K. ALQUIST.

SPUR GEARING.

APPLICATION FILED JAN. 29, 1916.

1,220,811.

Patented Mar. 27, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

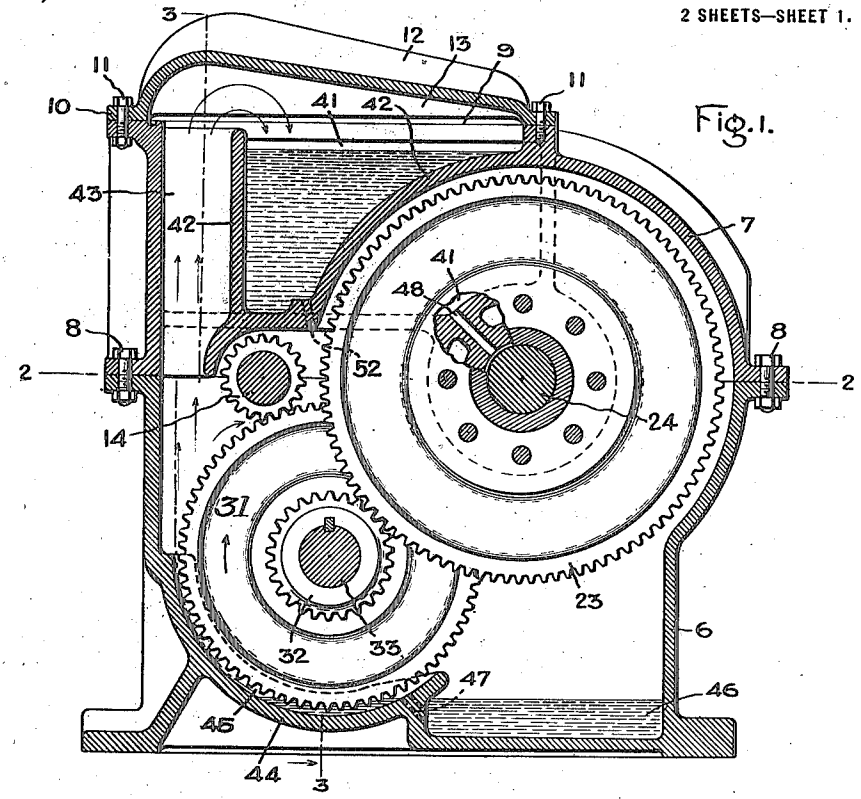
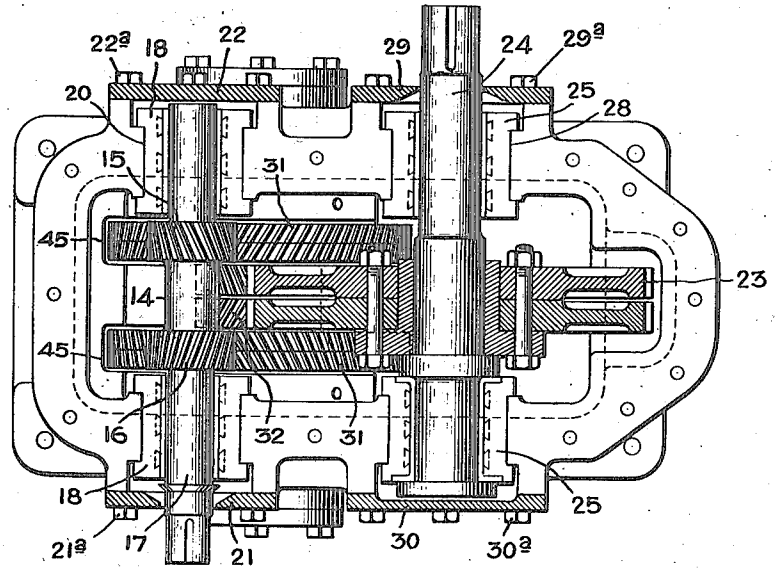


