Dec. 5, 1961 M. B. MOORE 3,011,358

GEARHEAD

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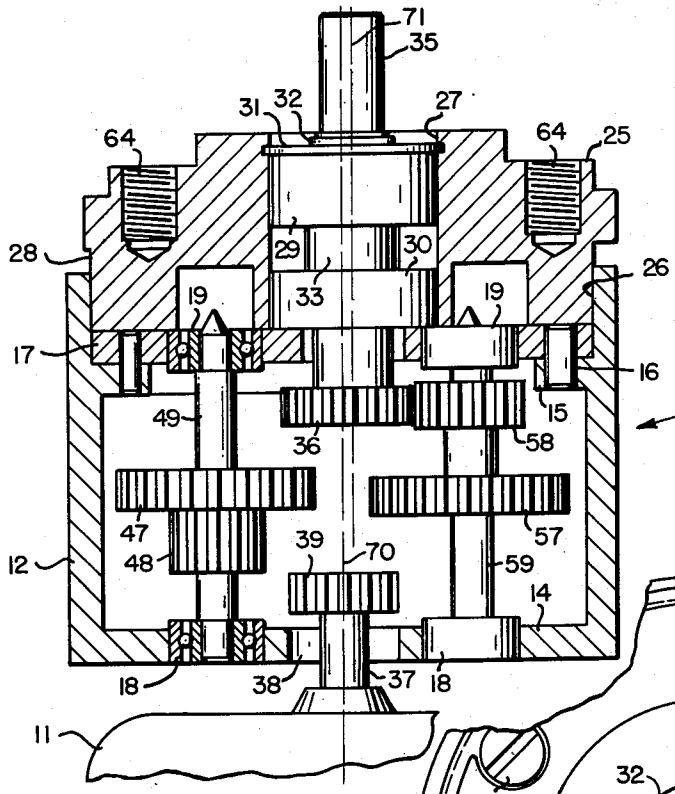

