No. 667,658.

Patented Feb. 5, 1901.

H. B. KEIPER.

BALL GEARING.

(Application filed July 24, 1897.)

(No Model.)

2 Sheets—Sheet 1.

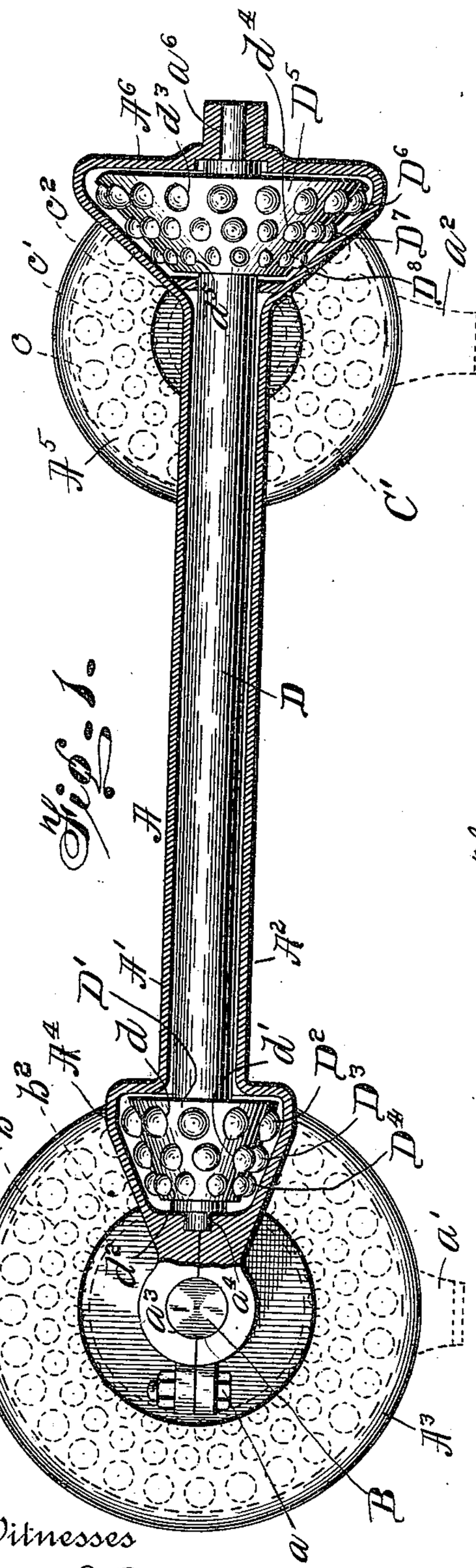

Fig. 1.

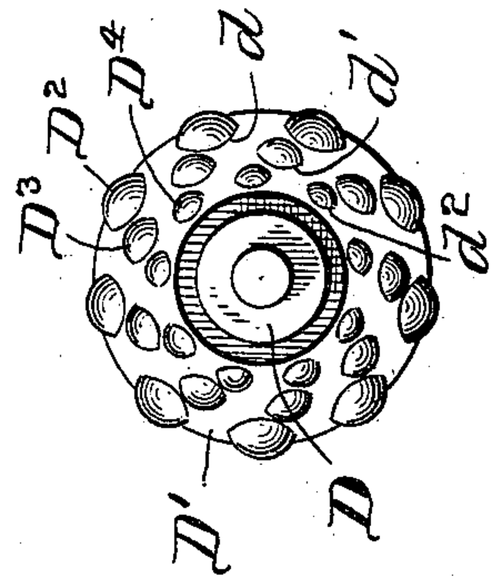

Fig. 5.

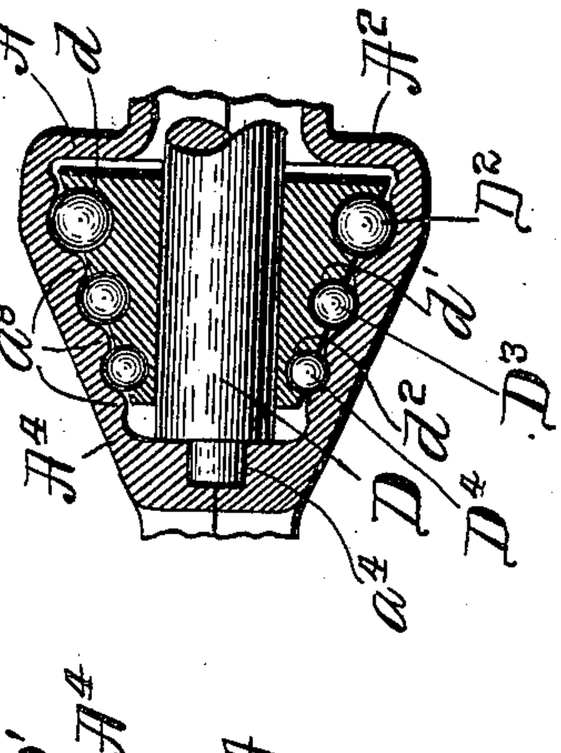

Fig. 4.

