel, and a rotary hollow shaft-section arranged as an extension of that first mentioned and connected therewith so that the two sections move together in one direction and are movable relatively to each in the opposite direction, in combination with a variable gear arranged to transmit the rotation of said shaft-sections to said wheel and adjustable through the longitudinal movement of the first-mentioned shaft-section to vary the rate of transmission, a driving or pedal shaft parallel with the axis of the said wheel and arranged to rotate the same through said shaft-sections and said variable gear, and means inclosed within said hollow shaft-sections for imparting longitudinal motion to the first-mentioned shaft-section through the rotation of said shaft-sections relatively to each other, substantially as described.

14. In a driving mechanism, a rotary longitudinally-movable device or shaft-section, and a variable gear arranged to transmit the rotation of the said device or shaft-section and having therewith a connection for controlling the adjustment of said gear through the longitudinal movement of said device or shaft-section, in combination with a rotary device or shaft-section connected with said longitudinally-movable device or shaft-section by clutch-teeth which transmit rotation in one direction while permitting rotation in the opposite direction, means whereby the said teeth are disengaged through the rotation permitted by them, and means for imparting longitudinal motion to the first-mentioned device or shaft-section through the torsional manipulation of the rotary device or shaft-section connected therewith, substantially as described.

15. A gear-wheel having face-teeth integral with the wheel on the side thereof at its periphery, the slots between the teeth extending to such periphery, and provided with a rim fastened to said wheel and covering the ends of said teeth and slots, substantially as described.

16. A vehicle-propelling wheel provided with a gear-wheel which has face-teeth formed integral with the wheel on the side thereof at the periphery, and slots between the teeth extending to such periphery, and also provided with a brake-rim fastened about the periphery of said gear-wheel and covering the ends of said teeth and slots, substantially as described.

17. A gear-wheel provided with spur-teeth in the form of detachable pins enlarged at their inner ends and fitting in holes in a ring which is detachably secured over the hub of said wheel so as to prevent the pins from escaping from their holes, substantially as described.

18. A toothed gear-wheel consisting of a body portion and a rim in separate pieces of metal secured together with the gear-teeth integral with one of said pieces, said teeth being arranged to occupy in the completed wheel a position inside the rim alongside the body of the wheel at the periphery thereof, so that the outer ends of the teeth and the slots between them are covered by said rim, substantially as described.

19. The combination in a bicycle-gear, of a double driving-wheel composed of a bevel-gear and a spur-gear rigidly connected with each other and adapted to be rotated and to be moved endwise, and a double driven wheel composed of a bevel-gear for intermeshing with the first-named bevel-gear and a crown-gear for intermeshing with the spur-gear according to the position of the said driving-wheel, the endwise motion of the latter serving to put the respective gears into and out of action, substantially as described.

20. The combination in a bicycle-gear, of a double driving-wheel composed of a bevel and a spur gear and adapted to be rotated and to be moved endwise, a double driven wheel composed of a bevel-gear and an enlarged crown-gear, and means for throwing either the bevel-gears into engagement with each other or the spur-gear into engagement with the crown-gear, substantially as described, whereby the speed may be changed or the power increased or diminished at will.

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

GEO. T. SMALLWOOD.

Witnesses:
PHILIP MAURO,
WALTER E. ALLEN.