No. 821,340. PATENTED MAY 22, 1906.

J. S. COPELAND.

DRIVING MECHANISM FOR CHAINLESS BICYCLES.

APPLICATION FILED NOV. 26, 1897.

3 SHEETS—SHEET 1.

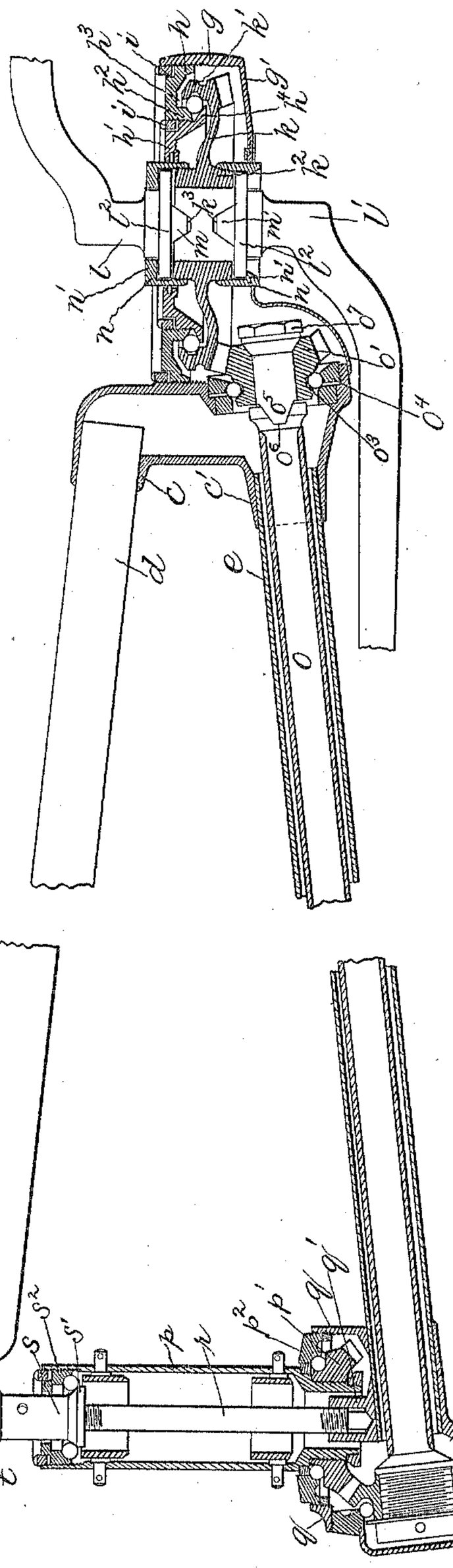

