June 9, 1953 L. E. BEISNER 2,641,139

SPEED REDUCER DEVICE

Filed Nov. 9, 1949 2 Sheets-Sheet 1

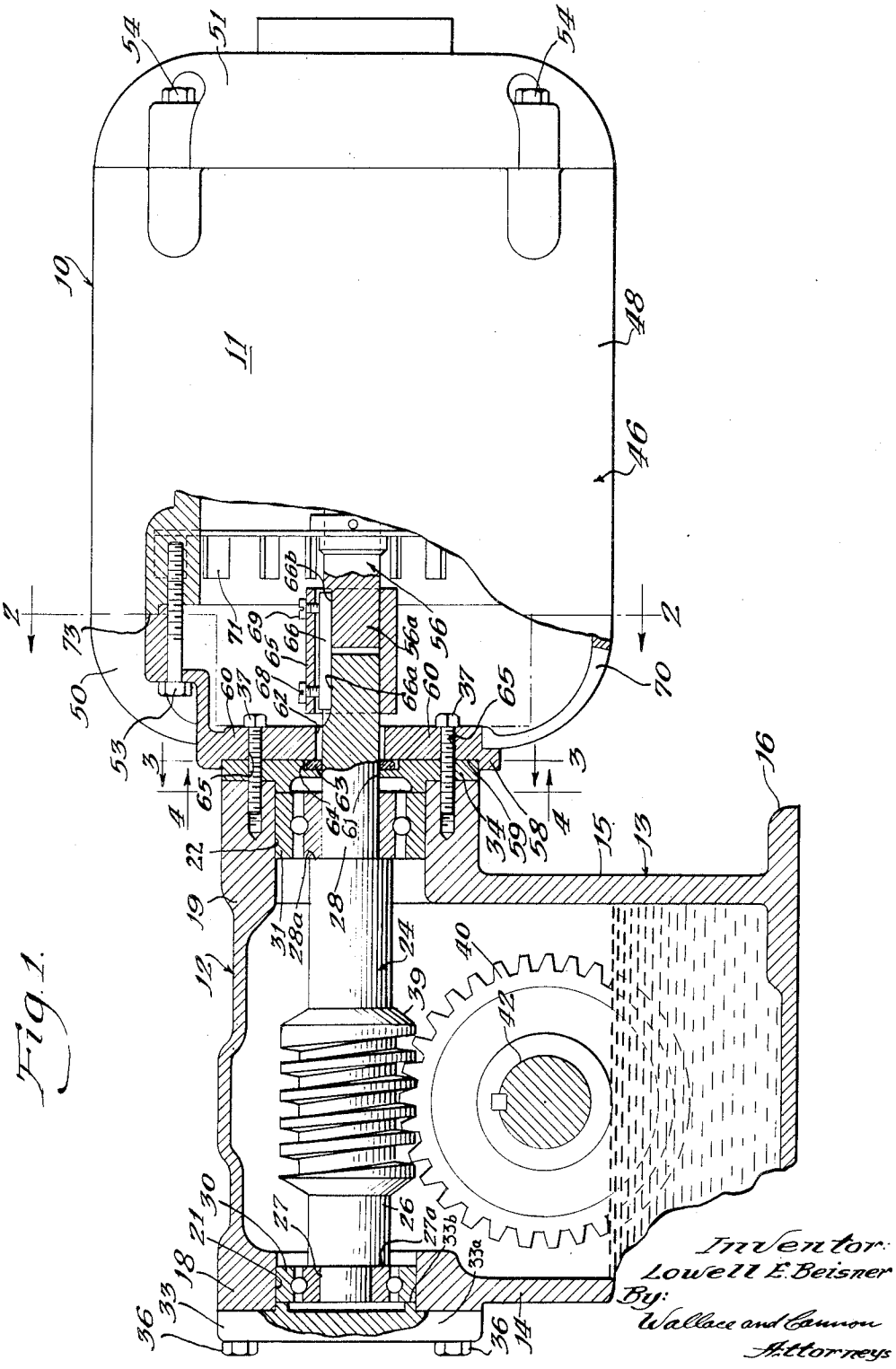


Fig. 1.

