

July 19, 1955

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2,713,237

SEMI-AUTOMATIC FEED MECHANISM FOR SANDER HEADS

Filed Jan. 27, 1954

2 Sheets-Sheet 1

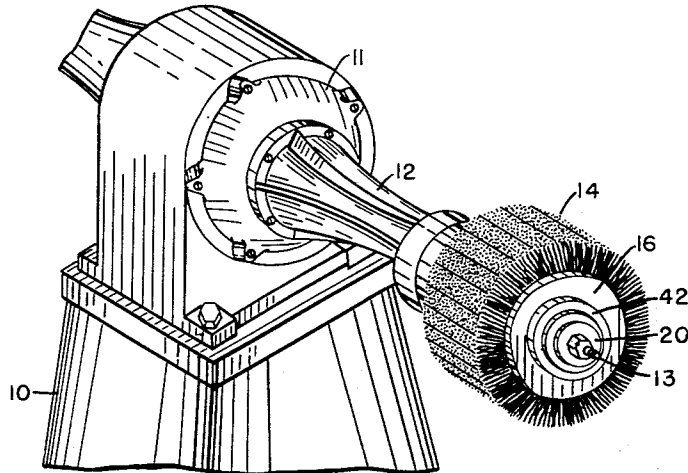


FIG. 1

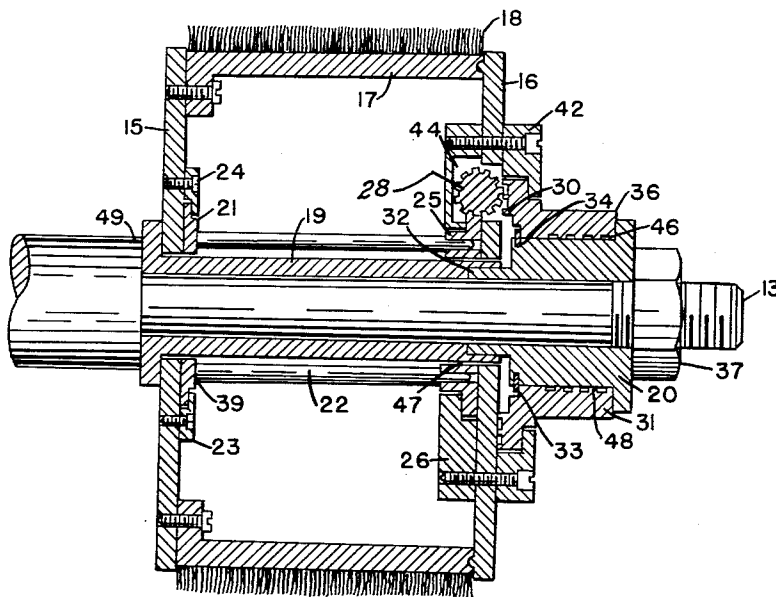


FIG. 2

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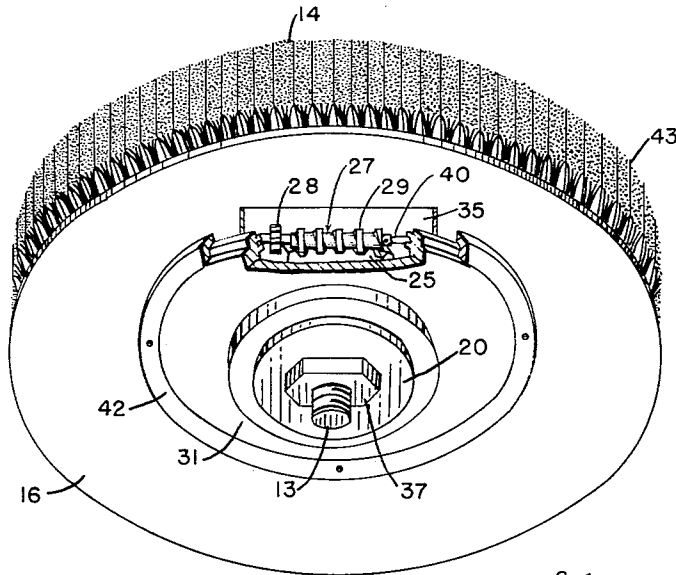


