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2,910,882

HOUSED SELECTIVE-ANGLE SPEED-REDUCER

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4 Sheets-Sheet 1

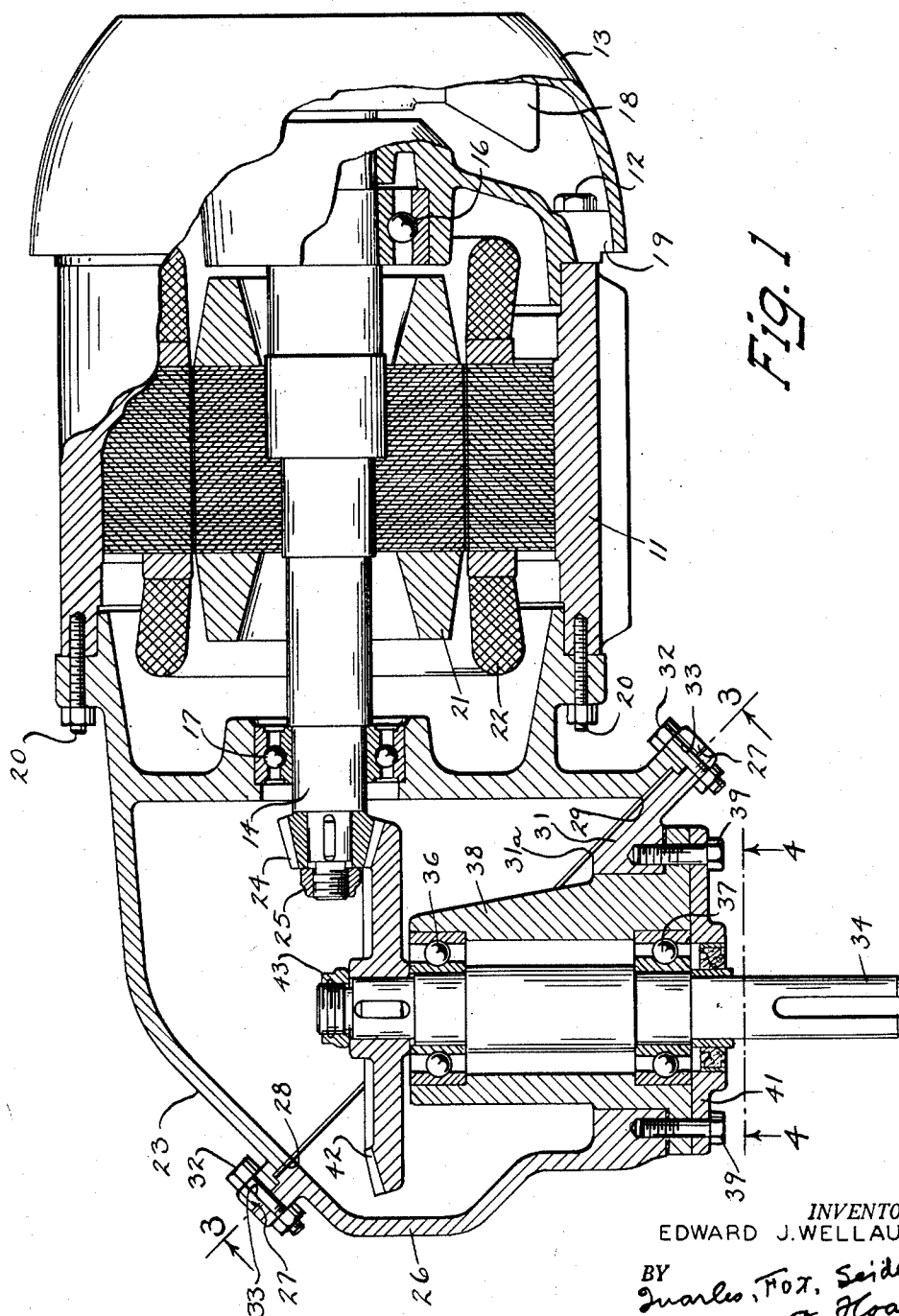


Fig. 1

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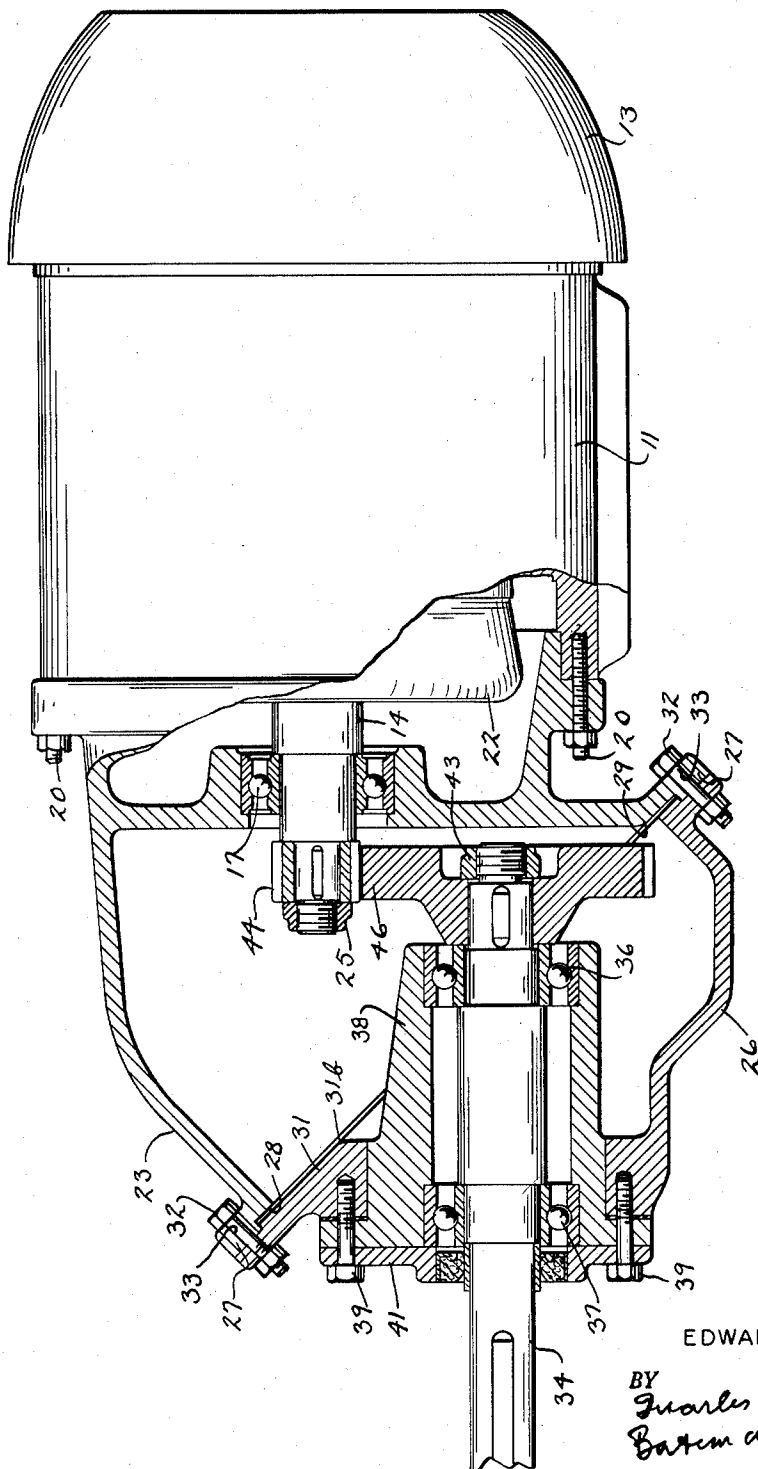


