Aug. 22, 1939. J. D. CHRISTIAN 2,170,548

SPEED REDUCTION UNIT

Filed June 13, 1938 2 Sheets-Sheet 1

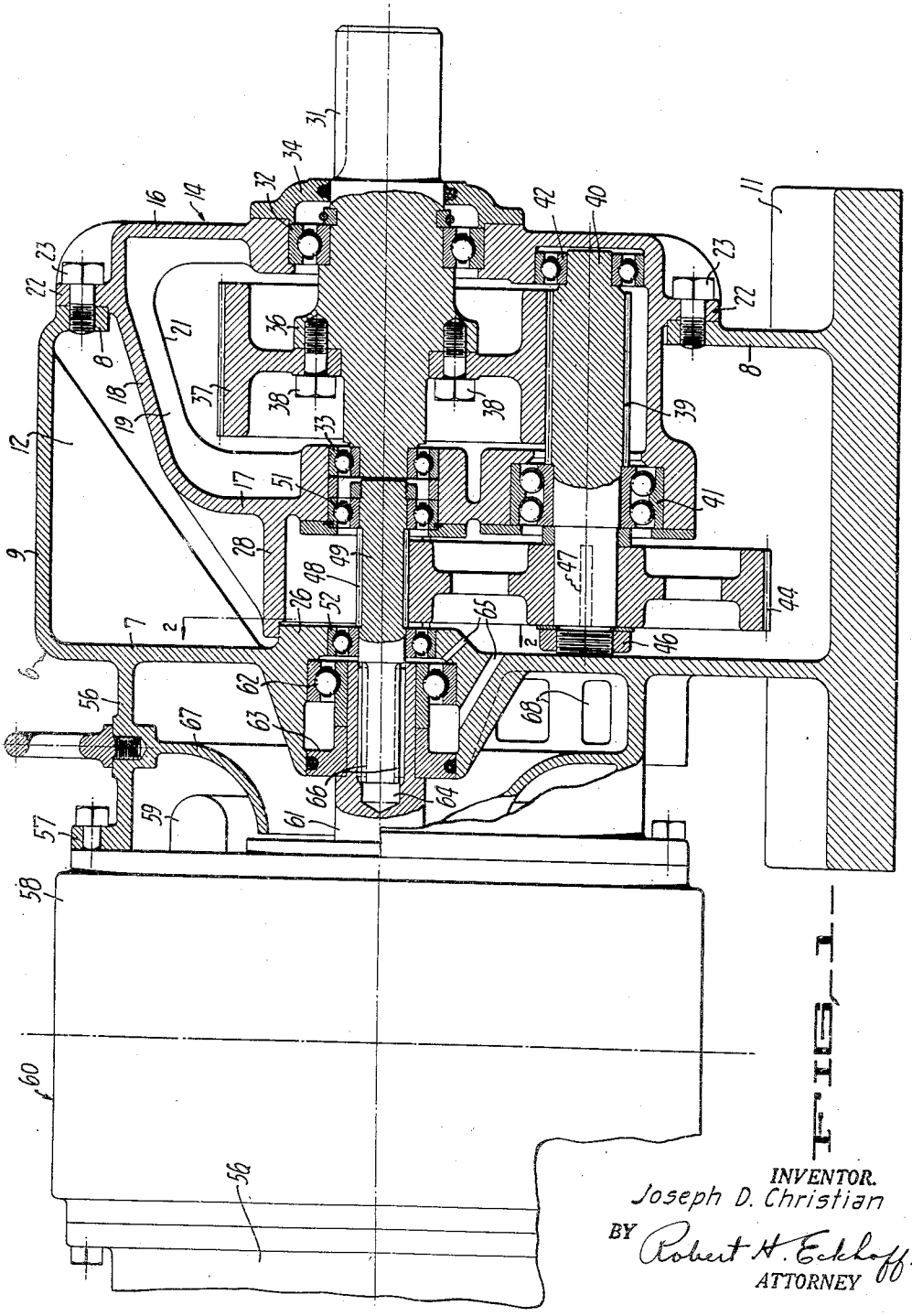


Fig. 1.

