No. 789,910. PATENTED MAY 16, 1905.

C. C. HILL.

DIFFERENTIAL GEARING FOR MOTOR VEHICLES.

APPLICATION FILED JULY 23, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

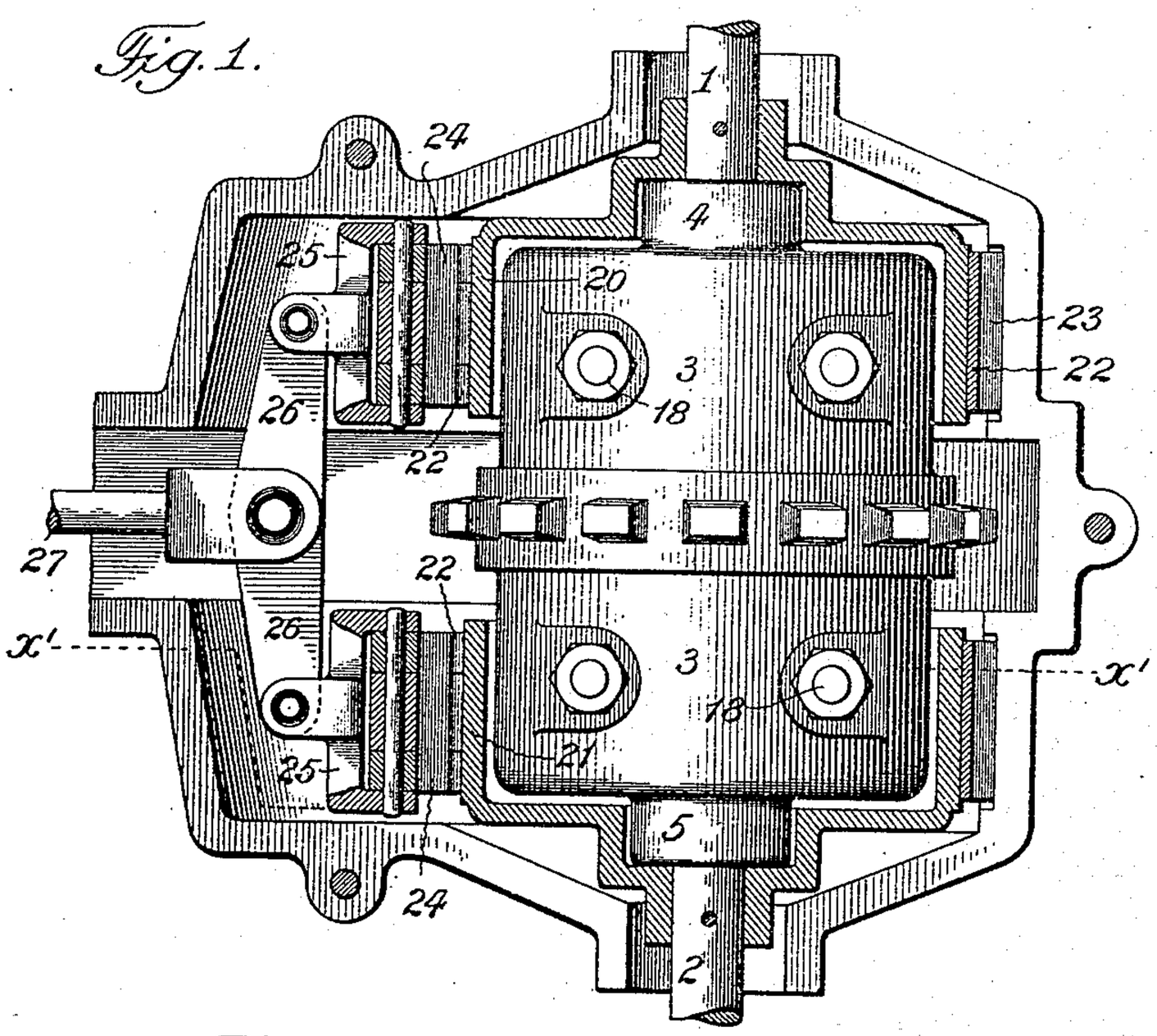

Fig. 2.