Fig. 2

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Fig. 3

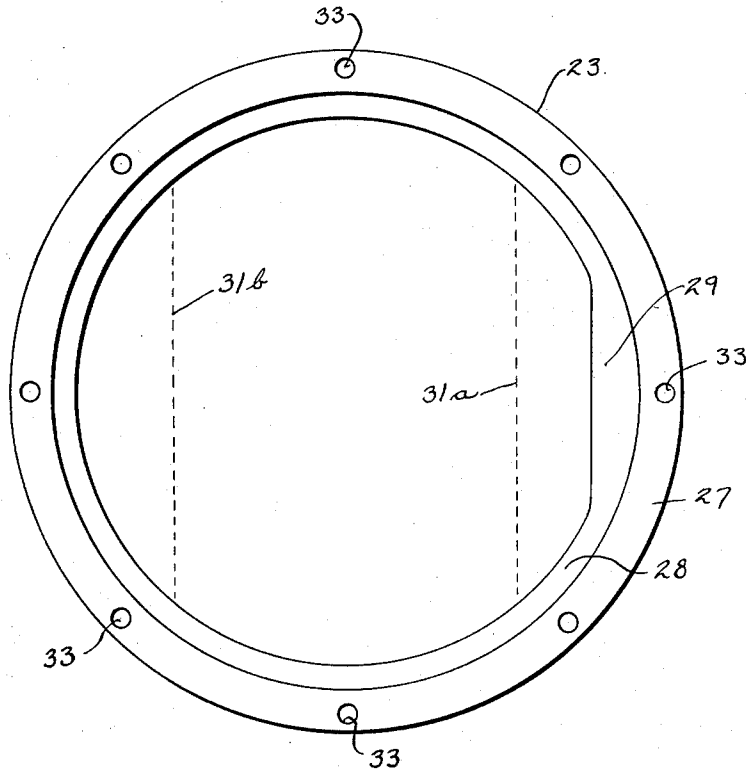
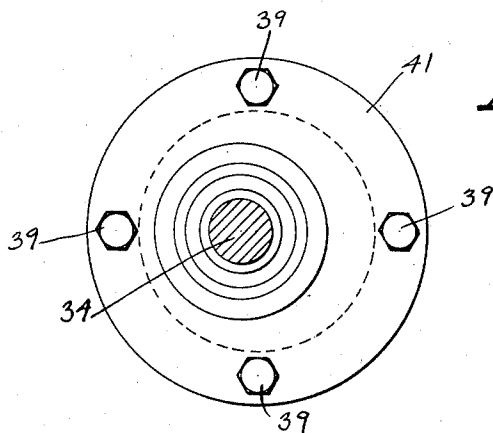


Fig. 4



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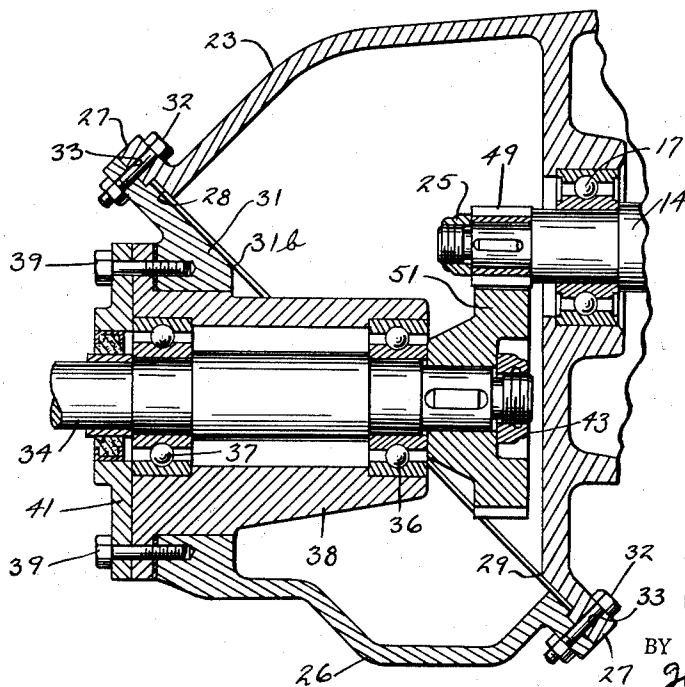
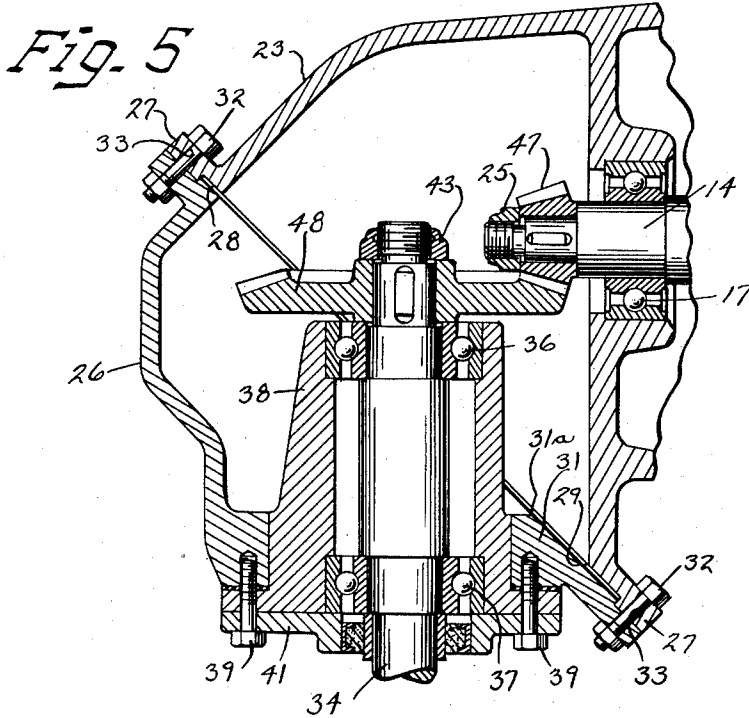
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HOUSED SELECTIVE-ANGLE SPEED-REDUCER

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2 Claims. (Cl. 74-412)

This invention relates to housed selective-angle speed-reducers, and more particularly to such a housed speed-reducer for a combined electric motor and gear-reducer.

