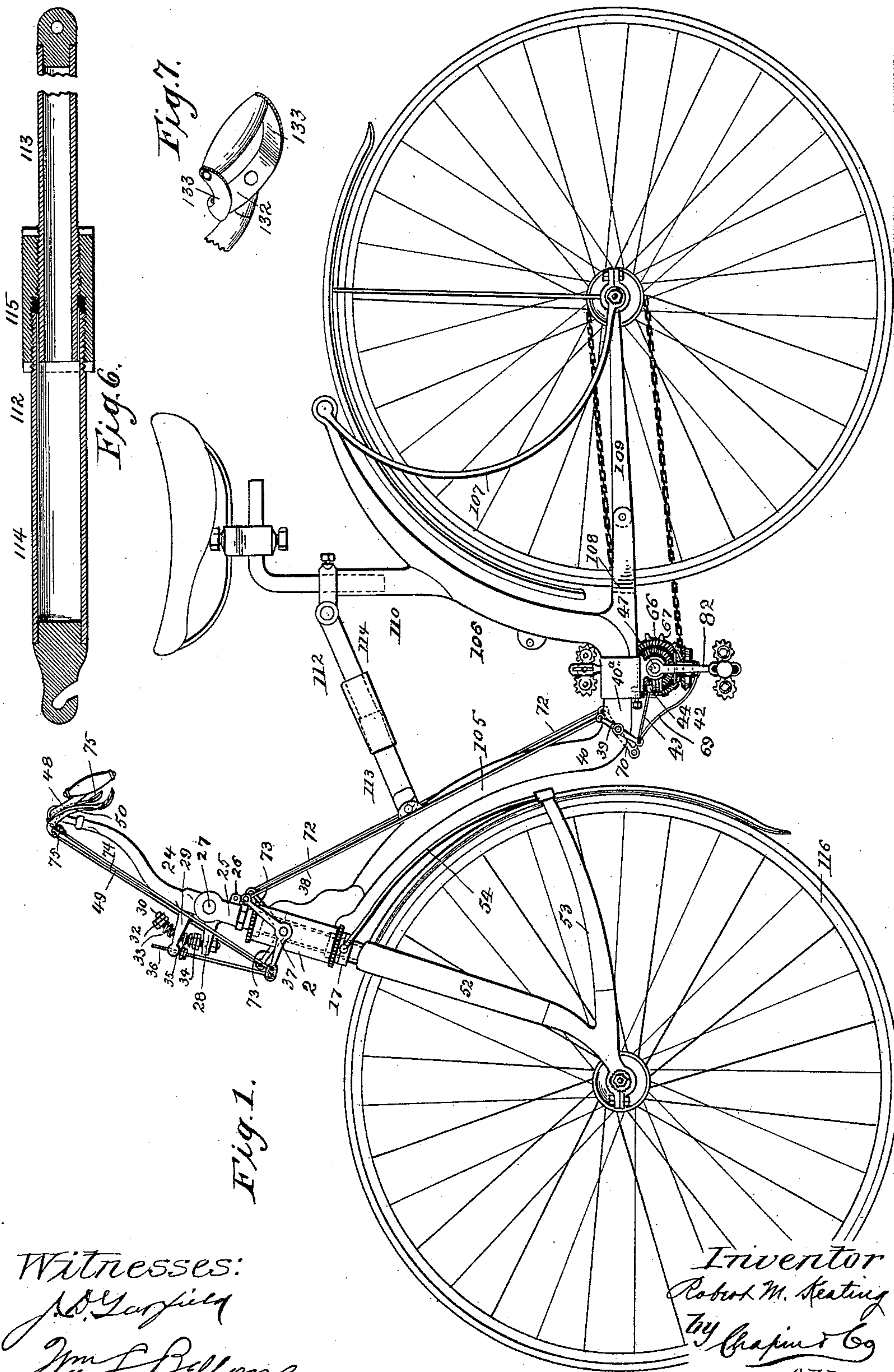


2 Sheets—Sheet 1.

No. 420,805.

Patented Feb. 4, 1890.



Witnesses:
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(No Model.)

2 Sheets—Sheet 2.

R. M. KEATING.
VELOCIPÈDE.

No. 420,805.

Patented Feb. 4, 1890.

Fig. 2.