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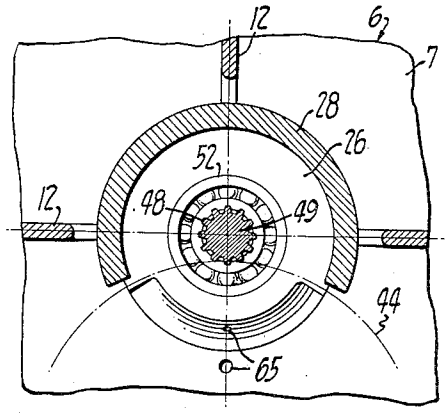
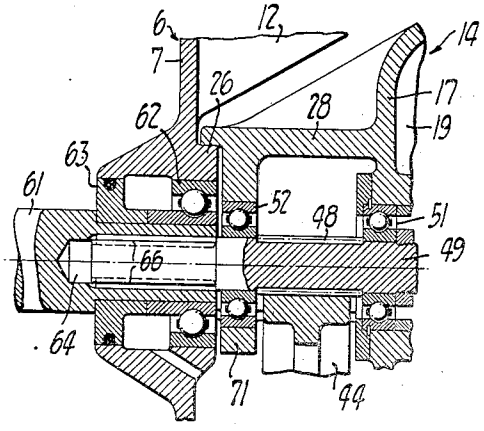


FIG. 2.

FIG. 3.



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Patented Aug. 22, 1939

2,170,548

UNITED STATES PATENT OFFICE

2,170,548

SPEED REDUCTION UNIT

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Application June 13, 1938, Serial No. 213,440

8 Claims. (Cl. 74—606)

This invention relates to a speed reduction unit and more particularly to an improvement in such a device as that disclosed in my Patent No. 1,860,703 of May 31, 1932, and my Patent No. 2,070,149 of January 7, 1936.

It is in general a broad object of the present invention to provide a speed reduction unit in which very rigid support is provided for the gears and shafting employed so that sudden reversals in stresses are possible in the unit.

A further object of the present invention is to provide a speed reduction unit which can be commercially made up to include a steel housing and a cast iron support unit for the gearing and shafting employed. Such a construction is simpler and more satisfactory.

A further object of the present invention is to provide a speed reduction unit of a novel and simplified construction.

The invention includes other objects and features of advantage, some of which, together with the foregoing will appear hereinafter wherein the present preferred form of the speed reduction unit of the present invention is disclosed.

In the drawings accompanying and forming a part hereof, Figure 1 is a side elevation partly in section illustrating the speed reduction unit of my invention.

Figure 2 is a section taken along the line 2—2 of Figure 1.

Figure 3 is a side elevation showing a modification of the structure in Figure 1.

The speed reduction unit of the present invention includes a casing structure generally indicated at 6. This structure includes first and second opposite end walls 7 and 8 connected together by an intermediate or side wall 9. Means are provided for supporting the casing structure and, as a typical support means, I have shown a base 11 as a portion of the casing. The casing structure is conveniently made of steel, either pressed or welded, to provide the necessary structure, webs 12 being employed to strengthen the structure as desired.

In accordance with this invention the speed reduction unit indicated generally at 14 is insertable in and removable as a unit from the casing structure. To this end, the second end wall 8 is apertured. The speed reduction unit 14 includes a plate structure having an outer wall 16 and an inner wall 17 joined together by an intermediate wall 18. Suitable ribs are also provided as at 19 to connect the two walls 16 and 17. The plate structure, and particularly the intermediate wall, is apertured as at 21 to admit a gear, as will presently appear. The plate structure is flanged as at 22 and studs 23 are employed to secure and position the plate structure on the wall 6.

In accordance with this invention the plate structure is also supported from the first end wall 7 and to this end an extension 26 is formed on the first end wall extending toward the opposite and second end wall. An extension 28 is formed on the plate structure and is adapted to engage the extension 26 on the first end wall 7 to support the plate structure. As appears from Figure 2, the extension 28 only partially encircles the extension 26 but this suffices to provide adequate support for the plate structure, particularly ensuring rigidity and ample support. The plate structure can be made of cast iron cast as a unit. Because of this its machining is simplified as is the assembly of the various speed reduction elements normally carried in the plate structure.

A power take-off shaft 31 is shown carried in a roller bearing 32 in wall 16 and in a roller bearing 33 in wall 17. A suitable lubrication retaining member 34 is secured in place about the take-off shaft adjacent to bearing 32. The take-off shaft is flanged as at 36 and a gear 37 is secured to this flange as by studs 38. Gear 37 is positioned by passing it through the aperture 21 and then inserting the power take-off shaft and making up the studs.