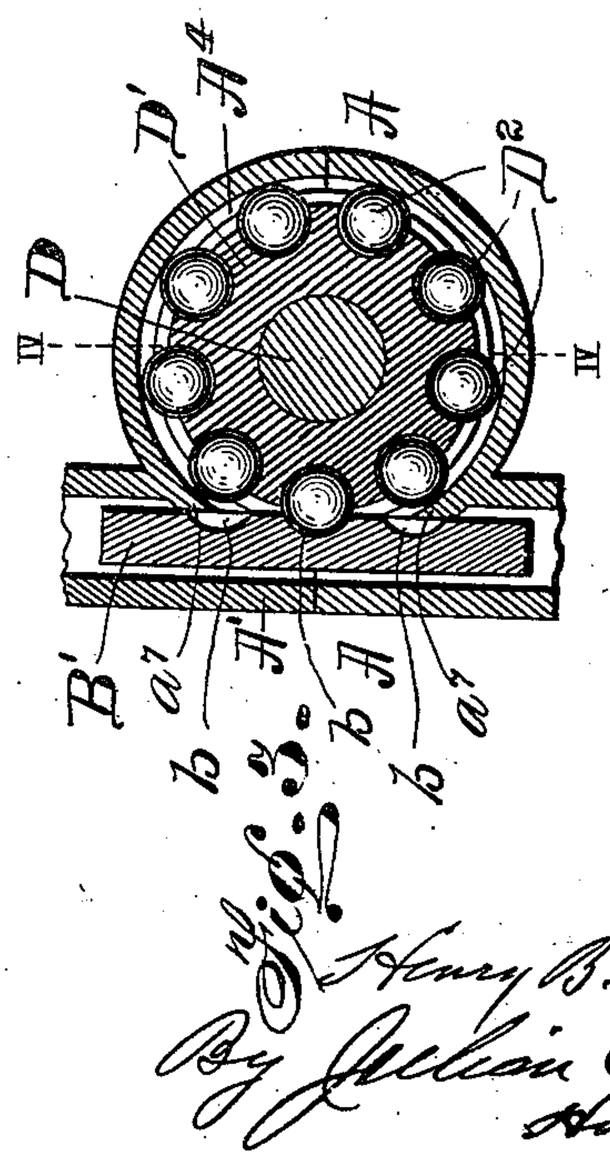

Fig. 3.

Witnesses

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2 Sheets—Sheet 2.

