United States Patent

Langhoff

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[54] **KNIFE GRINDING DEVICE FOR A MOTOR-DRIVEN CUTTING TOOL**

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[52] **U.S. Cl.**.....**51/246**

[51] **Int. Cl.**.....**B24b 19/00**

[58] **Field of Search**.....51/246

[56] **References Cited**

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Primary Examiner—Richard J. Herbst

Attorney—Edwin E. Greigg

[57] **ABSTRACT**

In a motor-driven cutting tool, at either side of the knife there are arranged rotary grinding elements supported by a grinder head reciprocating parallel to the knife. Mechanical means are provided which, as the grinder head moves in the one or the other direction, displace the one or the other grinding element and cause them to engage and thus grind alternately the two knife blade faces. The period of applying the force to said grinding elements during the reciprocation of the grinder head is changeable for grinding only selected ranges of the knife blade faces.

4 Claims, 8 Drawing Figures

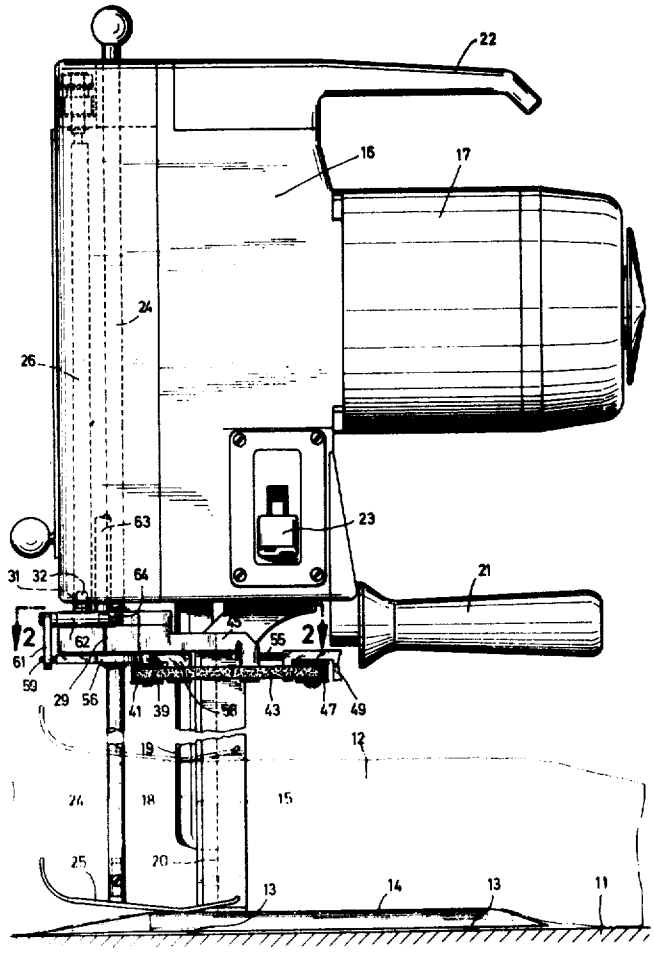

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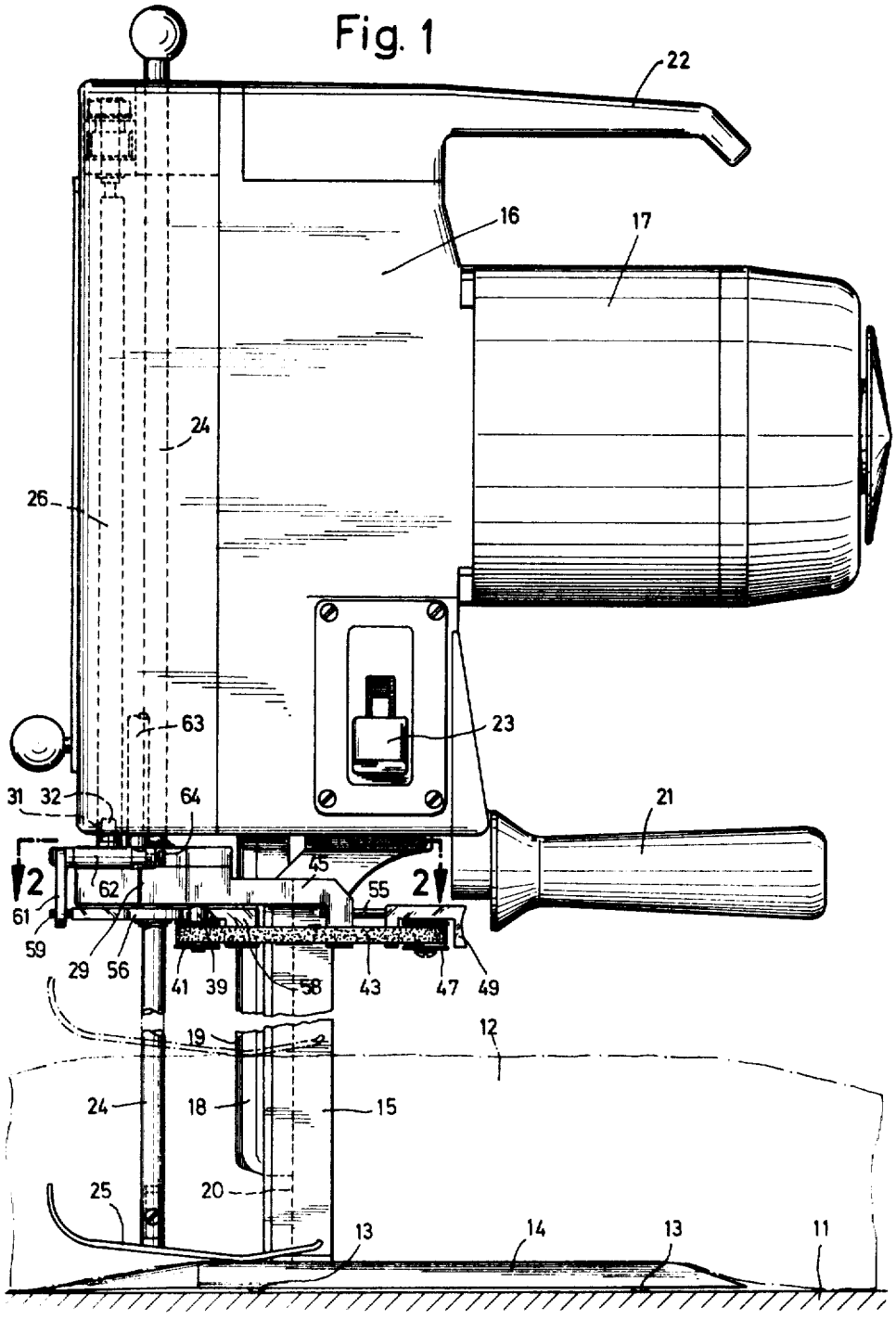
Fig. 1



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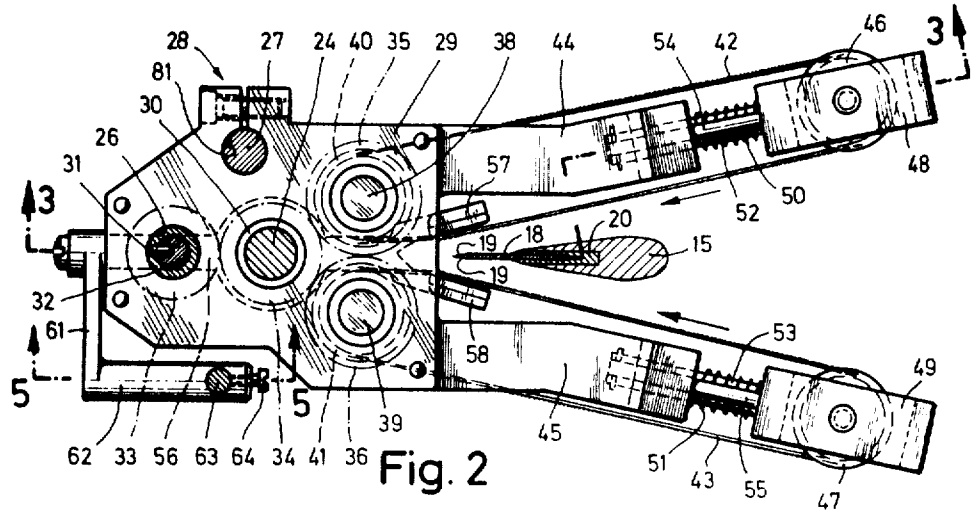
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Fig. 2