Gear 37 drives a gear 39 on a countershaft 40. Countershaft 40 is carried on a roller bearing 41 in the plate 17 as well as in a roller bearing 42 in wall 16. The end of the countershaft overhangs the bearing 41, extending toward the first end wall 7. Upon this overhanging end is secured a gear 44 retained in place by a lock nut 46 and a key 47. Gear 44 is driven from a pinion gear 48, preferably cut integral with shaft 49 carried in roller bearings 51 in wall 17 and roller bearing 52 in end wall 7. Shafts 49 and 31 are preferably coaxial, though this is not necessary.

The end wall 7 can include an extension 56 thereon which is flanged as at 57 to receive and support the stator 58 of an electric motor 60. The motor includes a rotor 59 mounted on a motor shaft 61 supported in suitable bearings including a roller bearing 62 carried in wall 7. Bearings 62 and 52 are sealed in place by lubrication sealing means 63 and oil is circulated through the bearings and through ducts 65. The motor shaft 61 is hollowed out as at 64 and is formed with cooperating key ways 66 connecting shaft 49 to a shaft 61 whereby the pinion gear is rotated directly by the shaft.

In the drawings I have shown the motor 60 as

mounted between two speed reduction units, the motor shaft extending on each side thereof to drive the oppositely positioned unit. However, this is not necessary and the motor can be employed to drive but one of the units.

The extension 56 includes an air guide way 67 for directing air through the motor, air being admitted or released through apertures 68 so that the motor is cooled.

In Figure 3, extension 28 is shown as provided with a wall 71 to support bearing 52. This construction ensures more certainly that shafts 49, 31 and 39 are maintained in the same relation to each other even under extreme load variations.

From the foregoing I believe it to be apparent that I have provided a relatively simple and yet rugged speed reduction unit to be adapted for use with an electric motor drive.

Various modifications are possible in the details of construction. For example, considering the high speed pinion 46 on shaft 49 and the support of shaft 49, it is possible to eliminate bearings 52 entirely. In this case, the end of the shaft 49 is supported in the drive shaft. Such constructions are shown in the Bannon Patent 1,949,643 of March 6, 1934, and my prior Patent 1,860,703 of May 31, 1932. It is also possible to eliminate bearings 51 and 52 entirely, and to have the high speed pinion either formed or mounted upon the end of the motor shaft after the disclosure in the Uggla Patent 1,817,216 of August 4, 1931. The pinion can be fastened to the extending motor shaft in various ways, as with a key seat and a nut. It is also possible to mount the high speed pinion shaft separately and independently from the structure 16, a nose or straddle being provided on wall 7 after the construction employed to support the high speed pinion shaft in my Patent 2,027,149 of January 7, 1936. The matter of support for the high speed pinion is not nearly so material as is the matter of support of the other shafts and gears. In this connection it is to be pointed out that I have provided a unitized or solid construction of the gear assembly having a fit on both end walls and accurately aligned and supported at all times. In this connection, while I have indicated that the speed reduction unit includes a plate structure having an outer wall 16 and an inner wall 17 joined together by an intermediate wall 18, it is to be remembered that it is not necessary that, so far as the term wall is concerned, the elements so described need to be solid, continuous members. Thus a skeletonized structure can be employed, either cast or fabricated, of a unitized but rigid construction, free from separate machine fits.

If desired, engagement of extension 28 with extension 26 can be a full circle engagement instead of approximately ⅔ circle engagement, as is shown in Figure 2. However, in this instance difficulty may be encountered in assembling the countershaft construction, particularly in placing gear 44 thereon. This can be overcome by employing the construction illustrated for the low speed gear 37, namely, by having the gear flanged onto a hub and removable, cap screws being employed.

Referring to the bearings, I have heretofore mentioned that bearings 32 and 33 were roller bearings. In employing this term it is to be remarked that these bearings should be such that they can take a thrust, bearings 32, 41 and 51 being located to take a thrust in either direction, while bearings 33, 42 and 52 are not located but float.

Another feature is that according to the speed of torque requirements to be delivered the shaft 31 in relation to the horsepower of the motor 60, the gear specifications will change. The housing 9 is somewhat dictated in its size or physical dimensions by the physical dimensions of the motor to which it is mounted, also the characteristics of the motor. For instance a 5 H. P. open motor and the size of case 9 must be accommodated to the physical dimensions of the motor irrespective of its horsepower capacity. The gear assembly, however, need only be sufficiently large to transmit the horsepower of the motor and if a 5 H. P. motor of special design required a housing big enough to house gears of 10 H. P. capacity, this construction permits inserting through the aperture of end wall 8 a unitized gear assembly large enough or small enough to suit the horsepower of the motor. On the other hand, one might have a condition where very heavy shock loads requiring extra heavy gearing would be necessary, although the motor was of only normal size. This construction permits inserting into the housing a gear assembly with face widths of gears enlarged to meet this heavy duty service.

