Nov. 19, 1963 J. V. KEEFE 3,110,992

DEVICE FOR FEEDING ABRASIVE MIXTURE TO A LAPPING MACHINE

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Fig. 1.

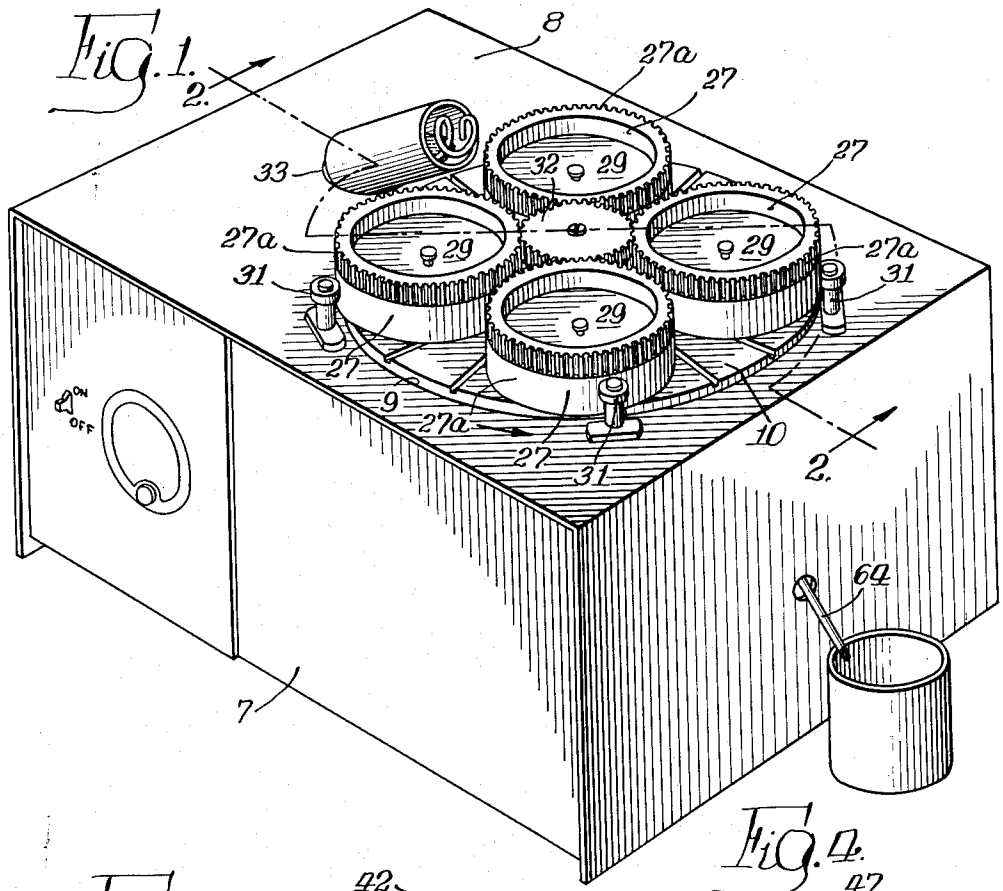


Fig. 3.

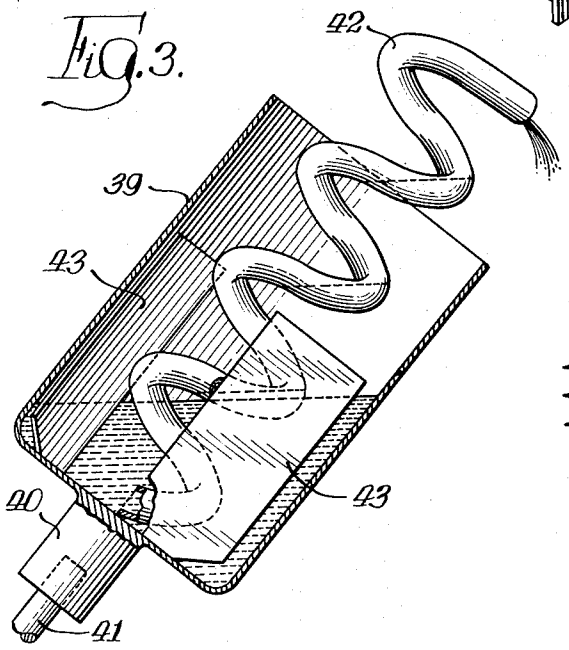
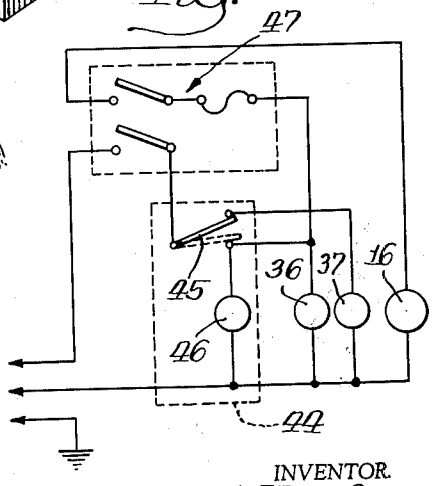