FIG. 3

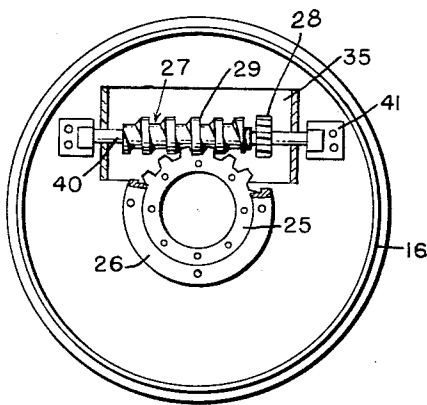


FIG. 4

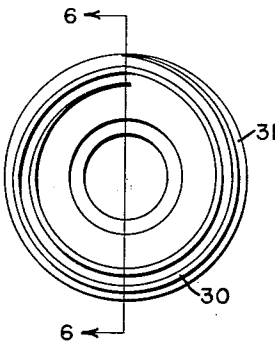


FIG. 5

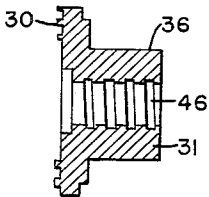


FIG. 6

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SEMI-AUTOMATIC FEED MECHANISM FOR SANDER HEADS

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Application January 27, 1954, Serial No. 406,519

6 Claims. (Cl. 51—193.7)

This invention relates to an abrasive head of the type that may be employed in abrading products of wood and other materials, including moldings, carvings, die castings and the like, having irregular surfaces, and particularly a spindle sander of the character disclosed in Letters Patent to Bradley No. 2,430,099. The invention particularly pertains to a semi-automatic means for feeding out new abrasive strips from within the head without having to turn off the drive motor and stop the rotation of the head.

Abrasive heads of this type contain within the head abrasive strips wound on some type of reel mechanism, which strips extend from the reel out through slots in the periphery of the head so as to be exposed to the work piece. Periodically, as the abrasive strip material exposed to the work piece becomes worn out, it is necessary to unwind more strip material from the reel and feed it out through the slots in the periphery of the head so as to maintain usable abrasive strip material at the periphery of the head. Heretofore, to feed out unused abrasive strip material it has been necessary to turn off the motor which drives the head at a high rate of speed, stop the rotation of the head, loosen the spindle nut or lock nut which prevents the abrasive reel from unwinding during grinding, and rotate the side plate or some other member connected to the abrasive reel, thereby unreeling more strip material. This is a time-consuming operation which in some types of grinding may be required as often as once every three minutes of grinding time. Such down time is a problem of particular importance when, as is usually the case in industrial operations, the drive motor rotates two such abrasive heads inasmuch as both grinding heads must be stopped when feeding out unused abrasive strip material on either head.

It is therefore an object of the present invention to provide an abrasive head of the abovementioned type comprising means for feeding out unused abrasive strip material from within the head which means does not require the stopping of the rotation of the drive motor or the abrasive head.

Other objects and advantages accruing from the present invention will become apparent as the description proceeds.

The abrasive head of the present invention comprises two annular side flanges about the periphery of which is an annular series of outwardly extending back-up brushes perpendicular to the side flanges; an abrasive reel located axially within the space defined by the side flanges and brushes, and means for rotating the abrasive reel relative to the side flanges while the abrasive head is rotating at operating speed whereby abrasive strip material wound on the abrasive reel may be fed out to the periphery of the head without stopping the rotation of the unit.

In order that the invention may be more fully understood reference is made to the various figures of the

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drawing which depict the abrasive head of the present invention and in which,

Figure 1 is a perspective view of an abrasive unit mounted for grinding;

5 Figure 2 is an axial cross-section of an abrasive head;

Figure 3 is a perspective view of an abrasive head partially cut away to show part of the gear mechanism;

Figure 4 is an inner side elevation of the outer flange and attached parts partially cut away to show the gear mechanism;

Figure 5 is an inner side elevation of the actuating ring showing the scroll gear portion thereof; and

Figure 6 is a sectional view of the actuating ring taken along line 6—6 of Figure 5.

Referring now to the drawings which depict a preferred embodiment of the present invention, there is illustrated in Figure 1 an abrasive or polishing unit having a supporting base 10 upon which is mounted an electric motor 11 driven from any suitable source of current, not illustrated. Extending from the motor is a bearing housing 12, and such housing may extend from both sides of the motor to provide dual abrasive units. Driven by the motor and supported by the bearing housing there is a spindle 13 for supporting and rotating the abrasive head 14.