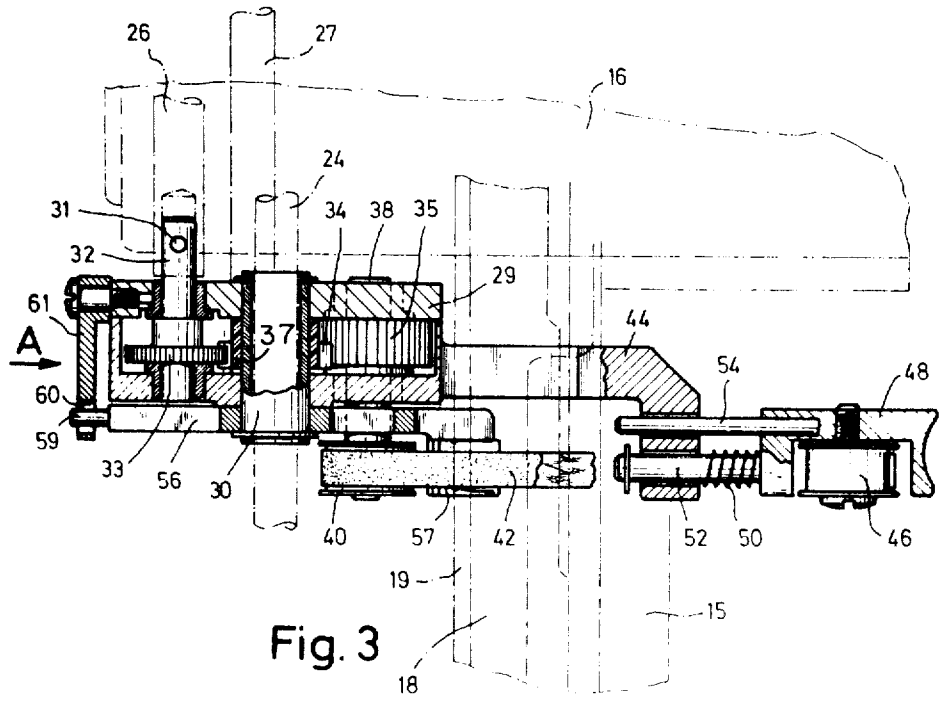
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Fig. 3

Fig. 4

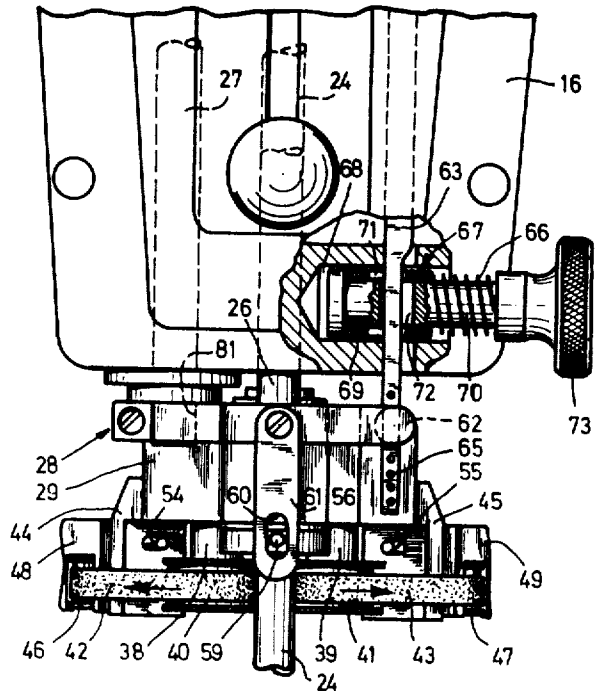
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Fig. 5

