R. E. ROSEWARNE.

EXPANSIBLE PULLEY AND SPEED GEAR.

APPLICATION FILED AUG. 5, 1907.

949,005.

Patented Feb. 15, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

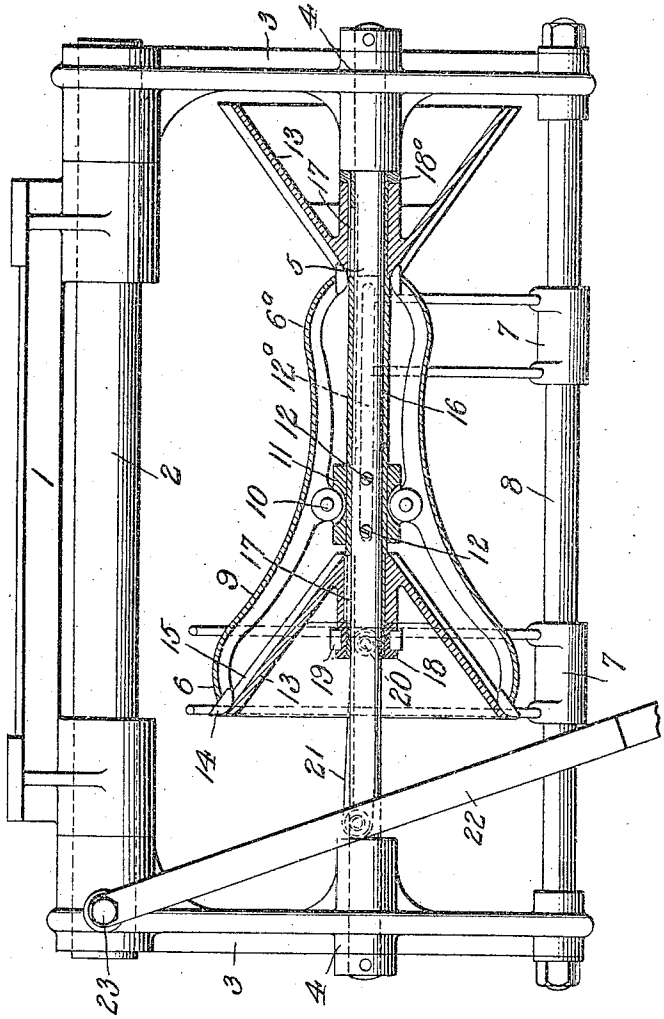


Fig. 5.

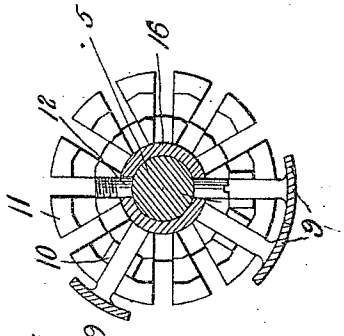
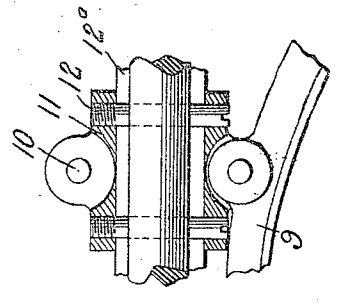


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 3.