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

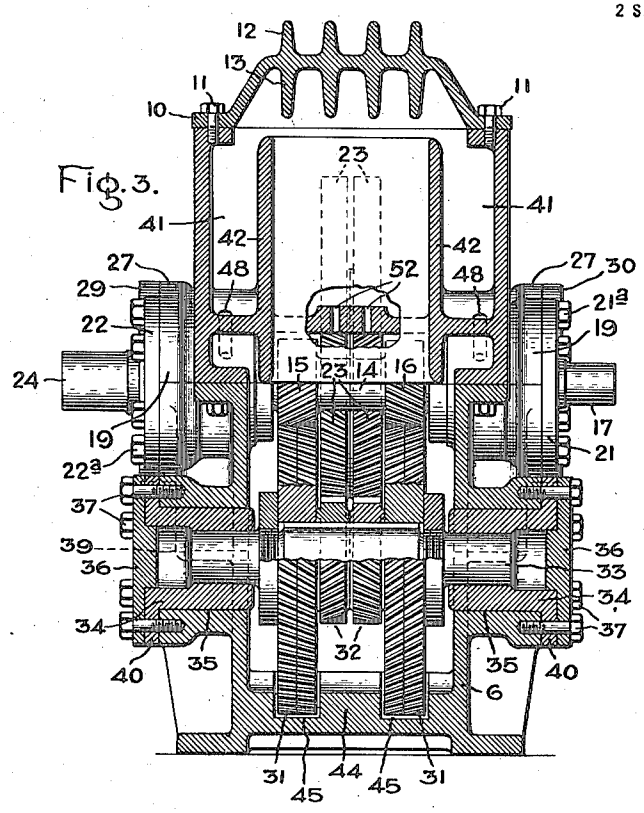


Fig. 4

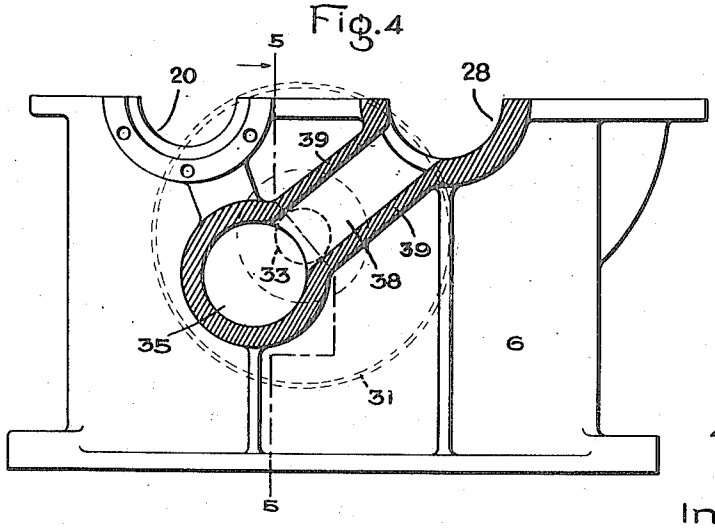
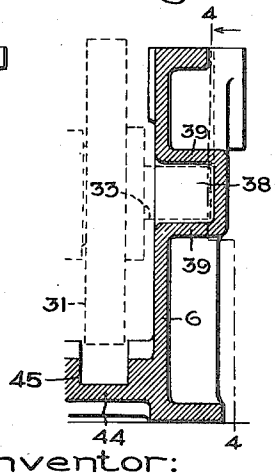


Fig. 5.



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UNITED STATES PATENT OFFICE.

KARL ALQUIST, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SPUR-GEARING.

1,220,811. Specification of Letters Patent. Patented Mar. 27, 1917.

Application filed January 29, 1916. Serial No. 75,159.

To all whom it may concern:

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

The present invention relates to spur gearing of the double reduction or multiplication type, and particularly to such gearing for relatively small supports and designed to run at relatively small speed reductions.

In my application, Serial No. 48,424, filed September 1, 1915, I have described and claimed broadly an improved lubricating system for a gearing, which system is entirely within the gear casing so that the gearing is entirely self-contained. In such application the invention is shown as applied to a single reduction gearing. One of the objects of the present invention is to provide an improved arrangement of double reduction gearing in which the invention of my above referred to application is embodied.

A further object of the invention is to provide an improved arrangement of the gear wheels in the casing whereby a compact structure is obtained so that the gear casing may be given small dimensions.