In many uses (for example, but not limited to, electric mixers) there is employed an integral motor and gear-reducer, in which it would be convenient for the shaft of the motor and the output shaft of the reducer to be adapted to be set selectively parallel or at right angles to each other, and in which it would be highly desirable that the housing of the reducer be adapted to house such alternative settings, without modification of the housing. Accordingly it is the principal object of the present invention to devise such a housing, and to design it as simply as possible.

A further object is that such housing shall permit change of gear-ratio, without modification of the housing.

Other objects and advantages will appear in the description which follows.

In the description, reference is made to the accompanying drawings, forming a part hereof, in which there is shown, by way of illustration and not of limitation, a certain specific form in which the machine of the present invention may be embodied.

In the drawings:

Fig. 1 is an elevation, mostly in section, of the gear-housing and gear-reduction of the present invention attached to an electric motor, showing the housing cover oriented on the housing base so that the two shafts are perpendicular, and the shaft-mounting member oriented on the cover so as to produce the greater of the two alternative gear-ratios.

Fig. 2 is an elevation, partly in section, of the gear-housing, gear-reduction, and motor, showing the cover oriented so that the two shafts are parallel; the gear-ratio being the same as in Fig. 1.

Fig. 3 is a view of the edge of the housing base, seen as viewed from the line 3-3 of Fig. 1, with some additional indications as will be explained later herein.

Fig. 4 is a view of the eccentric shaft-mounting member, seen as viewed from the line 4-4 of Fig. 1.

Fig. 5 is a sectional view of the gear-housing and gear-reduction showing the cover oriented on the base, as in Fig. 1, so that the shafts are perpendicular, but with the shaft-mounting member oriented on the cover so as to produce the lesser of the two alternative gear-ratios.

Fig. 6 is a similar sectional view, but with the cover oriented so that the two shafts are parallel; the gear-ratio being the same as in Fig. 5.

Throughout the description, the same reference-numeral is applied to the same member or similar members.

Referring now to the drawings, more particularly Fig. 1, will be seen that 11 is the main frame of an electric motor. To one end of this frame is fastened, as by bolts 12, of which one is shown, an end cover 13 known as the "bell."

Motor shaft 14 (which also serves as the input shaft of the gearing, as will later appear) is journaled in bearing 16 in the bell, and also in bearing 17 as will later

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appear. This shaft carries a cooling-fan 18, for surface-cooling the motor, by sucking-in air through the open end of bell 13, and driving this air out through openings 19 (of which one is shown) between the edge of the bell and motor-frame 11.

Shaft 14 also carries rotor 21. The stator is 22. These two elements are more or less conventionally shown in Fig. 1.

For the conventional end cover at the other end of the motor from bell 12, there is substituted the base 23 of a gear-housing. This housing-base will hereinafter usually be referred to as merely the "base." Bearing 17 of motor-shaft 14 is mounted in this base. The base is secured to motor-frame 11 as by bolts 20.

As already stated, from the point of view of the present invention, motor-shaft 14 serves as the input-shaft of the gearing. For this purpose it carries bevel-pinion 24, secured to it as by nut 25.

26 is the cover of the gear-housing. This housing-cover will hereinafter usually be referred to as merely the "cover."

For reasons which will later appear, the juncture surfaces between cover and base conform to certain criteria which will now be described.

Fig. 3 represents primarily a view of the edge of the base, seen as viewed from the line 3-3 in Fig. 1. By comparing Fig. 3 with Figs. 1 and 2 it will be seen that 27 represents the bolting flange of the base, to which the bolting flange of the cover exactly corresponds and fits. Offset slightly from flange 27, is a further portion 28 of the base, to which a further portion of the cover fits but does not exactly correspond. For there is an inward extension 29 of offset portion 28 of the base, and dotted line 31a in Fig. 3 indicates the position of the edge of an inward extension 31 of the cover, when the cover occupies its position as in Fig. 1. Dotted line 31b in Fig. 3 indicates the position of the edge of inward extension 31, when the cover has been rotated 180 degrees from its position as in Fig. 1 to its position as in Fig. 2.