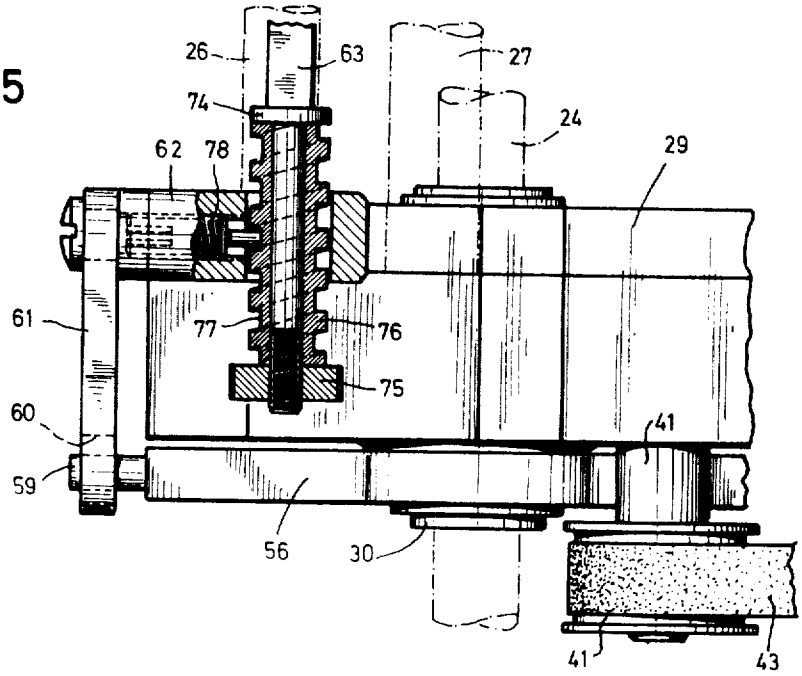
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Fig. 6