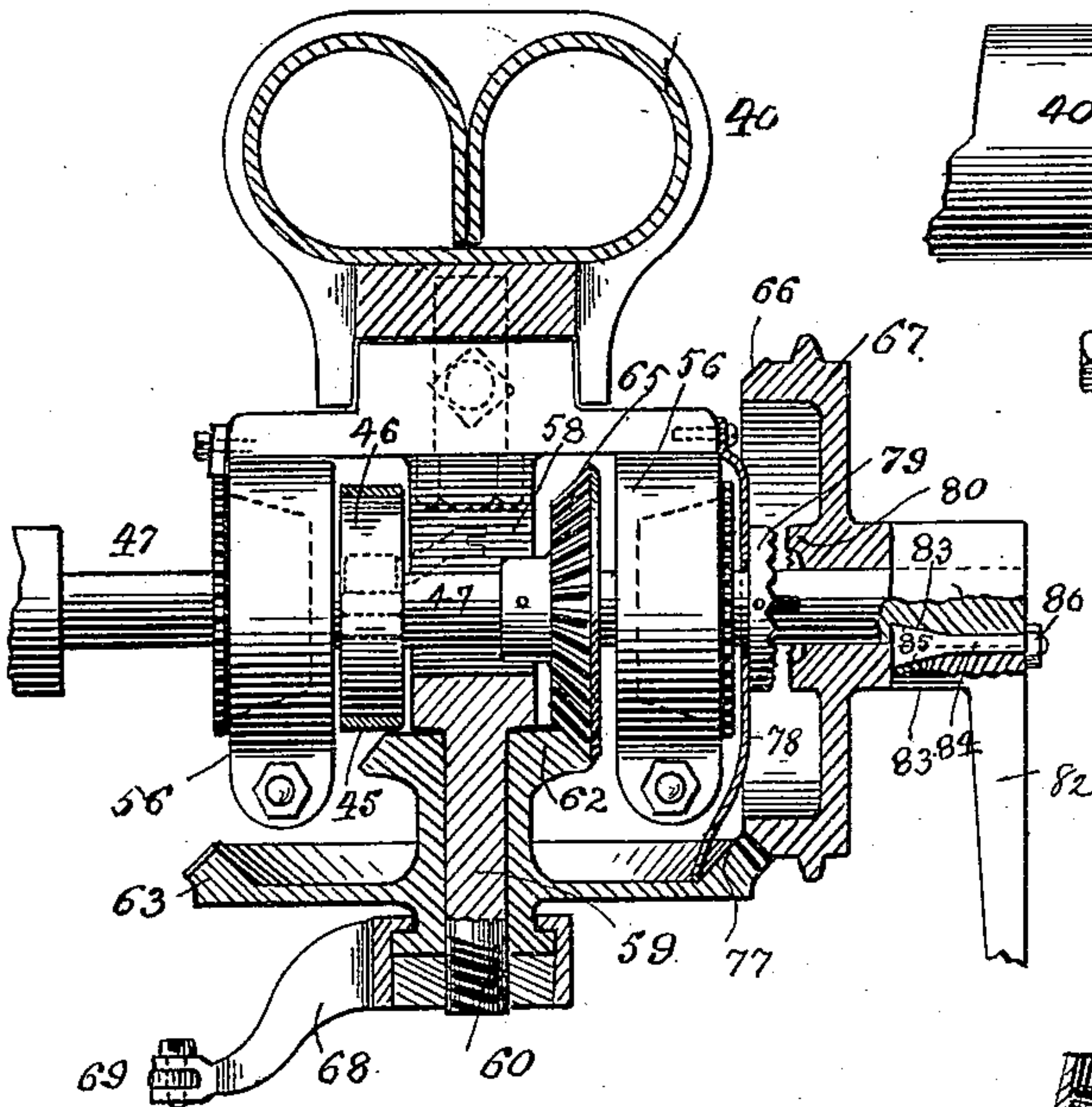


Fig. 3.

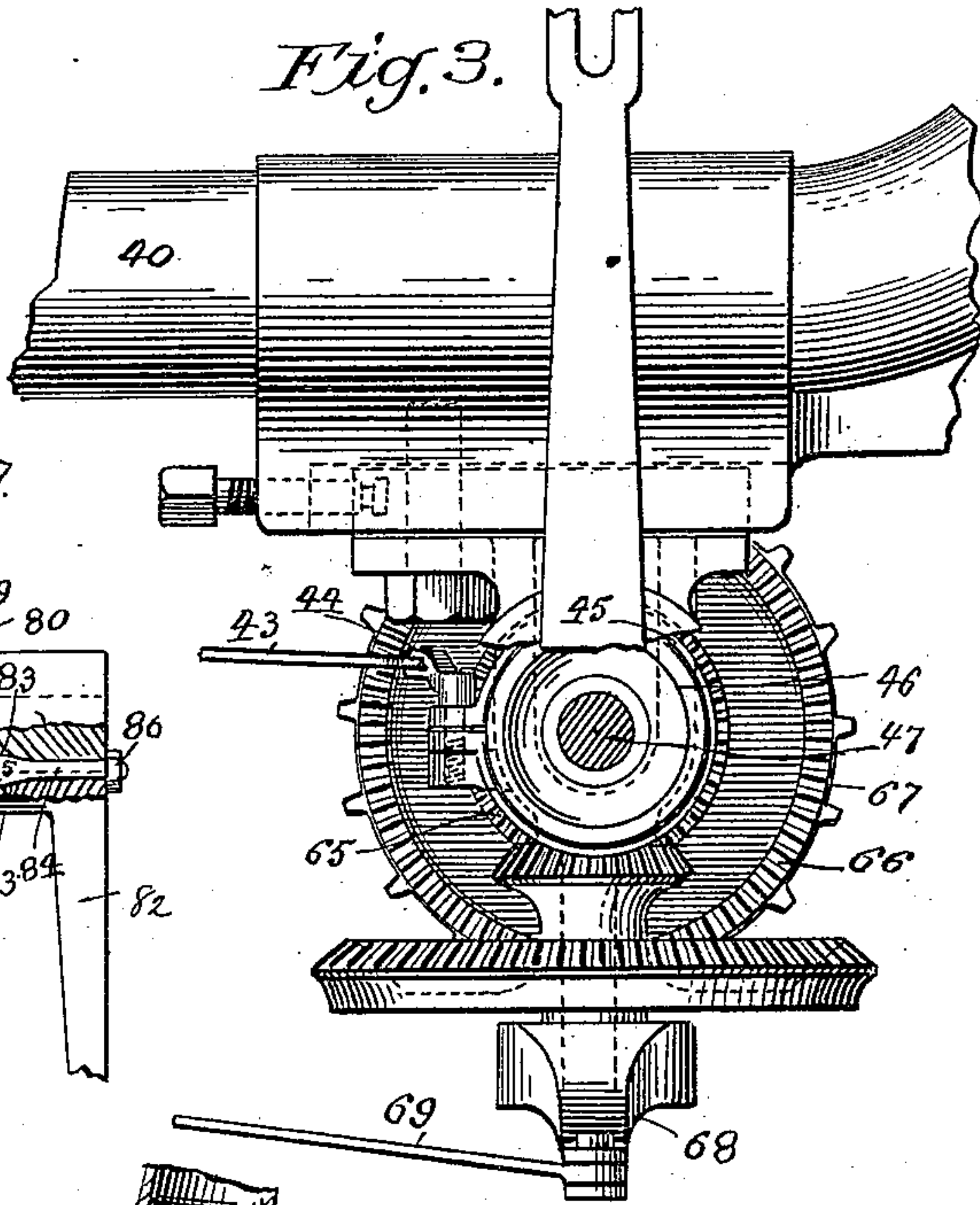


Fig. 4.