For the purpose of the present invention it is desirable that there be a complete closure contact between cover 26 and base 23 in the two positions of the cover on the base, 180 degrees apart as shown in Figs. 1 and 2, it is of no moment whatever that there be such closure contact in any other relative position of cover and base than these two. Accordingly, although the contact surfaces, as shown, are predominantly circular, they might as well be elliptical, rectangular, hexagonal, etc., etc. In fact, they need not even be plane, although this is desirable for convenience in machining. In further fact, they need not even be axially symmetrical about a common axis of base and cover, as is clearly demonstrated by the fact that such symmetry does not completely exist, even in the present exemplification of the invention.

Accordingly, all that can be said is that the cover must be reversible 180 degrees with respect to the base; or, more explicitly, that the cover be capable of being affixed to the base in either of two selective positions of relative rotation 180 degrees apart.

The cover is secured to the base in each of the cover's two selective positions by means of bolts 32, inserted through holes 33 in the base and corresponding holes in the cover.

Reverting now to Fig. 1, it will be seen that output shaft 34 is journaled in two bearings 36 and 37, in shaft-mounting member 38, which is secured to housing-cover 26 by bolts 39, which also pass-through, and serve to hold in place, oil-seal cover 41. See also Fig. 4.

Output shaft 34 carries bevel-gear 42, which is secured to it as by nut 43, and which engages bevel-pinion 24. The gear-ratio is the larger of the two gear-ratios employed; as shown, it is 4-to-1.

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Note that the two shafts 14 and 34 are coplanar and mutually perpendicular.

If now the positions of the journals of these two shafts on base and cover respectively, and the relation between cover and base, have been properly chosen (on which see later herein), and if the cover be removed and rotated 180 degrees and reapplied to the base, and if proper spur gears be substituted for the bevel gears of Fig. 1, there will exist the situation in which the two shafts will be coplanar and mutually parallel, with the gear ratio still the same as before, all as shown in Fig. 2. 44 is the substituted spur pinion, and 46 is the substituted spur gear.

Thus far in the description there has not yet been taken into account the function played by the eccentric mounting of output shaft 34 in shaft-mounting member 38.

Like the already-described relationship of housing-cover 26 and housing-base 23, it is sufficient for the purposes of the present invention that member 38 be capable of being affixed to housing-cover 26 in either of two selective positions of relative rotation 180 degrees apart.

Figs. 1 and 2 show member 38 in one of such relative positions, and Figs. 5 and 6 show said member in the other of such relative positions. Except for this and an appropriate substitution of gears, Fig. 5 is identical to the corresponding portion of Fig. 1, and Fig. 6 is identical to the corresponding portion of Fig. 2. In Fig. 5, 47 is the substitute bevel pinion, and 48 is the substitute bevel gear. In Fig. 6, 49 is the substitute spur pinion, and 51 is the substitute spur gear. The gear-ratio of Figs. 5 and 6 is 3.33-to-1.

Next, as how to design the various parts so that they will assume the proper relations under the various conditions shown and described.

Although this must be accomplished largely by cut-and-try, it is possible to outline one general course of procedure, roughly as follows. See Fig. 1.

Start by assuming the given position of input shaft 14. Design bevel-pinion 24 and bevel-gear 42 so as to have the larger of the two gear-ratios contemplated, and locate bevel-pinion 24 on input shaft 14 as close to the motor as convenient. Locate output shaft 34 coplanar and perpendicular to input shaft 14, and so that bevel-gear 42 meshes with bevel-pinion 24.

Design spur-pinion 44 and spur-gear 46 so as to have the same gear-ratio as above. See Fig. 2. Assume spur-pinion 44 on the end of input shaft 14, and locate output shaft 34 parallel to input shaft 14, and in the same plane as the plane of the first locating of the two shafts, and so that spur-gear 46 meshes with spur-pinion 44.

Determine a juncture between housing-cover 26 and housing-base 23, such that in one position the shafts and gears will lie as first determined above, and in a 180-degree reversed position they will lie as secondly determined above. (Note: To the extent that the juncture is substantially a plane, both shafts will lie at an angle of 45 degrees to that plane; but even in this event the further positioning of that plane with respect to the shafts, and the positioning of the juncture in that plane, will have to be determined by juggling.)

So much for satisfying the one gear-ratio if there be only one; or the greater gear-ratio if there be two.