Fig. 1

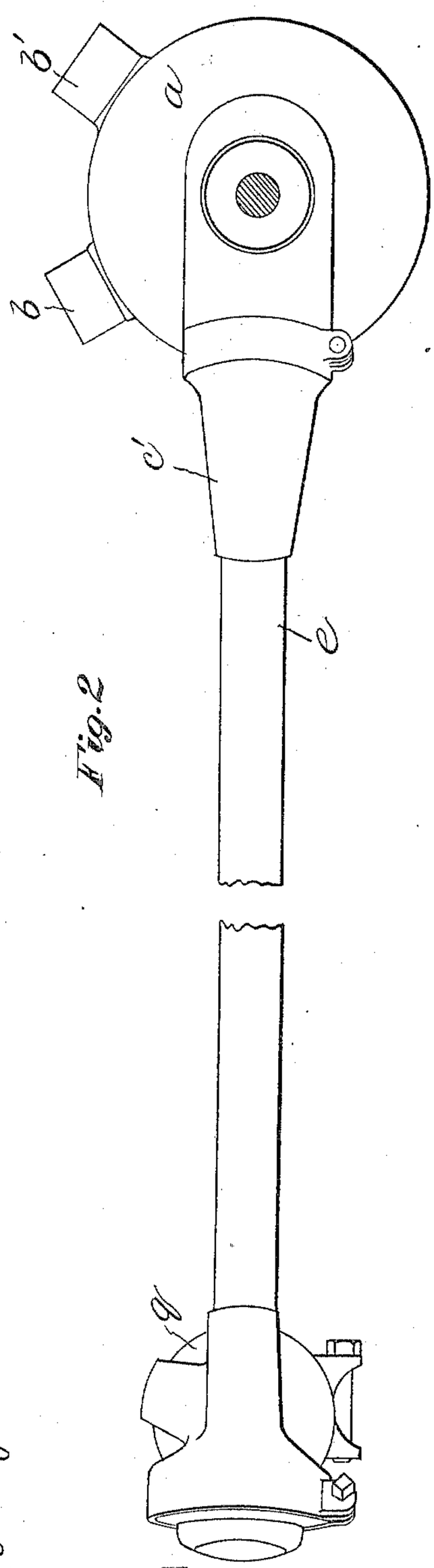

Fig. 2

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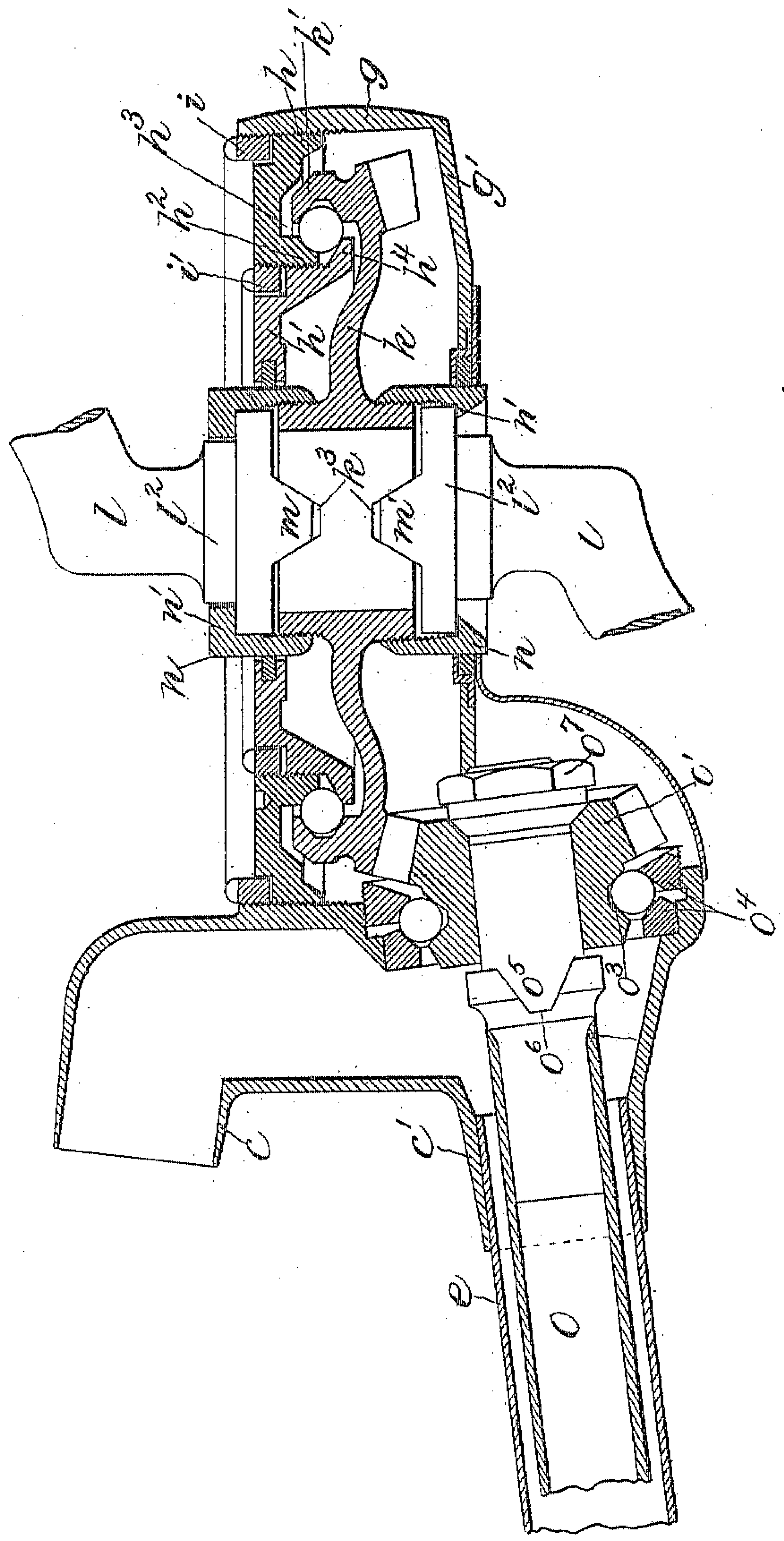
3 SHEETS—SHEET 2.

