July 24, 1956 P. H. DIXON 2,755,673

RECIPROCATORY DRIVE MECHANISM

Filed Jan. 9, 1951

Fig. 1

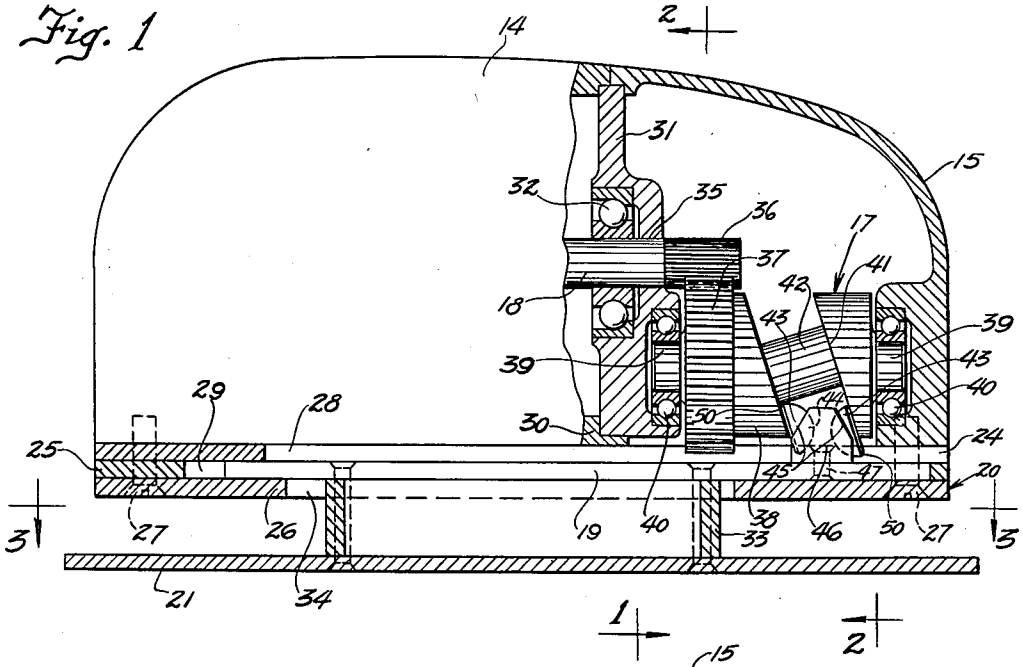


Fig. 2

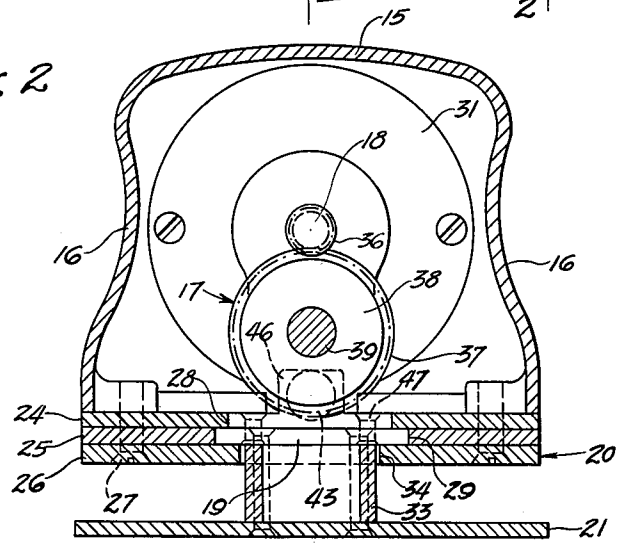
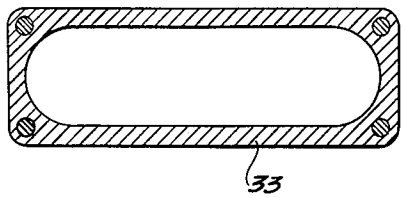


Fig. 3



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RECIPROCATORY DRIVE MECHANISM

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Application January 9, 1951, Serial No. 205,123

2 Claims. (Cl. 74—57)

This invention relates to drive mechanisms in which rotary movement of the driving shaft is converted into reciprocatory movement of the driven member, as, for example, a slide, which, in the case of a sander, operates the sanding pad holder that is rigidly secured thereto.