FIG. 1

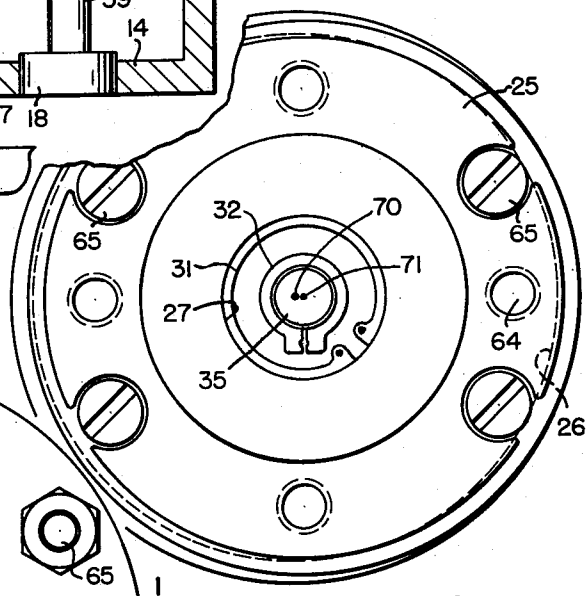

FIG. 2

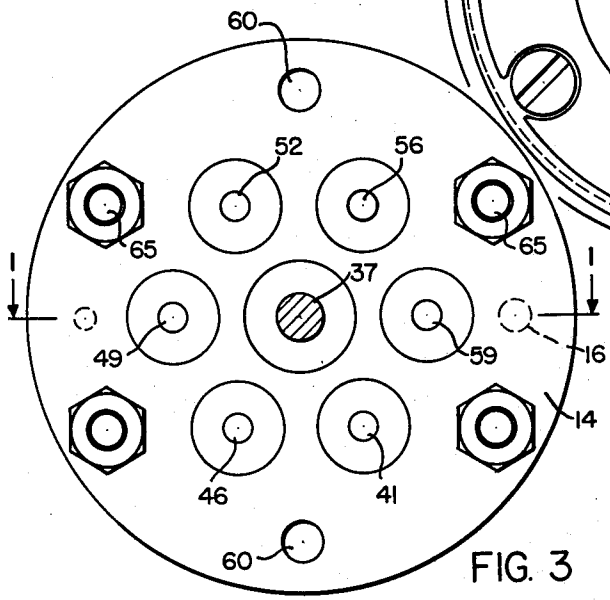

FIG. 3

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GEARHEAD

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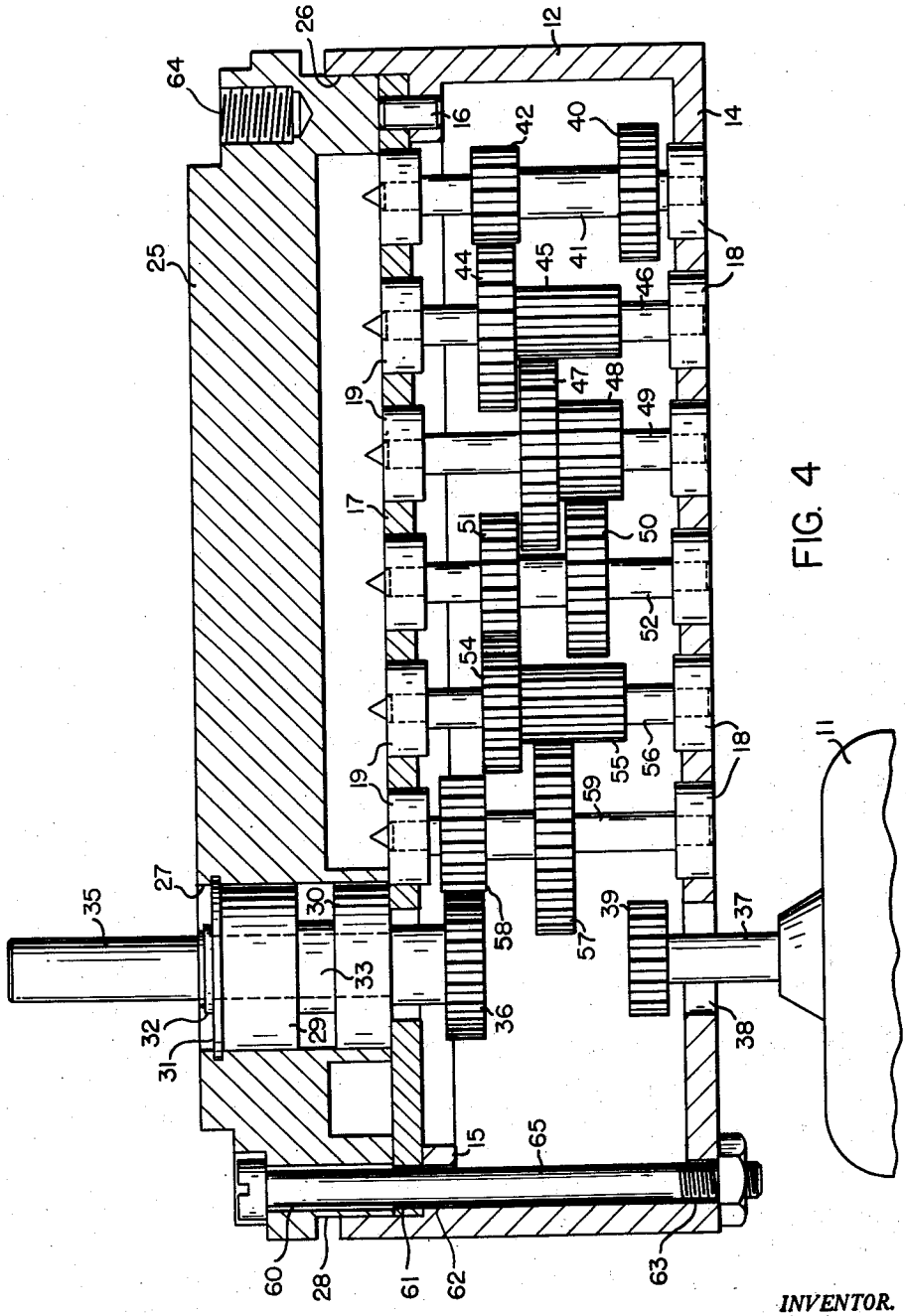