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 accompanying drawing, Figure 1 is a vertical section through a double reduction gearing embodying my invention; Fig. 2 is a section taken on line 2—2, Fig. 1, line 2—2 being located at the point where the casing is split; Fig. 3 is a vertical section partly broken away taken on line 3—3, Fig. 1 and looking in the direction of the arrows; Fig. 4 is a detailed view of the lower half of the casing taken on line 4—4, Fig. 5; and Fig. 5 is a section taken on line 5—5 of Fig. 4. In each of Figs. 4 and 5 certain of the gear wheels are shown in dotted lines for the purpose of illustrating the manner in which such gear wheels are slipped into place.

Referring to the drawings, the gear casing is shown as comprising a lower section 6 and an upper section 7 suitably joined together by bolts 8. The upper section is provided with an opening 9 to one side thereof, which is closed by a cover plate 10 fastened in place by bolts 11. This cover plate is curved as shown, and on its outer side is provided with a suitable number of ribs or fins 12. On the inner side it is provided with a series of webs 13 which are preferably in line with the ribs or fins 12 as shown in Fig. 3. The purpose of these parts will be pointed out hereinafter.

14 indicates the high speed pinion. It is of the herringbone type and comprises two spaced parts 15 and 16 carried by the high speed shaft 17. This shaft is supported in bearings 18 located at the dividing line of the two halves of the casing, the upper half of each bearing being located in a slot in the upper half of the casing formed by the wall 19, and the lower half of each bearing being located in a slot 20 (Fig. 4) in the lower half of the casing. One end of the shaft 17 projects beyond the casing wall to receive a coupling, and is surrounded by a cover plate 21, and the other end is covered by a cover plate 22. These cover plates are held in place by suitable bolts 21^a and 22^a. 23 indicates the low speed wheel mounted on a shaft 24 supported in bearings 25 also located at the dividing line of the two halves of the casing. One-half of each bearing is located in a slot in the upper half of the casing formed by the wall 27, and the other half is located in a slot 28 (Fig. 4) in the lower half of the casing. The one end of shaft 24 projects beyond the casing to receive a coupling and is surrounded by a cover plate 29, and the other end is covered by a cover plate 30. These cover plates are held in place by suitable bolts 29^a and 30^a. The gear wheel 23 is shown as being of the elastic or flexible type invented by me and comprises a plurality of laminations or disks suitably fixed on the shaft and slightly spaced apart at their periphery to permit of slight axial yielding under tooth pressure. The invention is not limited, however, to this type of gearing. Arranged between the pinion 14 and gear wheel 23 are the intermediate gear wheels 31 and 32 which transmit the power from the one to the other. They are mounted on a common shaft 33, the low speed intermediate wheel 32 being in two halves which are spaced apart and mesh with the two parts of the pinion 14, and the high speed intermediate wheel 31 being arranged between the two halves of wheel 32 to mesh with the low speed wheel 23. The wheels 31 are also

preferably of the elastic or flexible type invented by me and already referred to above. This constitutes a double reduction gearing. The shaft 33 is supported in bearings 34 located in openings 35, one on each side of the casing, the bearings being slipped into the openings from the sides and covered with cover plates 36 held in place by suitable bolts 37. In order to get the shaft 33 with the wheels 31 and 32 thereon into place without requiring that the casing be split at the center line of the intermediate gears I connect the openings 35 with the slots 28 by means of runways 38 formed by the walls 39. This is best shown in Figs. 4 and 5. When the gearing is being assembled the intermediate gear wheels 31 and 32 with their shaft 33 are first put into place by sliding the ends of the shaft down the runways 38. This is illustrated in dotted lines in Figs. 4 and 5. The two bearings 34 are then slipped into the openings 35 and over the ends of the shaft 33. The bearings 34 are provided with end flanges 40 which are located between the cover plates 36 and the gear casing, the bolts 37 extending through them so as to anchor the bearings firmly in position. Located inside the casing beneath the opening 9 and above and to one side of the gear wheels is a lubricant containing reservoir 41. This constitutes a storage reservoir for lubricant which is used to lubricate the bearings and the teeth of the gear wheels. It is preferably rectangular and has its wall 42 shaped, as shown, to accommodate the gear wheels 14 and 23. Extending up at one side of the reservoir 41 is a rectangular passage 43 formed by the walls 42 and connecting the lower portion of the gear casing with the reservoir. The passage 43 extends from the bottom of the reservoir to a point adjacent the top thereof. The passage 43 is of a length to extend to each side of the two sections of intermediate gear wheel 31 and is located over the left-hand side of such wheel (Figs. 1 and 3). The lower half of the casing 6 is provided with a curved wall 44 having two grooves 45 therein, as best shown in Figs. 1 and 3. This curved wall is set up above the bottom of the lower half of the casing and extends well around the gear wheel 31 so that to one side of it, is formed a lubricant containing well 46. The curved wall 44 conforms to the curvature of the gear wheel 31 and the two parts of such gear wheel run in the grooves 45, the grooves being of such size as to fit fairly close to the wheel. The lubricant containing well 46 is connected with each of the grooves 45 by small passages 47. The reservoir 41 is connected to the various bearings by means of suitable passages through which lubricant may be carried to them. All these passages do not show in the views of the drawing but the general arrangement of all will be readily understood from those which do show. 48 (Figs. 1 and 3) indicates passages leading to the bearings of the low speed wheel 23. 52 are passages through which lubricant from the reservoir 41 passes to lubricate the teeth of the meshing gear wheels 23 and 32. Lubricant from the reservoir drips through these passages directly onto the teeth of gear wheel 23.