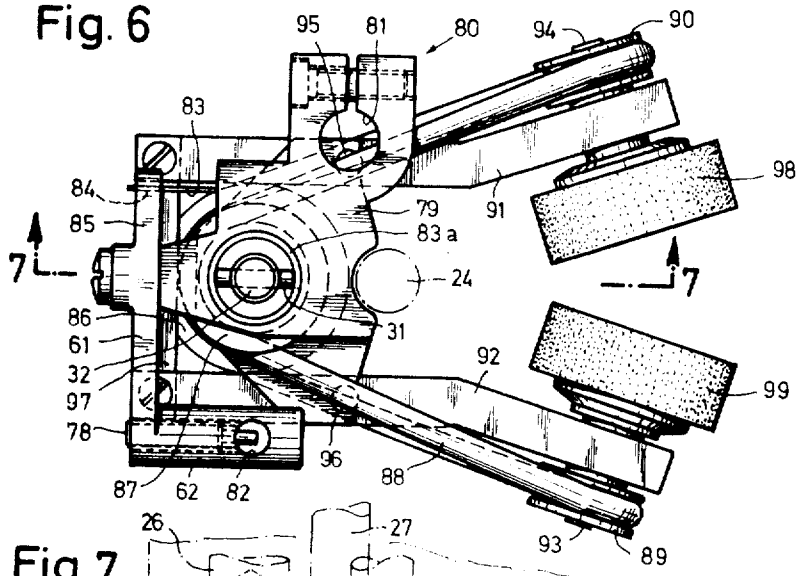


Fig. 7

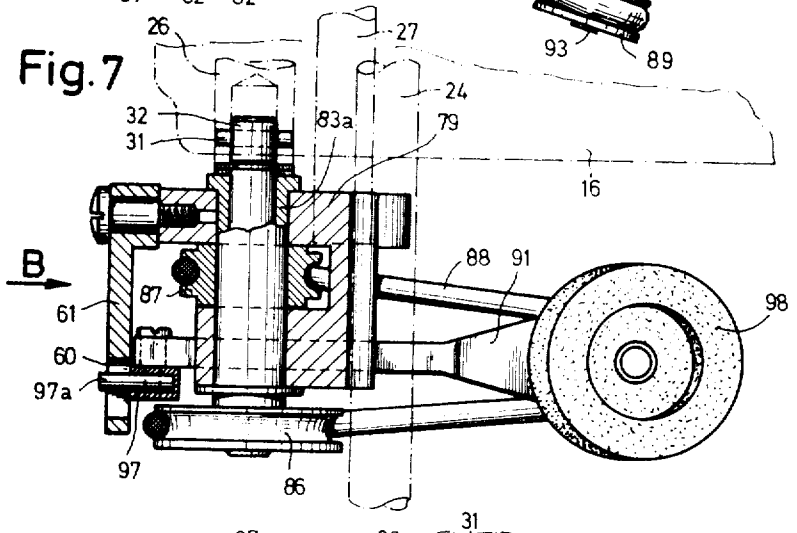
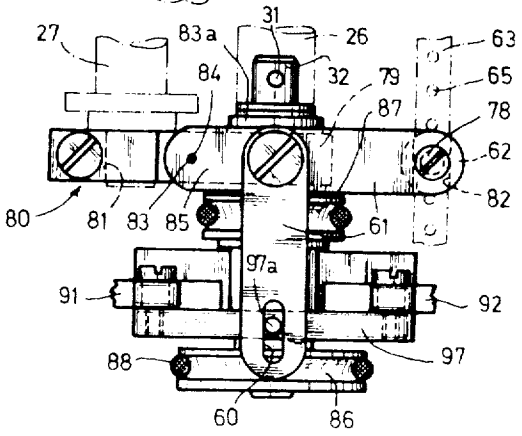


Fig. 8



KNIFE GRINDING DEVICE FOR A MOTOR-DRIVEN CUTTING TOOL

BACKGROUND OF THE INVENTION

This invention relates to a motor-driven cutting tool having a vertically reciprocating knife advanced through the material in the cutting direction and a grinder head secured to a vertically reciprocated lifting rod. The grinder head comprises, at either side of the knife, two laterally arranged swinger arms which may be pivoted into operational positions from a position of rest into which they are urged by spring means. Each swinger arm carries a driven grinding member selectively placeable into engagement with one or the other knife blade face by means of a setting member provided on the grinder head.

In known cutting devices of the aforenoted type, that swinger arm which, with its grinding member, is in an operative position, is swung away from such position by means of guiding components mounted on the cutting tool when the grinder head, during its reciprocation, is in the upper dead center. At the same time, the said guiding components also cause the other swinger arm to pivot and to assume its operating (grinding) position as the downward stroke of the grinder head begins. In a structure of this type it is thus not possible to interfere with either of the swinger arms in their respective operative position, after the grinder head leaves the upper dead center. Therefore, the stroke range of the grinder head has to be designed in such a manner that in its lower dead center it does not project beyond the range of the lower knife end.

Devices of the aforenoted type are further known wherein, with the aid of remote controlled setting magnets, the swinger arms may be switched even in the lower dead center.

The invention is based on the recognition that, for the purpose of improving the grinding operation, it would be desirable to move the swinger arm with the grinding element from its operative (grinding) position in the range of the lower dead center in such a manner that it omits the lower stroke reversal range from the grinding operation proper. It is noted that because of the stroke reversal, there is a lower stroke speed before and after the stroke reversal, so that in this range the grinding effect is decreased.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved manually movable motor operated cutting tool in which the aforenoted desired mode of grinding operation is achieved purely with mechanical means.