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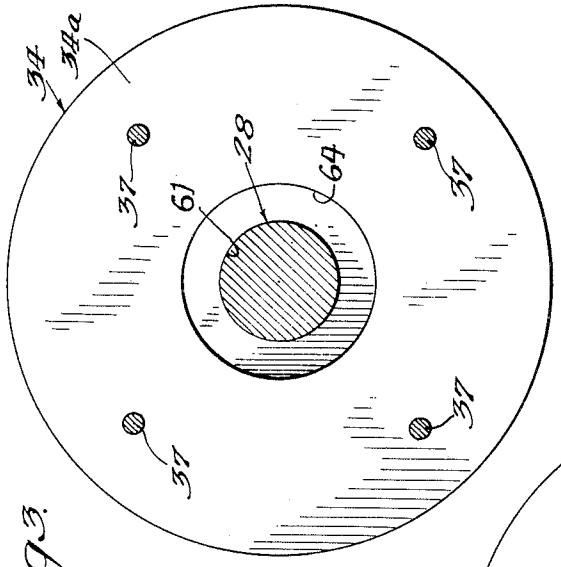



Fig. 3.

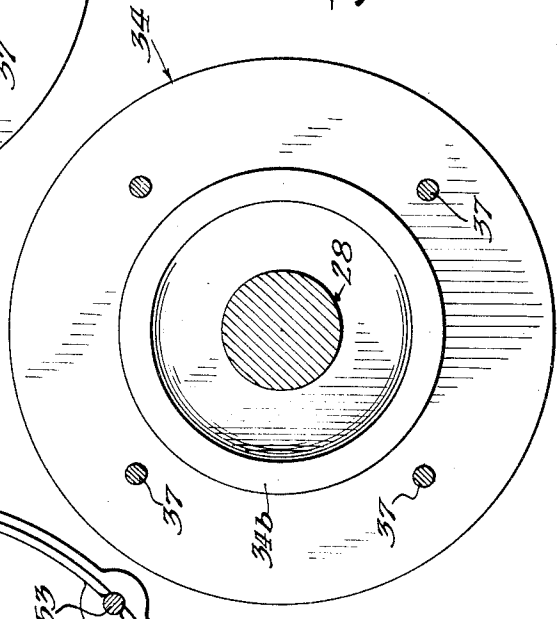



Fig. 4.

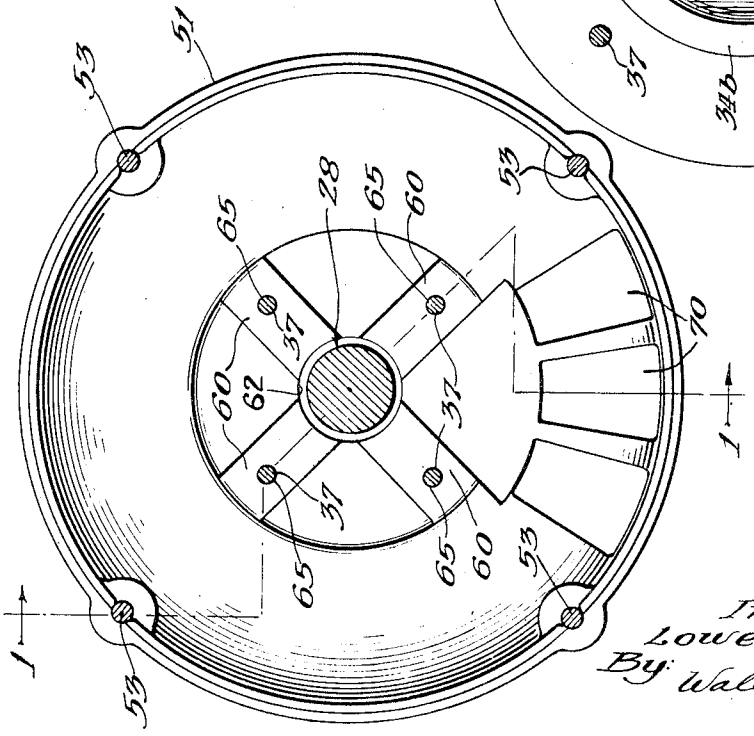



Fig. 2.

