No. 730,421. PATENTED JUNE 9, 1903.

H. L. WARNER.

DIFFERENTIAL GEARING.

APPLICATION FILED APR. 7, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

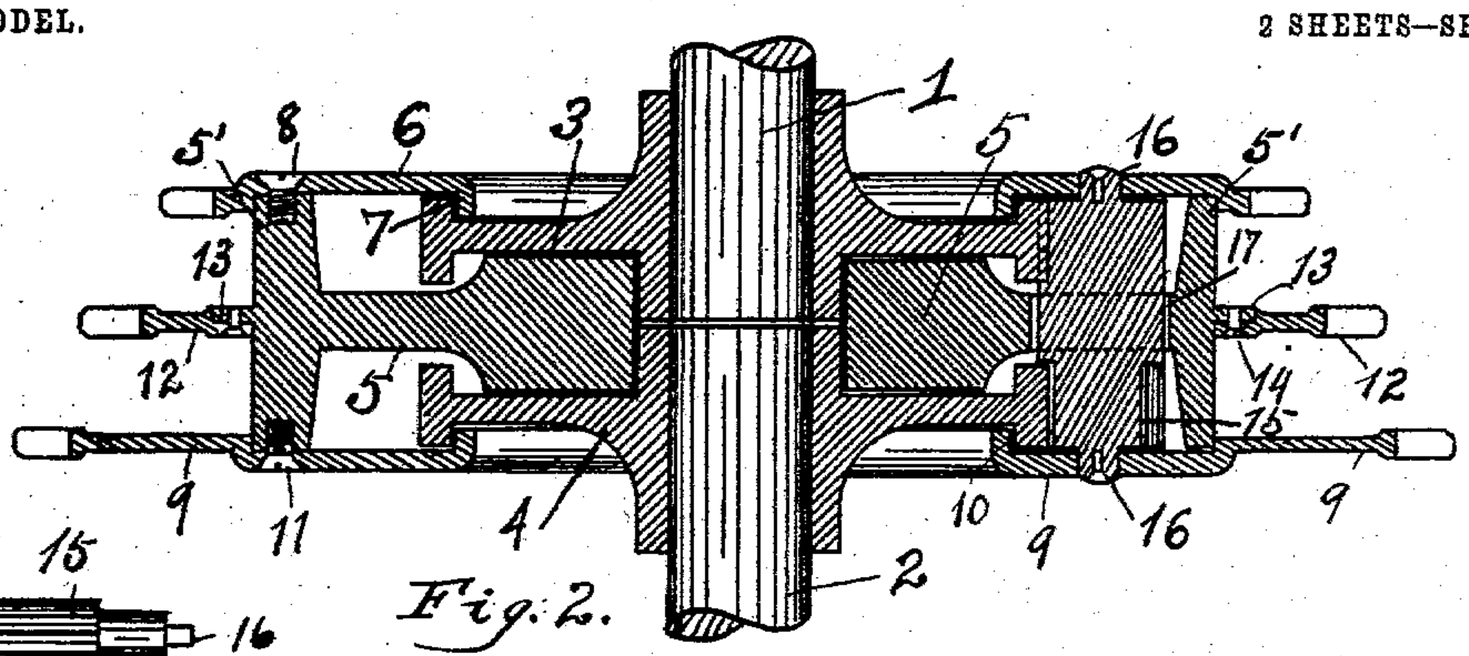

Fig. 2.

Fig. 4.

Fig. 1.