The abrasive head 14, as depicted in Figures 2 and 3, comprises annular inner side flange 15 and annular outer side flange 16, about the periphery of which flanges is an annular series of outwardly extending brush holders 17 slightly spaced from each other and perpendicular to the side flanges. The holders 17 are rigidly and permanently secured to the inner side flange 15 and hold back-up brushes 18 which flexibly back up the abrasive strips 43. Brushes 18 extend the full width of the head with the bristles thereof extending outwardly. The outer side flange 16 has an axial recessed portion 47, through which extends the outer bushing ring 20.

Permanently affixed to the inner side flange 15 and extending axially within the head there is a support cylinder 19 surrounding the spindle 13, which cylinder serves the purpose of maintaining the correct axial distance between the inner side flange and the outer bushing ring 20 by abutting against the boss 32 of outer bushing ring 20.

Axially surrounding support cylinder 19 within the space defined by the side flanges and back-up brushes there is the abrasive reel 39, which consists of reel ring 21 from which extends axially within the head an annular series of abrasive anchoring pins 22. The reel ring is mounted adjacent the inner side of the inner side flange 15 by retaining ring 23. The abrasive reel is independently rotatable relative to the inner side flange 15 so as to wind or unwind abrasive strip material 43. A plurality of abrasive strips 43 are anchored to the anchoring pins, wound around the reel, and extended outwardly therefrom through slots between adjacent brush holders 17. Retainer ring 23 is removably secured to the inner side flange 15 by screws 24.

The outer ends of the abrasive anchoring pins 22 fit into recesses in the annular reel drive gear 25, which is rotatably mounted axially of the unit by retaining ring 26 adjacent the inner side of the outer side flange 16 with the gear portion of the reel drive gear in coacting relation with worm 29, of reduction gear assembly 27. Reel drive gear 25 is independently rotatable relative to the side flanges. Rotation of reduction gear assembly 27 causes reel drive gear 25 to rotate, which in turn causes rotation of the abrasive reel 39. Retaining ring 26 has a cut-away or recessed portion 44 which serves as a clearance space for reduction gear assembly 27 so that retaining ring 26 does not interfere with the reduction gear assembly.

As is best shown in Figure 4, reduction gear assembly 27 comprises a shaft 40 with a gear portion, such as worm 28, and a second gear portion, such as worm 29, thereon, the peripheral diameter of the worm 28 being somewhat larger than the peripheral diameter of the worm 29. The reduction gear assembly 27 is mounted in a cut-away portion 35 of the outer side flange 16 by means of mounting bearings 41, the worm 29 being at the proper distance from the axis of the flange to coact with the gear portion of reel drive gear 25. The axis of the reduction gear assembly is perpendicular to a radial line from the axis of the flange 16 to the center of the worm 29 and is mounted on the inner side of the outer side flange 16 so that the teeth of worm 29 do not extend outwardly beyond the outer side of the flange but so that the teeth of worm 28, because of the large diameter of this worm, do extend outwardly beyond the outer side of the flange. This prevents worm 29 from interfering with the actuating ring 31, but permits the worm 28 to coact with the scroll gear portion 30 of the actuating ring 31. The teeth of worm 28 may be curved to conform with the curvature of the scroll gear.

Referring again more particularly to Figures 2 and 3, rotatably mounted adjacent the outer side of the outer side flange 16 by means of retainer ring 42 is the annular actuating ring 31. The actuating ring rotatably bears on the boss 43 of the outer bushing ring 20. Lubricating rings 46 in the actuating ring provide for lubrication between the actuating ring 31 and the bearing ring 20. The actuating ring is independently rotatable relative to the side flanges, and, as is shown in Figures 5 and 6, comprises a scroll gear portion 30 which coacts with worm 28 of the reduction gear assembly 27. Rotation of actuating ring 31 relative to the outer side flange 16 causes reduction gear assembly 27 to be rotated by scroll gear 30. This in turn imparts rotation to the reel drive gear 25 relative to the outer side flange 16, and so to the abrasive reel 39. Therefore, if during operation the rotation of actuating ring 31 is slowed down or stopped while the abrasive head continues to rotate, the resulting relative rotation between the actuating ring and the outer side flange causes the reduction gear assembly 27 to rotate, thereby rotating the reel drive gear and the abrasive reel relative to the side flange.