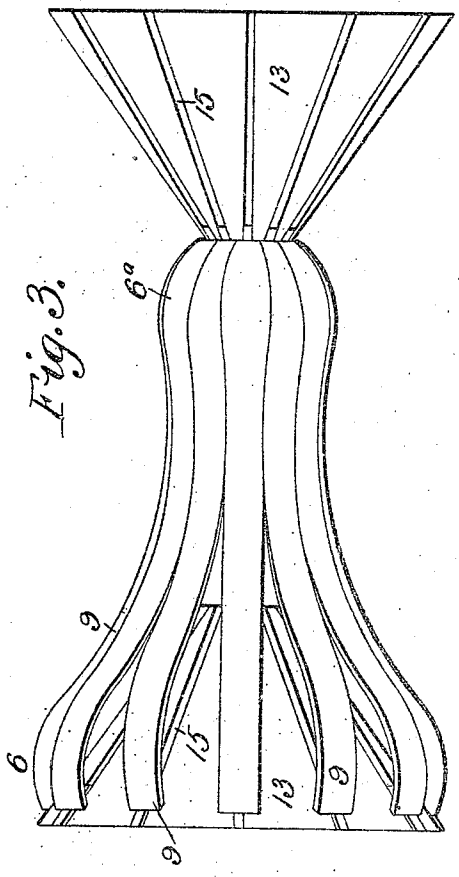
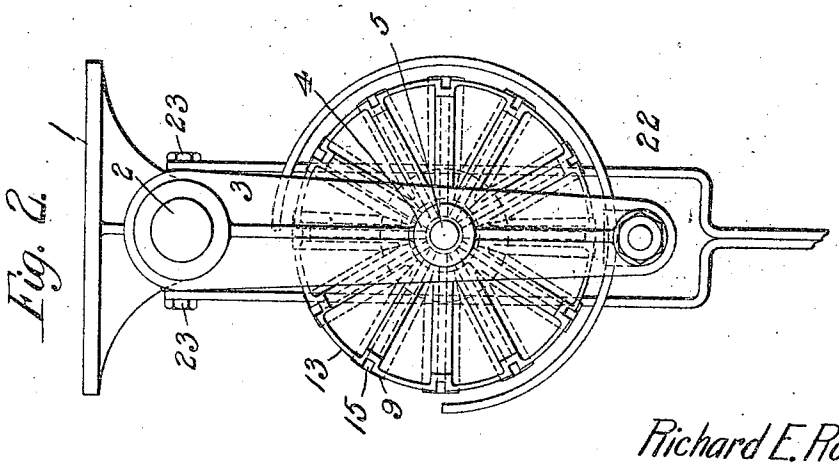


Fig. 2.



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EXPANSIBLE PULLEY AND SPEED-GEAR.

949,005. Specification of Letters Patent. **Patented Feb. 15, 1910.**

Application filed August 5, 1907. Serial No. 387,209.

To all whom it may concern:

Be it known that I, RICHARD E. ROSEWARNE, a citizen of the United States, and a resident of Covington, in the county of Kenton, State of Kentucky, have invented certain new and useful Improvements in Expansible Pulleys and Speed-Gears, of which the following is a specification.

One object of my invention is to construct a pulley of a plurality of longitudinal rim-forming parts or sections arranged to be symmetrically and simultaneously adjustable, radially, to vary the circumference of the pulley and consequently its ratio of transmission.

Another object is to provide a pair of such pulleys and render them reciprocally adjustable and enforce simultaneous rotation in them, without restricting their adjustment, in order to provide a practical speed-changing gear.

A further object is to so yoke together the corresponding longitudinal sections of the respective pulleys, by intermediately fulcrumed arms, or otherwise so couple them in pairs, that, in the reciprocal adjustment, the expansion of either pulley enforces contraction of the others, and to effect the adjustment by providing an expanding member for each pulley.

A further object is to so connect the expanding members of the respective pulleys as to enforce simultaneous movements therein and to so dispose them in their relations to their pulleys that as either moves in the direction to permit contraction, the other moves in the direction to enforce expansion, wherefore the tendency of either expander, under peripheral pressure, to move in the direction of reducing, is transmitted to the other expander in the direction of expanding; hence, the adjusting means are counterbalancing or in equilibrium at every point by reason of the opposing or peripheral pressure on one pulley, by that on the other, and the adjustment may be accomplished rapidly and with ease, through means of a simple shifting lever without the complication of elaborate locking means.

A further object is to so construct the several parts of the pulley and speed gear that the several objects above enumerated may be attained in an economical, effective and durable manner.

In the accompanying drawings, forming part of this specification, in which one embodiment of the invention is shown by way of illustration:—

Figure 1 is an axial section, through the new speed gear and the novel construction of pulleys embodied therein, the hanger-frame and shifting-lever being shown in elevation; Fig. 2 is an end view of the same, Fig. 3 is a side elevation of the pair of coupled pulleys of a speed gear, and their expanding means; Figs. 4 and 5 are detail views of the fulcrum member in which the longitudinal rim-forming members have their rocking bearings.