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# UNITED STATES PATENT OFFICE

2,641,139

## SPEED REDUCER DEVICE

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Application November 9, 1949, Serial No. 126,400

5 Claims. (Cl. 74—425)

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This invention relates to speed-reducer units, and more particularly to gearmotors and the like.

A primary object of my invention is to provide a novel speed-reducer unit embodying an electric motor and a reduction gear unit constituted and arranged in a novel and expeditious manner.

A further object is to so construct a novel speed-reducer unit of the aforementioned type that the electric motor and the reduction gear unit are each readily interchangeable with corresponding units of other sizes, in a novel and expeditious manner, whereby several possible combinations of various size motors and reduction gear units may be afforded from a minimum number of separate motors and reduction gear units. This, it will be appreciated, is especially advantageous to the smaller shops selling units of this character because it enables them to provide numerous speed-reducer units of various ratings while maintaining a minimum inventory on hand.

Yet another object of my invention is to so construct a novel speed-reducer unit of the aforementioned type in such a manner that the motor and reduction gear unit thereof, when separated, each affords a complete unit which may be quickly and easily assembled with a corresponding reduction gear unit and motor, respectively, for operation therewith.

Another object is to provide a speed-reducer unit of the aforementioned type which affords a novel means of assembling driving mechanisms such as electric motors with reduction gear units in a manner whereby a strong, rigid, and efficient coupling is afforded therebetween.

Yet another object of my invention is to provide a speed-reducer unit of the aforementioned type wherein the drive shaft of the motor is efficiently supported in a novel and expeditious manner by anti-friction bearing means disposed within the housing of the reduction gear housing.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings, which, by way of illustration, show a preferred embodiment and the principles thereof and what I now consider to be the best mode in which I have contemplated applying those principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

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In the drawings:

Fig. 1 is a side elevational view, partly in section, illustrating a speed reducer unit embodying the principles of my invention;

Fig. 2 is a detail sectional view taken substantially on the line 2—2 in Fig. 1;

Fig. 3 is a detail sectional view taken substantially on the line 3—3 in Fig. 1; and

Fig. 4 is a detail sectional view taken substantially on the line 4—4 in Fig. 1.

A gearmotor or speed-reducer unit 10 is shown in the drawings to illustrate a preferred embodiment of my invention, and comprises an electric motor power unit 11 operatively connected to a reduction gear unit 12.

The reduction gear unit 12 comprises a housing 13 constructed of any suitable material such as, for example, cast aluminum, and including integral side wall portions 14 and 15, projecting upwardly from a base 16. Two bosses 18 and 19 are formed on the upper end portions of the side walls 14 and 15, respectively, and two openings 21 and 22, which are preferably of equal diameter, are formed in and extend through the bosses 18 and 19 in alignment with each other.

A drive shaft 24 having a central body portion 26 and two reduced end portions 27 and 28 is journaled in suitable anti-friction bearings such as ball-bearings 30 and 31 mounted in the openings 21 and 22, respectively. The openings 21 and 22 are smooth bored, and the bearings 30 and 31 are preferably disposed therein with the outer peripheral edge surfaces of the bearings in snug frictional engagement with the inner walls of the openings 21 and 22 to thereby hold the outer races of the bearings from turning. Two shoulders 27*a* and 28*a* are formed on the drive shaft 24 between the central portion 26 and the end portions 27 and 28, respectively, and when the shaft 24 is disposed in the desired operative position in the bearings 30 and 31, the shoulders 27*a* and 28*a* are disposed in abutting relation to the inner races of the bearings 30 and 31, respectively, Fig. 1.

Two caps or plates 33 and 34, having substantially flat circular-shaped body portions 33*a* and 34*a*, from one face of which project annular-shaped bosses 33*b* and 34*b*, Figs. 1 and 4, having an outside diameter complementary to the inside diameter of the openings 21 and 22, are mounted on the outer faces of the side walls 14 and 15, with the annular bosses 33*b* and 34*b* projecting into the openings 21 and 22 in close fitting engagement therein and the free end faces of the bosses 33*b* and 34*b* disposed in abutting relation to the other faces of the outer races of the bear-

ings 30 and 31, respectively. The plate 33 is releasably secured to the side wall 14 in the aforementioned position by suitable means such as bolts or cap screws 36 extending through the plate 33 into the side wall 14 exteriorly of the boss 33b, Fig. 1. Similarly, the plate 34 may be releasably secured to the side wall 15 by bolts 37 extending through the plate 34 exteriorly of the boss 34b, Figs. 1 and 4, as will be discussed in greater detail presently.