Fig. 4.



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Fig. 2.

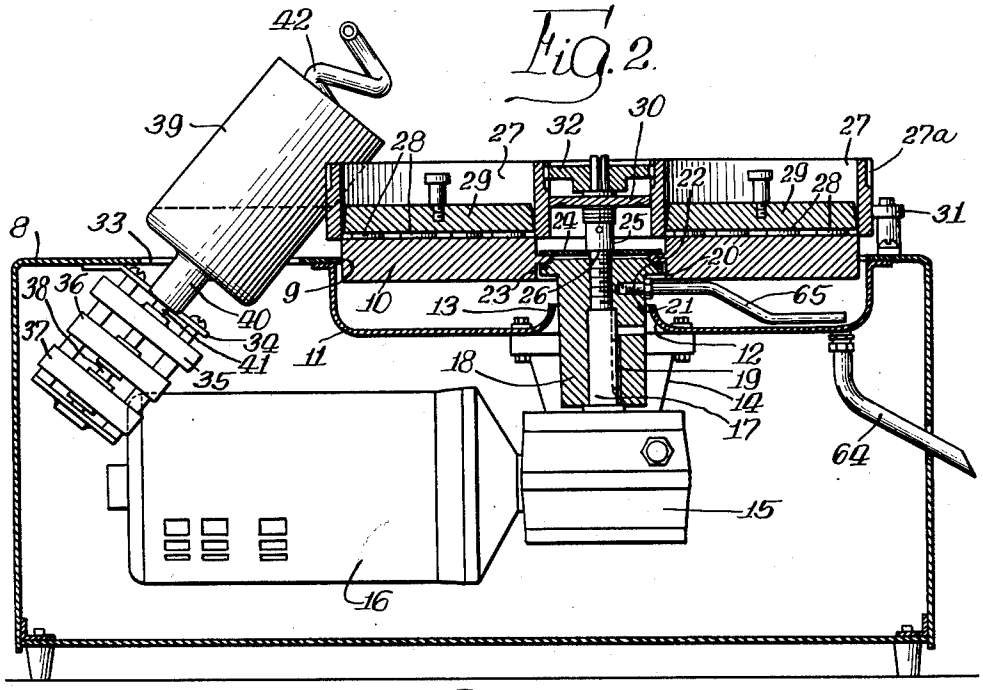


Fig. 5.

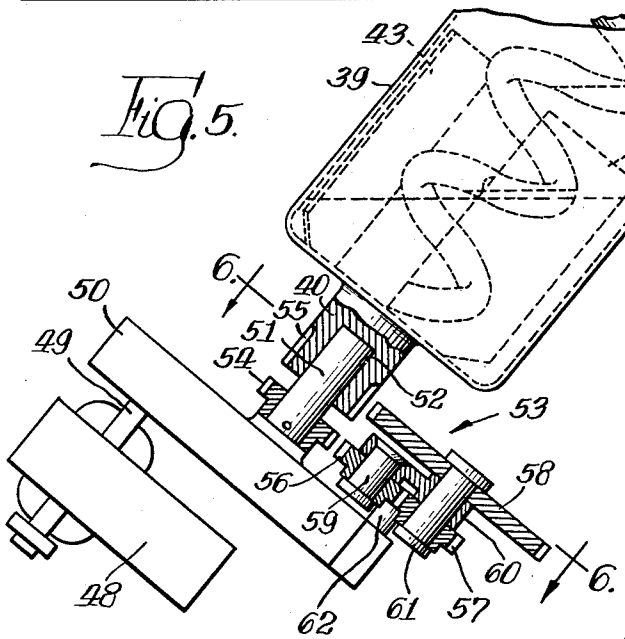
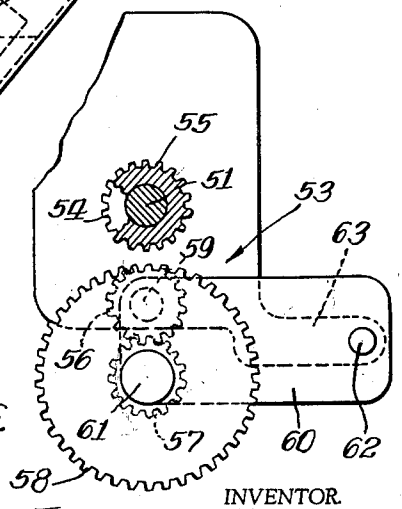