The embodiment selected for the illustration of my invention is on the principle of the so-called speed jack in which a pair of differential pulleys are mounted between two counter-shafts, each having a pulley belted to one of the differential pulleys. Some of the features of my invention, however, are applicable to an expansible pulley *per se* and are therefore not limited to use in the particular combination shown.

1 represents a bracket through which the pulley may be mounted when in use, 2 a shaft carried by said bracket, 3 the supporting arms mounted to swing upon shaft 2 and providing bearings 4 for the pulley shaft.

5 represents the pulley shaft, and 6, 6^a a pair of reciprocally adjustable pulleys, so constructed, and mounted upon the pulley shaft in such relation, that each may expand or contract and the expansion of one will enforce contraction in the other; also so that outward pressure due to centrifugal tendency in either pulley, is directly transmitted to and resisted by the other pulley; also so that each has positive and continuous driving connection with the pulley shaft so that power received through one pulley may be transmitted through the other. Each pulley is constructed as shown with a crowned belt face and while the adjustment of a pulley involves a change in the angular position of its constituent parts, that portion of the pulley which provides the belt face is so designed that the shape of the face remains constant notwithstanding angular adjustment. Again, it is to be observed that as the angle of the members changes, the belt will automatically climb to the crest of the

crown face so that it naturally tends to remain stationary while the surface of the rim-forming elements shifts beneath it. While not theoretically necessary, I prefer to employ belt guides 7 which prevent shifting of the belt in the direction of the axis of the pulley. These belt guides are conveniently located upon the rod 8 which connects the lower ends of the arms 3 and serves the additional purpose of making a rigid structure of the swinging pulley frame. Considered individually, or jointly, the pulleys are constructed of a plurality of longitudinal rim-forming members 9 each of which is pivoted at 10 on a central fulcrum or bearing member 11 adapted to be mounted upon and caused to rotate with the shaft 5 through means of transverse pins 12, the pulleys being thereby made radially adjustable but circumferentially immovable relatively to the pulley shaft. Each pulley is provided with an expanding cone 13 upon which each individual, longitudinal, pivoted rim-forming section has direct bearing, through the medium of a sliding shoe 14, to support the section in the direction of compression, and also lateral interengagement through the projection of the shoes into surface grooves 15 in the cone whereby the pulley is circumferentially fixed relatively to the cone. Each pulley is thus provided with solid support and positive driving connection.

As will be seen from the drawing, the sliding shoes 14 through which the longitudinal pulley sections bear upon the cones are curved conformably to the changing angle between the pulley sections and the surfaces of the cone upon which they bear, due to relative longitudinal movement between the said cones and pulley sections, so that the shoes maintain their bearing at different diameters of the cones presented to said shoes and thus adapt the parts to be maintained in tight fitting relation and avoid noise and undue wear incident to vibration between the parts.

Means are provided whereby relative movement between either cone and its controlled pulley, or rim, enforces simultaneous and equivalent relative movement between the other cone and its controlled pulley or rim, these relative movements being in directions that cause one cone to expand its controlled pulley as the other cone permits its controlled pulley to contract, and vice versa. These relations between the parts are preferably established by arranging the cones co-axially with the pulleys and presenting them in opposed positions and connecting the cones rigidly together as by means of a sleeve 16.

The cones 13 are rigidly fixed against axial and circumferential movement relatively to each other by splines 17 between the cones and the sleeve 16, and by the nuts 18, 18[a] on the ends of the sleeve. They are also held against circumferential movement relatively to the pulley shaft 5, by the extension of their spline 17 through the sleeve 16 and into a longitudinal groove in the shaft; they are further secured against rotation on the shaft and also against rotation relatively to the fulcrum 11, by means of the through pins 12. The grooves which receive spline 17 and the openings 12[a] in the sleeve 16 through which the pins 12 pass, are elongated to permit the sleeve 16 with its interlocked cones 13 to move axially upon the pulley shaft a distance substantially equal to the axis of one of the expanding cones, in order that the rim-forming members 9 may be caused to bear upon any desired portion of the periphery of a cone and the diameter of the pulley correspondingly determined. The nut 18 is enlarged sufficiently to receive a ring 19 carrying trunnion pins 20 (shown in dotted lines in Fig. 1) which receive the links 21 that connect the ring and through it the cone adjusting sleeve, with the shifting lever 22. Lever 22 is fulcrumed at 23 and may extend downwardly or otherwise to a point of convenient reach for attachment of a controlling connection.