A worm gear 39 is mounted on the central body portion 26 of the shaft 24 and is secured thereto for rotation therewith. The shaft 24 affords the driving member of the gear reduction unit 12, and the worm 39 is operatively meshed with a worm wheel 40 mounted on a shaft 42 below the worm 39 and journaled in the housing 13, the shaft 42 affording the driven member of the reduction gear train in the unit 12. Oil 44 is preferably carried in the lower end portion of the housing 13 into which the worm wheel 40 protrudes to afford lubrication for the gear train of the gear reduction unit 12. As will be appreciated by those skilled in the art, other types of lubricating means may be afforded and the reduction gear unit 12 may be disposed in other positions, such as, for example, in inverted position, without departing from the purview of my invention.

The electric motor 11 of gearmotor 10 includes a housing 46 within which the customary rotor, stator, and field coil windings, not shown, are disposed. The housing 46 includes side walls 48 and two end walls or end bells 50 and 51 releasably mounted on opposite end portions, Fig. 1, the end bells 50 and 51 being releasably secured to the side walls 48 by suitable means such as bolts or cap screws 53 and 54, respectively. A drive shaft 56 is rotatably mounted in the housing 46, one end of the drive shaft 56 being journaled in the customary manner in suitable bearings, not shown, in the end bell 51, and the other end 56a of the shaft 56 projecting toward and terminating within the confines of the end bell 50.

The end bell 50 of the motor 11 affords an adaptor bracket which is operatively engageable in a novel and expeditious manner with the plate 34, of the gear reduction unit 12 to afford novel means for quickly and easily connecting the reduction unit 12 and the motor 11 in operative relation to each other as will be discussed in greater detail presently.

As is best seen in Fig. 1, the end bell 50 comprises an outwardly projecting substantially cup-shaped member having an annular boss 58 projecting from the central portion of the outer face thereof to afford a recess 59 which is complementary to the periphery of the plate 34. Bosses 60 having openings 65 extending therethrough project inwardly from the inner face of the end bell 50 and are disposed in spaced relation around the central portion thereof to afford reinforced portions through which the bolts 37 may extend, as will be discussed in greater detail presently. Thus, it will be seen that in assembling my novel gearmotor, the motor 11 may be disposed in abutting relation to the housing 13 of the reduction gear unit 12, with the outwardly facing edge portion of the plate 34 disposed in registration in the recess 59 in the end bell 50. This assembly, it will be seen, affords support for the motor 11 and the reduction gear unit 12 against lateral movement relative to each other when the units are disposed in assembled relation. In the assembled gearmotor 10, the bolts 37, Fig. 1, extend through the openings 65 in the end bell 50 inwardly of the boss 58 thereon, and extend through the plate 34 on the reduction gear unit 12 exteriorly of the boss 34b thereon, into threaded engagement in the side wall 15 of the housing 13 to thereby firmly, but releasably, hold the end bell 50 and the plate 34 in registered position relative to each other on the outer face of the side wall 15 of the reduction gear unit housing 13.

As previously mentioned, the reduced end portion 28 of the drive shaft 24 projects outwardly from the housing 13 of the reduction gear unit 12, and two openings 61 and 62 are afforded in the plate 34 and the end bell 50, respectively, to afford passageways through which the reduced end portion 28 of the shaft 24 may project. Suitable sealing means, such as the sealing ring 63 disposed in an enlarged portion 64 of the opening 61 in the plate 34, are afforded to prevent the passage of dirt and other foreign material into the bearing 31, and also to prevent the passage of oil, grease, and the like from the reduction gear housing 13 into the housing of the motor 11. Also, it will be seen that the annular boss 34b on the plate 34, which abuts the outer race of the bearing 31 to thereby firmly hold the bearing 31 in engagement with the shoulder 28a on the shaft 24, also affords clearance between the plate 34 and the inner race of the bearing 31 to thereby permit free rotation of the inner race of the bearing 31 with the drive shaft 24.

