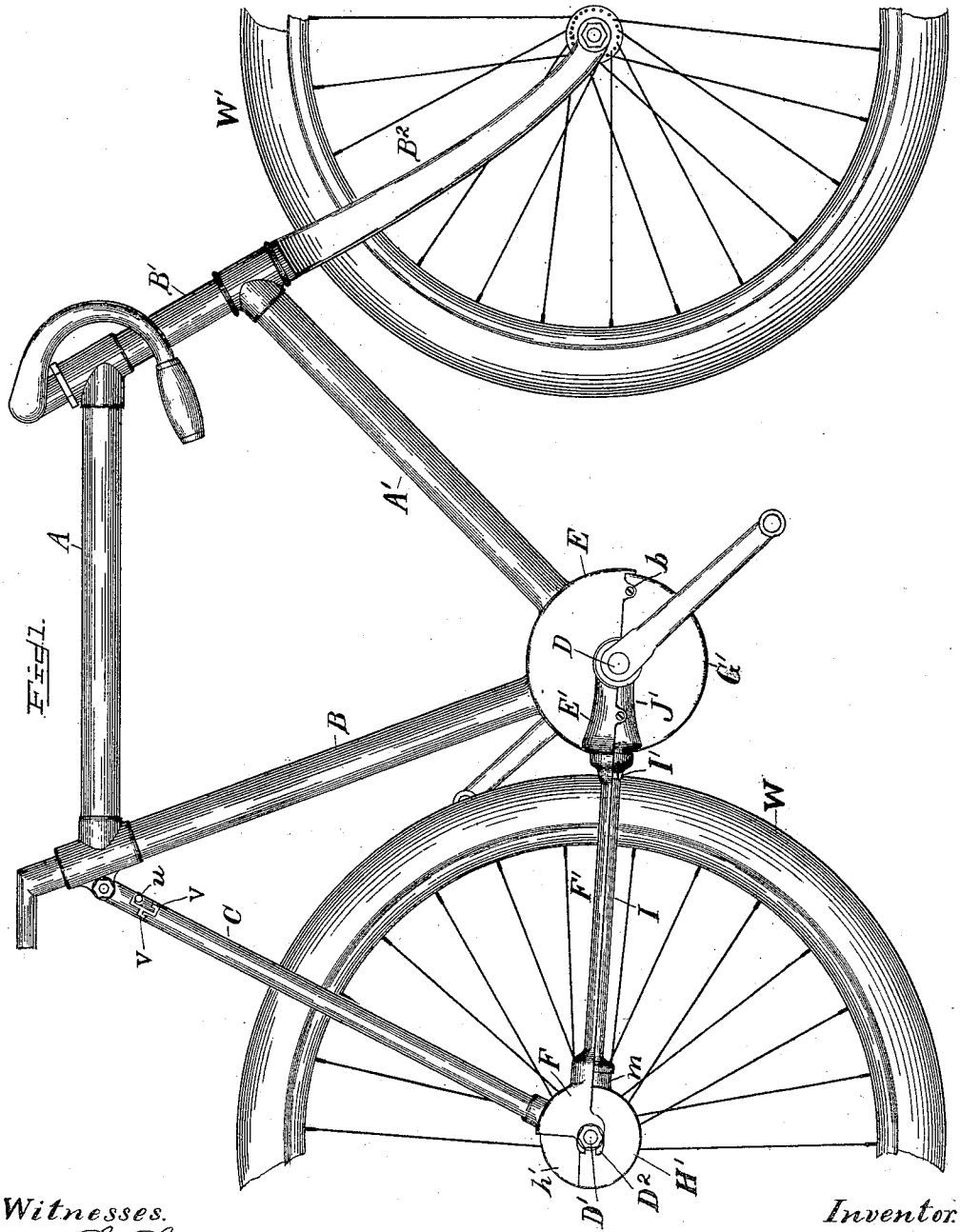
No. 620,929. Patented Mar. 14, 1899.

A. H. JOCELYN.

CHAINLESS BICYCLE GEARING.

(Application filed Jan. 14, 1898.)

(No Model.) 5 Sheets—Sheet 1.