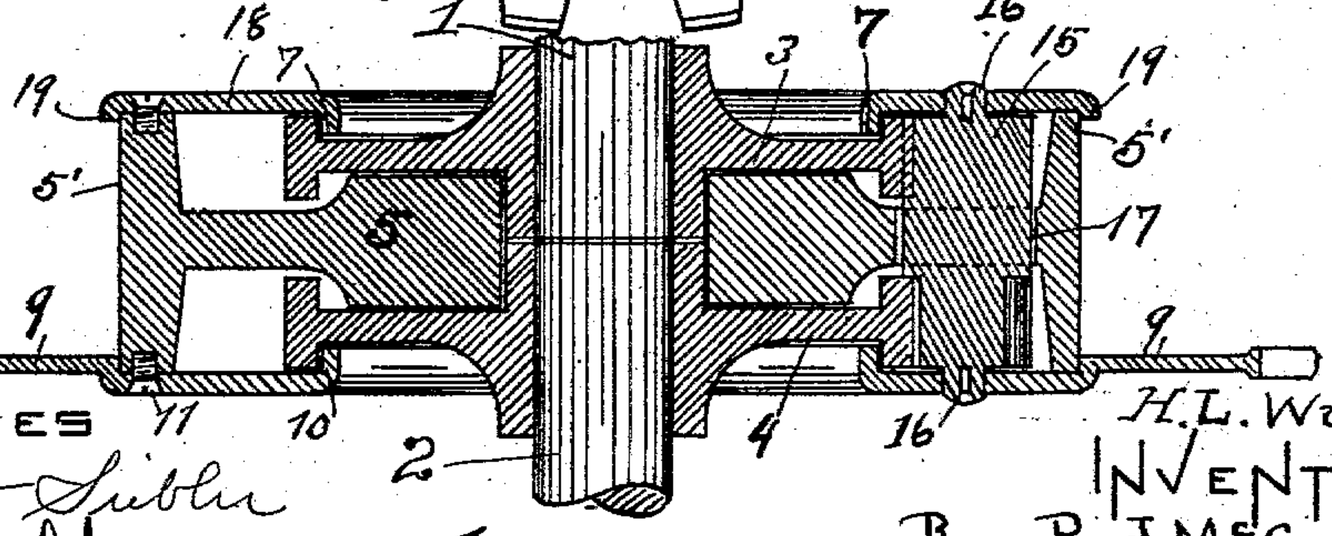

Fig. 3.

WITNESSES
Matthew Siblin
C. M. T. Theobald.

H. L. Warner.
INVENTOR
By R. J. McCarty,
ATTORNEY

No. 730,421. PATENTED JUNE 9, 1903.

H. L. WARNER.

DIFFERENTIAL GEARING.

APPLICATION FILED APR. 7, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

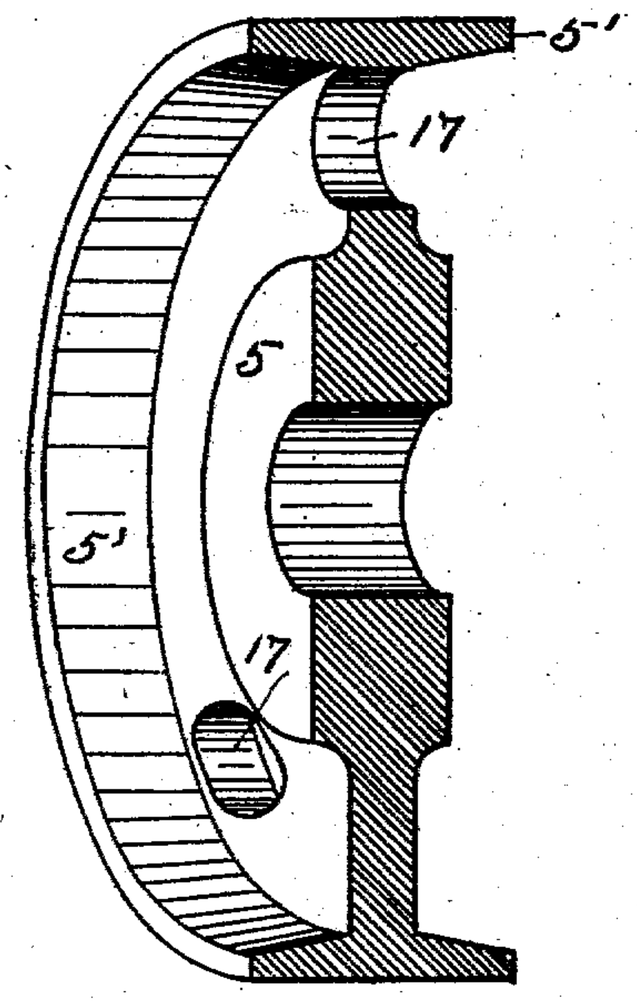

Fig. 5.

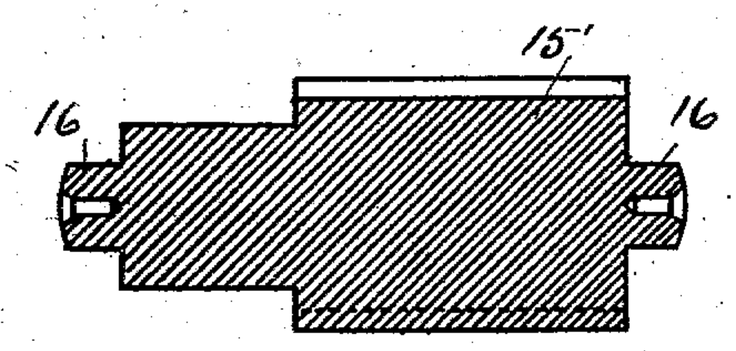

Fig. 8

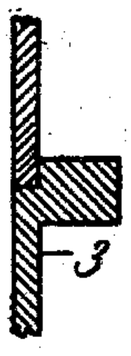

Fig. 6.

Fig. 7.

Witnesses.
Arthur Sibley
C. M. Theobald.

Hayt L. Warner,
Inventor.
By R. J. McCarty,
his Attorney.

