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POWER-DRIVEN HAND TOOL

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FIG. 1

FIG. 2

FIG. 3

FIG. 4

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This invention relates to a power-driven hand tool of the rotating type such as a sander, buffer, grinder, etc. It is an object of this invention to provide a hand tool of the above described type which is of economical construction and which is compact.

A further object of the invention is to provide a hand tool of the type described in which the rotating work member, such as the sanding disc, grinding wheel, buffing pad, etc., is designed to either rotate eccentrically about a fixed center or to both rotate about an eccentric and simultaneously revolve about its own axis.

In the drawing:
Fig. 1 is a side elevational view partly in section of a power-driven hand tool of the present invention.
Fig. 2 is a sectional view along the lines 2—2 in Fig. 1 and showing the locking member in the unlatched position.
Fig. 3 is a view similar to Fig. 2 and showing the locking member in the latched position.
Fig. 4 is a sectional view along the lines 4—4 in Fig. 2.

As indicated above, the hand tool of this invention may take the form of a sander, grinder, buffer and the like. For the purpose of description, the hand tool is illustrated in the drawing as a sander; but it will be appreciated from the following description that the principle of the invention may be applied to other power-driven hand tools.

The sander shown in the drawing comprises an air-driven motor 10 having a handle 12 and a finger-operated lever 14 for actuating a valve stem 16 that controls the operation of motor 10. The rotor of motor 10 which is not illustrated drives a shaft 18, and the shaft 18 in turn drives a pad 20 against the lower face of which is supported a sanding disc 22. Pad 20 and disc 22 form part of a pad assembly which includes a spindle 24, a locking screw 26 and a backing plate 28.

The present invention is directed primarily to the means by which the spindle 24 of the pad assembly is connected with the motor shaft 18. These means comprise a cylindrical driving head 30 having a socket 32 extending axially therethrough at the center thereof. Socket 32 is dimensioned to receive the end of shaft 18, and two set screws 34 are provided in head 30 for firmly locking the head 30 on the end of shaft 18. Head 30 is also fashioned with a second socket 36. Socket 36 has its axis offset radially from the axis of socket 32 as shown clearly in Fig. 4. Within socket 36, there is arranged a ball bearing 38. Bearing 38 has an outer race 40 which is pressed in socket 32. Spindle 24 has a reduced upper end portion 42 which is pressed into the inner race 44 of bearing 38. Thus, with the arrangement described, spindle 24 is free to rotate in bearing 38 and at the same time revolves with head 30 about the axis of shaft 18.

For reasons described hereinafter, it is desirable at times to lock spindle 24 against rotation relative to head 30. Locking means are thus provided to accomplish this. These means are preferably in the form of a ring 46 which is pivotally supported on the lower face of head 30 as by a screw 48. As shown more clearly in Figs. 2 and 3, ring 46 is provided with a central aperture 50 which surrounds spindle 24; and the inner periphery of ring 46 is provided with a detent 52 engageable in a keyway 54 in spindle 24. The arrangement is such that ring 46 can be pivoted in one direction about screw 48 to interengage detent 52 in keyway 54 and thereby lock spindle 24 relative to head 30 and may be pivoted in the opposite direction to disengage detent 52 from keyway 54 and thus permit spindle 24 to rotate freely in head 30.

In order to obtain smooth operation, I have found that it is necessary to counterbalance head 30 and thereby compensate for the eccentric mounting of the pad assembly on the head. This counterbalancing can be achieved most expeditiously by drilling holes such as indicated at 56 in the upper face of head 30. The holes 56 are spaced and located such that the head 30 is perfectly balanced somewhere between the latched and the unlatched positions of the locking ring 46.

One of the important features of my construction resides in the alignment of shaft 18 with spindle 24. The direction of rotation of the pad with locking ring 46 uncontrolled is by inclining spindle 24 either toward or away from shaft 18. I have found that to obtain best results and more particularly, to best avoid burn to rotate in a direction opposite to the rotation of head 30, the axis of spindle 24 should be inclined in a downwardly direction toward the axis of motor shaft 18. The extent of inclination, however, need not be very great; and I have found that when the axis of spindle 24 is inclined towards the axis of shaft 18 even as little as 1°, a very satisfactory operation results. I have also found that as this angle of inclination is increased, the rate of counter rotation of pad 20 is also increased. An inclination of spindle 24 from about 1° to 5° is preferred. The tilting of spindle 24 relative to shaft 18 may be accomplished in a variety of different ways. Since this angle of inclination may be as little as 1°, I have not attempted to show it on the drawings. The inclination of spindle 24 may, for example, be provided by forming shaft 18 with a slight taper or by forming the socket 32 with a slightly enlarging taper in an inward direction. The necessary inclination may also be imparted to the spindle 24 by boring socket 32 or socket 36 at the desired angle.