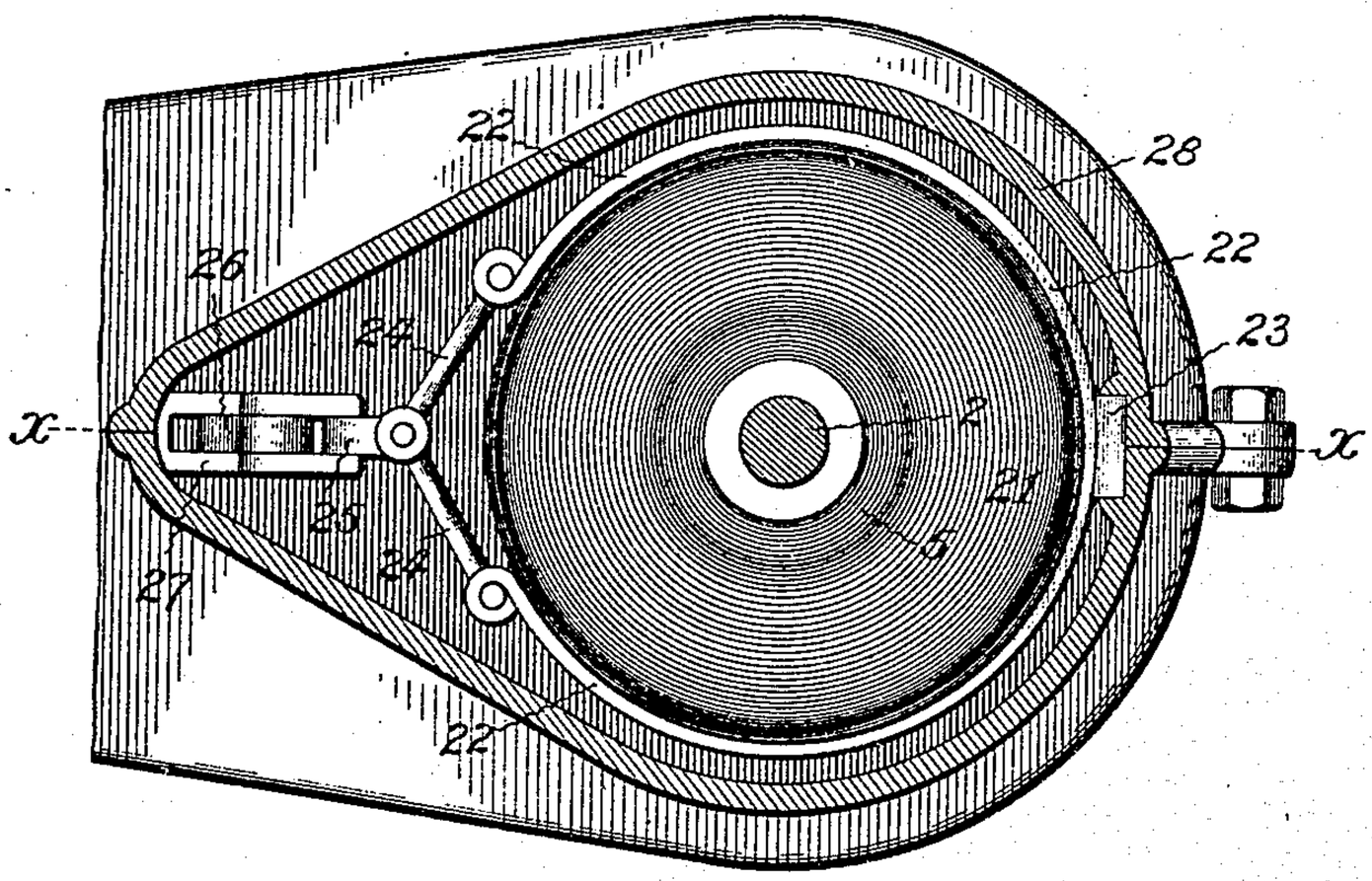

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Fig. 3.