Fig. 6.



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DEVICE FOR FEEDING ABRASIVE MIXTURE TO A LAPPING MACHINE

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8 Claims. (Cl. 51—263)

My invention relates to devices for feeding a freely flowing material comprised of abrasive particles and a carrier to the lapping wheel or disc of a lapping machine and the like, and more particularly to an abrasive feeding device wherein the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

To these ends, I provide container means which is adapted to receive the freely flowing material and which serves to feed material therefrom upon rotation in one direction, and means for rotating the container means in said one direction when the lapping wheel is in operation and in the opposite direction when the lapping wheel is idling whereby the material is continuously agitated.

My invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a perspective view of a lapping machine;

FIGURE 2 is a vertical sectional view, on an enlarged scale, of the lapping machine, taken substantially along the line 2—2 of FIGURE 1, looking in the direction indicated by the arrows;

FIGURE 3 is an elevational view, on a still larger scale, of the abrasive mixture containing and feeding device of FIGURE 2, the container being shown in section to reveal the interior parts;

FIGURE 4 is a schematic diagram of the electrical circuit of the electric motor drive means of the abrasive mixture containing and feeding device of FIGURE 2;

FIGURE 5 is an elevational view of an abrasive mixture containing and feeding device similar to the device of FIGURE 2, except for the modified embodiment of drive means provided therefor, with portions being broken away and shown in section; and

FIGURE 6 is a view of the modified embodiment of drive means for the abrasive mixture containing and feeding device, taken substantially along the line 6—6 of FIGURE 5, looking in the direction indicated by the arrows.

Referring now to FIGURE 1, there is shown a generally rectangular box-like housing 7, which is preferably formed of sheet metal upon and within which is mounted the mechanisms of a bench-type lapping machine. The lapping machine of FIGURE 1 is a preferred embodiment of a machine tool with which the principles of my present invention may be incorporated, and is described and claimed in the co-pending application of Stephen A. Boettcher, Serial No. 187,698, filed April 16, 1962. The housing 7 is formed with front and rear walls, side walls, and a top wall 8.

The top wall 8 is provided with a circular opening 9 to receive a lapping wheel or disc 10 which is rotatably mounted relative to the housing 7 in the following manner: Depending from the top wall 8 and attached thereto at the periphery of the opening 9 by welding or otherwise, as shown in FIGURE 2, is a combined drip pan and supporting member 11 having a generally horizontal wall with a central opening 12 therein, defined by an upturned annular flange portion 13. Bolted to the underside of the pan-shaped supporting member and axially aligned with the opening 12 therein is a tubular support 14, carrying a conventional worm-drive gear box 15 and an operatively connected, horizontally arranged, drive motor 16. The drive shaft 17 of the gear box 15 carries a driving hub 18 which is keyed thereto at 19. The hub 18 is journalled in the tubular support 14 and projects through the opening

12 in the supporting member 11. The upper end of the hub 18 is formed with an integral annular radial flange portion 20 that presents a shoulder 21 which serves to receive and seat an integral annular flange portion 22 extending inwardly of a central opening 23 formed in the lapping disc 10. The flange portions 20 and 22 are clamped together by means of a horizontal retaining disc 24 secured in position by a vertical stem 25 that is threaded into the upper end of the hub 18 and presents a shoulder 26 which bears against the disc 24. The aforedescribed drive means, which is carried by the supporting member 11, serves to support the lapping disc 10 and to drive the same in a counterclockwise direction, as indicated in FIGURE 1, when viewed from the top.

Resting on the lapping disc 10 are retaining and truing rings 27, the upper portions of which are formed with external gear teeth 27*a*. These rings serve to receive work pieces, as indicated at 28, lying on the lapping surface of the wheel or disc 10, and circular weight or pressure plates 29 are laid upon the work pieces.