With the tool described above, I have found that a variety of different operations can be performed. For example, when the tool is used as a sander, its versatility enables its use for a variety of different requirements. With the spindle 24 locked to the head 30 as shown in Fig. 3, the pad 20 and disc 22 rotate as a unit with head 30. In this condition, the sander is admirably suited for heavy stock removal; and yet, a fairly fine finish is obtained and the main objection of regular disc Sanders, namely, the formation of accute grooves, is eliminated. With the spindle locked to the head, the disc appears to produce a combined sanding and rubbing action. For example, a 4" disc with an eccentric mounting of 1/2" covers an area having a 5" diameter. This rubbing action while the disc is rotating tends to remove the swirls or grooves which unavoidably result from a perfectly circular motion. Even with an average heavy paper, the sander in this condition can be used for relatively heavy stock removal and a fine mirror finish can be produced. I have found also that with the spindle locked to the head, the heat produced is materially less than the heat encountered with a conventional sander where the sanding disc merely rotates about a fixed center. As a matter of fact, in this condition, the sander is admirably suited for trimming the edges of plastic without causing burning of the plastic or the formation of a burr around the edge
3 being trimmed or without producing objectionable heat on other materials. However, if the locking ring 46 is pivoted to the unlatched condition shown in Fig. 2, then the action of the pad 20 is entirely different. In this condition, with the motor 19 operating, when the pad 20 or disc 22 are brought to bear against a surface to be finished, I have found that the pad 20 rotates in a direction opposite to the direction of rotation of head 30. The cutting action is not as rapid as when the spindle is locked to the head; but on the other hand, a very fine finish is produced without leaving swirls in the finished pattern as is common with orbital type sanders. This dual action, namely, the counter rotation of disc 22 together with its oscillating motion, is also very desirable in that it has a tendency to unload the sanding disc 22; that is, it tends to prevent the grit of the sanded material from accumulating on the disc. Experience has shown that with a sander constructed in accordance with this invention, sanding discs last the combat 50 to 70 percent longer than they do with conventional sanders. Furthermore, since the pad 20 and disc 22 rotate freely in bearing 38, there is no burning whatever. In addition, when the sander is operating under this dual action condition with the disc 22 lying flat on the work, the torque on the handle which is experienced in conventional sanders is substantially eliminated; and there is practically no tendency for the sander to creep on the work.

Thus, depending on the type of work being finished and the type of finish produced, the user may operate the sander with the locking ring 46 in either the latched or the unlatched condition to meet the requirements. For example, when working with sheet metal, if heavy stock removal is required or if a mirror-bright surface is desired, the sander is operated with the locking ring 46 in the latched position. On the other hand, if it is desired to put on a very fine mat or etch-like finish on sheet metal, the sander is operated with the locking ring 46 in the unlatched position.

Another advantage of the tool described herein resides in the construction of the driving head 30. It will be appreciated that by forming the head 30 as a cylindrical member provided with sockets 32 and 36, a very economical coupling between the motor and the pad assembly is provided. Furthermore, the head 30 is in and of itself a counterbalance by reason of the bored holes 56.

I claim:

1. A portable disc sander or the like comprising a motor having a housing and a driven shaft thereon, a head rigidly mounted at the free end of said shaft, a work disc mounted on said head to rotate freely thereon relative to said housing about an axis which is offset radially from the axis of said motor shaft and means for optionally locking said disc to said head to cause the disc to rotate as a unit with said disc or to rotate freely on said head relative to said housing.

2. The combination called for in claim 1 wherein said last mentioned axis is inclined toward the axis of the motor shaft at an angle from about 1° to 5°.

3. A portable disc sander or the like comprising a motor having a projecting driven shaft, a work disc and means coupling said work disc to said shaft comprising a generally cylindrical driving head fixed on the end of said shaft to rotate therewith, said disc having a supporting spindle, means journaling said spindle for free rotation on said head about an axis radially offset from the axis of said shaft, said spindle and said shaft projecting from opposite ends of said cylindrical driving head, said head having a ring member pivotally supported on the face thereof from which said spindle projects, said ring member encircling said spindle and having means thereon for locking the spindle against rotation on said head when the ring member is pivoted into engagement with said spindle.

4. The combination called for in claim 3 wherein said spindle is provided with a socket and said last mentioned means comprises a detent on said ring member engageable in said socket on the spindle.

5. A portable disc sander or the like comprising a motor having a housing and a driven shaft projecting therefrom, a work disc and means coupling said work disc to said shaft comprising a driving head, means fixedly mounting said driving head on the end of said shaft, said head having a socket therein the axis of which is radially offset from the axis of said shaft, a bearing seated in said socket, said disc having a supporting spindle, said spindle being mounted in said bearing such that the spindle is journaled for free rotation on said head relative to said housing and means shiftably mounted on said head for movement to a position interengaging said spindle to thereby lock the spindle against rotation on said head.

6. The combination called for in claim 5 wherein said spindle is provided with a keyway and said last mentioned means comprises a detent engageable in said keyway.

7. A portable disc sander or the like comprising a motor having a driving shaft, a head fixedly mounted at the free end of said shaft and a work disc mounted on said head to rotate freely about an axis which is offset radially from and inclined slightly relative to the axis of said motor shaft.

8. The combination called for in claim 7 wherein said last mentioned axis is inclined towards the axis of the motor shaft at an angle from about 1° to 5°.

9. A portable disc sander or the like comprising a motor having a projecting driven shaft, a work disc and means coupling said work disc to said shaft comprising a driving head, means fixedly mounting said driving head on the end of said shaft, said head having a socket therein the axis of which is radially offset from the axis of said shaft, a bearing seated in said socket, said disc having a supporting spindle, said spindle being mounted in said bearing such that the spindle is journaled for free rotation on said head, the axis of said spindle being inclined slightly towards the axis of said shaft.

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