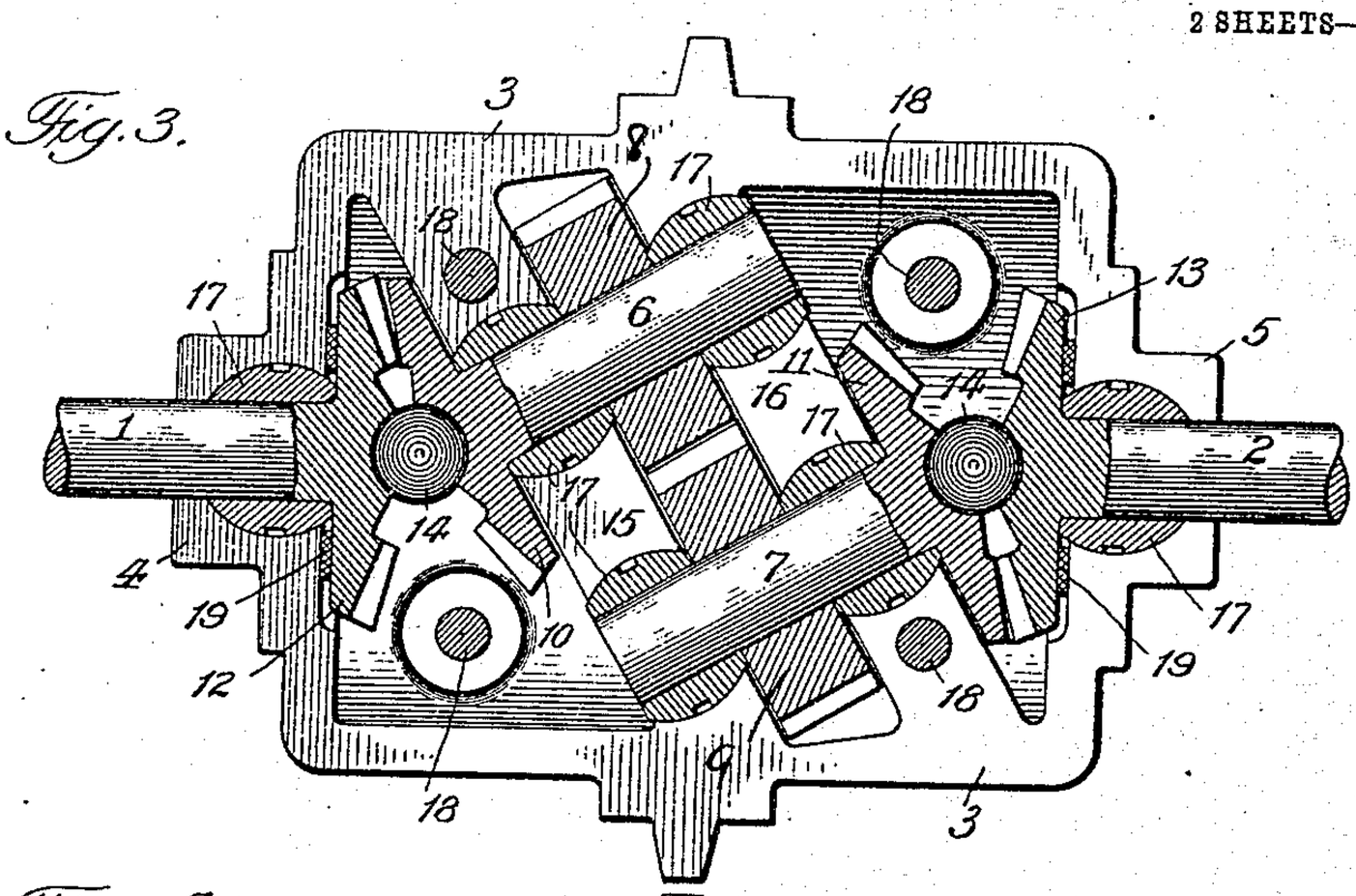


Fig. 4.