In assembling the gearing the intermediate gear wheels 31 and 32 are first put into place as already explained. The lower halves of the bearing members 18, and 25 are then fitted into the slots 20 and 28, in the lower half 6 of the casing, and shafts 17 and 24 which carry pinion 14 and low speed gear wheel 23 mounted therein, after which the upper half of the casing with the upper halves of the bearings in place thereon is put into place.

In operation a suitable amount of oil is filled into the lower half of the gear casing; *i. e.*, the well 46, and into the reservoir 41, the levels which it assumes in the well and reservoir not being material, for if the gear is standing idle, all, or substantially all, of the lubricant will run through to the well 46. The gearing revolves so that the gear wheel 31 moves in the direction indicated by the arrow. This wheel acts as a pump to pump lubricant from the grooves 45 up through the passage 43 into the reservoir 41 from which it is fed through the passages 48, etc., to the bearings, and also through the passages 52 to lubricate the teeth of gear wheels 23 and 32. When the gearing is started it will quickly pump lubricant from the grooves 45 up into the reservoir 41, as at such time these grooves will be flooded with lubricant owing to the level in the chamber or well 46 being fairly high. The passages 47 will be of such size that they will easily feed the return lubricant from the well 46 to the grooves 45. To do this it will only be necessary that the tips of the teeth engage with the lubricant. The arrangement of the grooved wall 44 having the grooves 45 in which the teeth run and to which lubricant is fed from the well 46 insures the proper direction of the lubricant during the pumping operation, as otherwise the angle of the teeth would tend to force the lubricant in an axial direction. The curved wall 44 acts in a way as a pump casing guiding the lubricant.

The lubricant pumped by the gear wheel and discharged through passage 43 will be in the form of a fine spray and fog, and it is desirable to condense this and separate the air out of it, and at the same time to cool it. It is for these purposes that the webs 13 are provided. The spray and fog in the passage 43 is thrown with considerable force against the top of the cover 10 between the webs 13.

This tends to condense the fog and separate it and the spray out from the air, a goodly portion of it clinging to the cover and to the webs 13, which also act in the capacity of surface condensers to further condense and separate out the lubricant. Owing to the curved shape of the cover the spray and fog and the drops of lubricant will tend to flow toward the right in Fig. 1, the drops of lubricant dropping into the reservoir 41. When the spray and fog strikes the cover 10 its direction is changed before being forced to flow down between the webs 13. This causes the air to flow under the lower edges of the webs 13 to the casing, separating out the air in a very satisfactory manner. At the same time the webs absorb a large amount of heat from the lubricant which heat is carried to the outside of the casing wall and dissipated. The ribs or fins 12 are for the purpose of assisting in this by providing additional radiating surface. The arrangement thus functions as a cooler and condenser for the lubricant and also as an air separator. By this arrangement I provide for lubricating all the bearings and all the gear teeth without a separate pump. In running only the tips of the teeth of the gear wheel 31 engage the lubricant and this involves practically no loss; and at high speeds the windage is practically sufficient for pumping the oil.