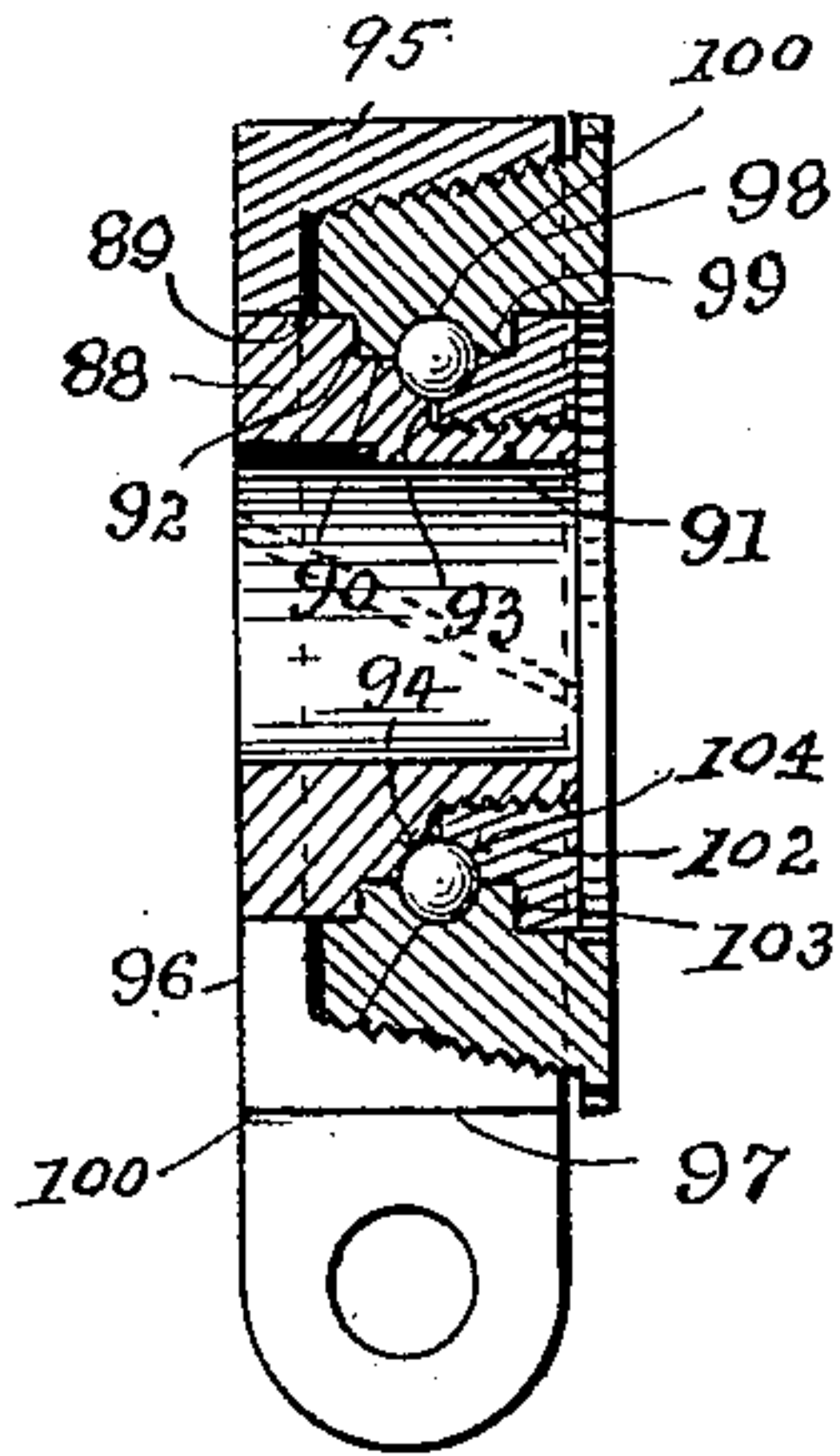
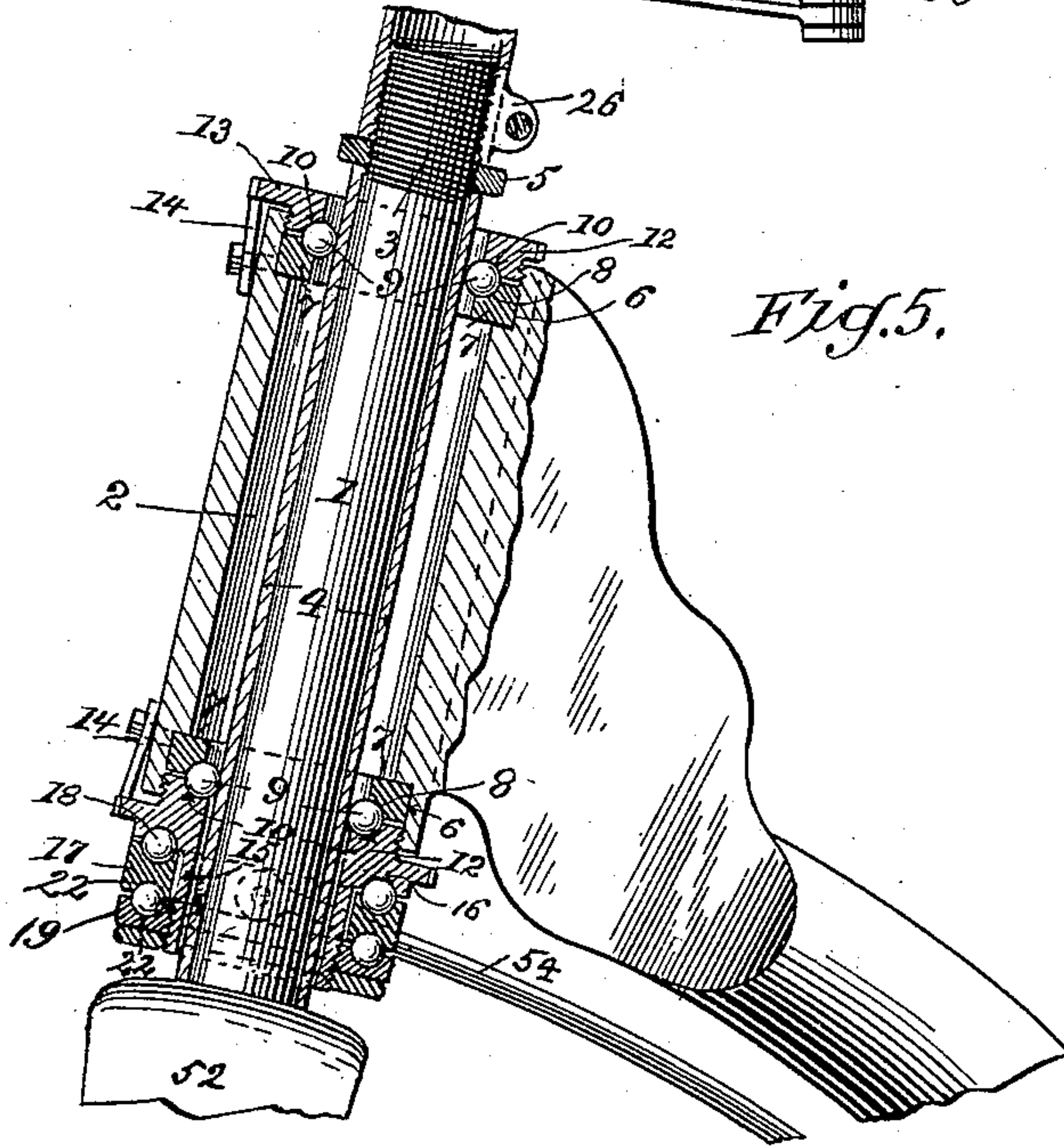