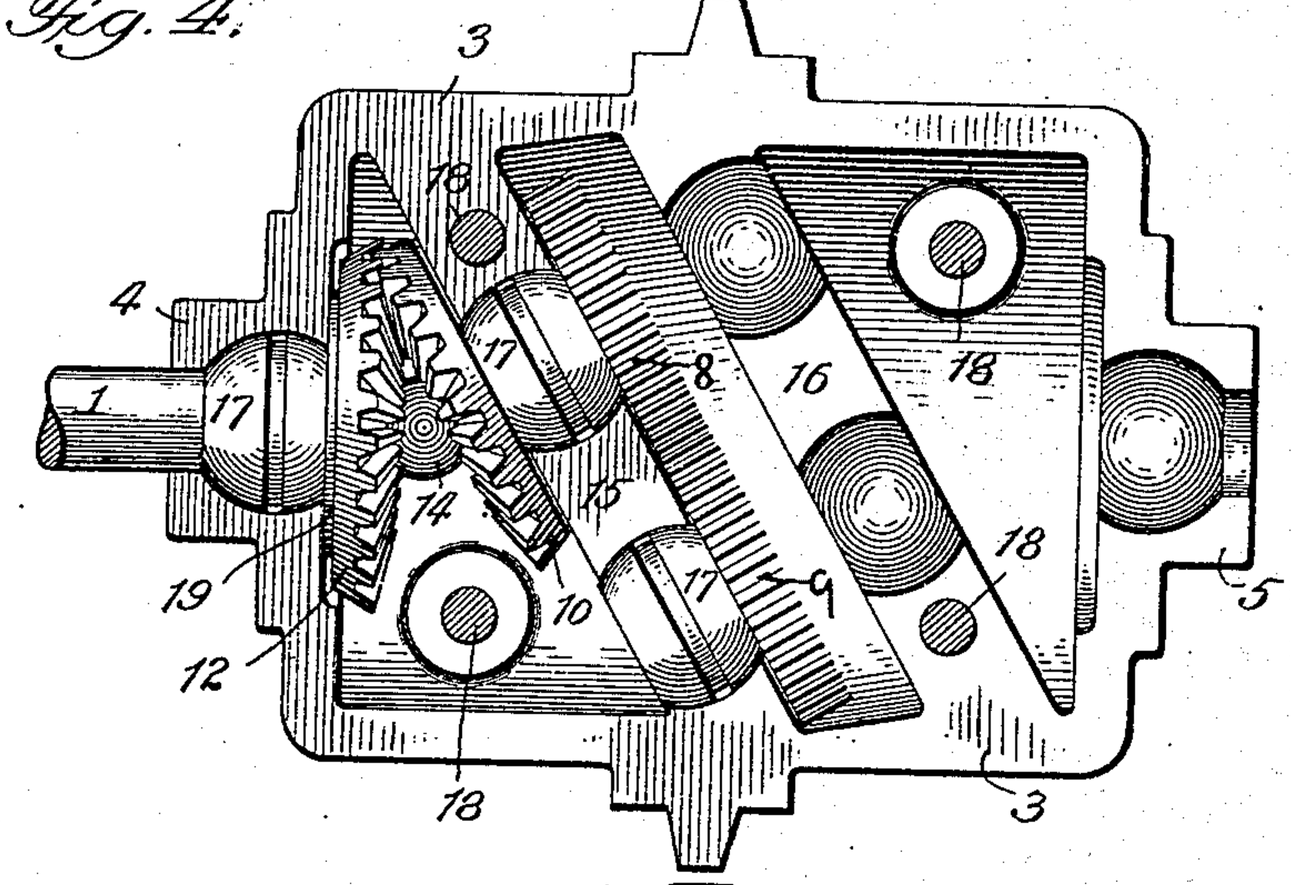