I claim:

1. In a device of the character described, a casing structure including first and second opposite end walls connected by a side wall, said second end wall being apertured, a plate structure partially extending through said apertured end wall into said casing structure, means securing said plate structure on said apertured end wall, said plate structure including an outer wall and an inner wall joined together as a unitary structure by an intermediate wall, an extension on said first end wall extending toward said second end wall, an extension on said plate structure extending beyond said inner wall and engaged with said extension on said first end wall, a first shaft, bearing means supporting said first shaft in said plate outer and inner walls, a countershaft, bearing means supporting said countershaft in said plate outer and inner walls, gearing interconnecting said first shaft and said countershaft, a second shaft, bearing means supporting said second shaft for rotation, and gearing interconnecting said second shaft and said countershaft.

2. In a device of the character described, a casing structure including first and second opposite end walls connected by a side wall, said second end wall being apertured, a plate structure partially extending through said apertured end wall into said casing structure, means securing said plate structure on said apertured end wall, said plate structure including an outer wall and an inner wall joined together as a unitary structure by an intermediate wall, an extension in said first end wall extending toward said second end wall and an extension on said plate structure extending beyond said inner wall and engaged with said extension on said first end wall.

3. In a device of the character described, a casing structure including first and second opposite end walls connected by a side wall, said second end wall being apertured, a plate structure partially extending through said apertured end wall into said casing structure, means securing said plate structure in said apertured end wall, said plate structure including an outer wall and an inner wall joined together as a unitary struc-

ture by an apertured intermediate wall, a first shaft, bearing means supporting said first shaft in said plate outer and inner walls, a countershaft, bearing means supporting said countershaft in said plate outer and inner walls, gearing interconnecting said first shaft and said countershaft including a gear on said first shaft insertable through said apertured intermediate wall, a second shaft, bearing means supporting said second shaft for rotation, and gearing interconnecting said second shaft and said countershaft.

4. In a device of the character described, a casing structure including first and second opposite end walls connected by a side wall, said second end wall being apertured, a plate structure partially extending through said apertured end wall into said casing structure, means securing said plate structure on said apertured end wall, said plate structure including an outer wall and an inner wall joined together as a unitary structure by an intermediate wall, a first shaft, bearing means supporting said first shaft in said plate outer and inner walls, a countershaft, bearing means supporting said countershaft in said plate outer and inner walls with an end of said countershaft overhanging beyond the bearing means in said plate inner wall, gearing interconnecting said first shaft and said countershaft, a second shaft, bearing means supporting said second shaft for rotation, and gearing interconnecting said second shaft and said overhanging end on said countershaft.

5. In a device of the character described, a casing structure including first and second opposite end walls connected by a side wall, said second end wall being apertured, a plate structure partially extending through said apertured end wall into said casing structure, means securing said plate structure on said apertured end wall, said plate structure including an outer wall and an inner wall joined together as a unitary structure by an intermediate wall, a first shaft, bearing means supporting said first shaft in said plate outer and inner walls, a countershaft, bearing means supporting said countershaft in said plate outer and inner walls, gearing interconnecting said take-off shaft and said countershaft, a second shaft, bearing means supporting said second shaft in said plate inner wall and said first end wall of said casing structure, and gearing interconnecting said second shaft and said countershaft.

6. In a device of the character described, a casing structure having first and second opposite end walls connected by a side wall, said second wall being apertured; a speed change unit including a first shaft, a second shaft and gearing connecting said shafts to effect a reduction therebetween, a support structure inserted through said aperture at least partially, bearing means supporting said shafts substantially in axial alignment in said support structure, means on said support structure engaged with said second wall to support said unit, and means on said support structure engaged with said first wall to support said unit.

7. A device as in claim 1 wherein the extension on the plate structure and the inner wall on the plate structure support the bearing means for the second shaft.

8. A device as in claim 1 wherein the first end wall of the casing structure and the inner wall on the plate structure support the bearing means for the second shaft.

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