Fig. 5.



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UNITED STATES PATENT OFFICE.

ROBERT M. KEATING, OF SPRINGFIELD, MASSACHUSETTS.

VELOCIPEDÉ.

SPECIFICATION forming part of Letters Patent No. 420,805, dated February 4, 1890.

Application filed October 4, 1889. Serial No. 326,046. (No model.)

To all whom it may concern:

Be it known that I, ROBERT M. KEATING, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Velocipedes, of which the following is a specification.

This invention in velocipedes particularly relates to that class thereof known as "Safety bicycles," although some of the features, as will hereinafter appear, are applicable to velocipedes of other descriptions; and the invention consists in the construction and combination of various parts, all substantially as will hereinafter more fully appear, and be set forth in the claims.

Reference is to be had to the drawings accompanying and forming part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of a Safety bicycle constructed according to this invention. Fig. 2 is a cross-sectional elevation, on an enlarged scale, of the intermediate portion of the frame and the driving mechanism supported thereon. Fig. 3 is a side elevation of the mechanism shown in Fig. 2, as seen looking at said view from the left, with parts broken out, and the driving-shaft shown in cross-section for better illustration. Fig. 4 is a cross-sectional view of a ball-bearing. Fig. 5 is a sectional elevation of part of the fork-head and the neck of the backbone, and of parts employed in the connection of the one with the other. Fig. 6 is a longitudinal sectional view of a brace-bar, to be hereinafter more particularly described. Fig. 7 is a view in perspective of a bicycle-handle of an improved form.

In this machine the front fork is provided, to constitute what is usually termed the "fork-head," with an upward spindle-like extension 1, of considerably smaller diameter than the usual fork-head, and the neck of the backbone terminates in a tubular portion or head 2, as shown in Fig. 5, the axis of which tubular head is inclined upwardly and rearwardly from a vertical line to correspond to the obliquity of the fork-head, the inner diameter of said terminal tubular head of the backbone being considerably greater than