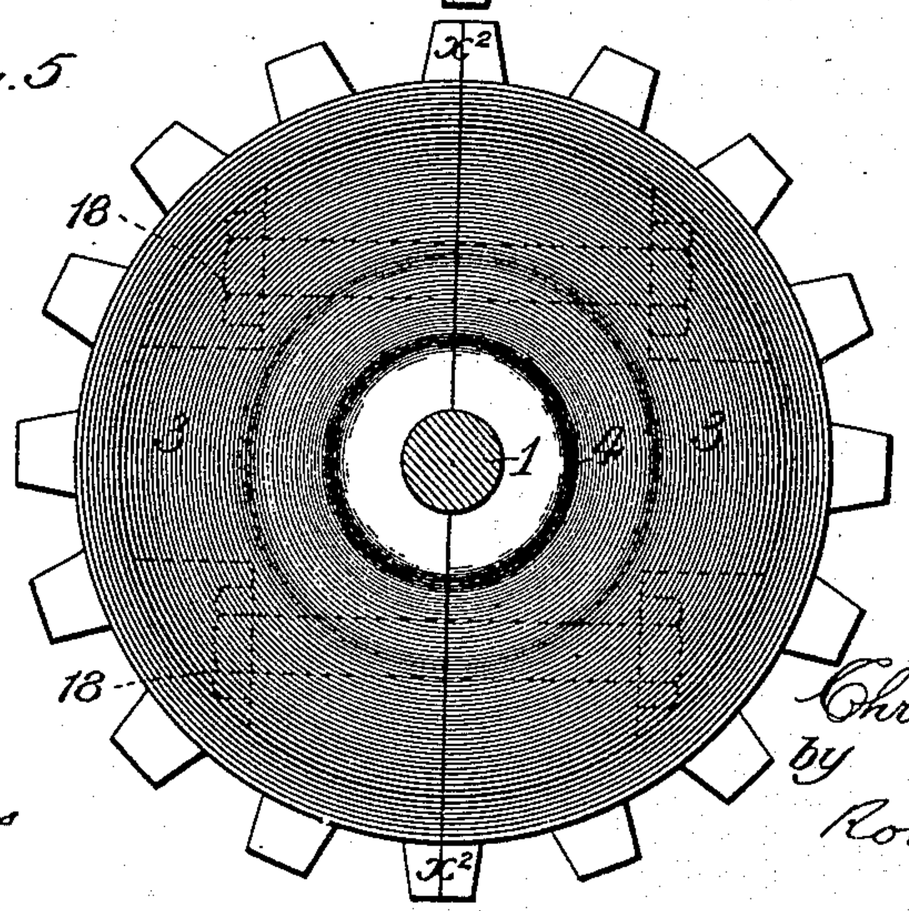