Thus, it will be seen that with the end bell 50 and the plate 34 disposed in operatively assembled relation relative to each other on the outer face of the side wall 15 of the housing 13, the reduced end portion 28 of the drive shaft 24 projects from the end bell 50. It will be remembered, of course, that the end bell 50 comprises the end wall of the motor 11 disposed adjacent to the housing 13 of the reduction gear unit 12 when the motor 11 and the reduction gear unit 12 are mounted in operative relation relative to each other, and therefore, it will be seen that the reduced end portion 28 of the drive shaft 24, which projects from the end bell 50, projects into the housing 46 of the motor 11 when the housing 46 is disposed in operative position on the end bell 50. The drive shaft 24 is so disposed in the housing 13 of the gear reduction unit 12, and the openings 61 and 62 are so disposed in the plate 34 and the end bell 50, that the projecting portion of the reduced end portion 28 of the drive shaft 24, which extends from the end bell 50, is disposed adjacent to, and in alignment with, the end portion 56a of the drive shaft 56 of the motor 11 when the motor 11 and reduction gear unit 12 are disposed in assembled relation relative to each other. Coupling means, comprising a collar 65 and a key 66, are mounted on the adjacent end portions 28 and 56a of the drive shafts 24 and 56, respectively, to interconnect the drive shafts 24 and 56 for rotation with each other. The key 66 is mounted in keyways 66a and 66b in the adjacent end portions 28 and 56a of the drive shafts 24 and 56, respectively, and is firmly held therein by suitable means such as set screws 68 and 69 threaded through the side wall of the collar 65 and abutting the outer surface of the key 66.

Thus, it will be seen that the gearmotor 10 comprises a motor 11 and a reduction gear unit 12 wherein the drive shaft 56 of the motor 11

is supported, at one end, by the bearings of the reduction gear unit 12. Also, it will be seen that it affords a novel motor 11 and a novel reduction gear unit 12 which may be quickly and easily assembled in the proper operative relation to each other, and when so disposed, are firmly held in a novel manner against movement in any direction relative to each other.

Suitable cooling means, such as air vent openings 70 and a fan 71, may be afforded in the motor 11, the air vent openings 70 preferably being disposed in the lower peripheral edge portion of the end bell 50, Figs. 1 and 2, and the fan 71, Fig. 1, being preferably mounted on the drive shaft 56 adjacent the reduced end portion 56a thereof for rotation therewith. In some instances, such as, for example, when the end portion 56a is necessarily short, the fan 71 may be mounted on the collar 65.

In assembling the motor 11 and the reduction gear unit 12 of the gear motor 10, the end bell 50 of the motor 11 is preferably removed from the housing 46 and may be mounted on the plate 34 on the wall 15 of the housing 13 in proper registered position thereon, with the outwardly facing edge portion of the plate 34 disposed in the recess 59, and the bolts 37 may then be extended through the openings 65 in the end bell 50 and through the plate 34 into threaded engagement with the adjacent portion of the end wall 15 of the housing 13. Preferably, the drive shaft 56 of the motor 12, which, of course, as will be appreciated by those skilled in the art, will include the rotor, not shown, of the motor 11, may then be coupled to the free end portion of the reduced end portion 26 of the drive shaft 24 by the key 66 and the collar 65, the key 66 being disposed in the keyways 66a and 66b with the collar 65 disposed thereover, and the screws 68 and 69 may then be adjusted in the collar 65 to tightly engage the outer surface of the key 66 to firmly hold the latter in the keyways 66a and 66b and afford a relatively rigid connection between the drive shafts 24 and 56. Thereafter, the remaining portion of the housing 46 of the motor 11, including the side walls 48 and the end bell 51, may be mounted in operative position on the drive shaft 56 of the motor 11 by slipping the housing 46 in a longitudinal direction thereonto, and the housing 46 may then be secured to the end bell 50 by cap screws 53, the inner peripheral edge portion of the end bell 50 and corresponding edge of the side walls 48 of the housing 46 engaging in a rabbeted joint 73, Fig. 1.

