

July 21, 1931.

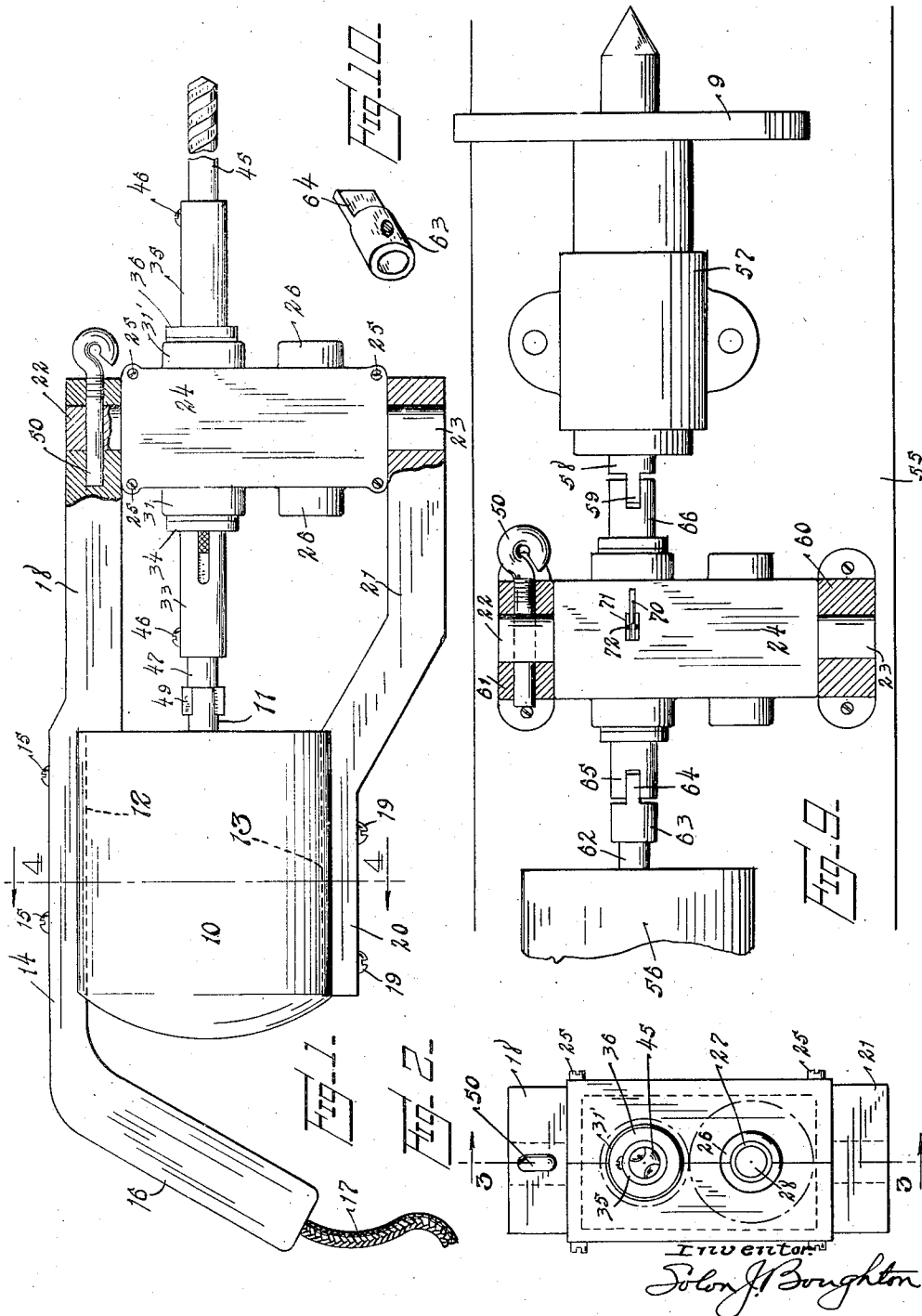
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CHANGE SPEED GEARING