Briefly stated, according to the invention, the setting member for pivoting the swinger arms is formed as a control rod moved by the vertically reciprocating grinder head through an adjustable linkage. The control rod is guided through an adjustable brake provided on the cutting tool. In the actuated position of the brake, the setting motion of the control rod effected by its delayed motion with respect to the grinder head is transmitted through said linkage to the swinger arms in such a manner that, dependent upon the direction of stroke of the grinder head, one or the other swinger arm is in an operative position with its grinding member with respect to one knife blade face. Further, the control rod has portions which are unaffected by the brake and which thus provide that only certain predetermined portions of the knife blade edges are submitted to the grinding operation.

The invention will be better understood as well as further objects and advantages will become more apparent from the ensuing detailed specification of several exemplary embodiments taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of one embodiment of the invention;

FIG. 2 is a sectional view along line 2—2 of FIG. 1 (some components are omitted for the sake of clarity);

FIG. 3 is a sectional view along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary front elevational view taken in the direction of arrow A shown in FIG. 3;

FIG. 5 is an enlarged front elevational view, partially in section, of a variant of some components of the same embodiment;

FIG. 6 is a view of a variant of a component taken similarly to FIG. 2;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 6; and

FIG. 8 is a front elevational view of one component of the device taken in the direction of the arrow B shown in FIG. 7.

DESCRIPTION OF THE EMBODIMENTS

Turning now to FIG. 1, the cutting tool shown therein may be guided manually on a table 11 which supports a material 12 to be cut. The cutting tool is provided with a foot plate 14 carrying table-engaging rollers 13 and moving under the material 12. The foot plate 14 is attached to the underside of the housing 16 of the cutting tool by means of a leg 15. To the housing 16 there is secured an electric motor 17 which, in a known and therefore not illustrated manner, causes a knife 18 to reciprocate vertically. The knife 18 is, at its end remote from the knife blade faces 19 (FIG. 2) guided in a knife sheath 20 which, in turn, is held in a suitable opening provided lengthwise in the leg 15.

A handle 21 serves for guiding the cutting tool during operation, while a carrier handle 22 may be used for transporting the same. For the control of the electric motor 17 there is provided a switch 23 mounted on the housing 16. In the leading portion of the housing 16 there is guided a pressure rod 24 to the lower terminus of which there is secured a material pressing plate 25 which holds the material immediately adjacent the knife 18 during the cutting operation. Further, in said portion of the housing 16, there is disposed a drive shaft 26 rotated by the motor 17. The same housing portion also holds a lifting rod 27 which, in a known manner, is vertically reciprocated by the electric motor 17.

To the lifting rod 27 there is affixed, by clamping means 28 (FIG. 2), a grinder head 29 which, when the lifting rod is operating, is vertically reciprocated by the latter.

According to the embodiment shown in FIGS. 1–4, the grinder head 29 contains a guiding sleeve 30 which surrounds and slides on the pressure rod 24. The drive shaft 26, which is extensible to follow the displacements of the lifting rod 27, transmits its rotary motion

to a pinion 33 through a rotary pin 32 keyed to the shaft 26 by means of a transverse pin 31. The pinion 33 meshes with an intermediate pinion 34 which, in turn, meshes with two adjacent spur gears 35 and 36. The intermediate pinion 34 is held on the guide sleeve 30 by means of a collar 37, while the two spur gears 35 and 36 are keyed to respective shafts 38 and 39 supported in the grinder head 29. The shafts 38 and 39 project downwardly beyond the grinder head 29 and carry at their free ends pulleys 40 and 41, respectively.

About the pulleys 40 and 41 there are trained endless abrasive grinding belts 42 and 43, respectively, which, at the end of arms 44 and 45, are trained about respective tensioning idler pulleys 46 and 47. The latter are held in respective bearing brackets 48 and 49 having pins 52 and 53 slidably held in the terminus of arms 44, 45. Springs 50, 51 urge the bearing brackets 48 and 49 with their respective pulleys 46, 47 away from arms 44, 45 and thus, the abrasive belts 42, 43 are resiliently tensioned. The bearing brackets 48, 49 are prevented from rotating by pins 54, 55 also slidably received in arms 44, 45. This tensioning feature is best illustrated in FIGS. 2 and 3.

