K. ALQUIST.

METHOD OF ASSEMBLING GEARING.

APPLICATION FILED DEC. 28, 1917.

1,304,242.

Patented May 20, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

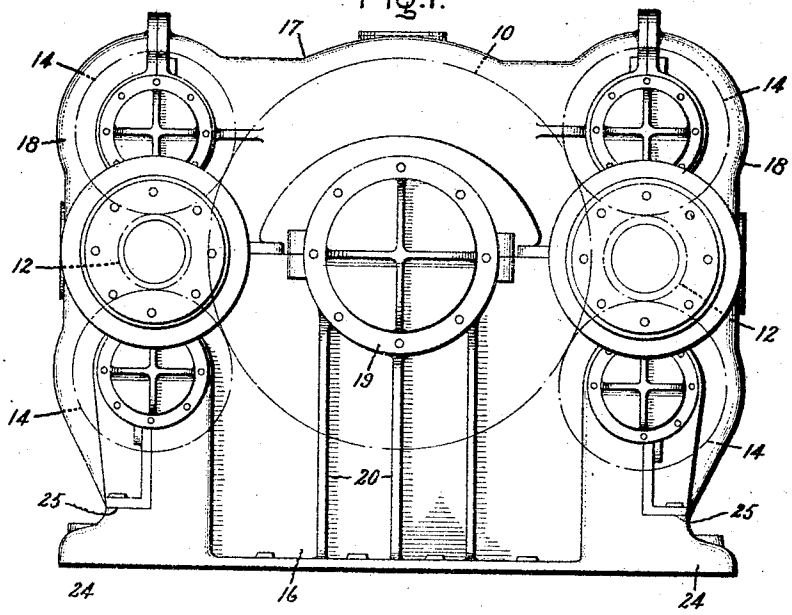
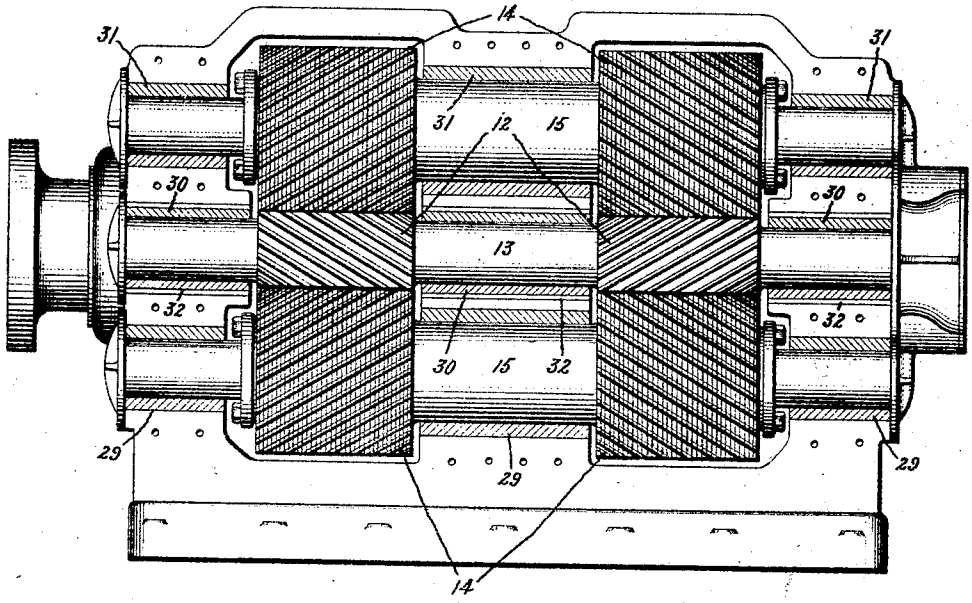


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4

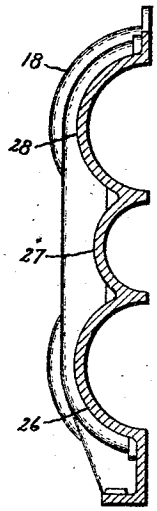


Fig. 3.