The corresponding rim-forming sections in the two pulleys are rigidly connected, being preferably integral, so that movement in either, enforces movement in the other.

Cones 13 are spaced apart by the length of the pairs of rim-forming members 9 and said rim-forming members are so constructed that when one end of each rests upon the base of one cone, the other end will rest at the apex of the other cone and vice versa.

From the foregoing construction, it will be observed that with a pulley made up of the pivoted sections 9 and having an expanding cone 13 bearing relations thereto as described, longitudinal movement of the cone will change the diameter of the pulley. With the plural pulley construction, the members of which are yoked or coupled together in pairs and secured upon a common pivot serving as a fulcrum, simultaneous movement of the cones will cause expansion at one end during which the movement of the parts is transmitted to enforce contraction at the other end which is permitted by the corresponding movement of the cone at the contracting end and thus the diameters of the pulleys become reciprocally adjustable; moreover, a perfect equilibrium is established between the ends so that end thrust upon the cones is balanced and the adjustment may be effected through the simple form of shifting lever and thus avoid the slow and tedious adjustment of the complicated shifting mechanism incident to the expansible pulleys as heretofore constructed.

Having thus described my invention, what

I claim and desire to secure by Letters Patent is:

1. In an expansible pulley, a plurality of pivoted members each having a rigidly related rim-section, a spreading means upon which said members impinge and slide, swinging said members on their pivots to expand the rim produced thereby, and simultaneously shift their rim sections under the belt and means engaging said members to hold them in impingement.

2. An expansible pulley comprising fulcrumed members carrying rim-forming sections, a spreading member over which the fulcrumed members slide, in determining the radial distance of the rim-forming sections and diameter of the rim generated thereby, and means pressing against said fulcrumed members at points on said fulcrumed members remote from the rim-forming sections carried thereby, and in a direction to hold the rim-forming sections against the spreading member.

3. An expansible pulley comprising intermediately fulcrumed members each carrying on one side of its fulcrum, a rim-forming section, a spreading member over which the fulcrumed members slide, in determining the radial distance of the rim-forming sections and diameter of the rim generated thereby, and means pressing against said fulcrumed members on that side of their fulcrums that is remote from their rim sections, and in a direction to hold them against the spreading member.

4. An expansible pulley comprising fulcrumed members carrying rim-forming sections, a spreading member over which the fulcrumed members slide, in determining the radial distance of the rim-forming sections and diameter of the rim generated thereby, and means pressing against all of said fulcrumed members simultaneously at a point remote from the rim forming sections and in a direction to hold them against the spreading member, said means moving as the spreading member moves, to maintain its relation to said fulcrumed members.

5. In a speed gear, a pair of reciprocally adjustable, co-axial pulleys comprising rigid, intermediately fulcrumed longitudinal members, each of which is provided at each of its free ends with a rim section in rigid relation thereto, and spreading means for rocking said longitudinal members on their pivots and determining the relative diameters of the pulleys produced thereby, sliding beneath said fulcrumed members on opposite sides of their pivots, and each pressing the fulcrumed members in a direction to hold said fulcrumed members in impingement with the other spreader.

6. A speed changing device comprising a plurality of fulcrumed longitudinal members, each having at each end a section of a rim, and a pair of spreaders having sliding contact with the fulcrumed members at points longitudinally remote from their fulcrums, located on opposite sides of said fulcrums, and reciprocally enforcing enlargement of the rims generated by the rim sections, and each spreader holding the fulcrumed members in contact with the other spreader.

7. A speed changing device comprising a plurality of fulcrumed longitudinal members, each having at each end a section of a rim, and spreaders for the respective rims, having sliding contact with the rim sections and reciprocally coöperating therewith to expand the rims and maintain contact between them and the spreaders.

8. An expansible pulley comprising a plurality of longitudinal rim-forming members, a fulcrum member to which each is pivoted, a shaft or supporting member upon which the fulcrum member is mounted, and a pair of spreaders also mounted on said shaft sliding within and reciprocally expanding the rims formed by the rim-forming members; and each spreader holding said rim-forming members in contact with the other spreader; means being provided to develop relative axial adjustment between the pair of spreaders and the rim-forming members.