FIG. 4

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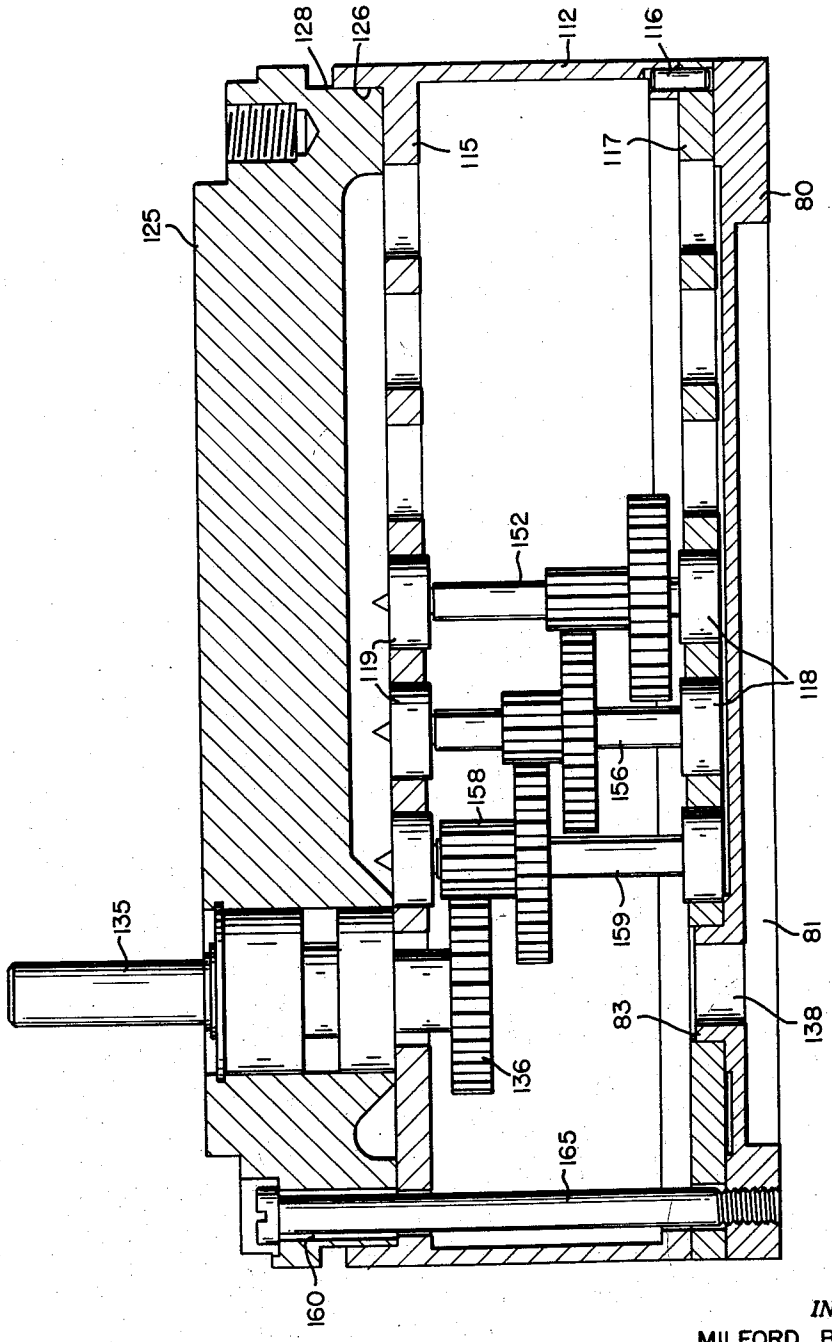

FIG. 5

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GEARHEAD

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2 Claims. (Cl. 74—409)

The present invention relates to gear reducers particularly for combination electric motor-gear reduction units, although it can be applied also to other types of geared speed reducers.