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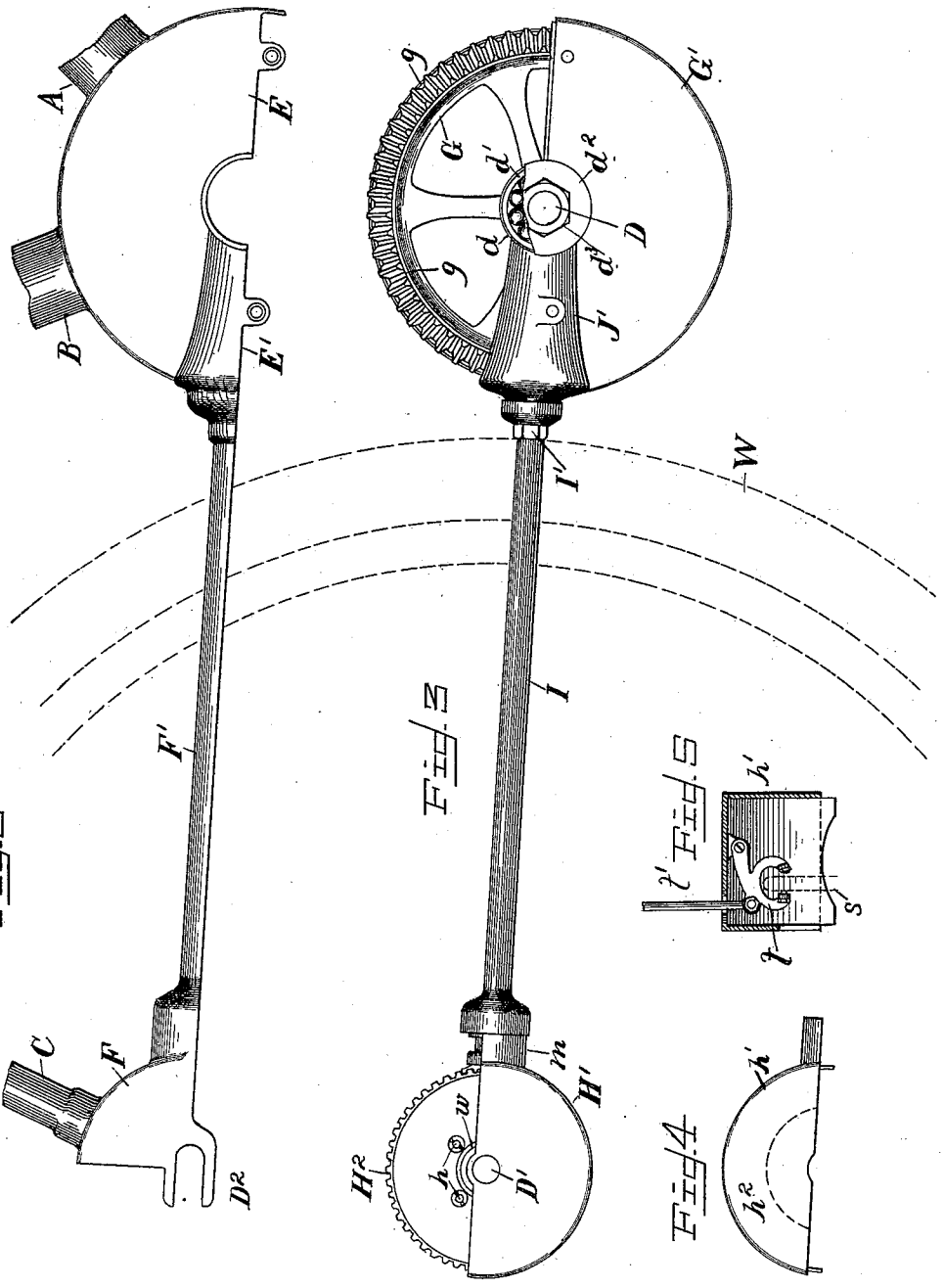


Fig. 2. Fig. 3. Fig. 5. Fig. 4.

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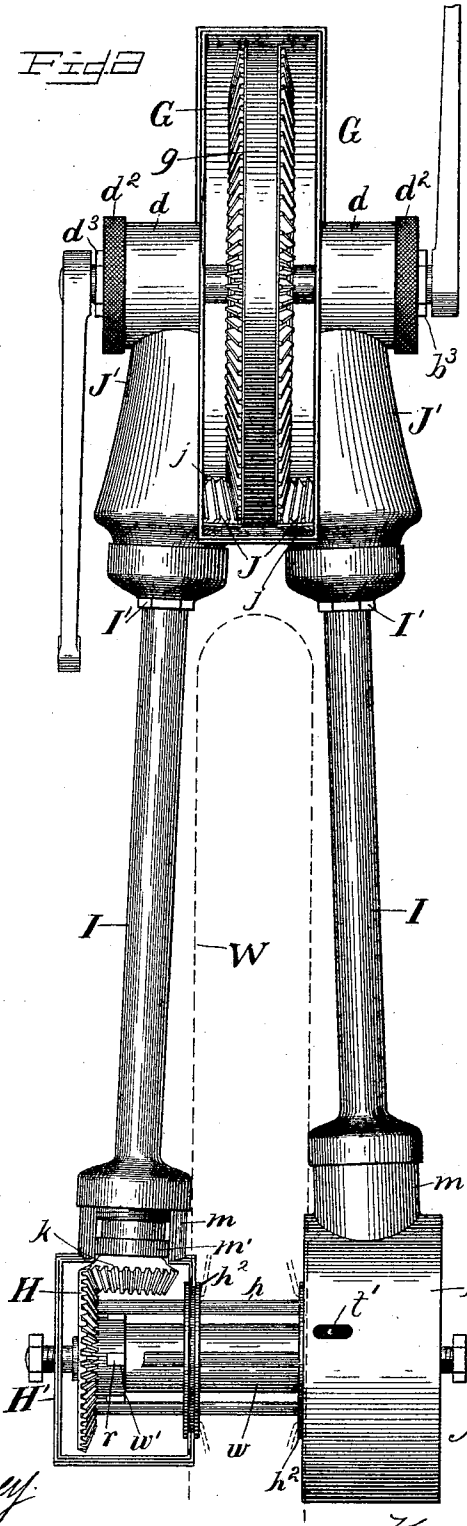
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Fig 3