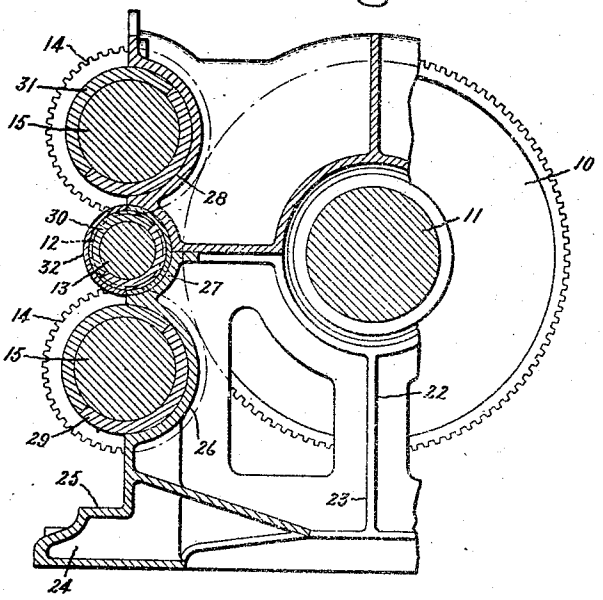


Fig. 5.

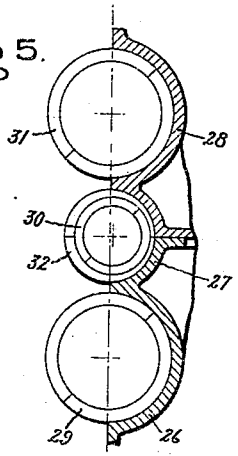


Fig. 7.

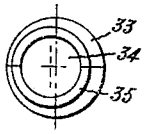


Fig. 8.

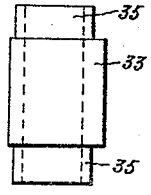
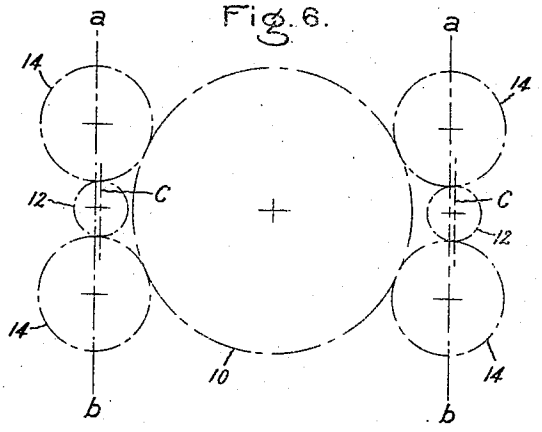


Fig. 6.



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UNITED STATES PATENT OFFICE.

KARL ALQUIST, OF SCHENECTADY, NEW YORK.

METHOD OF ASSEMBLING GEARING.

1,304,242. Specification of Letters Patent. Patented May 20, 1919.

Original application filed November 20, 1917, Serial No. 203,063. Divided and this application filed December 28, 1917. Serial No. 209,215.

To all whom it may concern:

Be it known that I, KARL ALQUIST, a subject of the King of Sweden, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Methods of Assembling Gearing, of which the following is a specification.

The present application is a division of my application Serial No. 203,063, filed November 20, 1917, and is filed in accordance with a requirement made by the United States Patent Office.

The present invention relates to gearing of the type comprising a driving pinion, a driven gear wheel, and two intermediate gear wheels located on opposite sides of the pinion and through which power is transmitted from the pinion to the driven gear wheel, the pinion being thus balanced between such intermediate gear wheels.

The object of my invention is to provide an improved method for obtaining the correct adjustment for and positioning of the pinion bearings so that the teeth of the gearing will mesh correctly.

My invention, particularly as to some of its aspects, relates to gearing intended to transmit large power, but it is, of course, not necessarily limited thereto.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying specification and the claims appended thereto.

In the drawing, Figure 1 is an end elevation of a gearing and casing in connection with which my invention may be carried out; Fig. 2 is a side elevation thereof with one side casing section removed; Fig. 3 is a sectional view, partly broken away, of the gearing and casing; Fig. 4 is a vertical sectional view of a side casing section; Figs. 5 and 6 are views of a diagrammatic nature illustrating certain features of the invention, and Figs. 7 and 8 are end and side views respectively of a modified structure of certain parts.

Referring to the drawing, 10 indicates a driven gear wheel carried by a shaft 11, and 12 a driving pinion carried by a shaft 13. Power is transmitted from the driving pinion 12 to the driven gear wheel 10 through two intermediate gear wheels 14 carried on shafts 15 and both meshing with the pinion and the driven gear wheel. The pinion 12 is located at one side of the gear wheel 10 with its center line in the same horizontal plane as that of wheel 10, and wheels 14 are located one directly above and the other below the pinion. This arrangement of driving pinion and intermediate gear wheels is duplicated on the diametrically opposite side of the gear wheel 10 and in operation each pinion 12 may be driven by a separate driving agent, for example, an elastic fluid turbine. By this arrangement very large powers may be transmitted to the driven shaft 11 without exceeding the permissible limits of pinion length.