9. An expansible pulley comprising a plurality of longitudinal rim-forming members, each pivoted at one point and formed with integral convex rim sections providing belt bearing surfaces at varying distances from the pivot points, and means for expanding the free ends of said sections.

10. In an expansible pulley a plurality of pivoted longitudinal members respectively provided with rim sections in rigid relation thereto, and means for simultaneously swinging said members on their pivots to expand the rim produced thereby; the portions of said members which produce the pulley rim sections being curved to maintain a crown face at different angular positions of the members, corresponding to different diameters to which the pulley may be adjusted.

11. An expansible pulley comprising a fulcrum or bearing member, a plurality of pivoted longitudinal rim-forming members fulcrumed upon said fulcrum or bearing member, each having a rim-forming portion in rigid relation thereto, and means for expanding the rim formed by said members, comprising a cone against which the members bear and means causing relative movement between said members and said cone, in the direction of the axis of the pulley.

12. An expansible pulley comprising a plurality of pivoted longitudinal members each having a rigidly attached rim-forming portion and an expanding cone mounted co-axially with said pulley, said longitudi-

nal members being provided with bearing shoes through which they bear against the expanding cone, curved conformably to the variations in angle between the longitudinal members and the surface of the cone, due to the expansion and contraction of the pulley, and means for causing relative longitudinal movement between the rim-forming members and the expanding cone.

13. An expansible pulley comprising a plurality of longitudinal members, pivoted at fixed points and each having at its free end, a rigidly connected rim-forming section, and means for expanding the free ends of said members, comprising a cone movable longitudinally of the shaft, but fixed against rotation thereon, and upon which the free ends of the rim-forming members rest; said cone and rim-forming members engaging to provide positive driving connection between the rim and cone.

14. A speed gear comprising a pair of coaxially mounted pulleys, reciprocally adjustable and comprising longitudinal, pivoted, rim-forming parts, each of which has a free end, and oppositely acting spreaders for the pulleys, engaging the free ends of the rim-forming parts thereof, tending to move in opposite axial directions under the pressure of their respective rim-forming parts, secured co-axially with the pulleys, without relative rotation, and rigidly connected together and simultaneously adjustable relatively to and in the direction of the axis of the pulleys.

15. In a speed-gear, a pair of reciprocally adjustable pulleys comprising longitudinal rim-forming sections, the corresponding sections of the respective pulleys being united and fulcrumed upon common pivots, whereby the expansion of either pulley enforces contraction in the other, and a pair of spreading cones for the free ends of the rim-forming sections.

16. In a speed-gear, a pair of reciprocally adjustable pulleys comprising longitudinal rim-forming sections, the corresponding sections of the respective pulley being united and fulcrumed upon common pivots, whereby the expansion of either pulley enforces contraction in the other, a common shaft for said pulleys, a fulcrum for the rim-forming sections, fixed against rotation on said shaft, and a pair of cones on said shaft, presented in spreading relation to the respective pulleys, movable longitudinally on the shaft to spread the pulleys but fixed against rotation relatively to both the pulleys and the shaft.

17. The combination of the shaft, the sleeve keyed on the shaft, but movable axially thereon, the fulcrum member fixed both axially and circumferentially upon the shaft, the plural rim-forming sections pivoted intermediately on the fulcrum member and providing a pair of expansible pulleys by their free ends and a pair of spreading cones fixed upon the sleeve, in spreading relation to the pulley sections, spaced apart to present the reduced part of one to either pulley as the larger part of the other cone is presented to the other pulley, whereby as either pulley is caused to expand the other is permitted to contract, and means for imparting axial movement to the sleeve.

18. A pair of co-axial reciprocally expanding and contracting pulleys respectively composed of longitudinal rim-forming sections, of which the corresponding sections of the respective pulleys are rigidly united and fulcrumed at a common point, a pair of expanding cones arranged co-axially with the pulleys in spreading relation thereto and with the free ends of the pulley sections resting upon the cones, and means enforcing in said cones simultaneous movement relatively to the pulleys, in directions that cause one cone to expand its controlled pulley as the other cone permits contraction in its controlled pulley and vice versa.