Fig. 3



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3 SHEETS—SHEET 3.

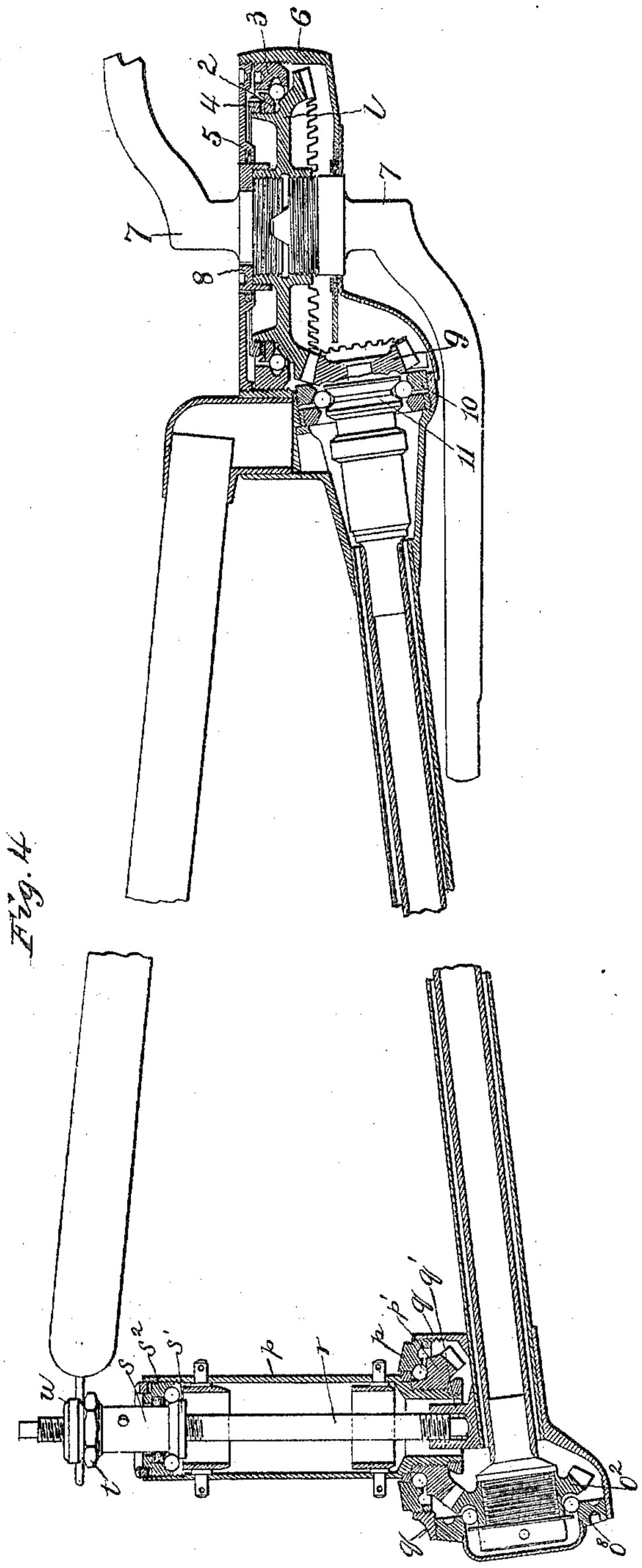

Fig. 4.