the diameter of the fork-head spindle. The upper end portion of said fork-head spindle is screw-threaded, as at 3, said spindle receiving therebelow a tubular bushing 4, of hard steel, which is held in place by the nut 5. The upper and lower ends of said tubular backbone-head is formed with a circular rabbet 6, screw-threaded at its orifice, and in each of said rabbets is placed a ring 7, having its corner toward the end of the head, and also toward its axis, grooved, as at 8, to form in part the bearing-channel for hardened balls 9, each of said channels being further formed by the groove 10 in the corner of the nut 12, which screws into said threaded orifice at each end of the tubular backbone-head. Each of said nuts has a flange 13 overlying the end of the backbone-head, the edge of which is serrated, and said nuts are held firmly against turning on the head, but made certain to always turn with the head by dogs 14, secured on the backbone-head by screws and engaging the serrations in the flanges of said nuts. The balls bearing in and confined against endwise movement by the annular channels formed by the said rings 7 and nuts 12 bear by their innermost surfaces on the periphery of said tubular bushing. The lowermost nut 12 extends downwardly below the plane of its flange in a neck-like portion 15, closely surrounding the fork-head or spindle, being at its end portion screw-threaded, and the flange portion of said nut on its lower surface is provided with an annular ball-groove 16, of semicircular or other equivalent cross-section. Below said flange is a collar 17, loosely fitting around the downward neck-like extension 15 of the lower nut 12, in the upper surface of which is an annular groove which is opposite to and corresponds with the said groove 16, and the hardened balls 18 are provided within and between said upper and lower grooves to form a ball-bearing between the said collar and the nut, forming practically part of the backbone-head, which parts have movements of partial rotation, the one upon the other. Below the said collar 17 is a nut 19, which screws on the said neck-like extension of the nut 12, and below said nut is a check-nut 20. The under side of the said collar 17 and the upper side of the nut 20 have formed therein

annular grooves 22, in which balls are placed to form a ball-bearing between said collar and the nut below it.

The means of attachment of the handle-
 5 bar post 24 to the fork-head consists of a
 socketed piece 25, split longitudinally and
 internally threaded, and screws onto the
 said threaded extremity 3 of the fork-head,
 whereby it is adjustable up and down. Said
 10 socket-piece 25 of the handle-bar post has
 each side of its split an ear-piece 26, and a
 screw acts through and upon said ear-pieces
 to draw them together and binds the socket-
 piece on the fork-head. The handle-bar
 15 post 24 is pivotally connected to the socket-
 piece, as at 27, so that it may be swung for-
 ward and back subject to the action of
 springs applied as follows: On the socket-
 piece is a forwardly-extending arm 28, fixed
 20 thereon, and above same, fixed on the handle-
 bar post, is another forwardly-extending arm
 29, and a rod 30 passes from the bottom of
 said lower arm through same and loosely
 through and above said upper arm 29, receiv-
 25 ing at its upper end a lock-nut 32, which
 serves as a stop for one end of a spiral spring
 33, which by its other end bears on the
 upper side of said arm 29 and between the
 lower side of said upper arm and a suitable
 30 rest therefor, which may be the upper side
 of the lower arm, but is preferably comprised
 in a lock-nut 34. On the rod just above the
 lower arm 28 is placed a spiral spring 35, the
 one of said springs acting against the other to
 35 normally maintain the handle-bar post in the
 proper upright position, as shown, and con-
 sequent upon the provision of the devices
 just described the handle-bar is freed from
 the disagreeable rigid and vibratory effect
 40 common to many other machines. The said
 upper arm 29, which is extended outwardly
 beyond the point of passage through it of
 said spring-rod 30, has an engagement with a
 nut on a rod 36, which by its lower end is
 45 connected to the forward arm of an elbow-
 lever 37, pivoted on the backbone-head. The
 engagement of said elbow-lever arm 37 with
 the rod 36 is such that when the arm is
 swung upwardly as the handle-bars are
 50 swung rearwardly it will move freely away
 from the nut on the rod without effect on the
 latter, but on forcing forwardly on the han-
 dle-bars the rod will be depressed, swinging
 said elbow-lever 37, with the rearward arm
 55 of which one end of a connecting-rod is at-
 tached, which by its other end is connected
 to one end of a lever 39, intermediately piv-
 oted on the frame 40 of the machine in ad-
 vance of the sprocket-driving and brake
 60 mechanism, which is located at 42, and with
 the other end of said lever 39 one end of a
 rod 43 is connected, which by its other end
 is connected with an arm 44 on a "quick-
 thread" screw, which engages both lug-formed
 65 ends of a friction-brake ring or strap 45, that
 surrounds a drum 46 on the crank-axle 47.

The handle-bar 48 is provided with a brake-

lever 50, intermediately pivoted thereon, one
 end thereof extending into proximity to one of
 the handles of the handle-bar, and to the other
 70 end thereof one end of a connecting-rod 49 is
 attached, which by its other end is also con-
 nected with the forward arm of said elbow-
 lever 37. It will be seen that the said elbow-
 lever 37 may be swung to operate the brake-
 75 lever ring 45 by swinging the brake-lever 50
 on the handle-bar, or by swinging the han-
 dle-bar post forward. Riders seeing danger
 ahead will instinctively, as if to ward it off,
 throw their hands forwardly, and thereby al-
 80 most unconsciously the brake will be applied,
 and yet, on premeditation, the brake may be
 employed with less discomfort by swinging
 the lever 50. Both forms of the brake-actu-
 ating mechanism are to be employed in one
 85 machine, it being deemed desirable, in order
 to render to the machine the most effective
 equipment, to so provide both brake-operat-
 ing devices.

The legs 52 of the front fork at each side
 90 of the wheel are provided with rigid rear-
 wardly and upwardly extending bracket-pro-
 jections 53, which may terminate about op-
 posite the rim of the wheel, and on the ends
 thereof are connected spring-arms 54, which
 95 extend forwardly and upwardly into a pivotal
 engagement with the ring 17 beneath the
 lower nut 12, which is in screw engagement
 with the backbone-head; and it is by the pair
 of such spring-arms 54 that the tubular head
 100 of the backbone is yieldingly supported on
 the spindle-like fork-head, a vertical play of
 the one upon the other being permitted, as
 will be perceived on inspection of said Fig.
 5, the series of balls 9 9 serving to insure
 105 easy movements of the fork and backbone
 heads one on the other, whether they be move-
 ments of partial rotation or of up and down
 slide.