The casing comprises four principal parts—a base section 16, a top section 17, and two side sections 18, the side sections being similar. The plane of division between the base and top sections 16 and 17 is that of the center lines of gear wheel 10 and pinions 12.

In the transmission of large powers by gearing, one of the difficulties is to obtain sufficient bearing surfaces for the shafts, and to provide this it is often desirable to space the halves of the gear wheels and pinions apart and place a bearing between them, thus providing two end and an intermediate bearing for each shaft. In the case of double helical gearing, which is the type shown in the drawing, this spacing falls naturally between the right-hand and left-hand halves of the gear wheels and pinions. The base section 16 has two end bearing supports 19 for the ends of shaft 11, which supports are strengthened by vertical ribs 20. 22 indicates an intermediate transverse web strengthened by a rib or ribs 23 which serve to tie the two sides of the casing together. If found desirable a central bearing for shaft 11 may be supported by this web, but ordinarily this will not be necessary. Along the two side edges of base section 16 are reinforced flanges or projections 24 which form supporting feet for the gearing. These parts are made strong as directly over them are the driving pinions 12 and gear wheels 14, and they are provided with finished top surfaces 25 which form ledges upon which the bottoms of the side sections 18 rest. The top casing section 17 rests on the base section 16 and carries the upper or cover portions of the bearing supports 19. The side sections 18 rest on the ledges 25 and are bolted to the base and top sections. Formed

in the sides of the top and bottom sections on the one hand and in the side sections on the other are bearing supports 26, 27 and 28 for the lower gear shafts 15, pinion shafts 13 and upper gear shafts 15 respectively. As best shown in Fig. 2, each of these shafts has three bearings, one at each end and one in the middle between the two toothed gearing sections. The bearings are vertically alined and are formed one-half in the base and top sections 16 and 17 and one-half in the side sections 18. This is clearly illustrated by Figs. 3 and 4. The bearing liners for shafts 13 and 15, which may be provided with babbitted surfaces in the usual manner, are indicated at 29, 30 and 31.

As stated above, one of the difficulties met with in connection with gearing for transmitting large powers is to provide sufficient bearing surfaces. In an arrangement of gearing, as described, each pinion 12 is balanced between two gear wheels 14 since one is located on each side thereof. The bearing pressures for such pinions, therefore, will not be large and the provision of sufficient bearing surface for them offers no great difficulty. As to intermediate gear wheels 14, however, this is not the case and the problem of providing sufficient bearing surface is a serious one. In connection with my improved structure I provide additional bearing surface for gear wheels 14 without increasing the length of shafts 15 by making the shafts 15 of greater diameter between the two halves of the gear wheels than they are at the ends. This provides the additional bearing surface at a point where most needed. The provision of additional shaft diameter at this point also has the advantage that it provides shoulders against which the gear wheel sections abut and to which they may be bolted. In the present instance the gear wheels 14 are shown as being of the elastic type invented by me and comprising a plurality of disks clamped together at their central portions and slightly spaced apart at their peripheries so that they may yield axially under tooth pressure, and the shoulders provided by the enlarged central shaft diameters are especially useful with this type of gear wheel, as it is desirable that the disks be held between end plates or supports and firmly bolted thereto. The shoulders formed by the enlarged shaft diameter form a very firm abutment for one side of the disks of which the gear wheel is made up.

In a gearing of this type in which a pinion is balanced between two intermediate gear wheels it is difficult in practice to locate accurately the position of the pinion bearings as the position of these bearings depends on the number of teeth and the diameters of the gear wheels in mesh. The center of the pinion will very seldom lie on the straight line through the centers of the intermediate gear wheels. The correct position is also inconvenient to ascertain by direct calculations. It is desirable, however, when boring out the bearing supports to have the centers of the bores for the intermediate gear wheel bearings and those for the pinion bearings in line.

In carrying out my invention, the supports for the pinion bearings are bored in the casing with their centers approximately on the straight line through the centers of the intermediate gear wheels, but the bore of the pinion support is made larger in diameter than would ordinarily be required for the bearing liners, this difference being made more than sufficient to allow for the eccentricity that may be required when the liners are in the position in which the pinions and intermediate wheels are properly in mesh. The exact position of the pinion is found by placing the gear wheels in their bearings but leaving out the liners for the pinion, the pinion being temporarily suitably held in its middle position midway between the centers of the two intermediate gear wheels, while free to adjust itself to the required position in the plane through the center of the pinion and the low speed wheel. A small torque is then put on the gear train which will serve to bring the pinion to its correct position which it should occupy when the gearing is running. The position of the pinion center line relatively to the plane through the centers of the intermediate gear wheels can then be closely ascertained by measuring, this giving the eccentricity relatively to the bore in the casing required by the pinion bearing liners for carrying the pinion in its correct position in the gear train. I then construct an eccentric cylinder having an outer diameter equal to the diameter of the bore in the casing, and an inner diameter adapted to receive the liners, the eccentricity being being equal to the amount that the center of the pinion is out of line with the centers of the intermediate gear wheels ascertained as above. The eccentric cylinder may be suitably split in halves and fastened firmly to the corresponding halves of the bore when, as is usually the case, the gear housing is split through the bearing. By this method the pinion, it will be seen, can be very accurately located with a minimum amount of labor and machine work.