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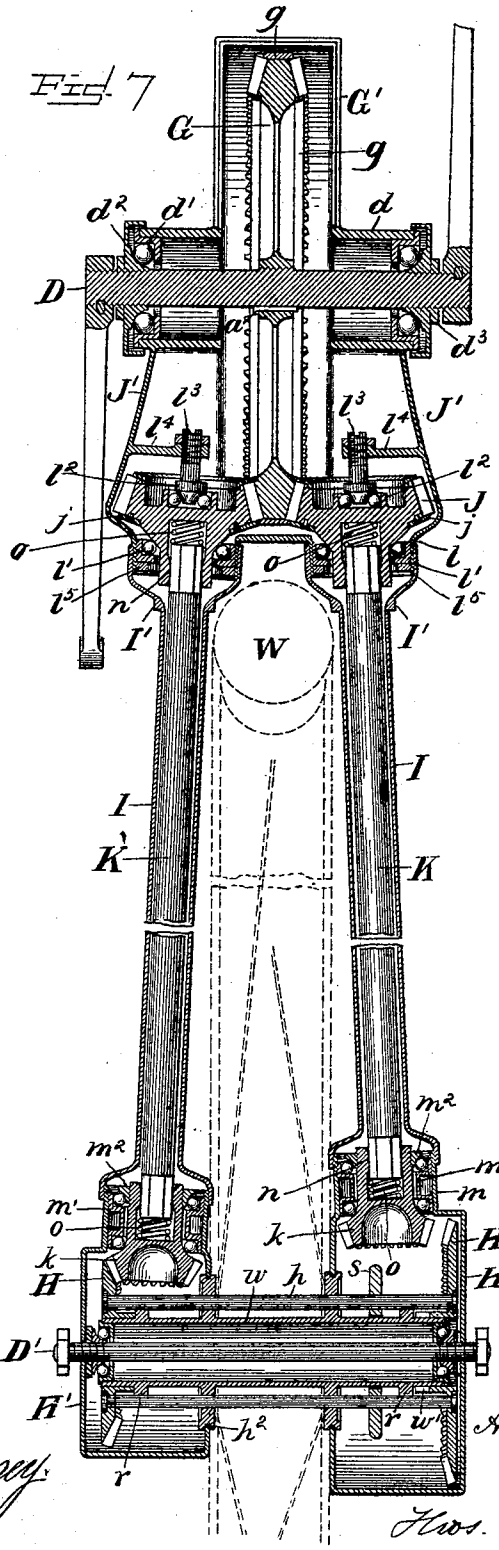
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Fig. 7