Filed Oct. 19, 1928

2 Sheets-Sheet 1



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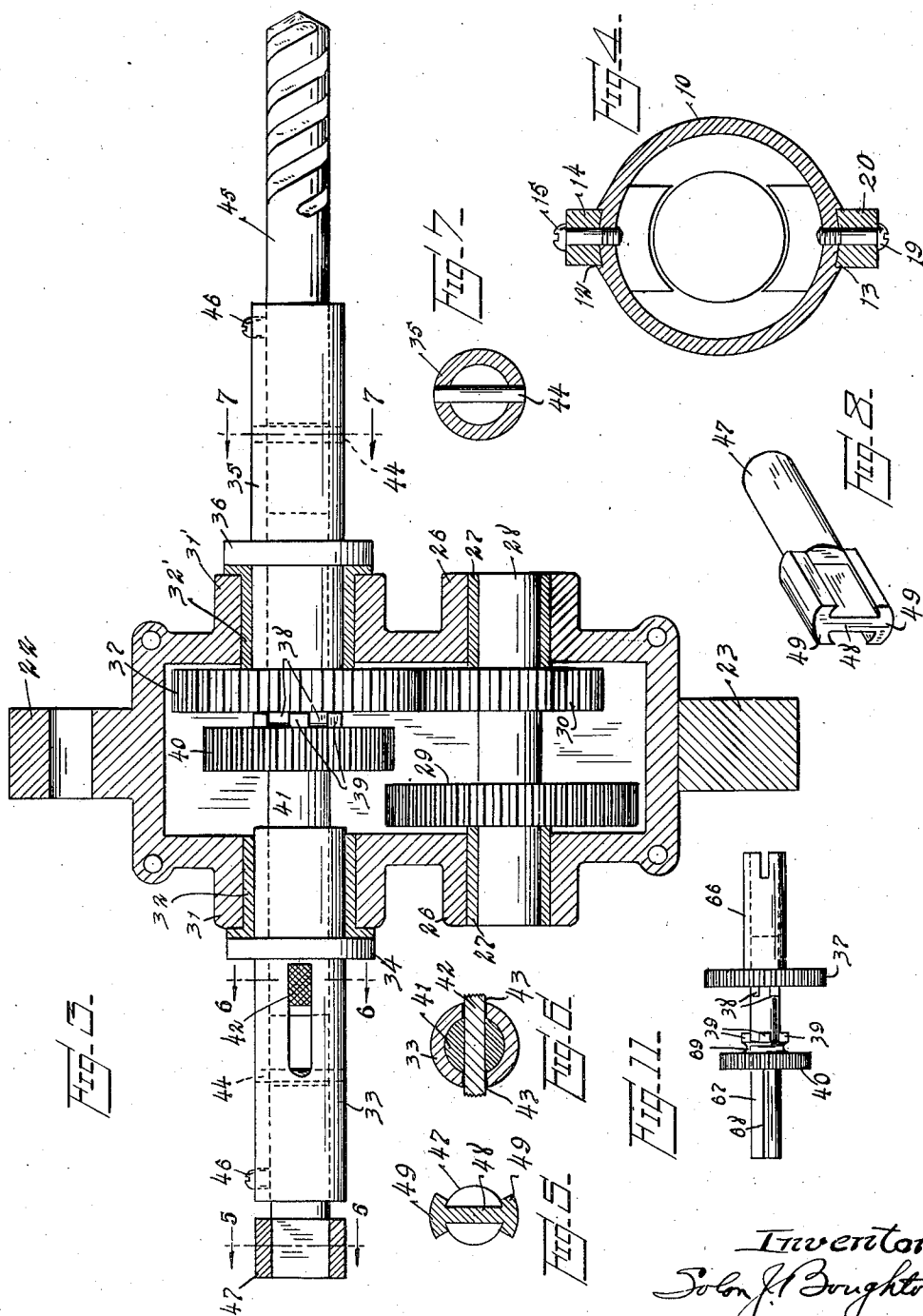
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CHANGE SPEED GEARING

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This invention relates to change speed gearing. While susceptible of more or less general application, it is intended primarily for use in connection with portable power tools, small lathes, and the like.