No. 730,421. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

HUGH L. WARNER, OF DAYTON, OHIO, ASSIGNOR TO THE DAYTON MOTOR VEHICLE CO., OF DAYTON, OHIO, A CORPORATION OF WEST VIRGINIA.

DIFFERENTIAL GEARING.

SPECIFICATION forming part of Letters Patent No. 730,421, dated June 9, 1903.

Application filed April 7, 1902. Serial No. 101,759. (No model.)

To all whom it may concern:

Be it known that I, HUGH L. WARNER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Differential Gearing; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in gearing of the type known as "differential" or "compensating" gearing. As I am engaged in the manufacture of automobile parts and supplies, I have calls for and find the need of an equalizing-gearing having in some instances two and sometimes three sprockets or driving-wheels, and sometimes these sprockets must vary in size, so as to give different speeds to the driven shaft, and thus avoid what is known as a "variable-speed" transmission, which is costly and heavy. In some instances it is desirable to have only one sprocket, but to have it interchangeable with the other side of the gearing. This can be done after the gearing has been secured to the driving-shafts. This I have provided for, so as to avoid disturbing the mechanism as a whole, by a simple interchange of side plates, and, further, to provide a gearing that is compact, low in cost, self-contained, perfect in alinement, and practically dust-proof.

With this object in view the invention consists in the combination and arrangement of parts, as hereinafter set forth and described.

Referring to the accompanying drawings, which fully illustrate my invention, Figure 1 is a face view of my improved differential gear, part of which is broken away. Fig. 2 is a cross-sectional view of Fig. 1 on the line A B. Fig. 3 is a similar sectional view showing a less number of sprocket-wheels. Fig. 4 is a detail of the internal pinions. Fig. 5 is a sectional perspective view of the driving member. Figs. 6 and 7 are detail sectional views showing modifications in the manner of connecting the side plates and gear-wheels. Fig. 8 is a longitudinal sectional elevation, full size, of one of the internal pinions.

In a detail description of the invention similar reference characters indicate corresponding parts in the several views of the drawings.

The improved differential gear comprises two shafts 1 and 2, placed in alinement, two gear-wheels 3 and 4, secured to said shafts, and a driving member 5, loosely surrounding the hubs of and inclosed between the two gear-wheels 3 and 4. The driving member 5 is provided with a peripheral braking-surface 5′. Plates 6 and 9 are secured to said driving member by suitable means, such as screws 8 and 11, which penetrate the sides of the band-periphery of said driving member. The said plates 6 and 9 are slightly offset, so as to engage the rim 5′ of the driving member, and each of said plates is provided with driving or sprocket teeth on its outer periphery. At their inner peripheries the said plates 6 and 9 engage the outer rims of the gear-wheels 3 and 4 by suitable flanges 7 and 10, so as to hold said gear-wheels in true alinement, and thereby close up against the driving member 5. It is obvious that these plates 6 and 9 may be of the same size and have the same number of teeth; but in the drawings they are shown in graduated sizes or one much larger than the other, so as to give a variation of speed from the driver through said various sizes of sprockets or driving-wheels. It is further obvious that these plates or sprockets 6 and 9 are interchangeable one with the other.

The sprocket-ring 12 is attached to the outer band periphery 5′ of the driving member 5 by means of a suitable flange 13 and a series of fasteners or screws 14 or other suitable devices. It is further obvious that this sprocket-ring 12 is of a size between the sprocket-plates 6 and 9; but they may be all of one size, or many changes may be made by varying the number of teeth to suit requirements.

Fig. 3 of the drawings illustrates the differential gear substantially the same as Fig. 2, but minus the sprocket-ring 12 and flange 13. In this construction the plate 18 is sub-

stantially the same as plate 6, but is minus the sprocket-teeth, and slightly engaging the periphery 5′ is an overhanging edge 19. The internal pinions 15 and 15′ preferably have solid spindle ends 16 and are made of one integral piece, as shown in Fig. 8. They may, however, have their spindles independent and separate. In either case the said pinions engage each other, as shown in Fig. 4, near their center portions, leaving the toothed ends free from engagement with each other, but adapted to engage the gear-wheels 3 and 4 in such a manner that pinion 15 may engage gear-wheel 3 and pinion 15′ may engage gear-wheel 4, thus causing a differential motion to the driving-shafts 1 and 2 when they travel at different speeds. The said pinions are mounted in pairs, having their spindles in planes parallel to the alined shafts 1 and 2 and their spindle ends mounted in the side plates 6 and 9.

In Fig. 1 the pinions 15 and 15′ will be seen engaged with each other and engaging the gear-wheels 3 and 4, gear-wheel 4 being hid from view. The said pinions pass through openings 17 in the driving member 5, but are independent of said driving member.