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Fig. 8

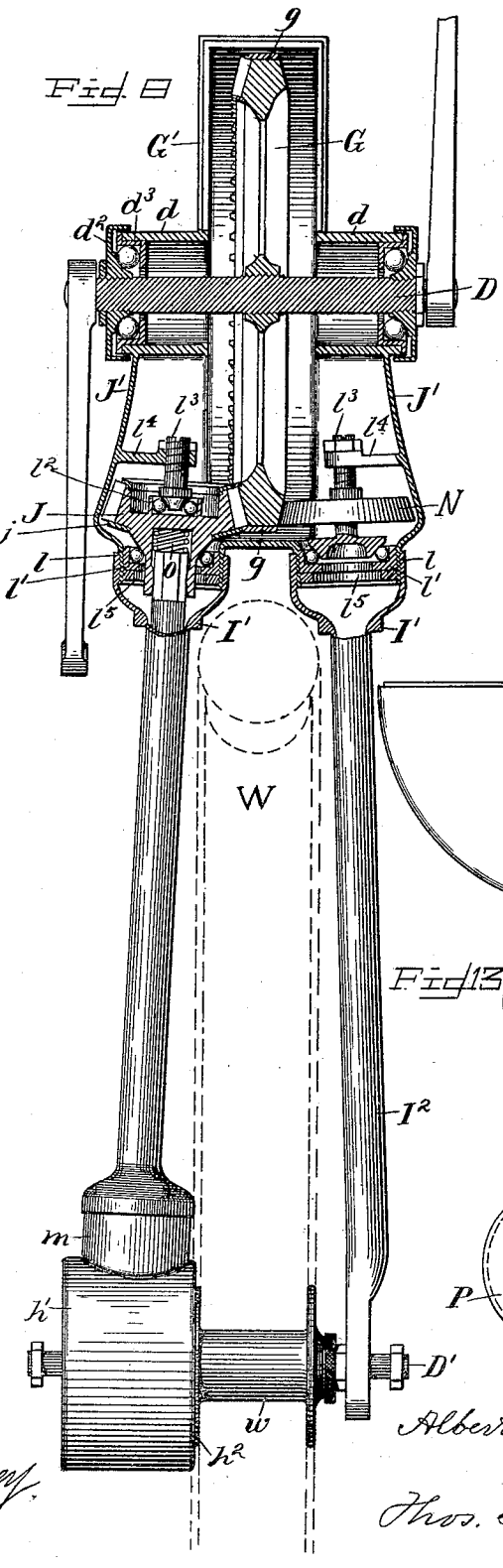


Fig. 9

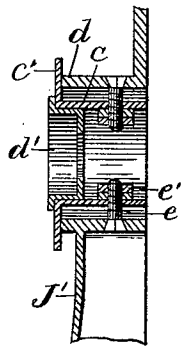


Fig. 10

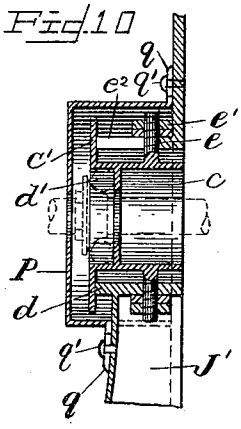


Fig. 11

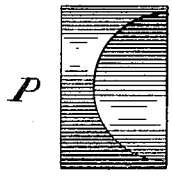


Fig. 14

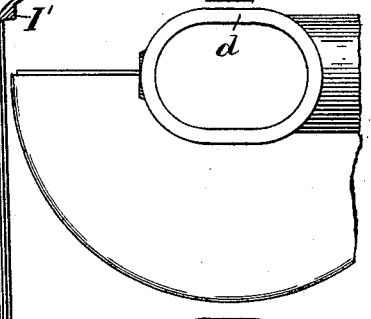


Fig. 13

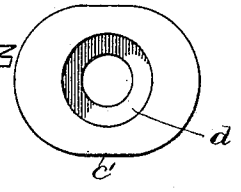
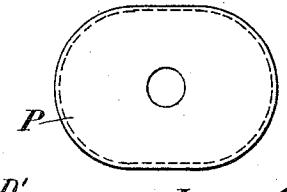


Fig. 12



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UNITED STATES PATENT OFFICE.

ALBERT H. JOCELYN, OF NEW YORK, N. Y.

CHAINLESS-BICYCLE GEARING.

SPECIFICATION forming part of Letters Patent No. 620,929, dated March 14, 1899.

Application filed January 14, 1898. Serial No. 666,632. (No model.)

To all whom it may concern:

Be it known that I, ALBERT H. JOCELYN, a citizen of the United States, residing at New York, (Brooklyn,) Kings county, State of New York, have invented certain new and useful Improvements in Chainless-Bicycle Gearing, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is partly to furnish an improved construction for the gearing of a chainless bicycle, whereby such gearing may be mounted and adjusted upon a suitable support independently of the bicycle-frame and then attached to the lower part of the frame. To effect this object, the lower ends of the frame-bars are provided with half-casings connected by a permanent tie, so as to maintain them rigidly in the right relation, and the independent support for the gearing is provided with the lower halves of such casings and with an adjustable tubular tie adapted to wholly exclude the dirt and set the gears in the right relation. The construction renders the parts accessible, while it protects them while in use from mud and dirt and facilitates the repair and adjustment of the parts when required. These objects and others which are incidentally secured in the construction will be understood by reference to the annexed drawings, in which—

Figure 1 is a side elevation of a bicycle embodying the improvements, with a portion of the front and rear wheels broken away for want of room. Fig. 2 is a side elevation of the lower ends of the frame-bars with the parts of casings which are attached thereto. Fig. 3 is a side elevation of the gearing-boxes which in practice are attached to such casings. Fig. 4 is a side view of the cover containing the clutch-shifter, and Fig. 5 is a transverse section of the same. Fig. 6 is a plan of the gearing for changeable speed and its independent support with the cover removed containing the clutch-shifter. Fig. 7 is a similar view with the parts in horizontal section at the center line where hatched. Fig. 8 is a plan of the gearing for single speed with the parts at the right-hand end in horizontal section at the center line where hatched. Figs. 9 and 10 are horizontal sections showing alternative constructions for the crank-shaft bearing. Fig. 11 is an end view of the cap for such bearing, which is shown in horizontal section in Fig. 10. Fig. 12 is a front or outside view of such cap turned at right angles to the position shown in Fig. 10. Fig. 13 is an outside view of the adjustable ball-race turned at right angles to the position shown in Fig. 10. Fig. 14 is an outside view of the cover to inclose such adjustable ball-race.

The invention is shown applied to a diamond-frame bicycle, but is adapted to frames of any description.

The constructions shown herein provide means for connecting the crank-shaft with the rear axle by two sets of gearing to secure changeable speed or by one set of gearing to form a chainless bicycle in which the gearing is wholly inclosed. In either case the crank bevel-gear is preferably mounted midway between the cranks, and a centrally-disposed casing is provided to inclose the same and furnished with lateral casings or guards to cover the pinions driven by such wheel and which are termed "primary" pinions herein. The teeth of the crank bevel-gear and the pinion or pinions driven thereby are preferably provided with guard-flanges which extend to the pitch-line of the teeth and are arranged to roll in contact. Where two side shafts are used, these flanges upon opposite sides of such crank bevel-gear entirely balance the lateral strain upon the gear, and thus prevent any end thrust upon the crank-shaft. Where only one side shaft is used, a blank bevel-wheel is arranged to roll in contact with the rear side of the bevel-gear to remove the thrust from the crank-shaft. The crank-shaft bevel-gear may with this arrangement be made very much lighter than otherwise, and the wear upon the crank-shaft bearings is greatly reduced by the prevention of end thrust. The gear is represented in the drawings much heavier in proportion than it would be made in practice to avoid any indistinctness of illustration. The casings, which are shown attached to the frame of the bicycle in the drawings, are adapted to inclose only the upper sides of the gear-wheels, the lower sides being contained in removable boxes, in which all the bearings and the means for adjusting the parts are provided.