As for the second (i.e., lesser) gear-ratio.

First, design bevel-pinion 47 and bevel-gear 48 so as to have the lesser of the two gear-ratios contemplated. Consider input shaft 14 located as before, and bevel-pinion 47 substituted for bevel-pinion 24. Determine a new location for output shaft 34, shifted laterally in the same plane, with bevel-gear 48 applied and meshing with bevel-pinion 47. See Fig. 5.

Shaft-mounting member 38 can now be designed so as to have such a 180-degree-reversible juncture with housing-cover 26, that in one position the two shafts will ac-

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commodate meshing bevel-gears 24 and 42, and in the other position the two shafts will accommodate meshing bevel-gears 47 and 48. (Note: To the extent that this juncture is substantially a plane, this plane will be perpendicular to the plane common to the axes of the two shafts, and will also be perpendicular to the axis of output shaft 34.)

Finally, with shaft-mounting member 38 in the position with respect to housing-cover 26 such that the two shafts accommodate meshing bevel-gears 47 and 48, consider housing-cover 26 to be thereupon reversed so that the two shafts become parallel. See Fig. 6. Spur-gears 49 and 51 can now be designed so as to mesh and produce the same lesser gear-ratio as bevel-gears 47 and 48.

It will be seen that, by virtue of two 180-degree-reversible junctures (i.e., one between housing-cover 26 and housing-base 23; and the other between shaft-mounting member 38 and housing cover 26), it is possible to attain the following four selections: (1) greater gear-reduction, shafts mutually perpendicular (Fig. 1); (2) same greater gear-reduction, shafts mutually parallel (Fig. 2); (3) lesser gear-reduction, shafts mutually perpendicular (Fig. 5); and (4) same lesser gear-reduction, shafts mutually parallel (Fig. 6); all without modification of the gear-housing.

Although it is contemplated and desirable that there be only two different gear-ratios involved; i.e., one for each of the two settings of shaft-mounting member 38, regardless of whether the two shafts are mutually perpendicular or mutually parallel; yet it is within the scope of the invention to have any number of different gear-ratios, if this be desired for any reason. This is readily attainable by virtue of the fact that, although when the shafts are set as in Fig. 1 or Fig. 5 the gear-ratio is pretty much circumscribed, yet when the shafts are set as in Fig. 2 or Fig. 6 it is a simple matter to substitute spur-gears of down to 1-to-1 gear-ratio and even beyond.

It will be readily evident from the foregoing description that the present invention affords a novel and useful housed selective-angle speed reducer, which also permits selective change of gear ratio.

Now that one embodiment of the invention has been shown and described, it is to be understood that the invention is not limited to the specific form or arrangement of parts herein shown and described, nor to the specific procedure outlined herein for designing the various elements so that they will assume the proper relations recited in the claims.

What is claimed is:

1. In a housed speed-reducer, the combination of: a housing, comprising a base and a cover, having such juncture surfaces that the cover is capable of being affixed to the base in either of two selective positions of relative rotation 180 degrees apart; an input shaft, journaled to extend within the housing in a fixed direction with respect to the base; an output shaft, journaled to extend within the housing in a fixed direction with respect to the cover; said two journalings, and the relation between the cover and the base, being respectively such that, in one of the two positions of relative rotation the two shafts are coplanar, parallel, and oppositely extending, and in the other of said two positions the two shafts are coplanar and perpendicular; a set of two intermeshing spur-gears for use on said shafts when parallel; a set of two intermeshing bevel-gears for use on said shafts when perpendicular; and means for securing the cover to the base in each of the cover's two selective positions; said two sets of gears being selectively mounted on and fixed to the shafts according to whether the shafts are parallel or perpendicular.

2. A housed speed-reducer according to claim 1, wherein: the output shaft is journaled eccentrically in a shaft-mounting member supported by the cover; and wherein said member and the cover have such juncture surfaces

that said member is capable of being affixed to the cover in either of two selective positions of relative rotation 180 degrees apart, whereby there are attainable two selective positions of the output shaft when parallel to the input shaft, and two selective positions of the output shaft when perpendicular to the input shaft; and wherein there are correspondingly two different sets of intermeshing spur gears for use on the shafts when parallel, and two different sets of intermeshing bevel gears for use on the shafts when perpendicular; and wherein there are means for securing the shaft-mounting member to the cover in each of said member's two selective positions; said four sets of gears being selectively mounted on and fixed to the

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shafts according to which of the four selective positions the output shaft occupies.

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