As will be clear, my improved arrangement provides a very compact gearing by reason of the arrangement of the gear shafts relative to each other and the arrangement of the gear wheels thereon. There is practically no wasted space within the gear casing. At the same time it is necessary to provide only one split in the casing in order to mount all the gears in place.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

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

1. The combination in a double reduction gearing, of a casing divided into upper and lower sections, a high speed pinion and a low speed gear wheel, separate shafts therefor, said shafts being journaled in the casing at the dividing line between the casing sections, a shaft journaled in openings formed in the lower section of the casing at a point below the first named shafts, and gear wheels mounted on the last named shaft which mesh with the high speed pinion and the low speed wheel.

2. The combination in a gearing, of a casing divided into upper and lower sections, said sections having slots at the dividing line of the casing adapted to receive bearings, the lower half of the casing being provided with openings located below the slots also adapted to receive bearings, and with runways connecting the openings with certain of said slots whereby a shaft may be slid down said runways to the openings and have bearings slipped over its ends and into said openings.

3. The combination in a double reduction gearing, of a casing divided into upper and lower sections, said sections having slots at the dividing line of the casing, said lower section being also provided with openings located below the slots, and with runways connecting said openings with certain of the slots, bearings in said slots, shafts in said bearings, a high speed pinion and a low speed wheel mounted on said shafts, bearings in said openings, a shaft in said bearings, and gear wheels mounted on said shaft which mesh with the pinion and low speed wheel.

4. The combination in a double reduction gearing, of a casing, a shaft therein, a high speed pinion mounted on said shaft and formed in two sections which are spaced apart, a second shaft journaled in the casing, a low speed wheel mounted on it which is of a width equal to the space between the two sections of the pinion, a third shaft journaled in the casing, an intermediate high speed wheel mounted on it which meshes with the low speed wheel, and an intermediate low speed wheel also mounted on the third shaft and formed in two sections one on each side of the intermediate high speed wheel, said two sections extending on each side of the low speed wheel and meshing with the sections of the high speed pinion.

5. The combination in a double reduction gearing, of a casing, a high speed pinion and a low speed gear wheel mounted therein with their centers in the same horizontal plane, intermediate gear wheels mounted in said casing below such plane, which transmit power between the pinion and low speed wheel, means forming a lubricant containing reservoir located in the upper portion of the casing, a lubricant containing well being formed in the lower portion of the casing from which lubricant is pumped by one of the intermediate gear wheels to the reservoir, and means for conveying lubricant from the reservoir to lubricate the gearing.

6. The combination in a double reduction gearing, of a casing, a high speed pinion and a low speed gear wheel mounted therein with their centers in the same horizontal plane, intermediate gear wheels mounted in said casing below such plane which transmit power between the pinion and low speed

wheel, said casing being formed with a groove in which one of said wheels runs, means forming a lubricant containing reservoir located in the upper portion of the casing, the casing having a wall forming a passage which extends from the lower portion thereof to said reservoir, a lubricant containing well being formed in the lower portion of the casing, and also a passage through which lubricant is fed by gravity from the well to said groove, said gear wheel which runs in the groove acting to pump lubricant from the groove up through said first named passage to the reservoir, and means for conveying lubricant from the reservoir to lubricate the gearing.

7. The combination in a double reduction gearing, of a casing, a shaft therein, a high speed pinion mounted on said shaft and formed in two sections which are spaced apart, a second shaft journaled in the casing, a low speed wheel mounted on it which is of a width equal to the space between the two sections of the pinion, a third shaft journaled in the casing, an intermediate high speed wheel mounted on it which meshes with the low speed wheel, an intermediate low speed wheel also mounted on the third shaft and formed in two sections one on each side of the intermediate high speed wheel, said two sections extending on each side of the low speed wheel and meshing with the sections of the high speed pinion, and said casing being formed with two grooves in which said two sections run, means forming a lubricant containing reservoir located in the upper portion of the casing, the casing having a wall forming a passage which extends from the lower portion thereof to said reservoir, a lubricant containing well being formed in the lower portion of the casing, and also a passage through which lubricant is fed by gravity from the well to said groove, said gear wheel sections which run in the grooves acting to pump lubricant from the grooves up through said first named passage to the reservoir, and means for conveying lubricant from the reservoir to lubricate the gearing.

In witness whereof, I have hereunto set my hand this 28th day of January, 1916.

KARL ALQUIST.