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UNITED STATES PATENT OFFICE.

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DRIVING MECHANISM FOR CHAINLESS BICYCLES.

No. 821,340. Specification of Letters Patent. Patented May 22, 1906.

Application filed November 26, 1897. Serial No. 659,805.

To all whom it may concern:

Be it known that I, JAMES S. COPELAND, a citizen of the United States, and a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Driving Mechanisms for Bicycles, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

My invention relates to the class of velocipedes and such light vehicles in which the driving mechanism is operated by the rider, and especially among other forms to that subclass of such vehicles in which the driving mechanism is made up of gears as distinguished from those vehicles in which a drive-chain is used to connect the crank-shaft and the driving-wheel, but is not wholly limited to that.

The object of my invention is to provide a gear driving mechanism in which the bearings on the main driving-gear shall be reduced in number and also to provide improved means for connecting the cranks; and it also further consists in details of the several parts making up the machine as a whole and in the combination of such parts, as hereinafter described, and more particularly pointed out in the claims.

Referring to the drawings, Figure 1 is a top or plan view of the rear portion of a bicycle-frame, showing the parts directly related to the driving mechanism and with such parts broken away in section to show construction. Fig. 2 is a view in side elevation of the crank-bracket, rear bracket, and side-frame tube. Fig. 3 is a detail sectional view, on enlarged scale, of that portion of the driving mechanism located adjacent to the crank-shaft. Fig. 4 is a detail top or plan view of the rear portion of a bicycle-frame and of the parts directly related to the driving mechanism with parts broken away in section, illustrating the construction and showing a modified form of the invention.

In the accompanying drawings the letter *a* denotes a crank hanger or bracket—that is, a somewhat narrow circular box or casing—located in the central plane of the frame and having suitable devices, as lugs *b b'*, for the attachment of the down-tube and other member and lugs *c c'* for the attachment of the rear fork members *d* and *e*. This bracket has a peripheral wall *g* and a side wall *g'*, the latter located at one end thereof and with an opening therethrough for the crank-shaft and slightly larger than the diameter of the shaft, and on the opposite end of the bracket is an interior thread to receive the threaded edge of a cone consisting of the outer section *h* and inner section *h'*. The outer section *h* is backed up by a locking-ring *i*, that serves to close and pack the joints and also to hold the section against accidental movement. The inner section *h'* is secured in a central opening in the outer section by means of interengaging screw-threads, this section being backed up by a locking-ring *i'*, similar to the locking-ring *i*, although smaller in diameter, but used for the same purpose. A flange h^2 is located adjacent to the opening in the section *h* of the cone, this flange forming a recess h^3, into which a flange *k'* on the main driving gear-wheel *k* projects. A projection or flange h^4 is located on the periphery of the inner section *h'* of the cone, a portion of the ball-race being located between this flange h^4 and the flange h^2 on the outer section. This portion of the ball-race is of angular shape, and by means of the adjustable connection between the two sections of the cone any wear between the parts may be readily taken up. The sloping surfaces on the cone are preferably arranged in a plane obliquely to a line passing diametrically through two of the balls located directly opposite each other on the cone.

Within the bracket the main driving-gear *k* is located, with the ball-case for the balls formed in an angular recess on the inner surface of the flange *k'* on the gear, the walls of the recess being arranged in opposition to the bearing-surface of the sections of the cone just described.

The crank-shaft is made in two sections *l l'*, each section having a projection *m m'*, adapted to fit in sockets k^3 in the hub of the gear *k*. Shoulders l^2 are formed on each of the crank-shaft sections and are engaged by a flange *n'* on each of the sleeve lock-nuts *n*, the inner surface of the wall of each of these sleeves being threaded to engage an exterior thread on each end of the hub k^2 of the gear *k*, and by means of which the crank-shaft sections are firmly secured to said gear. The sleeve lock-

nuts n closely fit a central opening in the side wall of the gear-case and an opening in the inner section h' of the sectional cone, any suitable packing being used to prevent the entrance of dirt or dust within the case.