Snap ring 33, which fits in groove 34 on the outer bushing ring 20, secures the outer bushing ring to the unit when the spindle nut 37 is not in place by abutting against the actuating ring 31. The outer bushing ring supports the entire outer side of the abrasive head on the spindle. Retaining ring 42 holds the actuating ring 31 in position rotatably mounted adjacent the outer side flange 16 and in coacting relation with worm 28. Retaining ring 42 also secures the sub-assembly consisting of the outer bushing ring, snap ring and actuating ring to the unit when the spindle nut is not in place.

In assembling the abrasive head of the present invention first the abrasive reel is placed in position adjacent the inner side flange 15 and rotatably secured by retaining ring 23. Then abrasive strip material 43, such as that disclosed in the aforementioned U. S. Patent No. 2,430,099 or otherwise abrasive strip material, is anchored on each abrasive anchoring pin 22, one such strip extending through each opening or slot between adjacent brush holders 17. Next the actuating ring 31 is placed on outer bushing ring 20 and rotatably secured by snap ring 33 which is forced into the groove 34 on the outer bushing ring. This sub-assembly of parts 20, 31, and 33 is then positioned axially adjacent the outer side of the outer side flange 16 with the outer bushing extending through the axial recess 47 in the outer side flange. The sub-assembly is then secured by retaining ring 42. Then, reel drive gear 25 is positioned axially adjacent the inner side of the outer side flange 16 and is secured by retainer ring 26. Retaining rings 26 and 42 may be secured to the flange by the same screws, as shown in the drawings.

The outer side flange 16 with parts 20, 31, 33, 42, 25, and 26 is then assembled with the rest of the abrasive head, with the boss 32 on the outer bushing ring 20 abutting against the support cylinder 19 and the abrasive anchoring pins 22 entering the recesses in the reel drive gear 25. The abrasive strip material 43, which has been anchored to pins 22 and extended through the slots, is then wound onto the abrasive reel 39 in the direction opposite from the unwinding direction by turning the outer side flange 16 and its attached parts in the direction of rotation of the head during operation while holding the inner side flange 15 stationary. The abrasive strips are wound in until only the ends extend beyond the brushes 18. The assembled abrasive head 14 with the reel of abrasive strip material therein is then mounted on the spindle 13 against the shoulder 49 of the spindle and the spindle nut 37 is securely tightened so as to prevent relative rotation between the spindle and the abrasive head. The support cylinder 19 abutting against the boss 32 on the outer bushing ring 30 prevents binding of the gears by excessive tightening of the spindle nut. The spindle nut is the only element securing the inner and outer side flanges together. The unit is then ready for operation.

In operation the abrasive head mounted on the spindle is rotated at a high rate of speed and the work piece is held against the abrasive strip material extending beyond and backed up by the brushes. After a period of use, the abrasive strip material becomes worn or torn and unsuitable for further abrading. Fresh abrasive is then fed out from within the abrasive head without stopping the rotation of the abrasive head by merely applying pressure by hand or by some other braking means, not illustrated, on the boss 36 of the actuating ring 31. The pressure, which is applied so as to slow down or stop the rotation of the actuating ring, does not affect the rotation of the outer side flange. As a consequence reduction gear assembly 27 is rotated by coaction of scroll gear 30 with worm 28. Worm 29 is consequently also rotated, causing rotation relative to the side flanges of reel drive gear 25 which in turn rotates the abrasive reel 39, relative to the side flanges, thereby winding out new abrasive material. Therefore, by means of the unique gearing means of the abrasive head of the invention, new abrasive strip material may be fed out from within the head without turning off the drive motor and stopping the rotation of the abrasive head. Furthermore, no spindle nut or fastening means need be loosened to permit rotation of the abrasive reel to wind out unused abrasive.

The materials from which the various gear members are made is dictated to some extent by the type of use to which the abrasive head is to be put. For example, if the abrasive head is to be used at high speeds and with a heavy work pressure, the pull of the work on the abrasive strip material will be extremely great so that it may be necessary to use hardened steel for the gear portions of the reel drive gear and the reduction gear assembly. However, if the head is to be so used that there will not be too great a pull on the abrasive strip material during use, materials having less strength, such as brass, may be used for the gear portions.