The invention is more particularly concerned with improvements applicable to devices of the kind disclosed in the copending application of George A. Larson, Serial No. 205,377, filed January 10, 1951.

In the reciprocatory movement transmitted to a sander pad there is a tendency to produce noise and transmit excessive vibration to the handle held by the operator, thus causing too much fatigue when the sander has to be operated for an hour or so at a time. Such operation is also accompanied usually with excessive wear on the mechanism. It is, therefore, one of the principal objects of my invention to provide transmission gearing of improved design between the armature shaft of the motor and the sander pad converting the rotary motion to reciprocatory motion in such a way that noise and vibration, as well as wear, are reduced to a minimum.

The invention is illustrated in the accompanying drawing, in which—

Fig. 1 is a view partly in side elevation and partly in longitudinal section on line 1—1 of Fig. 2 through an electrically driven sander similar to that disclosed in the copending application but embodying the improved drive mechanism of my invention;

Fig. 2 is a cross-section on broken line 2—2 of Fig. 1, and

Fig. 3 is a horizontal section on line 3—3 of Fig. 1.

The same reference numerals are applied to corresponding parts in these three views.

Referring to the drawing, I shall first describe the construction of the sander in general in order that the improvements added by my invention may be more fully appreciated and understood. The reference numeral 14 designates the housing of an electric motor which, like the end cover 15, is substantially flat on the top and hollowed out on the sides, as indicated at 16 in Fig. 2, to facilitate the operator's holding the tool and guiding it easily in its operation. The cover 15 lies substantially flush with the housing 14 and serves as an enclosure for the transmission gearing of my invention indicated at 17, provided between the armature shaft 18 of the motor and a slide 19 that is reciprocable in the base 20 and transmits reciprocatory motion to the pad-holder 21. The latter, it will be understood, may be equipped with any suitable pad on the bottom and also with any suitable abrasive clamping means on the top, so that a sheet of abrasive laid across the pad may be clamped in place by its end portions which are folded back over the top of the end portions of the plate 21. The base 20 is made up of three plates, 24–26, suitably secured together and to the housing 14 and cover 15, as by means of screws 27. The plate 24 has an elongated opening 28 provided therein through which lubricant from inside the cover 15 is free to flow onto the slide 19 to the far end, the slide being

guided for reciprocation in an elongated opening 29 provided in the middle plate 25. The lubricant cannot enter the motor housing 14, because its bottom wall 30 seals it off, and there is an end plate 31 suitably fixed to the housing 14 supporting one of the bearings 32 for the armature shaft 18 serving as a closure for the end of the motor housing inside the cover 5. A spacer 33 of hollow rectangular form is rigidly secured between the slide 19 and pad holder 21 and extends through an elongated opening 34 provided in the bottom plate 26. It is apparent, therefore, that if an adequate supply of semi-fluid lubricant is put in the cover 15 at the time the sander is assembled, the transmission gearing 17 and the slide 19 will be assured of good lubrication indefinitely, and, due to the way the slide is enclosed, leaving only a very little of the slide 19 uncovered, there is very little, if any, danger of contamination of the lubricant, despite the inevitable dust and grit churned up in the operation of the sander. The bearing 32 for the armature shaft 18 will also receive some lubrication through the opening 35 in the end wall 31. These features all form a part of the copending Larson application and are claimed therein.