A designates the top bar of the frame; A',

the bottom bar; B, the seat-post tube; B′, the steering-head; B^2, the steering-fork, and C the rear braces.

W is the rear driving-wheel, and W′ the front steering-wheel.

D is the crank-shaft, and D′ the axle of the rear wheel W.

E is the half-casing, attached to the lower ends of the seat-post tube B and bottom bar A′, to receive the crank bevel-gear, and E′ are lateral projections from such casing, adapted to form guards or casings over the primary pinions.

F is a segmental casing upon the lower end of each of the rear braces C, and F′ is a semitubular tie-bar connecting each of the casings F with the guard or lateral casing E′. Each casing F′ is formed upon its outer side with a fork D^2 to receive the axle D′. These features are clearly shown in Figs. 1 and 2, while the independent support for the gearing, which carries the bearings for the crank-shaft and side shafts, is shown in Figs. 3, 6, and 7.

In Fig. 7 the bevel-gear G is shown connected at opposite sides with the primary pinions J, from which shafts K extend toward changeable gear-wheels H H^2 upon the hub w of the bicycle driving-wheel W. These wheels are coupled together by rods h, so as to be moved at pleasure into contact with the secondary pinions k upon the side shafts K. The support for this gearing comprises the crank gear-box G′, with pinion-boxes J′ projected at opposite sides of the same, changeable gear-boxes H′, and sleeves I, connecting the boxes H′ and J′. The box G′ is provided with projecting bearings d to receive the ball-races d' of the crank-shaft D, and the boxes J′ are provided with bearings l to receive the ball-races l' for the side shafts K. (Shown in Fig. 7.) The boxes H′ have perforations for the rear axle D′, and at right angles to such perforations have bearings m for the ball-races m' of the pinions k. The ends of the bearings l and m are provided with external screw-threads, and the sleeve I is formed with threaded sockets to screw upon the same. The primary pinions J are formed upon the back to fit the balls in the races l', and the front of each of such pinions is formed with a ball-race l^2, into which a stud l^3, having a conical point, is adjusted. Such stud is shown in Fig. 7 supported by a bracket l^4, which is extended from the side of the box J′ into line with the center of the shaft K. Each pinion J is shown formed upon the back with a polygonal socket n, each side of the polygon being slightly rounded, as shown in Fig. 7, and the end of the shaft K is made of polygonal form to fit such socket and oscillate slightly therein, as is necessitated by the slight yielding of the bicycle-frame when in use. The ball-races for the pinions k are made double, and a cone m^2 is secured by a lock-nut upon the rear end of each pinion to adjust it to such ball-races, and the pinion is formed with a socket n, like the pinion J, into which the end of the shaft K is similarly fitted. Spiral springs o are inserted between the ends of the shaft K and the bottoms of the sockets n, into which they are fitted, thus holding the shaft elastically and permitting the parts to operate when adjusted independently. With this construction the pinions are all journaled independently and are enabled to revolve smoothly when the frame of the bicycle is bent under the various strains to which it is subjected in use.

The crank bevel-gear G is shown with the guard-flanges g upon the inner and outer ends of the teeth, and the pinions J are shown with similar flanges j, which serve not only as a guide in adjusting the pinions to the bevel-gear, but operate by rolling contact when properly adjusted to sustain the bevel-gear in its central position, which permits a very great lightness of construction, as shown in Fig. 3. Such rolling contact sustains the bevel-gear without any friction, as the rolling contact produces none, while it enables each of the pinions to sustain the thrust of the other when in operation. The bevel-gear G is shown with a threaded hub, and the crank-shaft D is shown with a threaded enlargement in the center, upon which such wheel can be screwed and locked, as by the key a, Fig. 7. A seat for the key is shown in the thread upon the shaft, as well as in the center of the bevel-gear, and the wheel can be adjusted within the limit of a revolution upon the screw-thread and the key inserted when the key-seat in the gear is turned to the seat in the shaft. The screw-thread is made fine enough to furnish a satisfactory adjustment in practice, while the key positively connects the wheel to the shaft and drives the wheel the same as in other key constructions and does not depend upon any frictional connection of the parts with the screw-thread.

The cones d^2 upon the axle D are provided with the usual lock-nuts d^3, which serve to adjust the axle longitudinally in a slight degree for varying the position of the bevel-gear G; but any greater adjustment that may be required is effected by removing the key a and turning the bevel-gear upon the threaded portion of the shaft. One of the gear-boxes H′ is shown in Fig. 6 provided with a cover h', (shown separately in Figs. 4 and 5,) which serves to inclose the upper half of each gear H and H^2 when adjusted. When these boxes and the sleeves I are suitably connected and the gearing adjusted therein, they are secured upon the bottom of the bicycle-frame by slipping the ends of the rear axle D′ into the fork D^2 and applying the gear-box G′ to the semicasing E, with the pinion-boxes J′ fitted inside the lateral casings E′, the boxes and casings being secured together by the screws b, (shown in Fig. 1,) and the sleeve I fitting within the semitubular tie F′.

The sleeve I is formed of flats I′ to apply a wrench to set the crank-shaft D parallel

with the rear axle D', the jointed connection of the side shafts K with the pinions permitting such adjustment at any time.