Since in operation this type of abrasive head is rotated at relatively high speeds such as 2000 revolutions per minute and the work piece pressure may be relatively great, there is a strong pull by the work piece on the abrasive strip material tending to unwind it from the abrasive reel. For this reason it is necessary that the various gear elements of the head be designed to meet another important requirement; namely, they must be able to prevent turning of the abrasive reel by the pull of the work on the abrasive strip material while still permitting the actuating ring to be mounted rather loosely so as to be relatively free to rotate. In a preferred embodiment of the present invention which fulfills this requirement very satisfactorily, the scroll gear on the actu-

ating ring is a single spiral course and the worm portion of the reduction gear assembly which coacts with the scroll gear has ten teeth. Therefore, the reduction gear assembly makes one revolution for every ten revolutions of the actuating ring relative to the side flange. The reel drive gear, which coacts with the other worm portion of the reduction gear assembly, has one hundred teeth and so makes one revolution relative to the side flange for every one hundred revolutions of the reduction gear assembly. Therefore, there is a gear ratio of 1000:1 between the actuating ring and the reel drive gear. Because of this large gear ratio the pull on the abrasive strip material cannot turn the abrasive reel and coacting gear elements although the actuating ring is mounted so as to be easily rotated by manual pressure.

A further advantage of a large gear ratio between the actuating ring and the reel drive gear is that it causes the abrasive strip material to be fed out slowly enough for accurate regulation of its length. For example, in an abrasive head having the above-described gear system, if the head is rotating at 2000 R. P. M., stopping the actuating ring will cause rotation of the reduction gear assembly at 200 R. P. M., which in turn will cause the reel drive gear to rotate relative to side flange at only 2 R. P. M. The net result is that while the abrasive head is rotating at 2000 R. P. M. and the actuating ring is stopped, the abrasive reel will be slowed down to an actual speed of rotation of 1998 R. P. M. and so abrasive strip material will be fed out at the relatively slow rate of two turns about the reel per minute, which rate is highly satisfactory for accurate regulation of the amount of strip material fed out.

While the abovementioned gear ratio has been found to be highly satisfactory for many purposes, other gear ratios are also satisfactory. For example, if relatively long increments of abrasive are to be fed out, it may be desirable to have a lower gear ratio between the reel drive gear and the actuating ring so as to feed out the strip material faster. Similarly, if the operating speed and/or the work piece pressure are low it is not necessary that the gear ratio be so large, substantially lower gear ratios often being completely satisfactory.

In the design of the abrasive heads of the invention many modifications of the above-described preferred embodiment may be made, all of which are within the scope of the present invention. For example, the support cylinder may be dispensed with. However, in such a case care must be taken when tightening the spindle nut not to screw it down too tightly so as to force the central portion of outer side flange inwardly thereby binding the gear elements.

As another embodiment of the present invention the reel retaining ring which anchors the abrasive reel in position is eliminated, the abrasive reel being designed to bear on the support cylinder. However, in this embodiment, the abrasive reel may come out of the assembly when the outer side flange and its attached parts are removed from the assembly. In a further embodiment the snap ring which retains the actuating ring on the outer bushing ring is eliminated. In this embodiment there is nothing to secure the outer bushing ring to the assembly when the spindle nut is not in place.

In still another embodiment of the present invention the reel ring and the reel retaining ring are dispensed with, the abrasive anchoring pins being permanently secured to the reel drive gear. In this embodiment removal of the outer side flange causes removal of the abrasive reel as well. In another construction, the outer bushing ring is threaded so as to screw into a threaded portion on the support cylinder rather than to merely abut against it. Also the outer bushing ring can be threaded so as to receive a threaded retaining ring in place of the snap ring which retains the actuating ring on the outer bushing ring. Furthermore, the retaining ring which holds the actuating ring against the outer flange

may be dispensed with, so that the subassembly of the outer bushing ring, the actuating ring, and the slip ring, is readily removed upon removal of the spindle nut.

In some cases where the operating speed of the head is low and the abrasive feed is relatively fast it is not necessary to have lubricating means where the actuating ring bears on the outer bushing ring.