Change speed gearing, as ordinarily constructed, comprises a considerable number of parts and is correspondingly heavy and expensive.

One of the objects of the present invention therefore is the provision of a simple gearing providing at least two different speeds, which shall be of light weight, few parts, and low cost.

Another object is the provision of a device of the character described which may be constructed with constantly meshing gears for supplying two different speeds.

Another object is the provision of change speed gearing particularly adapted for use in connection with portable power driven tools.

Other objects and features of novelty will appear as I proceed with a description of those embodiments of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawings in which,

Figure 1 is a side elevational view of a portable power tool in which the invention is employed.

Fig. 2 is an end elevation of the same.

Fig. 3 is a longitudinal sectional view on a larger scale of the gear carrier and related parts, the view being taken substantially on the line 3—3, Fig. 2.

Fig. 4 is a cross sectional view on the line 4—4, Fig. 1.

Figs. 5, 6 and 7 are sectional detail views taken on the lines 5—5, 6—6 and 7—7 respectively of Fig. 3.

Fig. 8 is a perspective view of a coupling which may be employed in connection with the invention.

Fig. 9 is a plan view of a portion of a lathe embodying the invention, certain parts being broken away in order to more clearly illustrate the invention.

Fig. 10 is a perspective view of another coupling which may be employed; and

Fig. 11 is a detail view illustrating a slightly modified means for directly connecting the aligned shafts.

Referring first to Figs. 1 to 8, inclusive, I have illustrated at 10 a small electric motor having a shaft 11 which is diametrically slotted on its outer extremity for a purpose hereinafter mentioned. The casing of the motor is provided along opposite sides with grooves 12 and 13. In the groove 12 there is mounted a bar 14 held in place by screws 15. The rear end of this bar is bent inward at an angle to constitute a handle 16 which is hollow, and through which an electric cable 17 extends for supplying electric current to the motor. The bar 14 also has an arm 18 extending beyond the forward face of the motor. In the groove 13 there is mounted by means of screws 19 a bar 20, which has an offset forwardly projecting arm 21 paralleling the arm 18.

The forward extremities of arms 18 and 21 have aligned bearings therein at right angles to the shaft 11 for the reception of trunnions 22 and 23 formed upon a gear carrier 24, which in this instance is a casing split through the middle. The trunnion 22 is cast integral with one half of the split casing, and the trunnion 23 integral with the other half. The two halves may be held together by bolts 25. The gear casing 24 is formed with two opposed bosses 26 in which are mounted cylindrical bushings 27, rotatably supporting a jack shaft 28 upon which are fixed two gears 29 and 30. The shaft 28 is parallel with the shaft 11. The bosses 26 are bisected by the division between the two halves of the casing 24.

Two other bosses 31, 31', somewhat larger than the bosses 26, are similarly bisected. They carry bushings 32, 32', the axes of which are in alignment with the axis of shaft 11. The bushing 32 rotatably supports a hollow shaft 33 provided with a thrust collar 34. The bushing 32' rotatably supports a similar hollow shaft 35 with a thrust collar 36 thereon. These two hollow shafts extend identically the same distance outwardly from the common axis of the trunnions 22 and 23, so that either one of them may be brought into

close relationship with the motor shaft 11, and in alignment therewith.