To operate the changeable gear and produce the desired variation of speed when driving the bicycle, each of the bevel-wheels H H^2 is fitted movably upon the hub *w* and provided with notches *w'*, and the hub is provided with adjacent clutch-teeth *r*, upon which the notches fit when the wheel is in mesh with its pinion. The rods *h*, which couple the wheels H and H^2, are extended movably through collars h^2, attached rigidly to the hub *w*, and thus serve as guides to the longitudinal movement of the wheels while carrying the wheels around continuously with the hub. A shifting collar *s* is attached rigidly to the rods and serves when pushed in either direction to bring one of the wheels H or H^2 into contact with its appropriate pinion. The means for shifting such collar and wheels is provided in one of the box-covers *h'*, where a shifter-fork *t* is pivoted upon a lug and provided with arms having each a ball journaled in its end to embrace the opposite sides of the collar *s*. The shifter-fork is actuated by the rider when seated upon the saddle through the agency of the rod *t'*, which is extended from the cover upwardly through one of the rear braces C and provided at the top with a handle *u*. This handle is inserted through a slot in the rear brace, which slot is provided with three notches *v*, adapted to hold the handle in three different positions, the extreme position serving to engage the wheels H and H^2, respectively, with their pinions and the intermediate position serving to hold both of the wheels detached from the pinions *k*, as is desired when coasting, for such detachment permits the cranks to stand still while the wheels of the bicycle are turning. Each of the notches *v* has a recess at its inner end, by which the handle may be shifted backward slightly after moving the shifter-fork to the desired position, thus relaxing the pressure of the fork upon the collar *s* and relieving the latter from contact with the anti-friction-balls upon the arms of the fork. It will be observed that the bevel-wheels H and H^2 do not turn upon the hub *w*, and the notches in such wheels are therefore always coincident with the clutch-teeth *r* upon the hubs. Owing to this construction the notches and teeth *r* are wholly prevented from wear, and these bevel-wheels may be shifted in and out of the gear while the machine is in motion, for which reason the handle *u* is arranged below the saddle, where it can be easily reached by the rider. The same frame, excepting one of the boxes H' and sleeves I, can be used in constructing a bicycle without the changeable gear, a blank bevel-wheel N being substituted for one of the primary pinions J and fitted against a smooth beveled surface upon the rear side of the crank bevel-gear G, as shown in Fig. 8, to balance the strain of the opposite primary pinion. The smooth surface upon the rear side of the bevel-gear is beveled reversely to the side which is toothed, by which means it is adapted to run without friction in contact with the blank bevel-wheel N. This modification is fully shown in Fig. 8, where one of the sleeves I is replaced by a different sleeve I^2, having a fork D^3 at the rear end, which permits the adjustment of the axle D' to set the rear wheel W parallel with the frame. Such construction furnishes a chainless bicycle having independently-journaled pinions and a side shaft with jointed connections to such pinions, so as to compensate for any yielding of the frame, while the use of the blank bevel-wheel N upon one side of the crank bevel-gear serves to wholly remove the thrust of such gear from the crank-shaft.

It will be noticed that the primary pinions have no direct means of adjustment to and from the face of the bevel-gear with which they are meshed; but an indirect means of effecting such adjustment may be secured by employing horizontally-adjustable bearings for the crank-shaft which permits the primary pinions to be moved forwardly.

As the side shafts are arranged at an inclination to the center of the frame such forward movement of the pinions brings them nearer together, and the extent of such movement may, when the pinions are worn, be regulated by adjusting the crank-shaft to secure the proper contact between the bevel-gear and pinions.

An adjustable ball-race for the crank-shaft is shown in Figs. 9 and 10, the bearing *d* shown in these figures and in Fig. 14 being made oblong in a horizontal direction and a movable socket *c* being fitted therein to carry the ball-race *d'* and provided with a flange *c'* to close the face of the bearing. Such flange is oblong, as shown in Fig. 13. The socket *c* is adjusted within the bearing by screws *e* and nuts *e'*, which may be inserted through the walls of the bearing and socket, as in Fig. 9, or made as integral studs upon the socket, as in Fig. 10, with the nuts applied to the outside of the bearing. In this latter case the bearing is formed with a slot e^2 at one side to facilitate the introduction of the socket with its projecting screw-studs.

To adjust the pinions forward, the studs l^3 are adjustable, and the ball-race *l'* behind each of the primary pinions is screwed into the bearing *l* and provided with a lock-nut l^5, as shown in Fig. 8. In thus adjusting the pinion to the bevel-gear the guard-flanges *g* and *j* serve perfectly as guides in effecting the adjustment, and serve thereafter to support the gears smoothly in their rotary movement, thus preventing much of the jar and vibration which is common with toothed wheels.

Covers P (shown in Figs. 10, 11, and 12) may be employed to inclose the movable flanges *c'* and the bearings *d* to wholly exclude the dust and dirt therefrom, such cover being fitted

snugly to the crank-shaft, as shown in Fig. 10, and secured in place when adjusted by means of slotted feet q and screws q'.

The dust is prevented from access to the rear axle D′ upon the side next the driving-wheel W, through which side the hub w extends, by making one of the spoke-flanges of the wheel with a suitable groove and forming the inner side h^2 of the casing H′ and of its cover h' to enter such groove, as indicated by the dotted lines h^2 in Figs. 3 and 4.

