April 28, 1936. G. E. GUNDERSON 2,038,731

DRIVING MECHANISM

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Fig. 2

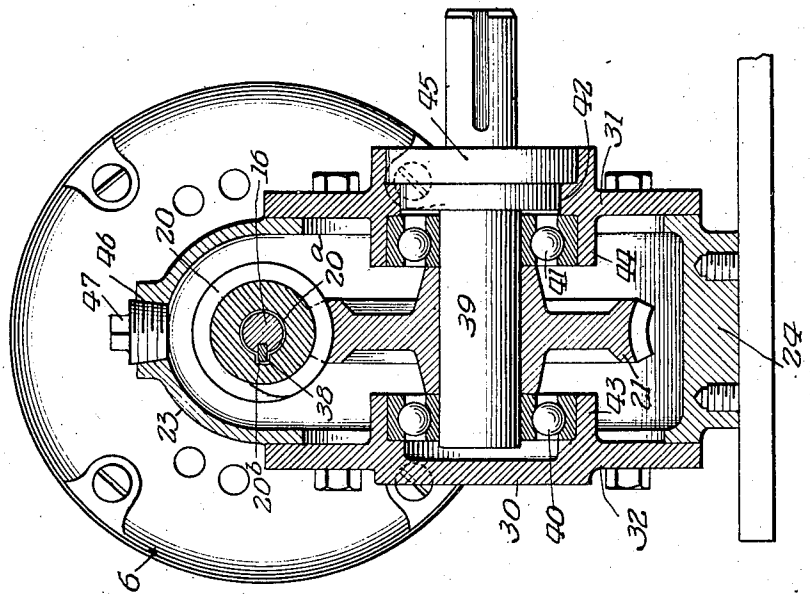
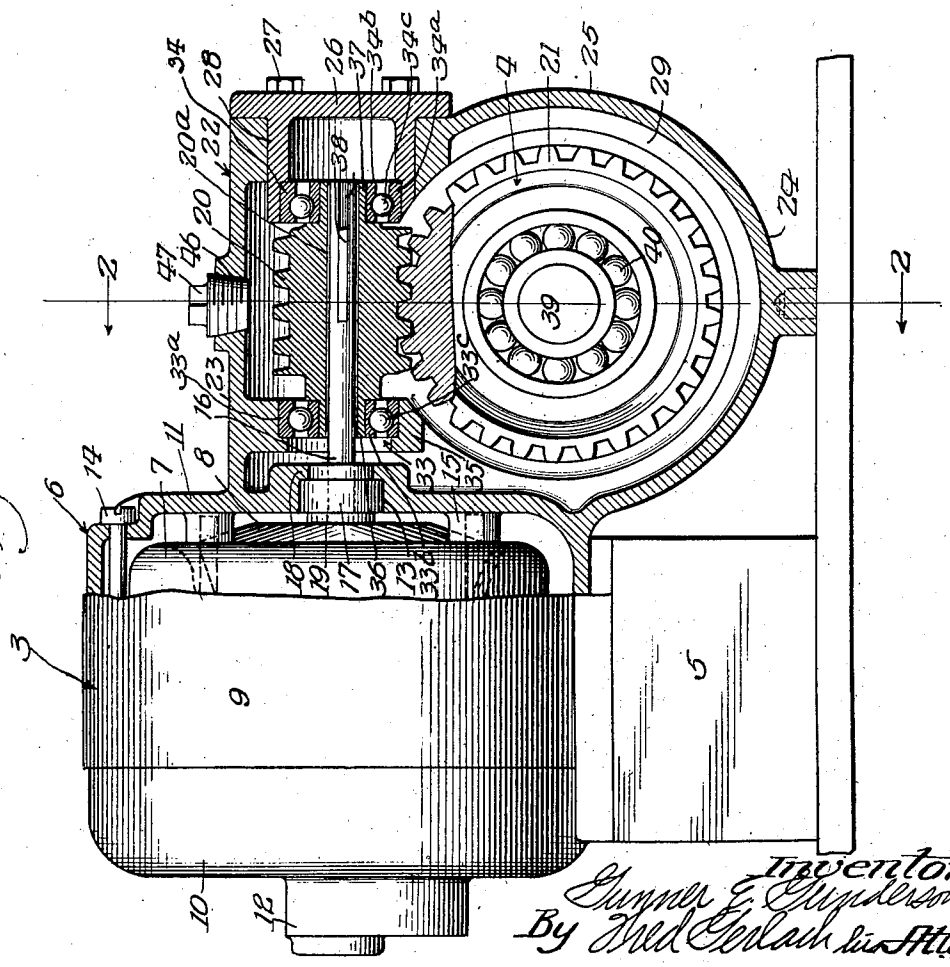