One of the important features of my invention, is that a gearmotor, such as the gearmotor 10, may be constructed in a manner whereby the motor thereof or the reduction gear unit thereof may quickly and easily be removed from the reduction gear unit or the motor, respectively, and mounted on corresponding units of different size or rating. An equally important aspect of my invention is that the reduction gear unit and the motor of the gearmotor constructed in accordance with my invention each comprises a complete unit wherein the interiors thereof are protected by a housing which adequately protects them from the entrance of dirt and other foreign matter thereinto, so that when the motor and gear reduction unit, such as, for example, the motor 11 and the reduction gear unit 12 shown in the drawings, are removed from each other, each comprises a separate complete unit which may be used as a separate unit and which may be stored as such without providing special cover plates, or the like, thereon. Also, it will be seen that with the gear motors constructed in accordance with my novel invention, a shop selling or otherwise handling devices of this type, may readily have a stock of gearmotors having widely varied ratings, with a minimum inventory of various parts, for example, if it is desired to use different sizes of reduction gear units 12 with the motor 11, the reduction gear unit 12 may readily be removed from the motor 11, and the end bell 50 may be removed therefrom, and a reduction gear unit may be substituted for the reduction gear unit 12 by merely using an end bell 50 of the proper size and having an annular boss 58 thereon of the proper size to engage with the plate 34 of the new reduction gear unit 12 in registration therewith. In many instances, the variations in size between the various reduction gear units 12, which may be used with the same motor, are so small that plates 34 of different sizes are not required and, therefore, of course, it would then be unnecessary to change the end bell 50 on the motor 11. However, it will be seen that even when the reduction gear unit substituted for the unit 12 is of sufficiently different size that it is desired to use a plate 34 of different size than that shown in the drawings, the only change required on the motor 11 is to change the end bell 50 for an end bell having a boss 58 of the proper corresponding size.

Such construction, it will be appreciated, comprises an important advantage to persons stocking gearmotors of this type because of the great number of various units of different ratings which may be carried by such persons with a minimum of stock. Thus, for example, I have found that a shop may stock gear motors having a ½ H. P. motor and output speeds of 144 R. P. M., 43 R. P. M., 24 R. P. M., and 14.4 R. P. M., by stocking one ½ H. P. motor having a motor speed of 1725 R. P. M., and stocking four reduction gear units, such as the reduction gear unit 12, the four reduction gear units having a 12:1, 40:1, 72:1, and 120:1 ratio, respectively. Thus, it will be seen, that by storing one complete ½ H. P. motor, the interior of which is efficiently protected from the entrance of dirt and other foreign substances thereinto, and by stocking four complete reduction gear units, having different gear ratios, and each of which is likewise a complete unit, the interior of which is efficiently protected from the entrance of dirt and other foreign substances thereinto, a shop is enabled to sell or use a complete gear motor unit of any one of four ratings. This, it will be appreciated, is merely by way of example and not by way of limitation, and other combinations of motor and gear reduction units may be made to afford a multitude of different gear motors having different ratings and power ratios. However, it will be appreciated from this example, that the gear motor disclosed in the accompanying drawings, comprises a unit wherein the parts thereof are constituted and arranged in a novel and expeditious manner whereby a novel, efficient, and practical gearmotor is afforded which overcomes many of the disadvantages heretofore known in the art.

Thus, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and

alterations as fall within the purview of the following claims.

I claim:

1. A speed reducer unit comprising input power means including a housing having a drive shaft rotatably mounted therein, output power means including a housing, bearings mounted in said last mentioned housing, and a drive shaft rotatably mounted in said bearings, connecting means releasably connecting said housing together in predetermined position relative to each other, said connecting means including a registration member extending into said second mentioned housing into abutment with one of said bearings for registering said housings in said predetermined position relative to each other, and coupling means in said first mentioned housing operatively connecting said drive shafts together for rotation of said second mentioned drive shaft by said first mentioned drive shaft.