The rings 27 are maintained in circumferentially spaced relation by means of a central, horizontal roller spacer 30 carried by the drive stem 25, and roller stops 31 mounted on the housing 7 slightly offset forwardly from the radial line of the disc and ring centers. When the disc 10 is rotating, the rings 27 are free to rotate on their own axes due to frictional contact with the disc 10, but are prevented from rotating about the axis of the lap wheel 10 by the roller stops 31 engaging the rings below the tooth portions thereof.

To control the wear effect of the rings 27 on the lapping disc 10, a pinion 32 is detachably keyed on the upper end of the drive stem 25 for meshing engaging with the gear teeth 27*a* of the retaining rings 27. When lapping is being performed, the pinion 32 is removed from the drive stem 25. When corrective treatment of the surface of the lap 10 is required, the pinion 32 is placed on the end of the drive stem 25 whereupon the rings 27 are driven in reverse direction. When the corrective treatment is completed, the pinion 32 is removed from the stem 25. By driving the rings 27 in reverse for selected periods of time, the wear effect of the rings 27 on the surface of the lap 10 can be suitably controlled as set forth in the copending application of Stephen A. Boettcher, Serial No. 60,815, filed October 6, 1960. Furthermore, the lapping disc is detachably mounted to the hub 18 in the manner previously described, to permit the disc 10 to be reversed, whereby either of two lapping surfaces which may be of the same or different surface finish may be presented to work pieces.

I shall now describe the device used to feed a liquid carrier, such as light oil, with abrasive particles in suspension to the lap wheel or disc during operation, and the means of my invention for continuously agitating the material so as to maintain the abrasive particles in suspension. In the top wall 8 of the housing 7, at one side of the lap wheel 10, a circular opening 33 is provided. Secured to the underside of the wall 8 adjacent to the opening 33, is a mounting bracket 34 that is inclined downwardly at an angle of approximately forty-five degrees as illustrated in FIGURE 2. Suitably mounted to the underside of the inclined portion of the bracket 34 in parallel spaced relation are a speed reducer in the form of a reducing gear box 35, and a pair of small electric motors 36 and 37. The electric motors 36 and 37, which may be of the shaded pole type, are arranged to rotate a common drive shaft 38 alternately in opposite directions. The drive shaft 38 is connected to the input member of the speed reducer 35, and the axis of the drive shaft 38 is at a right angle to the mounting bracket 34.

Arranged above the gear box 35, on the inclined axis of the drive shaft 38, is a cylindrical container 39 which has an open upper end and a closed lower end with an axial

hub 40 brazed or otherwise suitably secured thereto. By way of axial hub 40, the container 39 is fixedly mounted on the output shaft or member 41 of gear box 35 for rotation therewith. The output shaft 41 of the gear box is slow-turning, for instance 18 r.p.m.

As shown in FIGURE 3, an open-ended helically wound tube 42 is fixedly mounted in the container 39 with the helical coils thereof concentric with the axis of the container. Circumferentially spaced baffle plates 43, preferably of spring metal, are secured along their one edges to the helically wound tube 42. In assembly, the free ends of the baffle plates 43 are pressed radially inwardly to permit disposal of the tube 42 in the container, and are then released to spring radially outwardly forceably engaging the walls of the container, whereby the helical tube 42 is fixedly mounted in the container 36, with its lower end near the bottom of the container 39 and its upper end extending out of the container and over the lapping disc 10.

The coils of tube 42 are formed with a helix angle that is greater than the angle between the axis of the helix and horizontal, as is evident from FIGURE 3. When the assembly is at rest, the fluid mixture will stand at the same level in the helical tube and surrounding it. When the assembly is rotated in a clockwise direction as viewed from the upper end of the container 39, pools of mixture will form on the low side as indicated in FIGURE 3 and will progress upwardly in the tube 42; thus a continuous series of pools of mixture move from the bottom to the top of the tube 42 from which they pour onto the lapping disc 10. Rotation of the container 39 in a clockwise direction, whereby to feed abrasive material to the lapping disc 10 when the latter is being driven, may be effected, for example, by energizing the electric motor 36. Rotation of the container 39 in the opposite or counterclockwise direction, when the lapping disc 10 is not being driven and is idle during periods of insertion and removal of work pieces, may be effected by energizing the electric motor 37. When the container 39 is rotated in a counterclockwise direction, abrasive material is not fed from the upper end of the tube 42. Thus, the container 39 is rotated in one direction for feeding the abrasive mixture to the lapping disc 10 when the latter is being driven, and is rotated in the opposite direction when the lapping disc 10 is idling, whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier. Also, with the rotation of the container 39, the baffle plates 43 aid in agitating the mixture.