A connecting-shaft o is located along one side of the frame, preferably extending through the side fork e, and it supports on the front end a small bevel gear-wheel o' and on the rear end a bevel gear-wheel o^2. The bevel-gear o' projects into the casing a and engages the teeth on the main gear. The forward end of this connecting-shaft is provided with a cone-bearing o^3, and it coöperates with a sectional ball-case o^4, composed of two rings which are screwed into sockets in the crank-hanger.

In the form of device herein shown the cone-bearing is formed on the hub of the gear o', projections o^5 on this hub engaging recesses o^6 on the connecting-shaft o, these projections and recesses being similar to those already described with reference to the sectional crank-shaft and the main gear, a tapered nut o^7 being employed to hold the gear in place on the shaft.

As thus constructed the bicycle-frame may be built with an extremely narrow tread. The balls are arranged in a position directly back of the location of the teeth on the gear-wheel, and at least two of the oppositely-arranged supporting-surfaces of the cone are located at nearly right angles to the line of thrust caused by the resistance of the vehicle to forward movement under a force applied to the crank-shaft, as by means of the cranks and pedals. The difficulties presented by this end thrust on the bearings in older forms of construction are practically avoided in this improvement.

In the form shown in the drawings the rear wheel has a barrel-hub p, to one end of which is secured, as by means of threaded parts, a gear-wheel p', this gear-wheel meshing with the forward-facing gear-wheel o^2 on the rear end of the connecting-shaft o. The end of the hub p projects into a bracket or casing q, into which the rear end of the connecting-shaft extends and within which ball-bearings to support it are located, and the gear on the end of the hub p is also located within this bracket. The bracket q is shown in side elevation of uniform scale in Fig. 2 of the drawings. Within the bracket q and in line with the axis of the driving-wheel is a threaded socket q', in which the threaded end of the bolt r is held by interengaging threaded parts, a projection in which this socket q' is formed being located within the hollow end of the hub. On the back of the gear-wheel p' a cone is formed for ball-bearings, and a ball-case p^2, secured, as by means of interengaging threaded parts on the inner face of the bracket q, carries the complementary part of the ball-race and also serves to close the opening between the edge of the bracket q and the outer surface of the hub p. This bolt r serves to connect the fork members d and e, and on the end opposite the bracket q it is threaded and receives a threaded sleeve s. This sleeve s bears the cone s', which forms part of the ball-race for the ball-bearings at this end of the axle, the case s^2 being secured to the end of the hub, as by interengaging threaded parts, and by changing the position of the sleeve s on the bolt and the case p^2 in the bracket the contact of the gear-wheels o^2 and p' may be adjusted. A lock-nut t on the end of the sleeve forms a shoulder against which the toe-piece of the frame member d rests, and a thimble u on the outer side of the toe-piece is held by a nut (not shown in the drawings) on the outer end of the bolt. At the rear end of the shaft o the ball-race for the bearings is formed on the cone back of the gear-wheel and the case o^8, which is adjustably secured to the rear end of the bracket q. This case also forms a cover for the rear end of the shaft and closes the opening in the bracket.

In the modified form of the invention shown in Fig. 4 of the drawings the balls are located adjacent to the periphery of the main driving-gear 1; but in this construction the cone 2 is adjustably secured to the hub of the driving-wheel and the ball-case 3 is adjustably secured within the casing or crank-hanger, the balls being supported by this case and by the back of the gear-wheel and the cone supported on the hub thereof. A lock-nut 4 prevents accidental movement of the cone, and a cover 5 closes the side of the casing 6, being engaged therewith, as by means of interengaging screw-threads. In this form of construction the cranks 7 are connected with the hub of the main driving-gear 1 by means of exterior threads fitting the interior-threaded surface of the hub, the cranks being prevented from independent rotation, as by means of engaging recesses and lugs located on opposing crank-shafts. A cap 8 is secured to the hub of the gear and has a flange overlying a shoulder on one of the crank-shafts, this cap fitting within a central opening in the cover 5. The gear 9 is secured to the connecting-shaft in any suitable manner and is supported on ball-bearings located between the sectional ball-case 10, secured to the bracket and the cones formed on a sleeve 11, secured to the hub of the gear-wheel and the connecting-shaft.