In Figs. 2 and 3 the driving mechanism is
 110 shown, in connection with which the brake
 devices set forth are applied. The horizon-
 tal and transversely-extending crank-axle 47,
 which is mounted in suitable bearings in
 hangers 56, supported from the frame, has
 115 fixed thereon a bevel-gear 65, and on a yoke-
 frame 58, formed with the suspension means
 for the axle-bearings, is a downward stud
 59, on the lower end of which is a quick-
 thread screw 60, and above said screw on
 120 said stud two bevel-gears 62 63 are com-
 prised together as a single part united by the
 tubular neck 64, embracing said stud, and
 the upper of said gears meshes with the gear
 65 on the crank-axle, and the lower gear 63
 125 meshes with a gear 66, affixed on the sprock-
 et-wheel 67, which is loose on the crank-axle
 when the said double gear is in its upper-
 most position; but said gear 62 may drop out
 of engagement with the axle-gear 65, and the
 130 gear 63 may drop out of engagement with the
 sprocket-gear, as will appear in connection
 with means for securing a raising or lowering
 of the double gear on the stud which are to

be provided, and, as shown, said means consist of an arm 68, having an engagement with the quick screw-threads on said stud, whereby on a partial—say a quarter—turn of said arm it will move up or down on said stud sufficiently to throw the gears either into or out of engagement with the axle and sprocket-gears, as the case may be, said double gear resting on the hub of said arm and freely rotating independently thereof. A rod 69 is by one end connected to said arm 68, its other end being attached to one end of a lever 70 intermediately thereof, pivoted on the frame, (see Fig. 1,) and to the other end of said lever 70 a connecting-rod 72 is attached, which by its other end is secured to one arm of an elbow-lever 73, which is pivoted on the backbone-head, and to the other arm of said elbow-lever one end of a connecting-rod 74 is secured, which by its other end is attached to the end of a lever 75, pivoted on the handle-bar 48, which lever may be of similar form, and is mounted on the handle-bar in a similar manner to the brake-lever 50, its handle end, however, extending to the opposite end of the handle-bar from that at which the handle end of the lever 50, for operating the brake, terminates. By moving said lever 75—say, when the double gear is in the position shown in Figs. 2 and 3—the hub of arm 68 in turning will move axially down the stud 59, and the gears 62 and 63 will pass out of engagement with the axle and sprocket-gears, respectively. It will be noticed that the inner inclined periphery 77 of the gear 63, bounding the cored-out portion of said gear, is contiguous with the lower end of a spring-arm 78, which by its upper end is secured on a part of the hanger-fixture, so that as the gear is raised it will force said spring-arm to the left, there being next to said spring-arm surrounding the axle 47 a member 79 of a clutch, which, as said spring-arm moves to the left, moves with it and out of its engagement with the other member 80 of the clutch which is formed on the hub of the sprocket-wheel 66. Thus the sprocket-wheel may be driven directly from the crank-axle when the gears 62 and 65 and 63 and 66 are out of engagement and the clutch members are in engagement, or when said clutch members are out of engagement and the said gears are in engagement the sprocket will be driven from the axle through said gears, and by making the gear 62 smaller than the axle-gear 63 an increase of speed is insured; or, on the other hand, the machine may be equipped with the driving mechanism arranged as described, but having said axle-gear 62 smaller than the gear 63, in which event an increase of power is secured, which would be advantageous where the machines were to be employed to a considerable extent in hill-climbing.

In Fig. 2 is shown an improved keying device for securing the cranks 82 on the crank-axle 47, which consists in forming one end portion of the key-grooves in the shaft and

in the hub of the crank of an increased depth, as at 83, and to form the key 84 with double inclining enlargements, as seen at 85, the end of the key which is of the smallest diameter being threaded, receiving thereon a nut 86, which, on screwing up against the end face of the crank and shaft, draws the inclining parts of the key with increased force upon the inclined-groove walls therefor.

The ball-bearing shown in Fig. 4, which is a form of ball-bearing to be advantageously used for the crank-axle 47, as well as for other rotating parts in velocipedes, consists of the collar 88, to be affixed on the shaft the outer surface of which is of step form, comprising three peripheral surfaces 89, 90, and 91, of varying sizes, and two shoulders or rests 92 and 93, and the smaller peripheral portion 91 is externally screw-threaded. The corner of the shoulder 93 is cut out to form the arc-shaped channel 94. The outer box 95, within which the axle runs, is of annular form of L shape in cross-section surrounding said collar, bearing peripherally thereon by the portion 96, an annular space being left between the portion 97 thereof and said collar 88, and the inner periphery of said portion 97 of the box is screw-threaded, into which is entered an externally threaded annular plug or nut 98, having intermediate of the length of its inner periphery an inward extension or rib 99, formed with a peripheral groove 100, of semi-circular cross-section, which matches with and forms a continuation of the groove 94 in the collar, the said rib 99, by its inner end, bearing on the shoulder or rest 92 of the collar; and an annular nut 102 of L shape in cross-section, internally screw-threaded, by said screw-threads engages with those formed on the outer periphery of said collar, the shoulder or rest 103 of said nut 102 bearing on the outer end of the rib of said nut 98, and the outer corner of the inner end of said nut is grooved or channeled, as at 104, to match both the groove in the said collar and the groove in said rib 99 of the nut 98, the said three grooves conducing to form the annular ball-chamber, the hardened balls being placed therein, of course, as the said parts are being put together, and it will of course be understood that the collar 88 and the nut 102 are as one, and the box 95 and the nut 98 are also as one, and one set of parts may freely rotate on the other, and that by reason of the shouldered and screw-threaded formation of the parts, as described, the ball-bearing is rendered dust-proof.