19. A pair of coaxial expansible pulleys, each of which is composed of a plurality of rim-forming sections; the corresponding sections of the respective pulleys being rigidly united and the pairs of oppositely extending rim-forming sections thus produced being pivoted at intermediate points; and a pair of oppositely presented coaxial cones arranged in spreading relation to the respective rims formed by the sections, with the free ends of said sections resting upon the cones, whereby the axial pressing of either cone into a rim causes pressure upon the other cone by the sections of the other rim, and the parts may be assembled in tight relation free from vibration between the parts.

20. A pair of co-axial reciprocally expanding and contracting pulleys respectively composed of longitudinal rim-forming sections of which the corresponding sections of the respective pulleys are rigidly united and fulcrumed at a common point, a pair of expanding cones arranged co-axially with the pulleys in spreading relation thereto and with the free ends of the pulley sections resting upon the cones, and means enforcing in said cones simultaneous movement relatively to the pulleys, in directions that cause one cone to expand its controlled pulley as the other cone permits contraction in its controlled pulley and vice versa; the rim-forming sections being provided with and bearing upon the cones through the medium of sliding shoes.

21. A pair of co-axial reciprocally expanding and contracting pulleys respectively composed of longitudinal rim-forming sections, of which the corresponding sections of the respective pulleys are rigidly

united and fulcrumed at a common point, a pair of expanding cones arranged co-axially with the pulleys in spreading relation thereto and with the free ends of the pulley sections resting upon the cones, and means enforcing in said cones simultaneous movement relatively to the pulleys, in directions that cause one cone to expand its controlled pulley as the other cone permits contraction in its controlled pulley and vice versa; the rim-forming sections being provided with and bearing upon the cones through the medium of sliding shoes, and said sliding shoes being curved conformably to the changing angle between the surfaces of the cones and the rim-forming sections as relative angular movement takes place between said cones and sections.

22. A pair of co-axial reciprocating adjustable sectional-rim pulleys of which the corresponding rim-sections are united end to end and mounted upon common pivots at intermediate points, and a pair of coaxial cones introduced within the rims, in spreading relation thereto with their smaller ends opposed, whereby the pressing of either cone inward within and relatively to the rim-sections bearing thereon, causes pressure between the other cone and the rim-sections bearing thereon, and the members may thus be assembled without lost motion between the parts.

23. A pair of coaxial reciprocally expanding and contracting pulleys, each comprising pivoted longitudinal sections and oppositely presented coaxial conical spreaders; the corresponding sections of the respective pulleys being connected so that radial movement of either enforces opposite radial movement in the other; and the spreaders being introduced within the respective pulleys and connected so as to enforce simultaneous movement in an axial direction.

24. In a speed gear, the combination of co-axial reciprocally adjustable pulleys comprising pivoted longitudinal rim sections, the corresponding rim sections of the respective pulleys being united end to end and mounted upon common pivots at points intermediate of the pulleys, and a pair of oppositely presented cones arranged co-axially with the pulleys and with each other; said cones being introduced within and in spreading relation to the rims of the respective pulleys, and a co-axial connecting member for the cones upon which they are moved, in seating them, relatively to the respective rims with which they co-act, and in a direction in which they move to spread said rims.

25. In a speed gear, the combination of reciprocally expanding and contracting pulleys respectively formed by pivoted longitudinal rim sections, the corresponding rim sections of the respective pulleys being united together and pivoted at points intermediate of the pulleys, a co-axial member around which the pivots of the rim members are arranged, and a pair of cones having their smaller ends presented inwardly, seated upon the respective ends of the co-axial member and rigidly connected thereby, and arranged in spreading relation to the respective rims; said cones being moved upon said co-axial member, in assembling, relatively to and in the direction of spreading the respective rims with which they co-act; whereby said parts may be assembled with proper tension in the rim-forming sections, to prevent vibration in use.

The foregoing specification signed at Cincinnati, Ohio, this 17th day of May, 1907.

RICHARD E. ROSEWARNE.

In presence of two witnesses:
H. WHYRICH,
F. BROERMAN.