I claim as my invention—

1. In combination in a vehicle having gear driving mechanism, a driving-wheel, a crank-shaft bracket located in the central plane of the machine, a main bevel gear-wheel supported within the bracket, power-transmitting means operatively connecting the gear and driving wheel, a portion of the ball-race formed in the gear at or near its periphery,

one section of a cone secured to the bracket, the other section of the cone secured to the first section, and a single row of balls located in the ball-race between the gear and sectional cone, all substantially as described.

2. In combination in a vehicle having driving mechanism, a crank-shaft bracket located in the central plane of the machine, a main gear-wheel, a driving-wheel, power-transmitting means operatively connecting the gear and driving-wheel, a portion of the ball-race located near or at the periphery of the gear, one section of a cone adjustably secured to the bracket, the opposite section of the cone adjustably secured to the first section, and balls located in the ball-race between the sectional cone and the gear, all substantially as described.

3. In combination in a vehicle having gear driving mechanism, a narrow crank-shaft bracket located in the central plane of the machine, a main gear-wheel supported within the bracket, a driving-wheel, power-transmitting means operatively connecting the gear and driving-wheel, a ball-race formed on the gear-wheel, a sectional cone adjustably secured to the bracket and forming a cover therefor, and balls supported between the cone and gear, all substantially as described.

4. In combination in a vehicle, consisting of a frame having a narrow crank-shaft bracket located in the central plane of the frame, a main gear-wheel supported centrally within the bracket, cranks secured to opposite sides of said gear-wheel and projecting without the bracket, a driving-wheel supported in the frame, and connections between said driving-wheel and main driving-gear.

5. In combination in a vehicle including a frame, supporting-wheels and driving mechanism, a bolt secured between side parts of the frame, a driving-wheel having its hub surrounding said bolt, connections between the driving-wheel and driving mechanism, a ball-case secured within the hub and facing inward, a thimble adjustably mounted upon the bolt and extending through said ball-case and having means for moving it along the bolt, said thimble having a cone located thereon within the hub.

6. In combination in a vehicle, a frame including a narrow crank-shaft bracket located in the central plane of the frame and of circular outline, rear fork sides connected to said bracket near the periphery thereof, and a casing for the pinion of a connecting-shaft formed on one of the fork sides in position for said pinion to project through the side wall of the crank-shaft bracket.

7. In combination in a vehicle, a crank-shaft bracket, one section of a cone adjustably supported at one end of the bracket and forming a portion of the cover therefor, a section of the cone adjustably supported by the first section and forming a portion of the cover for said bracket, a main bevel gear-wheel located in the bracket, ball-bearings located immediately back of the teeth on said bevel gear-wheel and between it and the sectional cone, a main driving-wheel mounted in the frame, power-transmitting means connecting the main gear-wheel and the driving-wheel, and means for operating the main gear-wheel, all substantially as described.

8. In a vehicle, in combination with a frame including a bracket, one section of a cone removably secured to said bracket, another section of a cone removably secured to the first section, a gear-wheel having a circular flange with a groove coöperating with the cone, balls located in the ball-race between the cone and flange, cranks removably secured to opposite sides of the hub of the gear, a driving-wheel, and operative connections between the gear and driving-wheel.

9. In combination in a vehicle having gear driving mechanism, a narrow crank-shaft bracket located in the central plane of the machine, a main gear-wheel supported within the bracket, a driving-wheel, power-transmitting means operatively connecting the gear and driving-wheel, a ball-race formed on the gear-wheel at a point near the back of the teeth thereon, a sectional cone adjustably secured to the bracket and forming a cover therefor, and balls supported in the ball-race between the cone and gear.

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