The frame 40 (see Fig. 1) consists of a horizontal intermediate portion 40^a and forwardly and rearwardly and upwardly extending portions 105 and 106, each having a curvature corresponding more or less closely to the rim of the wheels. The said forward upwardly-extending portion 105, constituting the backbone, as before mentioned, terminates in the said backbone tubular head 2, and between and connected to the end of said rearward

upward extension 106 of the frame and the bearing for the rear wheel is a pair of stiff springs 107—one of each at each side of the wheel—and at the rear part of the intermediate portion 40^a of the frame a rearwardly-extended horizontal arm 108 is rigidly affixed, which is bifurcated in two members to be at either side of the wheel, and to the end of each member of the said bifurcated arm a link-bar 109 is secured, which, by its other end, is affixed to the rear wheel-bearing. The said springs 107 107 afford a yielding support for the rear part of the frame, while the linked bars 109 between the bearings and the horizontal portion 108 of the frame resist or transmit endwise longitudinal forces on the frame, the pivotal features of said bars freely permitting the springing motion of the rear end of the frame.

The frame proper is formed of a single blank of sheet metal, the side portions of which are rolled longitudinally to form a double tube, as seen in cross-section in Fig. 2—that is, each side portion of the blank from a point a little outside of a central longitudinal line is bent or rolled upwardly and around to return by its edge to or near to the said central longitudinal line of the blank, the said edge portions of both side parts of the blank being in contact, and are preferably to be connected or held together by soldering, brazing, or otherwise.

The saddle-post 110 is affixed on the rear arc portion 106 of the frame in any suitable manner, and an adjustable brace 112 is provided, which is adapted to be connected to the intermediate portion of the backbone and to extend therefrom to a connection with the saddle-post or to the rear portion of the frame, at quite a low point thereon, as may be most desirable for the accommodation of gentlemen or lady riders. Said brace-rod is formed in two sections 113 114, one adapted to telescope within the other and both thereof at or near their adjacent extremities being externally screw-threaded and adapted to be engaged by right and left hand screw-threads formed in the nut 115. The said brace can be adjusted as to length to extend from its place of connection with the ear-piece on the backbone to either the ear-piece on the saddle-post or on the part 106 of the frame.

Concerning the “spade-handles” of bicycles as at present formed, on the occasion of falling the rider while grasping said handles with the back of his palms near the cross-piece 132 at the shank often gouges out the flesh; but, as seen in Fig. 7, the separated arms 133 of the handle are bent so as to carry the grip-piece 134 out of the plane of the said cross-shank 132, whereby the liability to injury, as above explained, is overcome.

What I claim is—

1. In a velocipede, the combination, with the front fork provided with the arms 53, of the backbone adapted by its head to rotate on

the fork-head, and also to have a vertical movement thereon, and the spring-arms 54, connected to said arms 53 and supporting by their forward ends the said backbone-head, substantially as described.

2. In a velocipede, the combination, with the front fork provided with the spindle-head and having the arms 53, of the backbone having the tubular head encircling said fork-head and rotatable and movable up and down thereon, the collar 17, and the spring-arms 54, connected to said arms 53 and to said collar, substantially as described.

3. The combination, with the front fork-head spindle provided with the hardened tubular bushing 4, of the backbone having the tubular head encircling said fork-head spindle, and balls bearing between said head and said spindle, substantially as described.

4. The combination, with the front fork-head spindle, of the backbone provided with the tubular head having the rabbets 6 6 in the ends thereof, the rings 7 7, let into said rabbets, provided with the grooves 8, the annular nuts 12, screwed into said rabbets and provided with the grooves 10 and with serrated peripheries, the balls 9 9, lying in said grooves in the nuts and collars and between them and said fork-head spindle, and the dogs secured on said backbone-head and engaging said serrated nuts, substantially as and for the purpose described.

5. The combination, with the front fork-head spindle, of the backbone provided with the tubular head having the rabbets 6 6 in the ends thereof, the rings 7 7, let into said rabbets, provided with the grooves 8, the flanged annular nuts 12 12, screwed into said rabbets and provided with the grooves 10, and the lower one having in its flange the groove 16 and provided with the downward neck-like extension 15, the balls 9 9, lying in and between said grooves 8 and 10 and the fork-head spindle, the spring-supported collar 17, grooved in its upperside, and the balls 18 in and between the groove in said collar, and the one 16 in said nut-flange, substantially as and for the purpose described.

6. In a velocipede, in combination, the front fork having the spindle 1, screw-threaded at its upper extremity and provided with the tubular bushing 4 and the nut 5, for confining said bushing in place, the backbone having the tubular head encircling said bushed fork-spindle, and the handle-bar post having in its lower end a screw-socket engaging the threaded end of said spindle, substantially as and for the purpose described.

7. In a velocipede, in combination, a brake mechanism on the crank-axle, the handle-bar post pivotally mounted on the fork-head and provided with an arm 29, and connections between said arm and said brake mechanism, whereby on a swinging of the said post the said brake mechanism will be actuated, substantially as described.

8. The combination of the front fork having the arm 28 and the handle-bar post pivoted on the fork-head and provided with the arm 29, a spring applied to bear upwardly on said arm 29, and a counterbalancing-spring applied to bear downwardly thereon, substantially as described.