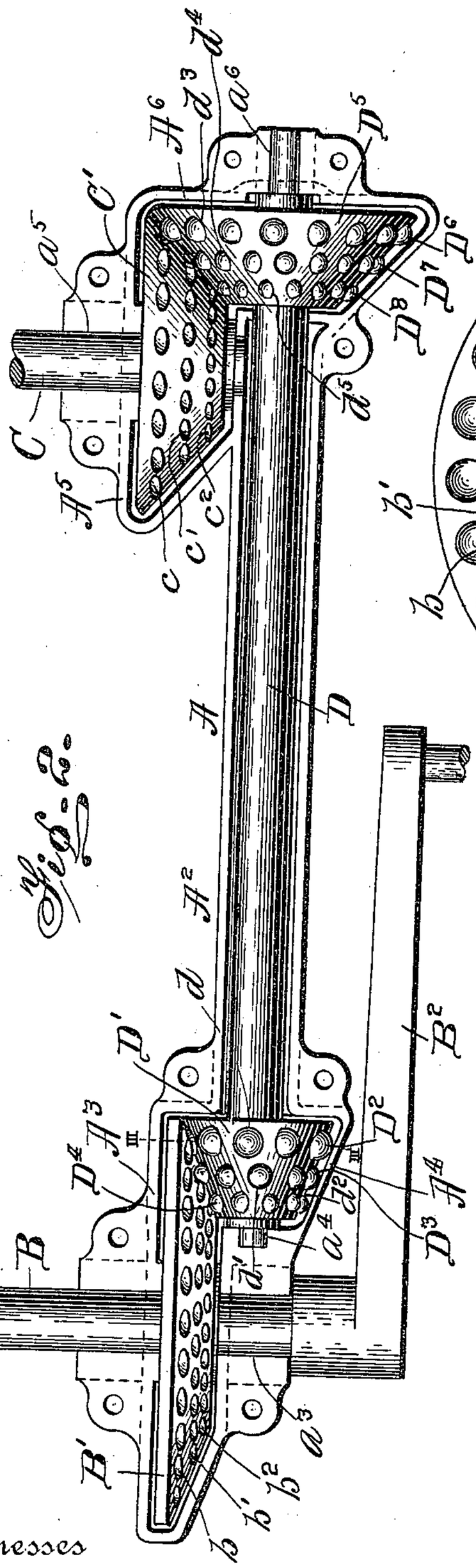

Fig. 2.

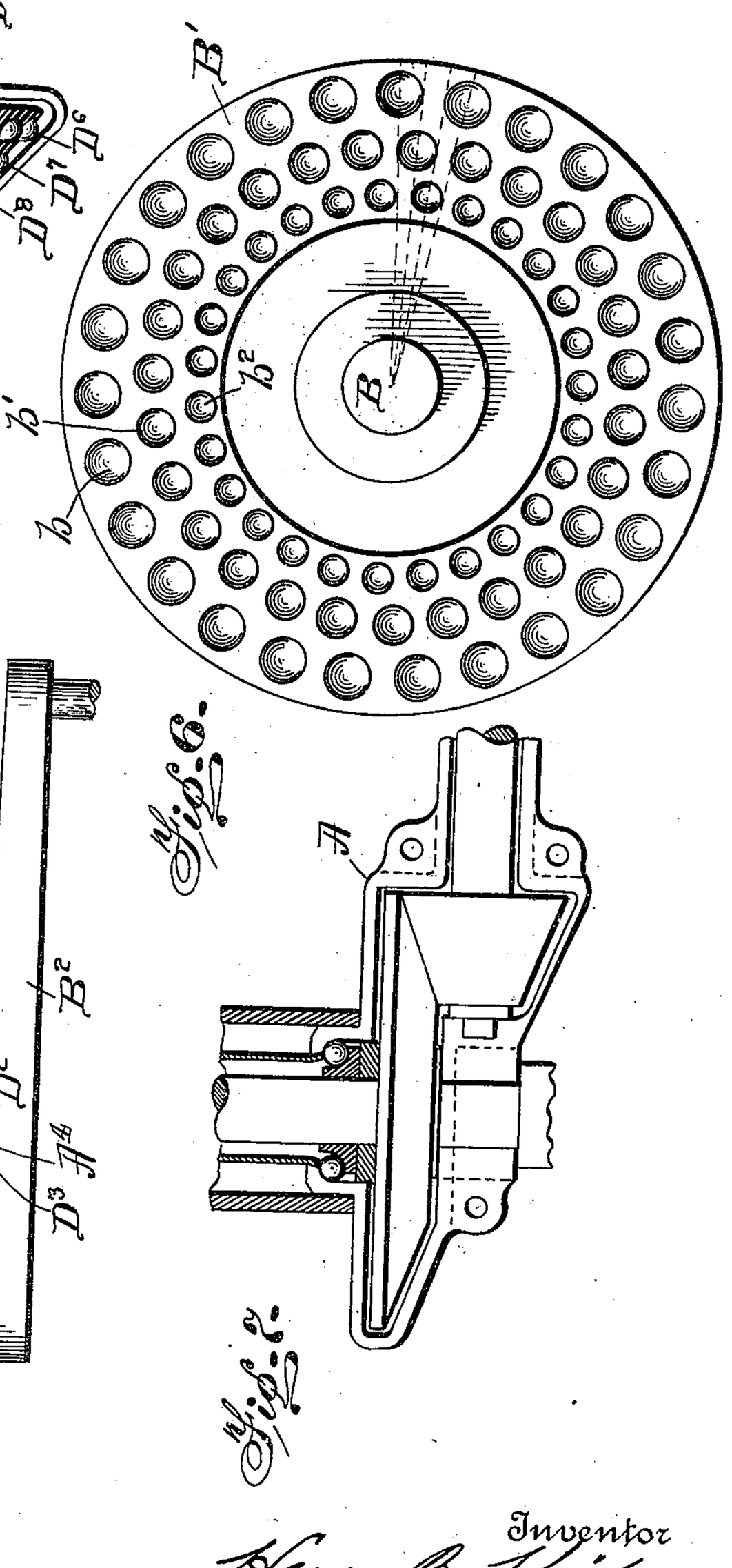

Fig. 3.