The electrical circuit for the lapping disc drive motor 16 and the drive motors 36 and 37 of the abrasive feeding device is schematically shown in FIGURE 4. Incorporated in the electrical circuit is a timer assembly 44 comprising a switch 45 that is responsive to the settings and operation of a timer motor 46. Also operatively connected in the circuit is an overload device indicated generally at 47. When the timer motor 46 is inactive, the switch 45 will assume the position shown in solid lines in FIGURE 4. If the overload device 47 is closed, current will flow through the electric motor 37 whereby the container 39 is driven in a counterclockwise direction for agitating the abrasive mixture therein while the lapping disc drive motor 16 is unenergized and the lapping disc 10 idling. After work pieces have been placed on the lapping disc 10, the timer assembly 44 is set for a predetermined period of operation and when actuated serves to move the switch 45 from the position shown in solid lines in FIGURE 4 to the position shown in dash lines. During the preset time that the timer motor 46 is operating, and again assuming that the overload device 47 is closed, current will flow both to the lapping disc drive motor 16 and the drive motor 36 of the abrasive feeding device, whereby abrasive material is fed to the rotating lapping disc 10. Upon completion of the lapping cycle, the switch 45 will return to the position shown in solid lines in FIGURE 4, thereby interrupting energization of the lapping disc drive motor 16 and the drive motor 36 of the abrasive feeding device and again effecting energization of the drive motor 37 of the abrasive feeding device. Those skilled in the art will recognize that a single reversible electric motor may be substituted for the two individual electric motors 36 and 37.

Referring now to FIGURES 5 and 6, I shall describe the modified embodiment of drive means which I provide for the abrasive feeding device. This embodiment of drive means comprises a small electric motor 48 having a drive shaft 49 suitably connected to the input member of a speed reducer or reducing gear box 50. The output member or shaft 51 of the speed reducer 50 projects into an opening 52 formed in the hub 40 of the container 39. The periphery of the output shaft 51 engages the walls of opening 52 so that a frictional driving connection is normally established between the output shaft 51 and the container 39. I also provide reversing means indicated generally at 53 which is operable to effect a positive reverse driving connection between the output shaft 51 and the hub 40, while overriding the normal frictional driving connection therebetween. The reversing means comprises a first gear 54 suitably secured to the output shaft 51, and a second gear 55 defined by external gear teeth formed in the hub 40. Driving connection between the gears 54 and 55 is adapted to be selectively effected by means of a cluster of gears comprising a pair of meshing gears 56 and 57, and a gear 58 having a radius equal to the sum of the diameter of gear 56 and radius of gear 57. The gear 56 is journalled on a shaft 59 suitably secured at one end in a lever 60, while the gears 57 and 58 are secured to the opposite ends of a shaft 61 journalled intermediate of its ends in the lever 60. The lever 60, in turn, is pivotally mounted at 62 to the projecting arm portion 63 of the speed reducer or gear box 50. When the lever 60 is in the position shown in FIGURE 6, and the gears 56 and 58 remain disengaged from the gears 54 and 55, energization of the electric motor effects rotation of the container 39 in one direction for feeding abrasive material to the lapping disc 10. When the lever 60 is pivoted upwardly from the position shown in FIGURE 6 so as to dispose the gears 56 and 58 into meshing engagement with the gears 54 and 55, energization of the motor 48 effects rotation of the container 39 in the opposite direction. In the normal course of events, when the lapping disc 10 is being rotated for lapping work pieces, the lever 60 will be positioned as shown, and, when the lapping disc 10 is idling, the lever 60 will be pivoted upwardly for rendering the reversing means 53 operable. Pivotal movement of the lever 60 may be accomplished manually or by conventional solenoid means.

Used abrasive mixture flowing from the lapping surface of the disc 10 is collected in the drip-pan supporting member 11. As used abrasive material flows down the outer periphery of the disc 10, a portion is thrown radially outwardly from the lower circumferental edge of the disc and, since the undersurface of the disc 10 lies below the plane of housing wall 8, such abrasive material strikes the annular wall of the member 11. The remainder follows the lower surface of lap 10 inwardly, dripping therefrom as it moves along, the residual abrasive material dripping from the lower circumferential edge of opening 23 in disc 10. As the abrasive material drips from the lower surface of the lap 10, it is received by the horizontal wall of the member 11. By arranging the opening 23 with a diameter greater than the diameter of the opening 12 in the drip-pan member 11, used abrasive material is prevented from reaching the hub 18 and the operative mechanism below.

