Dec. 9, 1958 I. W. EISENBERG ET AL 2,863,325

GEAR TRAIN

Filed May 4, 1956 2 Sheets-Sheet 1

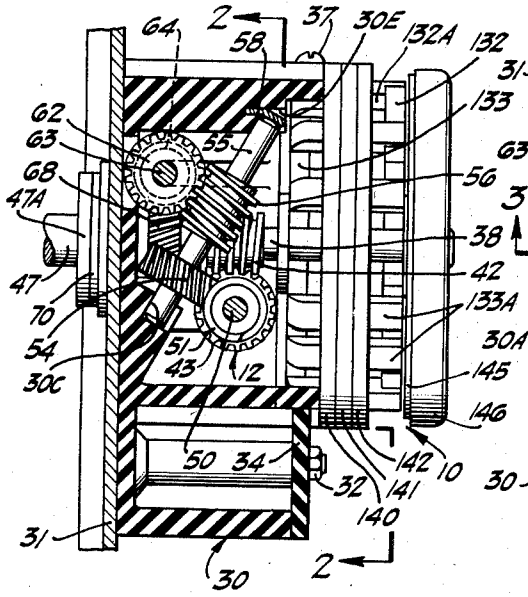


FIG. 1.

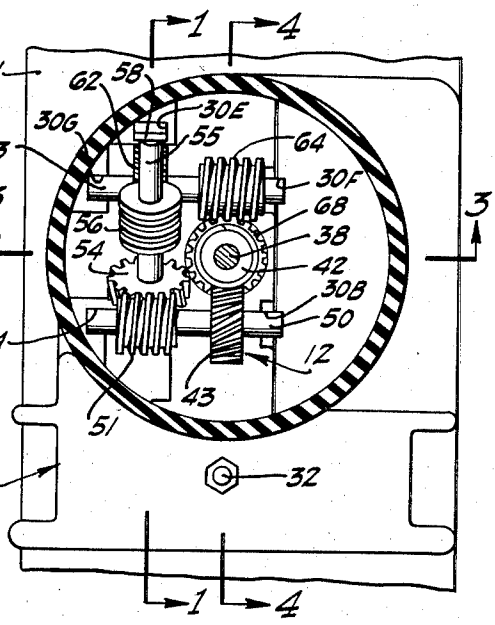


FIG. 2.

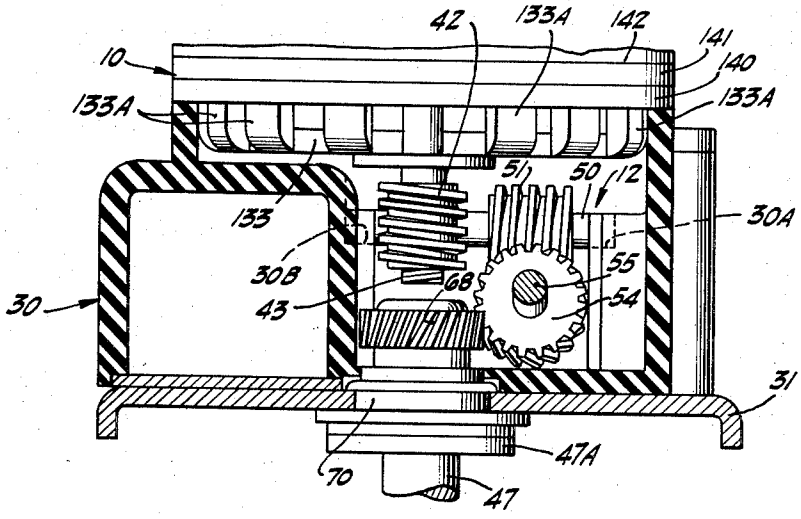


FIG. 3.

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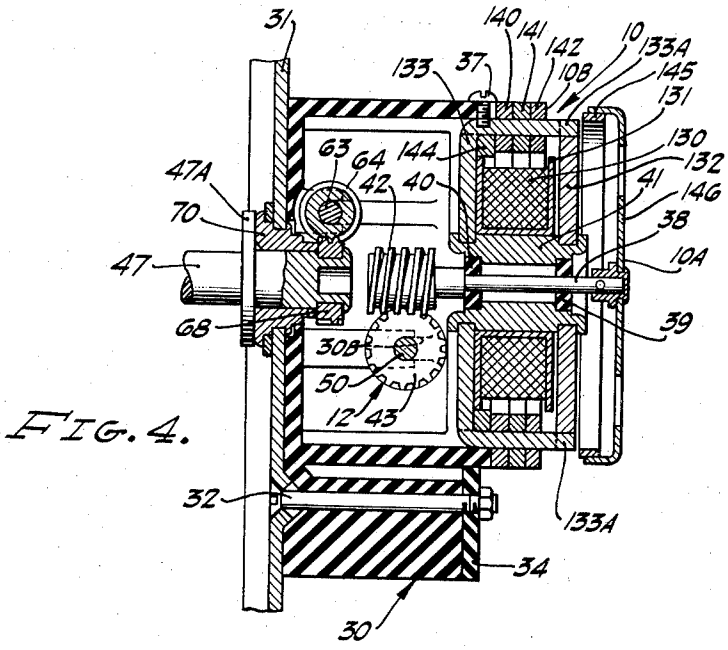