One object of the present invention is to provide means for controlling the backlash at the final reduction in a gear reduction unit, namely, the backlash between the driven gear on the output shaft of the unit, and its mating driving pinion. To this end it is a purpose of the invention to provide means for adjusting the center to center distance between the output shaft of the gear reduction unit and the shaft which carries the drive pinion for the output shaft.

Another object of the invention is to provide a better gearhead than heretofore available and having smaller backlash tolerances.

Still another object of the invention is to provide a gearhead which has improved rigidity.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

In the drawings:

FIG. 1 is an axial sectional view of a gearhead made according to one embodiment of this invention, and showing the end plate of the unit in one position of adjustment;

FIG. 2 is a top plan view of this unit, partly broken away;

FIG. 3 is a bottom plan view of this unit;

FIG. 4 is a developed sectional view of this unit, not a true section, a section taken through the input shaft of the unit and circularly through the other shafts of the unit, and then laid out in a plane; and

FIG. 5 is a similar developed section of a unit made according to another embodiment of this invention.

Referring now to the drawings by numerals of reference, **10** denotes the gearhead as a whole, and **11** designates the drive motor for the unit. The gearhead comprises a generally cup-shaped casing **12**, which is closed at its lower end by a transversely extending wall or web **14**. Adjacent its opposite end the casing **12** is formed with an internally extending annular flange **15** which is spaced axially from the web **14**. Mounted upon the flange **15** and secured thereto as by means of dowels **16** (FIG. 4) is a web or plate **17**.

The shafts, which carry the gears of the unit, are journaled at their opposite ends in ball bearings **18** and **19**, respectively, that are secured in the webs **14** and **17**, respectively.

The end of the housing **12**, which is remote from the end **14** thereof, the upper end as viewed in FIG. 1, is closed by an end plate **25**, which is rotatably adjustable within the cylindrical inside guide surface **26** of the housing formed above the web **15**. The end plate **25** seats with its lower face against the upper face of the web or plate **17**. The end plate **25** has a bore **27** therethrough which is eccentric of the peripheral surface **28** of the end plate and of the cylindrical guide surface **26** within which the peripheral surface **28** engages.

Journaled on anti-friction bearings **29** and **30** in the bore **27** is the output shaft **35** of the unit. Bearing **29** is spaced from bearing **30** by a spacer **33** and is held in place by snap-rings **31** and **32**. The shaft **35** has a gear **36** integral with or secured to it, which is driven from

the motor **11** through any desired number of gear reduction pairs. In the illustrated embodiment of the invention, the armature shaft **37** of the motor projects into the housing **12** through an opening **38** in the web **14** and carries, or has secured to it, at its upper end a drive pinion **39**. This pinion meshes with a gear **40** (FIG. 4) which may form part of a cluster gear that is secured to or integral with a shaft **41**. The shaft **41** has a pinion **42** integral with, or secured to, it which meshes with the gear portion **44** of a cluster gear that includes a pinion **45**, and that is secured to or integral with the shaft **46**. Pinion **45** meshes with the gear portion **47** of a cluster gear whose pinion portion **48** is integral with, or secured to, the gear **47** and is integral with or secured to the shaft **49**. Pinion **48** meshes with a gear **50**, which is integral with, or is secured to, a pinion **51** and a shaft **52**. Pinion **51** meshes with the gear portion **54** of a cluster gear whose pinion portion **55** is integral with, or is secured to, the gear portion **54** and is integral with or secured to the shaft **56**. Pinion portion **55** meshes with the gear portion **57** of a cluster gear whose pinion portion **58** is integral with, or secured to, the gear portion **57** and is integral with, or secured to, the shaft **59**. Pinion portion **58** meshes with the gear **36** that is secured to the output shaft **35** of the unit. The shafts **41**, **46**, **49**, **52**, **56**, and **59** are parallel to one another and are journaled at opposite ends in the ball bearings **18** and **19**, respectively, and are arranged circularly about and are equidistant radially from the axis **70** (FIGS. 1 and 2) of input shaft **37**. This axis coincides with the axis of internal surface **26** and with the axis of the peripheral surface **28** of the end plate.