Fig. 1




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## DRIVING MECHANISM

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1 Claim. (Cl. 74—425)

The present invention relates generally to driving mechanism. More particularly, the invention relates to that type of driving mechanism which is designed for use as the power unit for various forms of apparatus and mechanical devices, and comprises an electric motor and speed-reducing means in the form of worm gearing which is driven by the motor and consists of a worm on one end of the armature shaft of the motor and a worm wheel in mesh with the worm.

Heretofore, it has been customary in the manufacture of driving mechanism of this type, to mount the worm gearing in a housing at one end of the motor housing and to secure the worm to the armature shaft of the motor by means of a transverse driving pin, a set screw or any other type of rigid driving connection. In practice it has been found that with a connection of this character between the worm and the armature shaft, the life of the motor is comparatively short due to the fact that the armature shaft is subjected to a certain amount of strain and end thrust from the worm, and is not free so that the armature can float within, and center itself with respect to, the field windings of the motor.

One object of the invention is to provide driving mechanism of the type under consideration which is generally an improvement upon, and is more efficient in operation than, previously designed driving mechanisms of the same general character, by virtue of the fact that the worm is supported at the ends thereof by ball bearings in the housing for the worm gearing and is connected to the armature shaft of the motor by a key and groove connection which eliminates end thrust on the shaft, absorbs strain and permits the armature to float and center itself with respect to the field windings of the motor.

Another object of the invention is to provide driving mechanism of the aforementioned character in which the housing for the worm gearing is formed integrally with the housing for the electric motor and embodies a simple and improved bearing arrangement for the worm and novel means for lubricating the key and groove connection which serves as the driving medium for the worm and permits the armature to float and center itself with respect to the field windings of the motor.

A further object of the invention is to provide driving mechanism of the electric motor and worm gear type which is extremely efficient in operation and may be manufactured at a low and reasonable cost.

Other objects of the invention and the various advantages and characteristics of the present construction of driving mechanism will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the claim at the conclusion hereof.

In the drawing which accompanies and forms a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a view partly in side elevation and partly in longitudinal section of driving mechanism embodying the invention; and

Figure 2 is a transverse section taken on the line 2—2 of Figure 1 and illustrating in detail the manner in which the worm wheel is supported in the housing for the worm gearing.

The driving mechanism which forms the subject matter of the invention is adapted for use in connection with any apparatus or mechanical device requiring a power unit with speed reducing means. It is essentially a unitary structure and consists of an electric motor 3 and worm gearing 4. The motor is adapted to be supported on a block or rest 5 and consists of a housing 6, field windings 7 and an armature 8. The housing surrounds the field windings and the armature, as shown in Figure 1 of the drawing, and consists of a cylindrical side member 9 and a pair of cast metal end members 10 and 11. The end member 10 embodies at the central part thereof a bearing 12 and fits against one end of the side member 9. The end member 11 fits against the other end of the side member of the motor housing and is provided with a central aperture 13. Bolts 14 extend between the end members 10 and 11 and serve to hold the latter in clamped relation with respect to the cylindrical side member 9. The field windings 7 are centrally positioned in the cylindrical side wall 9 of the motor housing and are supported by bolts or pins which extend longitudinally of the motor housing and are supported at the ends thereof by bosses 15 which are formed integrally with, and project inwardly from, the end members 10 and 11. The armature 8 is disposed within the field windings 7 and embodies a shaft 16. One end of the shaft is journalled in the bearing 12 at the central portion of the end member 10. The other end of the shaft extends through the aperture 13 in the central portion of the end member 11 and is supported, as hereinafter described, so that the armature is free to rotate in response to flow of current or electrical