FIG. 4.

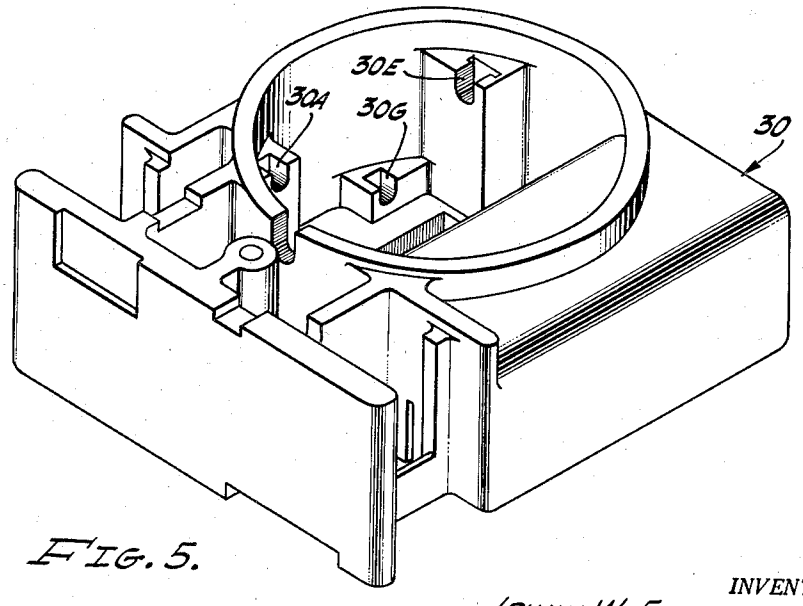


FIG. 5.

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GEAR TRAIN

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Application May 4, 1956, Serial No. 582,769

5 Claims. (Cl. 74—425)

The present invention relates to an improved gear train and is particularly useful in an electrical control unit of the character described in our pending application on Electrical Control Unit, filed January 16, 1956, Serial No. 559,411, and assigned to the same assignee as the present invention, for the general purpose described in such pending application, but, of course, the gear train has universal applicability and its use is not necessarily limited to the particular use described in such pending application.

An object of the present invention is to provide a relatively simple and compact gear train for speed reduction.

Another object of the present invention is to provide improved reduction gearing which may be confined in a relatively small space.

Another object of the present invention is to provide an improved gearing train which is relatively simple, inexpensive in manufacture and assembly.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a sectional view through a gear train embodying features of the present invention taken generally on the line 1—1 of Figure 2.

Figure 2 is a sectional view taken generally on the line 2—2 of Figure 1.

Figures 3 and 4 are sectional views taken on corresponding lines 3—3 and 4—4 in Figure 2.

Figure 5 is a perspective view of the casing of the unit shown in the previous figures.

Briefly, the unit as shown includes a synchronous clock motor 10 which drives a dial (not shown), mounted on the output shaft 47, at the rate of one revolution per twenty-four hours through a gear reduction unit 12, incorporating features of the present invention.

The gear reduction unit 12 comprises four pairs of gear combinations arranged in a compact manner to achieve features of the present invention.

The unit includes a specially-moulded body of material such as, for example, insulating material in the form of a casing 30 which is mounted on a mounting plate 31 by a mounting bolt 32 which passes through an apertured portion of plate 31, apertured portion of casing 30 and the insulating plate 34. The mounting plate 31, as described in the above pending application, is generally rectangular, having dimensions which are generally somewhat smaller than the internal dimensions of a conventional metallic junction box used to house the conventional type of wall toggle switch used generally in residences.

The casing 30 thus releasably secured to the mounting plate 31 has an upper hollow portion in the form of

an open-ended tube for housing the gear reduction train 12 and for supporting the driving motor 10. The motor 10 is fitted into the open end of such tubular portion and may be secured therein by conventional means such as a bayonet-type of connection and exemplified therein in the form of a set screw 37.