Fig. 5



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UNITED STATES PATENT OFFICE.

CHRISTIAN C. HILL, OF CHICAGO, ILLINOIS, ASSIGNOR TO MILWAUKEE AVENUE STATE BANK, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DIFFERENTIAL GEARING FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 789,910, dated May 16, 1905.

Application filed July 23, 1904. Serial No. 217,770.

To all whom it may concern:

Be it known that I, CHRISTIAN C. HILL, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Differential Gearing for Motor-Vehicles, of which the following is a specification.

The present invention relates to that form of equalizing-gearing employed on the driving-shafts or axles of motor-vehicles and the like and which in the travel of the vehicle in a curved path or around a corner is adapted to so distribute the driving power that there will be no slipping of the driving-wheels or loss of power resulting therefrom; and the present improvement has for its object to provide a simple and efficient construction and arrangement of parts embodying the features of great compactness, durability, and strength to withstand heavy strains and an equalized distribution of the braking force upon the axle-sections carrying the respective driving-wheels of the vehicle, all as will hereinafter more fully appear, and be more particularly pointed out in the claims.

In the accompanying drawings, illustrative of the present invention, Figure 1 is a longitudinal sectional elevation at line $x\ x$, Fig. 2, of the differential gearing and brake mechanism of the present invention. Fig. 2 is a transverse sectional elevation at line $x'\ x'$, Fig. 1. Fig. 3 is a detail longitudinal sectional elevation at line $x^2\ x^2$, Fig. 5, of the differential gearing. Fig. 4 is a detail longitudinal sectional elevation on the same plane as Fig. 3, showing at the left side of the view the gearing and bearing-bushings in elevation and at the right side of the view the gearing and bearing-bushings removed. Fig. 5 is an end elevation of the differential gear-casing with a driving-shaft or axle in section.

Similar numerals of reference indicate like parts in the several views.

Referring to the drawings, 1 and 2 are alined sections of the driving-shaft or axle of a motor-vehicle or the like. The adjacent ends of such sections are connected together by an annular shell or casing 3, having end bearing-hubs 4 and 5 for such adjacent ends of the shaft-sections 1 and 2 aforesaid. Such shell or casing is adapted to contain and house the intermediate differential gearing by which such sections 1 and 2 are connected together as usual in the present type of mechanisms. In the present invention such differential gearing comprises a construction and arrangement of parts as follows: 6 and 7 are counter-shafts journaled in an oblique direction in the casing 3 and geared together to rotate in opposite directions by counterpart spur-gears 8 and 9. 10 and 11 are bevel-gears individual to and carried by the counter-shafts 6 and 7 and adapted to mesh with and drive individual bevel-gears 12 and 13 on the respective ends of the alined sections 1 and 2 of the driving-shaft or axle. 14 represents balls or spheres arranged between the bevel-gears 10 12 and 11 13 in central concave sockets formed in the adjacent faces of said gears and adapted to maintain the gears in proper pitch-line relation against the usual heavy end thrust of the shaft-sections 1 and 2 aforesaid. The above-described construction is adapted to afford extreme compactness and lightness combined with strength and ability to transmit heavy strains without liability to breakage.

In the preferred construction as shown the inclosing shell or casing 3 aforesaid and which has the usual driven connection with the driving power or motor employed is formed by two counterpart longitudinal members or halves with the line of division extending through the hubs 4 and 5, so that one-half of each hub will be integral with its particular half or member of the casing.

15 and 16 are counterpart bearing bars or webs extending in an oblique direction across the interior of the casing 3 and arranged in parallel relation to form the seats or supports for the journal-bushings of the counter-shafts 6 and 7 aforesaid. Such bearing-bars are preferably formed in an integral manner with the said casing 3 and are divided on the common line of division which separates such shell or casing and its end hubs afore-

said and so that all of such component parts of each member or half of the shell or casing will be on a common level at the meeting faces of the respective members or halves. Such special construction of the shell or casing member provides for a ready and convenient removal of one or both sections of the shell 3 and intermediate gear parts 6, 7, 8, 9, 10, 11, and 17 from engagement with the driving-shaft sections without disturbing the position of such shaft-sections and in addition is adapted to afford a convenient construction in which the spherical form of seats employed for the journal-bushings of the different shafts can be formed in a ready, accurate, and economical manner.

With a view to aid in a ready removal and replacement of the parts in a rapid and convenient manner the various bearing-bushings 17 for the ends of the various shafts of the differential mechanism will each be formed of a single piece having a central cylindrical bore for the reception of its shaft end and with a spherical periphery, as shown. The seats for such spherical bushings in the hubs 4 and 5 and in the bearing-bars 15 and 16 will be formed by semispherical cavities in the respective meeting faces of such parts, as shown. In addition to affording a convenient detachable construction, as above set forth, the spherical form of bearing-bushings have the further advantage that in case the main bearings of the shafts in such bushings should "cut fast" or "seize" such bushings will act as auxiliary bearings to permit of the continued operation of the differential mechanism.