On the hollow shaft 35 just within the casing is keyed a gear 37 which meshes constantly with the gear 30 on shaft 28. The shaft 35 beyond the gear 37 carries clutch teeth 38 which are adapted to interengage with clutch teeth 39 carried upon gear 40 which is fixed to a hub member 41 that, in the present case, takes the form of a shaft extending axially in both directions from the gear 40 and slidably received by both of the hollow shafts 33 and 35. Near its outer extremity the shaft 41 has fixed therein a transverse key 42 which extends through slots 43 in the hollow shaft 33 and is adapted to be grasped by the thumb and finger of the operator. Thus the key 42 serves not only to join the hub element 41 with the hollow shaft 33 against relative rotation, but also to shift the element 41 longitudinally to cause it to take either the position illustrated in Fig. 3 by means of which the two hollow shafts 33 and 35 are rotatably joined for direct drive, or else a position to the left of that illustrated where it meshes with the gear 29.

Each of the hollow shafts 33 and 35 at a short distance from its outer end carries a diametrically positioned pin 34. The outer extremity of each of the shafts 33 and 35 is adapted to receive a tool 45 with a cylindrical shank, the end of the tool bearing against pin 44 and the tool being held against rotation by a set screw 46. Each of the shafts 33 and 35 is also adapted to receive a coupling member 47 which has a cylindrical shank that is adapted to be held against rotation by the set screw 46, and has a coupling head consisting of a flat plate 48 adapted to fit loosely within the transverse slot of shaft 11 and a pair of curved abutments 49 adapted to fit over the shaft 11.

While it may not be necessary in all cases, I prefer to provide means for locking the gear casing 24 in each of its two operative positions. In the present case I have illustrated for that purpose a pin 50 extending through registering openings in the arm 18 and the trunnion 22, the pin having a short threaded portion near its outer end for engagement with a threaded portion of the opening in the arm 18, in order to guard against accidental dislodgment of the pin.

Referring now to Figs. 9, 10 and 11 of the drawings, 55 represents a suitable base or support upon which are fixedly mounted a motor 56 and a lathe head stock 57, the latter supporting rotatably a shaft 58 cut away to form a diametrical dog 59. On the opposite side of the head stock 57 the shaft 58 carries a face plate 9 or other suitable work holding member. Intermediate the head 57 and the motor 56 the base 55 also carries a pair of vertical supports 60 and 61 that are provided with bearings for the reception of

the trunnions 22, 23 of the gear casing 24. The motor shaft 62 may have secured thereto a coupling consisting of a sleeve 63 adapted to fit upon the shaft 62 and a dog 64 which is a counterpart of the dog 59 upon the shaft 58. The hollow shafts 65 and 66, corresponding to the shafts 33 and 35 of the first described form of the invention, are slotted at their ends to receive the dogs 59 and 64 interchangeably. As in the first described form, each of these shafts extends the same distance outwardly from the axis of the trunnions 22 and 23.

The gearing within the gear casing 24 is similar in this form of the invention to that previously described, the jack shaft and its gears being identical, and the gear 37 being fixedly carried upon the inner end of hollow shaft 66. The gear 40 however is fixed upon a hub element 67 that is provided with a key 68 for sliding engagement within a keyway on the inner surface of hollow shaft 65. The gear 40 and its hub element 67 are shiftable longitudinally by means of a yoke of ordinary construction which engages with a collar 69, and which may be thrown from one position to the other by a lever 70 extending through a slot 71 in the casing 24 and pivotally mounted upon a pin 72 supported in the wall of the casing. In Fig. 11 the gear 40 is shown in position to mesh with gear 29.

The operation of the two forms of the invention herein described will be obvious from the above description of their constructions. Whenever the gear 40 is in mesh with the gear 29, the two shafts 33 and 35 or 65 and 66, as the case may be, are intergeared to turn at different speeds. With the gear casing in the position illustrated in Fig. 3 the speed of shaft 35 would then be less than that of the motor. If a speed greater than that of the motor should be desired, the motor is stopped, the coupling 47 is drawn out of engagement with the shaft 11, the screw 46 first having been loosened, the tool 45 is removed and the pin 50 withdrawn. The operator then swings the casing 24 upon its trunnions through 180°, puts the tool in the shaft 33 and the coupling 47 in the shaft 45 and adjusts the coupling so as to engage with the slot in shaft 11. The pin 50 is then replaced and the tool is ready to be operated at the higher speed. In either position of the casing 24 a change to direct drive, or motor speed, may be made by stopping the motor, grasping the ends of key 42 and pushing the latter toward the casing into the position illustrated in the drawings. It is obvious of course that the provision for direct drive may be omitted if desired with a consequent simplification of the device.