Fig. 6 illustrates in a diagrammatic manner the relative relations that may occur between the pinions 12 and gear wheels 14 when the pinions are in positions for correct meshing with the gear wheels. *a b* indicates the center lines of the intermediate gear wheels 14, and *c* the center lines of the pinions 12 which it will be seen are to one side of center lines *a b*. This is also shown in Fig. 5. The eccentric sleeves referred to

above which are utilized to position the pinion bearing liners are indicated at 32. In Fig. 6 the showing is exaggerated for purposes of illustration. According to my improved method, therefore, the bearing supports 27 for each pinion 12 are bored out on the same center line as the bearing supports 26 and 28. The intermediate gear wheels 14 and the pinions 12 with their bearing liners are then mounted in their respective supports and the pinion shaft 13 is fixed in any suitable manner against movement along the axial plane through the centers of gear wheels 14, but is permitted to move along the axial plane through the centers of such pinion and gear wheel 10. For example, it may be supported temporarily in the manner described by suitable blocks. The gearing train is then subjected to a small torque which brings the pinions 12 to their correct positions for meshing with gear wheels 14. The eccentricity of the pinion bearing liners 30 relative to their supports 27 is then determined by measurement and the eccentric sleeve 32 made according to such measurements.

Instead of providing a separate eccentric sleeve 32 I may make the pinion bearing liners 30 themselves eccentric, their outer diameters then being made to correspond to the diameter of the bores of the supports 27, and the openings in them being off center to the required extent. This is illustrated in Figs. 7 and 8 where 33 indicates a bearing liner and 34 the opening through it. In this case only a portion of the bearing liner 33 is made eccentric, and some part of it, preferably the two ends, as indicated at 35, are made concentric with the center of the pinion shaft 13. The purpose of this is to facilitate re-babbitting the liners while keeping the eccentricity correct.

The above described gearing, it will be seen, is very compact and symmetrical and lends itself exceptionally well to being built in very large sizes and for transmitting large powers. It is also very readily assembled and dismantled owing to the arrangement of the base and top sections and the two side sections with the bearing supports between them. Furthermore, by reason of my improved method for positioning the pinions, I am enabled to form the supports for the pinion shafts as a part of the casing and to bore them out on the same center line as the supports for the two adjacent intermediate gear wheels.

In accordance with the provisions of the patent statutes, I have described my invention and the particular method and apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the particular method and apparatus disclosed is only illustrative and that the invention can be carried out in other ways and by other means such as come within the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a gearing of the type comprising a pinion, a gear wheel, and two intermediate gear wheels between which the pinion is balanced and which transmit power between the pinion and first named gear wheel, the method of locating the correct position of the pinion in its bearings which comprises mounting the pinion in its bearing supports between the two intermediate gear wheels, putting a torque on the gear train to bring the pinion to its correct position, and providing lining means for the pinion bearings to hold it in such position.

2. In a gearing of the type comprising a pinion, a gear wheel, and two intermediate gear wheels between which the pinion is balanced and which transmit power between the pinion and first named gear wheel, the method of locating the correct position of the pinion in its bearings which comprises mounting the pinion in its bearing supports between the two intermediate gear wheels, putting a torque on the gear train to bring the pinion to its correct position, measuring its position relative to its bearing supports, and providing liners for such supports according to said measurements.

3. In a gearing of the type comprising a pinion, a gear wheel, and two intermediate gear wheels between which the pinion is balanced and which transmit power between the pinion and first named gear wheel, the method of locating the correct position of the pinion in its bearings which comprises boring the pinion supports in the gear casing oversize, mounting the pinion in said supports and between the two intermediate gear wheels, putting a torque on the gear train to position the pinion relative to its bearing supports, and providing a liner for the pinion bearings to hold the pinion in such position.

In witness whereof, I have hereunto set my hand this 26th day of December, 1917.

KARL ALQUIST.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."