energy through the field windings 7. An oil seal 17 fits within the aperture 13 and around the armature shaft, and prevents oil from entering the motor housing via the aperture. This seal is held in place between an inwardly extending flange 18 at one side of the aperture 13 and fiber spacing rings 19 at the other side of the aperture. The worm gearing 4 serves as the speed reducing means for the driving mechanism. It consists of a worm 20 and a worm wheel 21 and is mounted in a cast metal housing 22. The latter is formed integrally with the end member 11 of the motor housing 6 and comprises a semi-cylindrical top wall 23, a bottom wall 24 and an outer end wall 25. The top wall 13 of the housing for the worm gearing surrounds the end of the armature shaft which projects through the aperture 13, and is joined at the inner end thereof to the central portion of the end member 11. The outer end of the semi-cylindrical top wall 23 is closed by a cap 26 which is removably held in place by means of cap screws 27 and embodies an inwardly extending annular flange 28. This flange, as shown in Figure 1 of the drawing, fits slidably within the outer end of the semi-cylindrical top wall 23 of the housing for the worm gearing. The bottom wall 24 is arcuate and is joined to the lower portion of the end member 11 of the motor housing and the lower end of the outer end wall 25. The lower portion of the end member 11 forms the inner side wall of the housing for the worm gearing and defines with the bottom wall 24 and the outer end wall 25, a substantially cylindrical, transversely extending compartment 29 for the worm wheel 21. The sides of the housing 22 are closed by a pair of circular side plates 30 and 31. These plates close the ends of the compartment 29 for the worm wheel 21 and are removably secured in place by means of cap screws 32.

The worm 20 is journalled in a pair of ball bearings 33 and 34, has a longitudinal central bore $20^a$ through which extends the end of the armature shaft that projects through the aperture 13 and is surrounded by the semi-cylindrical top wall 23 of the housing 22. The bearing 33 is associated with a vertically extending, centrally apertured partition 35 in the end of the top wall 23 adjacent to the end member 11 of the motor housing 6, and consists of an outer race $33^a$, an inner race $33^b$ and an annular series of balls $33^c$ between the two races. The partition 35 is formed integrally with the top wall of the housing for the worm gearing and extends around the projecting end of the armature shaft. The outer race of the ball bearing 33 is connected by a drive fit to the portion of the partition that forms the central aperture. The inner race $33^b$ is shrunk or otherwise secured around a reduced stem 36 on the inner end of the worm 20, that is, the end adjacent to the electric motor 6. The ball bearing 34 is associated with the removable cap 26 at the outer end of the top wall of the housing 22 and consists of an outer race $34^a$, an inner race $34^b$ and an annular series of balls $34^c$ between the two races. The outer race $34^a$ is driven into connected relation with the inner periphery of the inner end of the annular flange 28 of the cap 26. The inner race $34^b$ is shrunk or otherwise secured around a reduced stem 37 on the outer end of the worm 20. By employing the bearings 33 and 34, the worm 20 is supported independently of the projecting end of the armature shaft and is held or confined against longitudinal movement in the housing 22 for the worm gearing. The worm is driven by the armature shaft through the medium of a longitudinally extending key 38. The latter is secured to, and extends longitudinally of, the projecting end of the armature shaft and fits within a longitudinally extending groove $20^b$ joining the bore $20^a$ in the worm. The key 38 fits within the groove so that the armature shaft is free to move longitudinally relatively to the worm. As a result of this arrangement and by supporting the worm in gearings independently of the armature shaft, the armature is not subjected to any end thrust from the worm and is free to float within and center itself with respect to the field windings 7. In addition, there is a complete absorption of any and all strain resulting during operation of the driving mechanism and the life of the electric motor is thereby prolonged or increased. The key and groove connection between the projecting end of the armature shaft and the worm exemplifies a simple driving connection whereby the worm is driven from the armature shaft and at the same time, the armature shaft is permitted to slide longitudinally of the worm so that the armature may float within and adjust itself to the field windings, as previously pointed out.