Fig. 4.

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

HENRY B. KEIPER, OF LANCASTER, PENNSYLVANIA.

BALL-GEARING.

SPECIFICATION forming part of Letters Patent No. 667,658, dated February 5, 1901.

Application filed July 24, 1897. Serial No. 645,806. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. KEIPER, a citizen of the United States, residing at Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Ball-Gearing; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to gearing of that class in which balls instead of the usual spurs or teeth of gear-wheels serve to transmit the rotary motion of one wheel to the other in each pair angularly rotating or in train.

The object of the invention is to provide means for loosely seating the balls in one of said wheels, together with an independent retainer holding them thereto, thereby reducing friction to a minimum, said gearing being dust-proof and especially adapted to the construction of chainless bicycles or kindred vehicles.

The invention will first be hereinafter more particularly described with reference to the accompanying drawings, which form a part of this specification, and then pointed out in the claims at the end of the description.

The purposes of the invention are attained by the mechanism and devices illustrated in said drawings, in which similar reference characters designate like parts throughout the several views.

Figure 1 is a side elevation of a chainless gearing embodying my invention, a portion of the casing being shown in vertical longitudinal section. Fig. 2 is a plan view of the same, the upper half of the casing being removed and a crank-arm being shown in place on the driving-shaft. Fig. 3 is an enlarged sectional elevation taken on the line III III of Fig. 2. Fig. 4 is a sectional view taken on the line IV IV of Fig. 3. Figs. 5 and 6 are face views of the contacting wheels shown in Fig. 3, and Fig. 7 is a view showing a portion of the left-hand end of the device illustrated in Fig. 2 modified and secured to one end of a tube appearing in horizontal section.

In the drawings, A designates any suitable casing made of any approved material and shaped in accordance with the conditions of the devices, such as disks or wheels and shafts, it is intended to house. In this instance the casing is made in two portions A' A^2, joined in a horizontal plane through the longitudinal center line and secured together by bolts and nuts a, dotted lines a' a^2 indicating legs or feet to support the casing when so desired. At the left-hand end of the casing are vertically-disposed wheel-housing chambers A^3 A^4, perpendicularly placed and having at their centers shaft-bearings or journal-boxes a^3 a^4. At the right-hand end thereof are similarly-disposed housing-chambers A^5 A^6, also perpendicularly placed and having at their centers shaft-bearings or journal-boxes a^5 a^6. In the bearings a^3 is journaled a shaft B, constituting the main or driving shaft of the device, on which is mounted within the chamber A^3 a beveled disk or wheel B', having in the beveled portion of its face prescribed circular sockets or recesses b b' b^2, arranged at a prescribed pitch in three concentric circles and so disposed that the radial center line of each will be tangent to the succeeding one in the order of rotation, as indicated by the dotted radial lines on the face of the wheel B' in Fig. 6, in which it will be seen that the line passing through the center of a recess b touches the edge of the circumference of the next recess b', that the line passing through the center of said recess b' touches the edge of the next recess b^2, and that the line passing through the center of said recess b^2 touches the edge of the succeeding recess b, and so on, the wheel rotating upwardly from the right-hand side toward the left.

B^2 indicates a crank-arm whereby said shaft may be rotated. In the bearings a^5 is journaled a shaft C, constituting the secondary or driving shaft of the device, on which is mounted within the chamber A^5 a beveled disk or wheel C', having in the beveled portion of its face prescribed circular sockets or recesses c c' c^2 at a prescribed pitch, arranged in three concentric circles disposed or staggered, as are the recesses b b' b^2, before mentioned.

In the bearings a^4 a^6 are journaled, respectively, the left and right hand ends of a shaft D, constituting the connecting or motion-transmitting shaft, having mounted on its end