The end plate **25** has, in the illustrated embodiment of the invention, four bolt holes **60** through it which are spaced from one another and which are concentrically arranged about the axis **70**. The web **17**, flange **15**, and the web **14** of the housing **12** have six bolt holes each through them which are equi-angularly spaced and arranged on a bolt circle also concentric with axis **70** and coaxial with the periphery **28** of the end plate and with the inside guide wall **26** of the housing. These bolt holes are designated **61**, **62** and **63**, respectively.

Four mounting screws or bolts **65** are used to fasten the end plate **25** in the selected angular adjusted position in the housing. The four bolt holes **60** are lined up with a selected four of the six bolt holes in the web **17**, flange **15**, and web **14**; and then the bolts **62** are passed through the aligned bolt holes **60**, **61**, **62** and **63** to secure the end plate **25** in any angularly adjusted position on the housing. Thus, the end plate **25** can have six finite angular positions with respect to the housing. Thus, the distance between the axis **71** of the output shaft **35** and any one of the six shafts **41**, **46**, **49**, **52**, **56** and **59**, can be varied six times as the end plate is rotatably adjusted through the six possible positions of its connection to the housing.

With this construction it is possible to adjust the end plate **25** so as to take up or control the backlash between the gear **36** on the output shaft **35** and the pinion **58** which meshes therewith, since the rotary adjustment of the end plate provides a means by which the center to center distance between the output shaft and its driving pinion can be adjusted. Furthermore, this construction permits any number of gear reductions, or meshes, to be interposed in the housing **12** between the drive or input shaft **37** and the output shaft **35**, up to the number of reductions illustrated in FIG. 4. Thus, pinion **39** on armature shaft **37** of the motor **11** might drive directly a gear on the shaft **59**, which carries the pinion **58** meshing with the driving gear **36**. A further reduction can be obtained by having the gear **39** mesh with a gear on the shaft **56**,

and having a reduction such as shown at 55, 57, 58 to gear 36. Still another arrangement would be to have the gear 39 mesh with a gear such as the gear 50, and retain the reduction 51, 54, 55, 57, and 58 to gear 36. Other arrangements would involve a drive from the shaft 37 to the shaft 49 and thence through the required number of reductions to the gear 36, or from the shaft 37 to the shaft 46, and thence through the required reductions to the shaft 35. Thus, a very great flexibility can be had as to the extent of reduction achieved by the unit between the input shaft 37 and the output shaft 35.

The holes 64 in the end plate 25 are for securing the gear reduction unit to the apparatus which is to be driven by output shaft 35.

The structure of the present invention described gives rigidity. The conventional design is a plate and post construction in which there are two parallel plates which are separated by four posts and there is a slip-on cover. This cover imparts nothing as regards rigidity. In the new design of the present invention the end plate 25 has guidance on the inside wall 26 of the housing 12, and therefore the output shaft 35 is rigidly mounted with reference to the other shafts of the reduction unit. The new design of the present invention, therefore, gives improved rigidity.

The embodiment of the invention shown in FIG. 5 is similar to that already described. For ready comparison of the two embodiments, similar parts in FIG. 5 are denoted by the same numerals as in FIGS. 1 to 4 increased by a hundred. Thus, the end plate in FIG. 5 is denoted at 125 instead of 25, and similarly the output shaft is denoted at 135 in FIG. 5, etc.