It is obvious that the shafts 1 and 2 may be a solid shaft in one piece, and to this one of said gear-wheels may be secured, and the other of said gear-wheels may be mounted on a tube or hub of said gear-wheel, or both gear-wheels 3 and 4 may be mounted on sleeves.

In Figs. 6 and 7 I have shown some modifications in the manner of connecting the inner peripheries of the side plates with the rims of the gear-wheels.

Having fully described my invention, I claim—

1. In a differential gear, the combination of two alined shafts, two gear-wheels mounted thereon, a driving member having an outer band-shaped periphery, said driving member being loosely mounted between said gear-wheels, face-plates engaging the outer rim of each of said gear-wheels and detachably secured to the outer band-shaped periphery of the driving member, one or both of said face-plates being provided with teeth, pinions engaging said gear-wheels and projecting through openings in the driving member, said pinions being mounted between the face-plates.

2. In a differential gear, the combination with two alined shafts, of a driving member provided with a braking-surface, a gear-wheel on each side of said driving member, the inner ends of the hubs of said gear-wheels abutting with each other, engaging pinions lying within the periphery of the driving member, and removable side plates carrying said pinions.

3. In a differential gear, the combination with two alined shafts, of a driving member having a peripheral braking-surface and a web connecting the hub of said driving member and the said periphery, said web having openings therein, removable side plates secured to the edges of the periphery of said driving member, elongated pinions mounted in said side plates parallel with the two alined shafts and projected through the openings in the web of the driving member and spur-wheels inclosed between said driving member and the side plates and engaged by said pinions.

4. In a differential gear, the combination of alined shafts, a driving member, removable side plates secured to said driving member, two or more pinions inclosed between said side plates, gear-wheels having inwardly-projecting hubs telescoping into the open center of the driving member and held in position by said side plates.

5. In a differential gear, the combination with alined shafts, of two gear-wheels on said shafts, pinions engaging said gear-wheels, an annular band-shaped driving member inclosing said gear-wheels at their peripheries, a removable side plate on each side of said driving member in which the pinions are mounted, the said driving member having a central hub-shaped center inclosing the inner portions of the hubs of the gear-wheels.

6. In a differential gear, the combination of two alined shafts, two gear-wheels mounted thereon side by side, a driving member having an outer annular band-shaped periphery and loosely mounted between said gear-wheels, side plates engaging the outer rim of each of said gear-wheels and detachably secured to said outer rim of said driving member, one or both of said plates provided with sprocket-teeth, pinions engaging said gear-wheels and projecting through openings in the body of the driving member, said pinions being supported in the side plates.

7. In a differential gear, the combination with alined shafts, of gear-wheels mounted on said shafts side by side, side plates partially inclosing the outer sides of said gear-wheels and engaging the sides thereof, a driving member between said gear-wheels terminating in an outer annular band-periphery to which said plates are attached, one or both of said plates being provided with driving-teeth, a series of pairs of pinions passing through said driving member, in gear with each other and in gear with their respective gear-wheels, said pinions mounted between said plates by spindle-bearings.

8. In a differential gearing, the combination with two alined shafts, and gear-wheels secured to the adjacent ends of said shafts, of an integral driving member between said gear-wheels, the rim of said driving member projecting laterally on each side to a point approximately in line with the outer sides of the peripheries of said gear-wheels, side or face plates having their inner rims projected under the inner sides of the peripheries of said gear-wheels, and the outer rims of said plates being projected over the outer periphery or rim of the driving member and termi-

nated in teeth, a series of pairs of pinions projected through said driving member, the said pinions having their spindle ends projected into said plates.

9. In a differential gear, the combination with two alined shafts, of a driving member, the periphery of which has a braking-surface, two independent side plates separated by the rim or periphery of said driving member, said side plates being attached to the edges of said rim or periphery, a gear-wheel mounted on each side of said driving member, and pinions carried by said side plates and engaging the gear-wheels, said pinions being essentially in positions parallel with the axis of the driving member.

10. In a differential gear, the combination with two alined shafts, of a driving member having an annular periphery, the edges of which project laterally beyond the hub of said driving member, the outer surface of said periphery being coaxial with the two alined shafts to provide a braking-surface, two gear-wheels secured to the adjacent ends of the shafts and upon the hubs of which the driving member is mounted, one or more side plates attached to the circumferential edges of the driving member, and one or more pairs of pinions journaled in said side plates.

11. In a differential gear, the combination with two alined shafts, of a driving member having an annular braking-surface, a sprocket-ring mounted on said driving member, side plates secured to the rim of said driving member, gear-wheels inclosing the hub of said driving member, and pinions mounted in said side plates and engaging said gear-wheels.

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

HUGH L. WARNER.

Witnesses:
R. J. McCARTY,
C. M. THEOBALD.