The operation of the second form of the invention is substantially the same as that just described, except that no interchange of couplings is necessary when the gear casing

is to be swung from one position to the other. At such times the pin 50 is withdrawn and the casing swung around, the slots in the shafts 65 and 66 being engageable laterally with either of the dogs 59 and 64.

While in the foregoing description and accompanying drawings I have presented a somewhat detailed disclosure of the invention, I desire it to be understood that such disclosure is merely for the purpose of illustrating the invention, and is not to be construed as limiting the scope thereof.

Having thus described my invention, I claim:

1. In combination, a gear carrier, a pair of trunnions therefor, and a pair of shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged in alignment at right angles to said trunnions.

2. In combination, a gear carrier, a pair of trunnions therefor, and a pair of shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged at right angles to said trunnions, the outer ends of said shafts being adapted for driving connection interchangeably with a power shaft or an element to be driven.

3. In combination, a gear carrier, a pair of trunnions therefor, and a pair of shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged in alignment at right angles to said trunnions and extending equal distances from the axis of said trunnions.

4. In combination, a gear carrier, a pair of trunnions therefor, and a pair of aligned shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged at right angles to said trunnions, and means for disabling said interconnecting gearing and directly connecting said shafts.

5. In combination, a gear carrier, a pair of trunnions therefor, and a pair of aligned shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged at right angles to said trunnions, and means for locking said carrier in either of two angular positions 180° apart.

6. In combination, a gear carrier, a pair of trunnions therefor, a first and a second shaft rotatably mounted in alignment in said carrier at right angles to said trunnions, a train of gears within the carrier adapted to interconnect said shafts to turn at different speeds, a hub for one of said gears concentric with said first shaft and slidably keyed thereto, and a pair of cooperating clutch elements carried by said hub and second shaft respectively, whereby the longitudinal movement of said hub serves either to place said gearing in operative relation or to disable said gear-

ing and directly connect said first and second shafts.

7. In a portable tool, a motor, a gear carrier, a pair of trunnions therefor, supporting arms attached to said motor having aligned bearings for said trunnions at right angles to the motor shaft, a pair of aligned shafts rotatably mounted in said carrier adapted to be brought into alignment with said motor shaft when the carrier is swung upon its trunnions into either of two positions 180° apart, the outer extremities of both of said shafts being adapted to be coupled interchangeably with a tool or the motor shaft.

8. In combination, a gear carrier, a pair of trunnions therefor, a pair of shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said carrier being shiftable upon said trunnions, to bring either one of said shafts into operative relation with a driving member, and means for coupling either of said shafts to said driving member.

9. In combination, a rotatable gear carrier, a pair of shafts rotatably mounted in said carrier out of alignment with the axis thereof and interconnected to turn at different speeds, one of said shafts being mounted at right angles to said axis, said carrier being shiftable upon its axis, whereby said last named shaft may be moved into or out of operative relation with a driving member.

10. In combination, a rotatable gear carrier, a pair of aligned shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged at right angles to the axis of the carrier, means for connecting said shafts to aligned driving and driven shafts, and means mounted in the carrier for directly connecting said driving and driven shafts.

11. In combination, a rotatable gear carrier, a pair of shafts rotatably mounted in said carrier and interconnected to turn at different speeds, said shafts being arranged in alignment at right angles to the axis of rotation of said carrier, the outer ends of the shafts being adapted for driving connection interchangeably with a power shaft or an element to be driven.

In testimony whereof, I hereunto affix my signature.

SOLON J. BOUGHTON.