The rotary motion of the armature shaft 18 is converted into reciprocatory motion of slide 19 by the novel transmission gearing 17 of my invention. This gearing includes a pinion 36 suitably formed directly on the end of the armature shaft 18 and meshing with a gear 37 provided as an integral part of a cylindrical cam 38, the piece 37—38 having coaxial journals 39 on the opposite ends thereof received in ball bearings 40, one of which is supported in a recess in the plate 31 and the other in a recess in the cover 15. The cam 38 is cut away annularly, as at 41, in a plane at an acute angle to the longitudinal axis of the piece, leaving a connecting center pin 42 in the annular cam track 41 thus formed. The connecting pin 42, which is on the axis of generation of the cam track groove 41, is normal to the planes of the two sides of the groove and at an acute angle to and intersecting at the mid-point of said pin 42 the axis of revolution of the cam 38. Because of this inclination of pin 42 with respect to the axis, it will be seen that the flat sides of the groove 41 leave only narrow width flat faces in the groove at opposite ends of the pin 42 on diametrically opposite sides of the cam 38. This connecting center pin 42 intersects at its midpoint the axis of rotation of the cam 38, so that the cam is truly balanced and will, therefore, operate smoothly at high speeds and not set up any vibration. Two semi-spherical bearing balls 43 which are of a diameter greater than the width of said narrow width faces have more than half the width of their flat sides slidable on the flat sides of the cam track 41 while their spherical sides are received with a close working fit in spheroidal bearing recesses 44 provided therefor in the upwardly converging sides 45 of a block 46 that projects into the cam track 41 and is riveted, as indicated at 47, to one end portion of the slide 19. It should be clear from this description that in the rotation of the cam 38 the semi-spherical bearing balls 43 sliding on the flat sides of the cam track 41 and using substantially the full width of the narrow flat faces will transmit reciprocation to the slide 19 as the semi-spherical balls oscillate and turn in their bearing recesses 44 in the block 46 with a low unit bearing pressure, the continuous oscillation and turning of the semi-spherical balls serving to distribute the wear evenly on their flat sides as well as their spherical slides. The edges of the semi-spherical balls 43 will, of course, be suitably chamfered to reduce friction and minimize wear. Such chamfering is indicated by the bevelled edges 50.

In operation, it should be clear that the gearing 17 of my invention, while highly desirable for a sander drive, is not limited to that specific use but may be used wherever a similar drive problem is presented. The gearing

17 operates much more smoothly and quietly than most other reciprocating mechanisms operating at the speeds common for sanders. There is also much less vibration, and the wear is reduced to a minimum because of the fact that surface to surface contact is substituted for the line contact otherwise obtained where a roller is used as the follower and runs in direct contact with the sides of the groove. Furthermore, no binding is possible, because the semispherical bearing elements 43 are universally shiftable in their sockets 44. It is, of course, a much easier matter and, therefore, less costly, to machine the plain groove 41 by a simple turning operation to get all portions of each side of the groove accurately in one plane than to mill out a cam groove of the conventional form. It is also easier by this method to keep within closer tolerances in quantity production.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn to cover all legitimate modifications and adaptations.

I claim:

1. A reciprocatory drive mechanism comprising, in combination, a one-piece cylindrical cam block having means for driving the same, said block having an annular cam groove provided therein in a plane at an acute angle to the axis of revolution of the block, each of the sides of the groove having all portions thereof in one plane, the opposite sides of the groove being in parallel planes, the portions of the block on opposite sides of the groove being integrally connected together by a longitudinal center pin portion which is on the axis of generation of the groove, its centerline being normal to the planes of the two sides of the groove and at an acute angle to and intersecting at the mid-point of said center pin portion the axis of revolution of the block, bearings in which said coaxial journals are received to support the cam block against endwise movement, a relatively reciprocable block projecting into said groove and having spheroidal-shaped recesses provided in opposite sides thereof, and semispherical bearing elements universally oscillatable in said recesses on their semispherical sides and slidable on their flat sides on the flat sides of the groove, said connecting pin by reason of its inclination with respect to the axis of the cylindrical block leaving only narrow-width flat faces in the groove at opposite ends of the pin on diametrically opposite sides of the cylindrical block and said semispherical bearing elements being of a diameter greater than the width of said narrow-width faces and being disposed so that more than half of the width of their flat faces is engaged with the flat sides of the groove, thereby utilizing substantially the full width of the narrow flat faces in the operation of said reciprocatory drive mechanism and causing continuous turning of said semispherical bearing elements so as to distribute the wear evenly on the flat faces of said elements.

2. A reciprocatory drive mechanism as set forth in claim 1 wherein the edges of the semi-spherical bearing elements are bevelled circumferentially of the flat sides thereof, substantially as and for the purpose described.

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