The worm wheel 21 meshes with, and is driven by, the worm 20 and is keyed or otherwise fixedly secured to a transversely extending drive shaft 39. This shaft is journalled in a pair of ball bearings 40 and 41 and is arranged so that one end thereof extends through a central aperture 42 in the side plate 31. The ball bearing 40 is associated with a side plate 30 and is carried by an annular, inwardly extending flange 43 in the central portion of said side plate. The ball bearing 41 is associated with the side plate 31 and is carried by an annular flange 44. The latter, as shown in Figure 2 of the drawing, is formed integrally with, and extends inwardly from, the central portion of the side plate 31. An oil seal 45 extends around the outer or projecting end of the shaft 39 and is confined in an outwardly extending flange in the side plate 31.

The housing 22 for the worm gearing is adapted to be filled with a lubricant, such as oil or grease, and embodies in the top portion of the cylindrical top wall 23 a lubricant charging hole 46. This hole, as shown in the drawing, is normally closed by a screw plug 47. When the housing 22 is filled with lubricant, the drive connection between the projecting end of the armature shaft and the worm is lubricated by reason of the fact that a certain portion of the lubricant flows into the space within the annular flange 28 of the cap 26 via the channel between the inner and outer races of the ball bearing 34, and then passes into contact with the key 38 in the groove $20^b$.

When current or electrical energy is supplied to the field windings of the motor, the armature is rotated and effects drive of the shaft 39 through the medium of the worm 20 and the worm wheel 21 which constitute speed reducing means and cause the shaft to rotate at a reduced speed with respect to the armature shaft. During operation of the driving mechanism, the worm 20 is held or confined against end thrust by the ball bearings 33 and 34, and the armature is allowed to float, that is, move longitudinally relatively to the field windings, by reason of the key and groove driving connection projecting between the end of the armature shaft and the worm. When it is desired to remove the worm 20 from the housing 22, it is only necessary to

remove the cap 26 and to withdraw the worm together with the bearings 33 and 34 through the outer end of the semi-cylindrical top wall 23 of the gearing housing.

The herein described driving mechanism consists of but a comparatively small number of parts and hence may be produced at a low and reasonable cost. It is exceedingly efficient due to the specific manner in which the worm is journalled in the gear housing and the armature shaft is connected to drive the worm, and incorporates a construction whereby ready accessibility is derived to all the operating parts.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claim, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

In driving mechanism of the character described, the combination of an electric motor embodying a housing with an aperture in one end wall thereof and comprising windings fixed in the housing, a rotatable armature within the windings and rotatable on an horizontal axis and a shaft for the armature with one end thereof projecting outwardly through the aperture in said one end wall of the housing, a second housing located adjacent to said one end wall of the motor housing and comprising a pair of sides, a substantially semi-cylindrical top wall around the projecting end of the armature shaft, having one end thereof formed integrally with said one end wall of the motor housing and embodying a depending centrally apertured partition around the projecting end of the armature shaft and spaced inwardly from the apertured end wall of the motor housing, and a removable cap at the other end of the semi-cylindrical top wall and in alignment with the armature shaft, a worm disposed in said semi-cylindrical top wall between the partition and the cap and having reduced cylindrical ends and a longitudinal bore therethrough through which the projecting end of the armature shaft extends, means for supporting the worm independently of the armature shaft comprising a pair of ball bearings carried by the partition and cap respectively and applied to the reduced cylindrical ends of the worm so that the worm is held against axial displacement in said second housing, a loose key and groove connection between said projecting end of the armature shaft and the worm whereby the shaft serves to drive the worm in response to rotation of the armature but is free to slide longitudinally relatively to the worm and thus permits the armature to float, a worm wheel mounted in the second housing between the sides and arranged so that it meshes with and is driven by the worm, means for introducing oil into said second housing for lubricating purposes, and an oil seal associated with the aperture in said one end wall of the motor housing for preventing oil from passing from said second housing into the motor housing while at the same time permitting of longitudinal movement of the armature shaft.

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