These and many other modifications of the present invention give a highly satisfactory abrasive head wherein the abrasive strip material may be fed from the abrasive reel to the work area without stopping the rotation of the head, or loosening any fastening means, all of which modifications are within the scope of the present invention.

Having described the invention, it is desired to claim:

1. An abrasive head comprising: two annular side flanges about the periphery of which is an annular series of outwardly extending back-up brushes, an abrasive reel located axially within the space defined by the side flanges and the back-up brushes which abrasive reel is free to be rotated independently of the drive shaft and on which abrasive reel may be wound abrasive strip material, an actuating ring comprising a gear portion which actuating ring is free to be rotated independently of the drive shaft by means of force applied to the actuating ring, a reel drive gear coacting with the abrasive reel which reel drive gear is free to be rotated independently of the drive shaft, and a reduction gear assembly mounted on a side flange comprising a gear portion which coacts with the gear portion of the actuating ring and a second gear portion which coacts with the reel drive gear whereby rotation of the actuating ring relative to the side flanges causes rotation of the reduction gear assembly which in turn causes rotation of the reel drive gear relative to the side flanges resulting in rotation of the abrasive reel relative to the side flanges.

2. An abrasive head in accordance with claim 1 in which the actuating ring is annular and comprises a scroll gear portion.

3. An abrasive head in accordance with claim 1 in which the reduction gear assembly comprises two worm portions.

4. An abrasive head in accordance with claim 1 in which the actuating ring is mounted adjacent the outer side of one of the side flanges, the reel drive gear is mounted adjacent the inner side of that side flange on which is mounted the actuating ring, and the reduction gear assembly is mounted on that side flange adjacent to which are mounted the actuating ring and the reel drive gear.

5. An abrasive unit comprising: two annular side flanges about the periphery of which is an annular series of back-up brushes; an abrasive reel located axially within the space defined by the side flanges and said brushes which abrasive reel comprises an annular series of abrasive anchoring pins extending axially within the head and is independently rotatable relative to the drive shaft; abrasive strip material anchored to said abrasive anchoring pins, wound around said abrasive reel and extended from said reel through slots between adjacent back-up brushes to the periphery of said head; an annular actuating ring mounted axially on the outer side of one of the side flanges which actuating ring comprises a scroll gear portion and is independently rotatable relative to the drive shaft; a reel drive gear mounted on the inner side of that side flange on which is mounted the actuating ring which reel drive gear comprises a gear portion and is independently rotatable relative to the drive shaft and coacts with the abrasive reel so that rotation of the reel drive gear relative to the side flanges rotates the abrasive reel relative to the side flanges; and a reduction gear assembly mounted on that side flange on which are mounted the actuating ring and the reel drive gear which reduction gear assembly comprises a worm portion which coacts with the gear portion of the reel drive gear so that

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rotation of the reduction gear assembly rotates the reel drive gear relative to the side flanges and another worm portion which coacts with the scroll gear portion of the actuating ring so that rotation relative to the side flanges of the actuating ring rotates the reduction gear assembly.

6. An abrasive unit comprising: two annular side flanges about the periphery of which is an annular series of back-up brushes; an abrasive reel, located axially within the space defined by the side flanges and said brushes which abrasive reel comprises an annular series of abrasive anchoring pins extending axially within the head and is independently rotatable relative to the drive-shaft, said abrasive reel being designed to carry abrasive strip material wound around the abrasive reel and anchored by the anchoring pins; an annular actuating ring mounted axially on the outer side of one of the side flanges which actuating ring comprises a scroll gear portion and is independently rotatable relative to the drive-shaft; a reel drive gear mounted on the inner side of that side flange on which is mounted the actuating ring which

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reel drive gear comprises a gear portion and is independently rotatable relative to the drive-shaft and coacts with the abrasive reel so that rotation of the reel drive gear relative to the side flanges rotates the abrasive reel relative to the side flanges; and a reduction gear assembly mounted on that side flange on which are mounted the actuating ring and the reel drive gear which reduction gear assembly comprises a worm portion which coacts with the gear portion of the reel drive gear so that rotation of the reduction gear assembly rotates the reel drive gear relative to the side flanges and another worm portion which coacts with the scroll gear portion of the actuating ring so that rotation relative to the side flanges of the actuating ring rotates the reduction gear assembly.

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