From the above description it will be observed that all parts of the gearing are adapted for proper adjustment to compensate for wear, so that they may be kept in the most efficient condition, and such adjustment is greatly facilitated at the outset or when the bicycle is sent to the repair-shop by the mounting of the gearing upon a support independent of the bicycle-frame, which permits of the gearing being separated from such frame, and thereby handled and adjusted with much greater convenience.

It is obvious that the changeable speed may be effected for the driving-wheel W by making the bevel-wheels H H^2 of the same size and their pinions of diverse sizes, or by making the variation in speed of the shafts K by making the pinions J of different sizes. Such changes can be readily effected in a construction where the crank-axle and rear axle are mounted with their gearing in an independent support, such as is shown in Fig. 3 and in which the lower end of the frame-bars is provided with the upper parts of the casings connected by the permanent tie F′. Such a construction for the frame and such a support for the gearing permits the gearing to be fitted to its bearings and adjusted with much less expense than where the parts are all fitted to and adjusted upon the frame itself, and this feature of my invention is obviously independent of the proportions of the gear-wheels.

Having thus set forth the nature of my invention, what I claim herein is—

1. In a bicycle-gear, the combination, with a bicycle-frame, of a double-faced bevel-gear, primary pinions meshing with the opposite sides of such gear, a driving-wheel hub with bevel-gears of diverse sizes fitted movably upon its opposite ends, tie-rods h extended through the spoke-flanges of the driving-wheel, and connected permanently to such bevel-gears, secondary pinions for driving such gears when connected, and shafts connecting them with the primary pinions, and means connected with the rods for shifting either of such driving-wheel gears at pleasure into mesh with its corresponding secondary pinion, substantially as herein set forth.

2. In a changeable gear for bicycles, the combination, with the driving-wheel hub w, of two bevel-gears H and H^2 fitted movably upon its opposite ends and permanently connected by the tie-rods h, guides, as the spoke-flanges h^2 upon the hub, to carry such rods, the pinions k to changeably drive such wheels, and the clutch-teeth r upon the driving-wheel hub to engage each of such wheels positively with the hub when meshed with its pinion, substantially as herein set forth.

3. In a changeable gear for chainless bicycles, the combination, with the driving-wheel hub w, of the bevel gear-wheels H and H^2 fitted movably upon the opposite ends of the hub and connected permanently by the tie-rods h, guides, as the spoke-flanges h^2 to carry such rods, bevel-pinions k to changeably drive such bevel-wheels, the clutch-teeth r upon the hub to engage each of such wheels positively with the hub when meshed with its pinion, the circular flange s attached to the rods to shift the gear-wheels simultaneously, the forked shifter t embracing such flange and having bearing-balls to press upon the same, a support for such shifter adjacent to the flange, and a handle t' to actuate the shifter, substantially as herein set forth.

4. In a bicycle-gear having a crank bevel-gear an individually-mounted primary pinion with polygonal socket in its hub, and a bevel-wheel upon the driving-wheel hub with secondary pinion individually mounted and having a polygonal socket in its hub, the combination, with such socketed primary and secondary pinions, of a connecting-shaft having polygonal ends fitted into such sockets, and springs inserted between the ends of such shaft and the bottoms of the sockets, to hold the shaft in an intermediate position, substantially as herein set forth.

5. In a bicycle, the combination, with a frame having upon the lower ends of the seat-post tube and bottom frame-bar a central casing for a bevel-gear with pinion-casings and bearings at its opposite sides, with crank-shaft fitted thereto, and a centrally-disposed bevel-gear G upon such crank-shaft, pinions J at the opposite sides of such bevel-gear, with ball-races and balls fitted to their front and rear ends, the bracket l^4 extended from the inner side of each pinion-casing to the center line of the pinion, and the pivot-stud l^3 mounted adjustably in such bracket and fitted within the front ball-race of the pinion, substantially as herein set forth.

6. A bicycle-frame having the frame-bars A′ and B provided with the half-casing E, and the rear braces C provided each upon its lower end with the casing F, the part casings E and F being connected permanently by the semitubular ties F′, substantially as set forth, and the casings being adapted to receive gear-boxes containing the crank-axle and rear axle with their connected gearing.

7. A bicycle-frame having the frame-bars A′ and B provided with the centrally-disposed half-casing E, with pinion shields or casings E′ projected at opposite sides of the same, the rear braces C provided each upon its lower end with the segmental casing F having the fork D^2, and the casings E′ and F being connected permanently by the semi-

tubular ties F', substantially as set forth, and the casings being adapted to receive gear-boxes containing the crank-axle and rear axle with their connected gearing.

8. In a bicycle, the combination, with the frame having frame-bars A' and B provided with the half-casing E, and the rear braces C provided each upon its lower end with the casing F, with the part casings E and F connected permanently by the semitubular ties F', of the crank-gearing and driving-wheel gearing with their connecting-shaft, and an independent support having bearings for the same, and means for connecting such support with the said casings, substantially as herein set forth.

9. In a bicycle, the combination, with the frame-bars, of a half-casing connecting the lower ends of the bottom frame-bar and seat-post tube, ties connecting such casing with the rear braces at opposite sides of the frame, and gear-boxes having the crank-gearing and driving-wheel gearing adjusted therein, and suitably connected with a side shaft, the boxes being attached respectively to the half-casing and to the lower ends of the rear braces, substantially as herein set forth.