The longitudinal members or halves of the inclosing shell or casing 3 may be secured together by the usual transverse clamping-bolts 18 or in any other usual and approved manner.

19 represents annular bearing-rings interposed between the backs of the bevel-gears 12 and 13 and the adjacent ends of the shells or casing 3 to receive the outward thrust of said bevel gears due to the outward pull of the sections 1 and 2 of the driving-shaft or axle.

20 21 are a pair of independent brake-drums secured to the respective axle-sections 1 and 2 in an individual manner, and in the preferred form of such brake-drums, as shown in Fig. 1, the brake-rims will extend laterally from the central supporting webs and hubs, so as to project over the respective ends of the aforesaid containing-shells 3 of the equalizing-gearing with a view to attain compactness in the arrangement of the mechanism as a whole.

22 represents the brake-bands of the respective brake-drums held from circular travel therewith by the surface enlargements 23 on such bands engaging in holding-recesses formed therefor in the hereinafter-described main housing of the mechanism.

24 represents toggle-links connected to the respective free ends of the brake-bands 2 25 represents shackle-links connecting t other ends of said toggle-links together pairs.

26 is an equalizing-lever, to the respecti ends of which the shackle-links 25 are co nected.

27 is a pull-rod connected centrally to t equalizing-lever 26 and extending to the c erating brake-lever of the vehicle.

28 is the usual main housing, inclosing t entire mechanism from dust and the weathe

Having thus fully described my said inve tion, what I claim as new, and desire to secu by Letters Patent, is—

1. In a differential gearing of the charact herein described, the combination of tv alined shaft-sections, a casing forming a bea ing connection for the ends of said section bevel-gears secured to the respective ends said sections, a pair of counter-shafts jou naled in an oblique direction in said casing spur-gears on said counter-shafts imposin reverse motion thereon, and bevel-gears ind vidual to said counter-shafts and geared wit the bevel-gears of the shaft-sections aforesaid substantially as set forth.

2. In a differential gearing of the characte herein described, the combination of tw alined shaft-sections, a casing forming a bear ing connection for the ends of said sections bevel-gears secured to the respective ends o said sections, a pair of counter-shafts jour naled in an oblique direction in said casing, spur-gears on said counter-shafts imposing reverse motion thereon, bevel-gears individual to said counter-shafts and geared with the bevel-gears of the shaft-sections aforesaid, and centrally-interposed spheres between the respective pairs of bevel-gears, substantially as set forth.

3. In a differential gearing of the character herein described, the combination of two alined shaft-sections, a casing forming a bearing connection for the ends of said sections, bevel-gears secured to the respective ends of said sections, a pair of obliquely-arranged counter-shafts geared together to rotate in opposite directions, obliquely-arranged bearing-bars for said counter-shafts formed with spherical seats, spherical journal-bushings for said counter-shafts arranged in said spherical seats, and bevel-gears individual to said counter-shafts and geared with the bevel-gears of the shaft-sections aforesaid, substantially as set forth.

4. In a differential gearing of the character herein described, the combination of two alined shaft-sections, a casing forming a bearing connection for the ends of said sections, bevel-gears secured to the respective ends of said sections, a pair of obliquely-arranged counter-shafts geared together to rotate in opposite directions, obliquely-arranged bearing-bars for said counter-shafts formed with

erical seats, spherical journal-bushings for counter-shafts arranged in said spherical s, bevel-gears individual to said counter-fts and geared with the bevel-gears of the ft-sections aforesaid, and centrally-inter-ed spheres between the respective pairs of el-gears, substantially as set forth.

. In a differential gearing of the character ein described, the combination of two ed shaft-sections, a casing forming a bear-connection for the ends of said sections, comprising two longitudinal halves pro-ed with bearing-hubs formed in halves, el-gears secured to the respective ends of l shaft-sections, a pair of counter-shafts rnaled in an oblique direction in said cas-, spur-gears on said counter-shafts impos-reverse motion thereon, bevel-gears indi-ual to said counter-shafts and geared with bevel-gears of the shaft-sections aforesaid, l means for connecting the halves of the ing together in a detachable manner, sub-ntially as set forth.