2. A speed reducer unit comprising a reduction gear unit comprising a housing having upstanding walls, anti-friction bearing means mounted in predetermined ones of said walls, a drive shaft rotatably mounted in said bearing means, said drive shaft having one end portion projecting outwardly through one of said walls, and a plate member, said plate member having a projection extending from one face thereof, said projection having a free end, said projection being mounted in said one wall with said free end abutting said bearing means in said one wall in retaining engagement therewith, a motor unit including a housing having an end wall, and a drive shaft rotatably mounted in said last mentioned housing, said end wall having a recess therein complementary to said plate and operable to receive said plate in operative position therein, connecting means extending through said plate exteriorly of said projection and operatively engaged with said end wall and said one upstanding wall and releasably holding said housings together in clamping relation to said plate with said plate disposed in said recess in said operative position in said end wall, and coupling means engaged with said two drive shafts for operatively connecting said drive shafts together when said housings are disposed in said predetermined relation to each other.

3. A speed reducer unit comprising a motor including a housing having an end bell, and a drive shaft mounted in said housing, said drive shaft having an end projecting toward said end bell and terminating short of the outer surface thereof, said end bell having a recess formed on an outer face thereof, a reduction gear unit including a housing having upstanding sidewalls, anti-friction bearings mounted in predetermined ones of said side walls, a drive shaft journaled in said bearings, said last mentioned drive shaft having one end portion projecting outwardly through one of said side walls, and a plate member having an annular shaped projection extending from one face thereof, said annular shaped projection having a free end face, and said plate member being mounted on said one side wall with said projection disposed therein around said shaft and with said free end face disposed axially outwardly of said bearing in said one side wall in retaining relation to said bearing, means for holding said motor and said reduction gear unit together in operative relation with said plate disposed in said recess, said means comprising bolts extending through said end bell and said plate into said last mentioned housing exteriorly of said projection, and a coupling member operatively connecting said drive shafts together when said reduction gear unit and said motor are disposed in said operative relation.



4. A gearmotor comprising a reduction gear unit including a housing having two oppositely disposed end walls, each of said walls having a substantially smooth bored annular opening therein, said openings being of the same diameter and disposed in axial alignment with each other, two anti-friction bearings, each of said bearings being mounted in a corresponding one of said openings, and drive means including a drive shaft rotatably mounted in said bearings, said drive shaft having one end projecting outwardly through said opening in one of said end walls, an electric motor including another housing having an end bell removably mounted thereon, and another drive shaft, said other drive shaft having one end rotatably supported in said other housing and another end projecting toward said end bell and terminating in spaced relation thereto, and means for operatively connecting said reduction gear unit and said motor together, said means comprising a plate member mounted on said one end wall of said first mentioned housing, said plate member having a projecting portion disposed in registration with said opening in said one end wall and having a free end portion abutting said bearing in said last mentioned opening, said end bell having a portion complementary to a portion of said plate and operatively engageable therewith, bolt means extending through said end bell and said plate member into said one end wall of said housing of said reduction gear unit for releasably securing said housings together with said last named portions of said end bell and said plate disposed in said operative engagement with each other, and coupling means engaged with said first mentioned drive shaft and said other end of said other drive shaft for supporting said other drive shaft and connecting said two drive shafts together for simultaneous rotation when said housings are interconnected by said bolt means with said portions of said end bell and said plate disposed in said operative engagement.

5. A gearmotor comprising an electric motor including a housing having a removable end bell, and an elongated drive shaft having one end rotatably supported in said housing and the other end projecting toward and terminating within the confines of said end bell, a reduction gear unit comprising a housing having two end walls, bearing means mounted in said end walls, and a drive shaft journaled in said bearing means in said end walls and having an end portion projecting outwardly through one of said end walls and inwardly through said end bell, a plate member interfitted in said end bell and said one end wall around said second mentioned drive shaft, means, comprising said plate member and bolts extending through said plate member and directly secured to said end bell and said one end wall, for securing said motor housing and unit housing together, and coupling means mounted on said end portion of said second mentioned drive shaft and supportingly engaging said other end of said first mentioned drive shaft and connecting said two drive shafts together for simultaneous rotation.

LOWELL E. BEISNER.

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