10. In a bicycle, the combination, with the frame-bars, of a half-casing connecting the lower ends of the bottom frame-bar and seat-post tube, ties connecting such casing with the rear braces at opposite sides of the frame, and gear-boxes having the crank-gearing and driving-wheel gearing adjusted therein, with a shaft connecting their respective pinions, the boxes being provided with threaded nozzles at the journals of such pinions, and the shaft being inclosed by a sleeve screwed at its ends upon such nozzles to connect the said boxes and hold the parts in the required adjustment, substantially as set forth.

11. In a bicycle, the combination, with a frame having upon the lower ends of the seat-post tube and bottom frame-bar a centrally-disposed half-casing with casings or guards at the sides for primary pinions, and a segmental casing at the bottom of each rear brace with a permanent semitubular connection to one of the lateral casings, of gear-boxes having bearings for the shafts and axle, and having the crank-gearing and driving-wheel gearing adjusted therein, the boxes inclosing the lower sides of the gears, and being adjusted respectively to the half-casing and to the segmental casings, substantially as herein set forth.

12. In a bicycle, the combination, with a frame having upon the lower ends of the seat-post tube and bottom frame-bar a centrally-disposed half-casing with lateral casings or guards for primary pinions, and a segmental casing at the bottom of each rear brace with fork to embrace the rear axle, of gear-boxes having the crank-gearing, driving-wheel gearing and their connecting-shaft adjusted therein, with the rear axle projected outside of the boxes and fitted to the forks upon the segmental casings, and the box for the crank bevel-gear being secured to the half-casing, the whole arranged and operated substantially as set forth.

13. In a changeable gear for chainless bicycles, the combination, with the frame-bars suitably connected at their lower ends, with casings and ties adapted to receive the crank bevel-gear with pinion and shaft at each side of the same, of three gearing-boxes suitably connected to contain respectively the crank-gearing and the bevel-gearing for changeable speed, the latter boxes having the rear axle extended through the same, and the side shafts being inclosed in the connections between the said boxes, the driving mechanism being independently supported and adjusted upon the said boxes and the latter being fitted for attachment to the casings upon the bottom of the bicycle-frame, as and for the purpose set forth.

14. In a changeable gear for chainless bicycles, the combination, with the frame-bars suitably connected at their lower ends with casings and ties adapted to receive the crank bevel-gear with pinion and shaft at each side of the same, of three gearing-boxes suitably constructed to contain respectively the crank-gearing and the bevel-gears for changeable speed, the latter boxes having the rear axle extended through the same, and the side shafts being inclosed in the connections between the said boxes, the boxes being suitably attached to the casing upon the bottom of the bicycle-frame, and a clutch and shifter being provided to connect the changeable gears respectively with the side shafts, as and for the purpose set forth.

15. In a changeable gear for chainless bicycles, the combination with the frame-bars suitably connected at their lower ends with casings and ties adapted to receive the crank bevel-gear with pinion and shaft at each side of the same, of three gearing-boxes suitably constructed to contain respectively the crank-gearing and the bevel-gears for changeable speed, the latter boxes having the rear axle extended through the same, and formed each with a removable cover, clutches being provided upon the rear hub to connect the changeable gears therewith when in operation, and a clutch-shifter being secured within one of the covers and provided with a handle for actuating the same, substantially as herein set forth.

16. In a changeable gear for chainless bicycles, the combination, with the frame-bars suitably connected at their lower ends with casings and ties adapted to receive the crank bevel-gear with pinion and shaft at each side of the same, of three gearing-boxes suitably constructed to contain respectively the crank-gearing and the bevel-gears for changeable speed, the latter boxes having the rear axle extended through the same, and formed each with a removable cover, clutches being provided upon the rear hub to connect the

changeable gears therewith when in operation, and a clutch-shifter being secured within one of the covers, and an actuating-rod extended therefrom within the rear brace, with a handle projected outside of such brace beneath the saddle, as and for the purpose set forth.

17. In a bicycle, the combination, with the frame-bars, of a half-casing connecting the lower ends of the bottom frame-bar and seat-post tube, ties connecting such casing with the rear braces at opposite sides of the frame, and gear-boxes having the crank-gearing and driving-wheel gearing adjusted therein, with a shaft connecting their respective pinions, the boxes being provided with threaded nozzles at the journals of such pinions, and a sleeve inclosing the shaft and provided with sockets at its ends to screw upon such nozzles, and having flattened collars for applying a wrench to adjust the said parts, substantially as herein set forth.

18. In a chainless bicycle having bevel-gear upon the crank-shaft and having a side shaft with gear connections between such bevel-gear and the driving-wheel hub, the combination, with the frame-bars, of a casing at the lower ends of the bottom bar and seat-post tube with oblong sockets at opposite sides of the same, ball-bearings fitted to such sockets with flanges to cover their openings, screws for adjusting the bearings in such sockets, and oblong covers fitted to the crank-shaft and attached to the casing to exclude the dust from such sockets, substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALBERT H. JOCELYN.

Witnesses:
THOMAS S. CRANE,
EDWARD F. KINSEY.