9. In combination, the front fork having thereon the arm 28 and the handle-bar post pivoted on the fork-head and provided with the arm 29, a spiral spring between said arms 28 and 29 and a spiral spring above the arm 29, a rod 30, connected to said arm 28 and passed through same and through the arm 29 and said spiral springs, and the tension-regulating nuts 32 and 34, substantially as described.

10. The combination of the drum on the crank-axle and the brake ring or strap surrounding same and provided with the lugs, and a screw for operating said brake-strap provided with an arm 68, a pivoted lever 39 on the frame, and a connecting-rod between said lever and said arm 68, the fork-head and the handle-bar post pivoted thereon and provided with the arm 29, the backbone-head having thereon the elbow-lever 37, the rod 36 between said arm 29 and one arm of the elbow-lever, and a rod 38 between the other arm of said elbow-lever and said lever 39, substantially as described.

11. The combination of a brake mechanism on the crank-axle and the fork-head provided with the handle-bar post pivoted thereon and provided with the arm 29, connections between said arm and said brake mechanism for actuating the latter on swinging the handle-bar post, and a hand-lever pivotally mounted on the handle-bar, and connections between one end of said lever and said brake mechanism, whereby the latter may also be operated by swinging said hand-lever, while the handle-bar remains stationary, substantially as described.

12. The combination, with suitable hanger-supports, of the frame provided with the stud 59, of the horizontally-mounted crank-axle provided with a gear 65, fixed thereon, and a sliding clutch member 79, the sprocket-wheel loosely mounted on the crank-axle, having its hub formed to constitute a clutch member and having its rim formed into the gear 66, the united gears 62 and 63, movable on said stud 59 and adapted to be projected into and out of engagement with said axle and sprocket-wheel gears, and a means for actuating said clutch member, substantially as described.

13. The combination, with suitable hanger-supports, of the frame provided with the stud 59, having thereon the quick screw-threads, and the arm 68, engaging said threads, whereby it is, when turned, movable vertically on said stud, of the horizontally-mounted crank-axle provided with a gear 67, fixed thereon, and the sliding and splined clutch member 79, the sprocket-wheel loosely mounted on the crank-axle, having its hub formed to consti-

tute a clutch member and having its rim formed into the gear 66, the united gears 62 and 63, axially mounted on said stud 59 and supported by the hub of the arm 68 and adapted to be thrown into and out of engagement with the said axle and sprocket-wheel gears, and the inner periphery 77 of the gear 63 being of inclined form, the spring-arm 78, by one end affixed to a stationary part of the frame, its intermediate portion in engagement with said clutch member 79, and its free extremity extended into a position to be operated on by said inclined periphery of said gear, and connections between said arm 68 and the head of the machine, whereby the said gears may be shifted for alternate engagement, substantially as described.

14. In a velocipede, the combination, with the alternate gear-driving mechanism applied on and in relation to the crank-axle, comprising the axle-gear 65 and sprocket-wheel having gear 66 and clutch member 80 thereon, the united gears 62 and 63, and the supporting-stud 59, having quick screw-threads, the arm 68 on said stud, and the splined clutch member 79, and means for shifting same, all substantially as described, of a hand-lever 75, pivoted on the handle-bar, an elbow-lever 73, and an intermediately-pivoted lever 70 on the frame, a connecting-rod 74 between said hand-lever 75 and one arm of the elbow-lever, a connecting-rod 72 between the other arm of the elbow-lever and one end of said pivoted lever 70, and a connecting-rod between the other arm of said lever 70 and the said arm 68, substantially as described.

15. In a Safety bicycle, the combination of the frame having the horizontal intermediate portion and the bifurcated arm 108 and the arc-shaped portion 106, extending rearwardly and upwardly, with the spring-arms 107, extending between and connected to the rear end of said frame portion 106 and the rear wheel-bearings at each side of the wheel, and the link-bars 109 between and connected to said bearings and the members of said bifurcated arm 108, substantially as described.

16. The frame of a velocipede formed from a single blank of sheet metal, having the side portions thereof bent longitudinally a little to each side of the central longitudinal line of the blank upwardly and around, returning together by their edges to or near to the said central longitudinal line of the blank, and forming two united tubes, substantially as described and shown.

17. The combination, with the frame of the machine comprising the intermediate portion, the forward and rearward upwardly-curving portions 105 and 106, each provided with an ear-piece, and the latter supporting the saddle-post, which is also provided with an ear-piece, of the extensible brace-connection consisting of the members 113 114, one telescoping within the other, each externally screw-threaded, and the nut 115, having the right and left hand screw-threads engaging

said screwed portions of the said members 113 114, and said brace-connection by one end connected to the ear-piece on the forward upwardly-extending frame and adapted by 5 its other end to engage the ear-piece either on the saddle-post or the part of the frame therebelow, substantially as and for the purpose set forth.

10 18. Parts to constitute a ball-bearing consisting of the collar of step form, whereby three varying circumferential surfaces 89, 90, and 91 and two shoulders or rests 92 and 93 are formed, the smaller circumferential portion 91 being externally screw-threaded and 15 the corner of the portion 90 provided with the groove 94, the annular casing 95, the walls of which are of L shape in cross-section, having the portion 97 thereof internally

screw-threaded, the annular nut 98, screwed into said casing 95 and provided with the 20 internal rib 99, bearing by its inner end on said rest 92 of the collar and having the peripheral groove 100, the annular nut 102 of L shape in cross-section, internally screw-threaded to engage the external threaded 25 portion 91 of said collar, having therein the groove 104 and by its rest 103 bearing on the outer end of the rib of said nut 98, and the hardened balls within the annular chamber formed by said grooves, substantially as 30 and for the purpose described.

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Witnesses:

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