3. In a differential gearing of the character rein described, the combination of two ned shaft-sections, a casing forming a bear-g connection for the ends of said sections, d comprising two longitudinal halves pro-ded with bearing-hubs formed in halves, vel-gears secured to the respective ends of id shaft-sections, a pair of counter-shafts urnaled in an oblique direction in said cas-g, spur-gears on said counter-shafts impos-g reverse motion thereon, bevel-gears indi-idual to said counter-shafts and geared with e bevel-gears of the shaft-sections aforesaid, entrally-interposed spheres between the re-pective pairs of bevel-gears, and means for onnecting the halves of the casing together n a detachable manner, substantially as set orth.

7. In a differential gearing of the character erein described, the combination of two alined haft-sections, a casing forming a bearing con-ection for the ends of said sections, and com-rising two longitudinal halves provided with earing-hubs formed in halves, bevel-gears se-ured to the respective ends of said shaft-sec-ions, a pair of obliquely-arranged counter-hafts geared together to rotate in opposite irections, obliquely-arranged bearing-bars or said counter-shafts formed with spherical eats, spherical journal-bushings for said coun-er-shafts arranged in said spherical seats, evel-gears individual to said counter-shafts nd geared with the bevel-gears of the shaft-ections aforesaid, and means for connecting he halves of the casing together in a detach-ble manner, substantially as set forth.

8. In a differential gearing of the character erein described, the combination of two alined haft-sections, a casing forming a bearing con-ection for the ends of said sections, and com-prising two longitudinal halves provided with bearing-hubs formed in halves, bevel-gears secured to the respective ends of said shaft-sections, a pair of obliquely-arranged counter-shafts geared together to rotate in opposite directions, obliquely-arranged bearing-bars for said counter-shafts formed with spherical seats, spherical journal-bushings for said counter-shafts arranged in said spherical seats, bevel-gears individual to said counter-shafts and geared with the bevel-gears of the shaft-sections aforesaid, centrally-interposed spheres between the respective pairs of bevel-gears, and means for connecting the halves of the casing together in a detachable manner, substantially as set forth.

9. In a driving mechanism for motor-vehicles, the combination of two alined shaft-sections adapted to carry the driving-wheels, an equalizing-gear forming a connection between said shaft-sections, individual brake-drums secured to the respective axle-sections, brake-bands surrounding said drums, an equalizing-lever, toggle-link connections between the ends of said equalizing-lever and the brake-bands, and a pull-rod connected centrally to said equalizing-lever, substantially as set forth.

10. In a driving mechanism for motor-vehicles, the combination of two alined shaft-sections adapted to carry the driving-wheels, an equalizing-gear forming a connection between said shaft-sections, individual brake-drums secured to the respective axle-sections and provided with laterally-projecting brake-rims adapted to extend over the ends of the inclosing shell of the equalizing-gear, brake-bands surrounding said drums, an equalizing-lever, connections between the end of said equalizing-lever and the brake-bands, and a pull-rod connected centrally to said equalizing-lever, substantially as set forth.

11. In a driving mechanism for motor-vehicles, the combination of two alined shaft-sections adapted to carry the driving-wheels, an equalizing-gear forming a connection between said shaft-sections, individual brake-drums secured to the respective axle-sections and provided with laterally-projecting brake-rims adapted to extend over the ends of the inclosing shell of the equalizing-gear, brake-bands surrounding said drums, an equalizing-lever, toggle-link connections between the ends of said equalizing-lever and the brake-bands, and a pull-rod connected centrally to said equalizing-lever, substantially as set forth.

Signed at Chicago, Illinois, this 20th day of July, 1904.

CHRISTIAN C. HILL.

Witnesses:
ROBERT BURNS,
M. H. HOLMES.