A drain spout 64 is secured in the base of the drip-pan supporting member for draining it. A wiper bar 65 is threaded into the driving hub 18 for rotaion therewith, and the free end thereof serves to sweep collected abrasive material toward the drain spout 64. The drain

spout 64 is inclined downwardly, extending through an opening in the side wall of the housing 7.

While I have shown and described preferred embodiments of my present invention, it will be understood by those skilled in the art that various modifications and rearrangements may be made therein without departing from the spirit and scope of my invention.

I claim:

1. In a device for feeding a freely flowing material comprised of abrasive particles and a carrier to a machine tool, the combination of container means adapted to receive the freely flowing material, said container means serving to feed material therefrom upon rotation in one direction, and means for rotating said container means in said one direction when the machine tool is in operation and in the opposite direction when the machine tool is idling whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

2. In a device for feeding a freely flowing material comprised of abrasive particles and a carrier to a machine tool, the combination of a container rotatably mounted on an inclined axis and being adapted to receive the freely flowing material, a helically wound tube fixedly mounted in said container, said tube having a lower end open to the lower portion of said container to receive material therefrom and having an upper end opening outwardly of said container to feed material therefrom upon rotation of said container in one direction, and means for rotating said container in said one direction when the machine tool is in operation and in the opposite direction when the machine tool is idling whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

3. In a device for feeding a freely flowing material comprised of abrasive particles and a carrier to a machine tool, the combination of a container rotatably mounted on an inclined axis and being adapted to receive the freely flowing material, a helically wound tube fixedly mounted in said container, said tube having a lower end open to the lower portion of said container to receive material therefrom and having an upper end opening outwardly of said container to feed material therefrom upon rotation of said container in one direction, means for rotating said container in said one direction when the machine tool is in operation, and means for rotating said container in the opposite direction when the machine tool is idling, whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

4. In a device for feeding a freely flowing material comprised of abrasive particles and a carrier to a machine tool, the combination of a container rotatably mounted on an inclined axis and being adapted to receive the freely flowing material, a helically wound tube fixedly mounted in said container, said tube having a lower end open to the lower portion of said container to receive material therefrom and having an upper end opening outwardly of said container to feed material therefrom upon rotation of said container in one direction, a speed reducer having an output member connected to said container, first drive means connected to the input member of said speed reducer for effecting rotation of said container in said one direction when the machine tool is in operation, and second drive means connected to the input member of said speed reducer for effecting rotation of said container in the opposite direction when the machine tool is idling, whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

5. The combination defined in claim 4, wherein said first and second drive means are each comprised of an electric motor.

6. In a device for feeding a freely flowing material comprised of abrasive particles and a carrier to a machine tool, the combination of a container rotatably mounted on an inclined axis and being adapted to receive the freely flowing material, a helically wound tube fixedly mounted in said container, said tube having a lower end open to the lower portion of said container to receive material therefrom and having an upper end opening outwardly of said container to feed material therefrom upon rotation of said container in one direction, means having a frictional driving connection with said container for rotating the latter in said one direction when the machine tool is in operation, and reversing means operable to effect a positive driving connection between said last-named means and said container for causing rotation of the latter in the opposite direction when the machine tool is idling, whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

7. In a device for feeding a freely flowing material comprised of abrasive particles and a carrier to a machine tool, the combination of a container rotatably mounted on an inclined axis and being adapted to receive the freely flowing material, a helically wound tube fixedly mounted in said container, said tube having a lower end open to the lower portion of said container to receive material therefrom and having an upper end opening outwardly of said container to feed material therefrom upon rotation of said container in one direction, a speed reducer having an output member frictionally connected to said container, drive means connected to the input member of said speed reducer for effecting rotation of said container in said one direction when the machine tool is in operation, and reversing means operable to effect a positive driving connection between said output member of said speed reducer and said container for causing rotation of the latter in the opposite direction when the machine tool is idling, whereby the material is continuously agitated so as to maintain the abrasive particles in suspension in the carrier.

8. The combination defined in claim 7 wherein said drive means is comprised of an electric motor and said reversing means is comprised of a cluster of gears.

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