The embodiment of FIG. 5 differs from that shown in FIGS. 1 to 4 among other things in that the lower end of the housing 112 is open, and is closed by a web or plate 117 which is doweled to the housing. Plate 117 in other words is secured to the lower end of the housing instead of resting on the web 115 adjacent the upper end of the housing. The end plate 125 seats directly on this part 115 which is here a web rather than merely a flange.

The embodiment of FIG. 5 further differs from the previously described embodiment in that the shafts 159, 156, 152, etc. of the reduction unit are journaled at opposite ends on bearings 118 and 119 in webs 117 and 115. Only four shafts have been shown in the unit of FIG. 5, but obviously the number of these shafts may be increased or decreased as stated in connection with the previously described embodiment of the invention.

In the embodiment of the invention shown in FIG. 5 moreover, there is an adapter 80 secured to the web 117, end plate 125 and housing 112 by the bolts 165. This adapter has a recess 81 in its lower face to receive one end of the drive motor of the gear reduction unit. The armature shaft (not shown) of this motor projects into the housing 112 through the hole 138 in the adapter 80, and, as before, carries a pinion which drives the train of gearing of the reduction unit. The adapter 80 is centered on the housing by a sleeve 83 that is formed integral with the adapter and that fits into hole 138.

As in the first described embodiment of the invention, the output shaft 135 is mounted in end plate 125 with its axis eccentric of the peripheral surface 128 of the end plate and of the internal surface 126 of the housing in which the end plate fits. Thus upon rotary adjustment of the end plate in the housing, backlash between the final drive pinion 158 of the reduction unit and the gear 136 carried by the output shaft can be taken up to a desired degree. Similar to the first-described embodiment, there may be four equi-angularly spaced bolt holes in the end plate 125 and six bolt holes in the web 115, web 117, and adapter 80, and the end plate 125 is adjusted angularly to line up its four bolt holes with any four of the six in the

housing, web 117 and adapter, the four of the six which are selected depending upon the radial distance between axes 70 and 71 (FIGS. 1 and 2) required to provide the desired backlash between gear 136 and drive pinion 158.

Obviously, of course, the invention is not restricted to use of four bolt holes in the end plate 25 or 125 and six in the housing 12 or 112, but any practical number may be employed in each.

After adjustment, the end plate is secured in adjusted position by passing bolts 165 through the aligned holes and threading them into adapter 80.

While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. A gearhead comprising a housing, an input shaft extending into said housing through one end wall thereof, a single cylindrical gear secured to said input shaft within said housing to rotate with said input shaft, an end plate mounted in the opposite end of said housing to close said opposite end of said housing, a web fixedly secured in said housing between said end wall and said end plate and extending parallel to said end wall, a plurality of shafts journaled at opposite ends, respectively, in said end wall and in said web and arranged in a circle about a common axis, said housing having a peripheral wall whose inside surface, at least beyond said web, is cylindrical and coaxial with said common axis, an output shaft journaled in said end plate eccentrically of said common axis and having one end projecting into said housing and its opposite end projecting outwardly beyond said end plate, said end plate having a peripheral cylindrical surface engaging said inside surface and coaxial therewith, gearing connecting said single gear with one of said plurality of shafts, gearing drivingly connecting said one shaft with another of said plurality of shafts to drive the other shaft from said one shaft, and gearing, including a pair of cylindrical gears, one of which is secured to that end of said output shaft which projects into said housing, for connecting said other shaft with said output shaft, whereby said output shaft is driven from said input shaft, said end plate being rotatably adjustable in said housing about the axis of its peripheral cylindrical surface, thereby to adjust the backlash between said pair of cylindrical gears, and means for securing said end plate in any adjusted position.

2. A gearhead as claimed in claim 1 wherein said securing means comprises a plurality of registering bolt holes in said housing arranged concentrically with said common axis, a plurality of bolt holes in said end plate in equi-angular spaced relation about an axis, the number of bolt holes in said end plates being less than in said housing and a plurality of bolts removably secured in said bolt holes to fasten said end plate in any adjusted position.

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