The motor 10 may be of conventional construction and includes generally a field structure 10B which is stationarily mounted on the casing 30 and rotatable armature 10A.

The armature 10A, in the form of a ring, is mounted on the rotatable shaft 38 which is journalled for rotation in the spaced bearing members 39 and 40 in the core 41. The shaft 38 is prolonged and has integrally formed therewith the gear 42 which cooperates with the gear 43.

The spindle 47 is continuously rotated by the motor shaft 38 at, of course, a greatly reduced speed through a gear reduction train comprising four pairs of gears, one of which being the aforesaid gear 42 and the gear 43.

The gear 43, as shown in Figures 2 and 5, is mounted on the shaft 50 which also mounts the gear 51, said shaft 50 being slidably received and journalled for rotation in grooves 30A and 30B, formed in the moulded casing 30. This gear 51 is in mesh with the cooperating gear 54, mounted on shaft 55, which also mounts the gear 56, the shaft 55 having its opposite ends similarly slidably received in grooves 30E and 30C within which such shaft is journalled for rotation. However, the grooved portion 30E has inserted therein a metal plate 58 contacting one end of the shaft 55 to accommodate thrust forces.

The gear 56 is in mesh with the gear 62 on shaft 63 which has the gear 64 also mounted thereon.

The shaft 63 in similar manner is slidably received and journalled for rotation at its opposite ends in the preformed grooves 30G and 30F in the casing 30. The gear 64 is in mesh with the gear 68 on the spindle 47 for purposes of driving the same at a greatly reduced speed. It is noted that the three shafts 50, 55 and 63, each carrying a first gear and a second gear, may be fabricated with such first and second gears integral therewith. It is noted further that the axes of the shafts 63 and 50 are substantially parallel and extend in a generally perpendicular direction with respect to the axis of the shaft 38, while the axis of the shaft 55 is inclined with respect to the axes of the other shafts 38, 50 and 63. This arrangement, using preformed grooves in the casing for receiving the ends of the various shafts and for rotatably supporting the same, allows relatively quick, easy and inexpensive construction, both in parts and in the assembly operation.

The spindle 47 which mounts the gear 68 has its axis coextensive with the axis of shaft 38 and is journalled for rotation in the stationary bushing 70 which is mounted on the mounting plate 31. The spindle 47 has integrally formed therewith an annular flange member 47A engageable in sliding relationship with one face of the bushing 70.

As indicated previously, the motor 10 may be of conventional construction, but the one presently described in detail is preferred. The motor 10 includes coil 130, mounted on an insulated bobbin 131, such coil 130 enclosed by a structure of magnetizable material comprising the annular core 41, the end plate or ring 132 and the L-shaped annular member 133 which is slotted to provide a plurality of pole pieces. The members 132 and 133 are recessed within the core 41 in a unitary structure. The member 133 is slotted to provide 16 pole pieces 133A. Three copper apertured shading rings 140, 141 and 142 are on the slotted portions of the member 133 with the apertured portions in the copper rings encircling

alternate ones of such pole pieces 133A. These copper rings are securely mounted on such pole pieces by press fitting, cementing or by other well known expedients. A spacer ring 144 is interposed between the copper ring 140 and the radial extending portion of the member 133. These pole pieces 133A produce a magnetic flux which interacts with the magnetizable armature ring 145 which is supported by the perforated cup-shaped aluminum disc 146, such disc 146 being secured to the armature shaft 38. It is noted that the end plate 132 is of special construction involving eight outwardly extending portions 132A which are notched to engage the same pole pieces that are embraced by the apertured portion of the copper rings 140, 141 and 142.

While the meshing gears may be of standard conventional worm and worm gears, preferably they are helical cut gears since they are less expensive to manufacture and do not require the accuracy in axial location with respect to the worm axis as in the case of a worm gear.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

We claim:

1. In a time clock wherein a synchronous clock motor drives a rotatable member with reduced speed, the combination comprising, a cylindrical hollow casing of size sufficiently small to fit inside of a conventional household outlet box, said casing having a closed front end and an open back end, a driven shaft rotatably mounted on said closed front end with its rotational axis aligned with said cylindrical casing, a motor mounted in the open back end of said casing and having its shaft aligned with the axis of said driven shaft, three worm type gear sets mounted in said casing and serving as the sole means for coupling said motor shaft to said driven shaft, said gear sets including a first shaft, a second shaft and a third shaft, said first shaft having a first worm type pinion and a first worm type gear, said second shaft having a second worm type pinion and a second worm type gear, said third shaft having a third worm type pinion and a third worm type gear, said motor shaft having a worm type pinion thereon meshing with said first worm type gear, said first shaft being rotatably mounted in a first pair of open slots in said casing which have their openings facing toward said back end of said casing to allow the ends of said first shaft to be inserted in said slots from said back end, said second first shaft having said first worm type pinion meshing with said second worm type gear on said second shaft, said second shaft being rotatably mounted in a second pair of open slots in said casing which have their openings facing toward said back end of said casing to allow the ends of said second shaft to be inserted in said second pair of slots from said back end, said second worm type pinion meshing with said third worm type gear on said third shaft, said third shaft being rotatably mounted in a third pair of open slots in said casing which have their openings facing toward the back end of said casing to allow the ends of said third shaft to be inserted in said third pair of slots from said back end, said driven shaft having a worm type gear thereon which meshes with said third worm type pinion on said third shaft, said first and third shafts each having its axis extending perpendicular to the aligned axes of said motor shaft and said driven shaft, and said second shaft having its axis inclined with respect to the axis of said motor shaft and being disposed between said first and third shafts.

2. In a speed reduction unit the combination comprising a hollow casing, said casing having a front end and a back end, a driven shaft rotatably mounted on said front end, a driving shaft mounted on the back end of said casing, three worm type gear sets mounted in said casing and serving as the sole means of coupling said driving shaft to said driven shaft, said gear sets including a first shaft, a second shaft and a third shaft, said first shaft having a first worm type pinion and a first worm type gear, said second shaft having a second worm type pinion and a second worm type gear, said third shaft having a third worm type pinion and a third worm type gear, said driving shaft having a worm type pinion thereon meshing with said first worm type gear, said first shaft being rotatably mounted in a first pair of open slots in said casing which have their openings facing toward the back end of said casing to allow the ends of said first shaft to be inserted in said slots from said back end, said first shaft having said first worm type pinion meshing with said second worm type gear on said second shaft, said second shaft being rotatably mounted in a second pair of open slots in said casing which have their openings facing toward said back end of said casing to allow the ends of said second shaft to be inserted in said second pair of slots from said back end, said second worm type pinion meshing with said third worm type gear on said third shaft, said third shaft being rotatably mounted in a third pair of open slots in said casing which have their openings facing toward the back end of said casing to allow the ends of said third shaft to be inserted in said third pair of slots from said back end said driven shaft having a worm type gear which meshes with said worm type pinion on said third shaft, said first and third shafts each having its axis extending perpendicular to the aligned axes of said motor shaft and said driven shaft, and said second shaft having its axes inclined with respect to the axis of said driving shaft and being disposed between said first and third shafts.

3. An arrangement as set forth in claim 1 in which said pinions and gears are helically cut.

4. An arrangement as set forth in claim 2 in which said gears and pinions are helically cut.

5. In a gear train assembly for coupling two axially aligned shafts, the combination comprising, a casing, three worm type gear sets mounted in said casing and serving as the sole means for coupling said axially aligned shafts on said casing for rotation thereon, said gear sets including a first shaft, a second shaft and a third shaft, said first shaft having a first worm type pinion and a first worm type gear, said second shaft having a second worm type pinion and a second worm type gear, said third shaft having a third worm type pinion and a third worm type gear, one of said axially aligned shafts having a worm type pinion thereon meshing with said first worm type gear, said first shaft being rotatably mounted in a first pair of open slots in said casing which have their openings facing toward said first axially aligned shaft to allow the ends of said first shaft to be inserted in said slots from the direction of said first axially aligned shaft, said first shaft having said first worm type pinion meshing with said second worm type gear on said second shaft, said second shaft being rotatably mounted in a second pair of open slots in said casing which have their openings facing in the same direction as said first pair of slots to allow the ends of said second shaft to be inserted in said second pair of slots from the same direction as said first shaft, said second worm type pinion meshing with said third worm type gear on said third shaft, said third shaft being rotatably mounted in a third pair of open slots in said casing which have their openings facing the same direction as said first and second pair of slots to allow the ends of said third shaft to be inserted in said third pair of slots from the same direction as said first and second shafts, the other one of said axially aligned shafts having a worm type gear thereon which meshes with said third worm type opening on said third

shaft, said first and third shafts each having its axis extending perpendicular to the aligned axes of said aligned shafts, and said second shaft having its axis inclined with respect to the axis of said aligned shaft and being disposed between said first and third shafts.

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