within the chamber A^4 a bevel-wheel D′, provided in its peripheral edge contacting with the beveled face of the wheel B′, before mentioned, with circular sockets or recesses $d\,d'\,d^2$, registering, as the wheel revolves, with the sockets $b\,b'\,b^2$ of said wheel B′, and in which sockets or recesses are seated pellets or balls $D^2\,D^3\,D^4$ to engage said sockets $b\,b'\,b^2$, whereby the latter wheel revolves the former, rotating the shaft D, and on its end within the chamber A^6 is mounted a bevel-wheel D^5, provided in its beveled peripheral edge contacting with the beveled face of the wheel C′, before mentioned, with circular sockets $d^3\,d^4\,d^5$, registering with the sockets $c\,c'\,c^2$, in which sockets or recesses are seated balls or pellets $D^6\,D^7\,D^8$, engaging the latter, rotating the wheel C′ and driving its shaft. Within the chambers $A^3\,A^4$, where the beveled portions of their walls join, are projecting edges a^7, lying closely to the beveled face of the wheel B′, which serve to pick the balls from its sockets and confine them to the sockets of the wheel D′, while between the balls from the inner face of the casing ridges a^8 may extend to form channels or guideways about said wheel, in which said balls will move, and the same construction will maintain within the chambers $A^5\,A^6$. Now the pitch-centers of the balls and sockets in each pair of contacting wheels are located in a circle lying a prescribed distance within the faces of the beveled edges of the wheels, to which the respective balls are confined, in order that the edges a^7 may engage said balls beyond their centers in picking them from the required sockets, and the balls are confined to the smaller one of the two contacting wheels in order that their number may be the least; but when preferred they may be confined to the larger wheel.

Fig. 7 shows a modification of the left-hand end of the casing, having an annular hub secured into one end of a tube, in which ball-bearings may be introduced to support the shaft, and a right-hand end of the casing may be secured in a similar way, while the casing itself instead of being in two parts or portions may be formed in any other approved manner that will entirely inclose the device. Three sets of balls are here shown in use with each pair of wheels, yielding continuous or uniform contact; but a single set of balls may be used when so desired, the shafts forming any angles with reference to each other, and when they are at right angles, as here shown, the wheels may be plain circular disks, the peripheral edge of the one contacting with the plain face of the other. It will here be observed that the shell or portion of the casing with the projecting edges a^7, retaining the balls within the recesses of the wheels, in which said balls are loosely seated, is independent of said wheels, remaining stationary while the wheels revolve, and, with the ridges a^8, before mentioned, cause the balls to revolve, and thereby insure a rolling contact with the sockets or recesses of the wheels in which the balls engage.

I claim—

1. In a device for transmitting rotary motion, in combination; shafts, rotatably mounted at angles with reference to each other, and having their extremities, in adjacent pairs, at each of said angles; wheels, with confronting faces, secured in pairs, near said extremities, to said shafts, and having registering circular recesses in said confronting faces; balls loosely seated in the recesses of one of each pair of said wheels, and a shell, with projecting edges, to confine the balls thereto; all substantially as described and for the purpose hereinbefore set forth.

2. In a device for transmitting rotary motion in angular directions, in combination, shafts rotatably journaled, with their extremities in pairs, at each angle of direction; wheels with confronting faces secured, in pairs, near said extremities, to said shafts, and having registering recesses in said faces; balls loosely seated in the recesses of one of each pair of said wheels; and an independent shell with projecting edges and guideway-ridges surrounding the wheels to confine the balls thereto; all substantially as described and for the purpose hereinbefore set forth.

3. Gearing comprising members between which motion is to be transmitted, said members having registering sockets, rollers seating loosely in the sockets of one member and projecting therefrom for engagement with the sockets of the other member, and a casing extending over the socketed surface of the roller-carrying member, confining the rollers in the sockets thereof, and excluding them from the sockets of the other member except when transmitting motion between the members.

4. Gearing comprising wheels associated together and having registering sockets, rollers loosely seated in the sockets of one wheel and adapted to engage the sockets of the other wheel to transmit motion, and a shell or casing embracing the roller-carrying wheel to confine the rollers in the sockets thereof, and extending in such close proximity to the socketed surface of the other wheel as to exclude the rollers from the sockets thereof except when transmitting motion between the wheels.

5. Miter-gearing comprising members having registering sockets arranged in a plurality of circular series, rollers seating loosely in the sockets of one member and projecting therefrom for engagement with the sockets of the other member, and a casing surrounding the roller-carrying member and confining the roller-bodies in the sockets thereof and excluding them from the sockets of the other member except when transmitting motion, said casing having ridges between the series of roller-bodies.

6. The combination of two gear members, each provided with projections, antifriction devices adapted to occupy the spaces between

the adjacent projections of the gear members, and a guard or shield arranged close to the contour of one of the gear members, whereby the antifriction devices are retained in the spaces between the projections of such members.

7. A pair of bevel-edged wheels arranged at an angle to each other, and having each a series of cavities in its bevel portion, in combination with a series of balls corresponding to the number of cavities in one of said wheels, and a closed casing extending entirely around the edge of said wheel and confining said balls in said cavities, and having an opening in its edge across the space of engagement by said balls with the opposite wheel, substantially as described.

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

HENRY B. KEIPER.

Witnesses:
DANL. H. HERR,
CHAS. E. LONG.