Immediately below the grinder head 29, on the downwardly extending part of the guide sleeve 30, there is swingably arranged a lever 56 which has a forked end to which there are attached guide shoes 57 and 58. The latter, in their central position shown in FIG. 2, engage the inner side of one flight of abrasive belts 42 and 43. The fork tines with the guide shoes 57 and 58 have the function of the swinger arms referred to in the introductory part of the specification. If the lever 56 is swung in one direction, one of the guide shoes 57 or 58 moves towards the adjacent knife blade face 19 of the knife 18 and deflects the grinding belt 42 or 43 urging it against said knife blade face, while the bracket 48 or 49 associated with the deflected grinding belt, moves against the force of the respective spring 50 or 51.

Turning now to FIG. 4, a pin 59 affixed to that end of the lever 56 that is remote from the guide shoes 57 and 58, passes through a slot 60 provided in one arm of a bell crank lever 61 serving as an adjustable linkage. At the end of the other arm of bell crank 61 there is affixed a bar 62 which is oriented opposite the cutting direction of the device and which, in its terminal range, is traversed by a control rod 63. According to the embodiment depicted in FIGS. 1–4, the control rod 63 is secured to the bar 62 by a setting screw 64. For ensuring a form-locking relationship between the setting screw 64 and the control rod 63, the latter may be provided with a series of spaced depressions 65 as well shown in FIG. 4.

The control rod 63 also passes through a brake 67 biased by a spring 66. The brake 67 is disposed in a cavity 68 of the housing 16 and has a cup-shaped portion 69 into which there extends a slidable pin 70 surrounded by the spring 66. The pin 70 is provided with a throughgoing opening 72, while the cup-shaped portion 69 has aligned, diametrically opposed openings 71. The spring 66 urges the cup-shaped portion 69 into a position in which the opening 71 on the one hand and the opening 72 on the other hand are out of alignment. As a result, the control rod 63, passing through the openings 71 and 72, is hindered in its motion by virtue of the aforenoted misalignment and the resulting friction caused by spring 66. This frictional effect may be increased or decreased by varying the tension of the spring 66 by turning a knurled knob 73. In the position of the control rod as shown in FIG. 4, the openings 71, 72 define a cross section which is larger than the full cross section of the control rod 63 in the range of the brake 67, so that the latter has no effect on the control rod 63. The lever 56 is, with the swinger arms carrying the guide shoes 57 and 58, in its middle position as shown in FIG. 2, whereas the grinder head 29 is in its upper dead center.

If, upon starting the motion of the lifting rod 27, the grinder head 29 is moved downwardly, the bell crank 61 moves the control rod 63 downwardly only to a short distance without moving it out of its mid position as shown. The flattened portion of the control rod 63 which, at the beginning of this motion, is disposed within the brake, may move downwardly without being frictionally engaged. As soon as the full cross section of the control rod 63 enters the range of the brake 67, the latter frictionally engages the control rod 63 and first prevents further motion thereof. During this withholding phase of the control rod 63, the latter lags behind the further downwardly moving grinder head 29 and the bell crank 61 is swung counterclockwise when viewed in FIG. 4. As a result, the pin 59 and the associated end of the lever 56 are swung in a horizontal plane until the guide shoe 58 presses the grinding belt 43 against the adjacent knife blade face 19 of the knife 18. Since thereafter no further swinging motion can occur, the downwardly moving grinder head 29 — in the tilted position of the bell crank 61 — pulls the control rod 63 downwardly, whereby the frictional effect of the brake 67 is overcome. During this last-named downward motion, the belt 43 grinds one knife blade face 19. The upper end of the control rod 63 has — similarly to the lower end thereof — a flattened cross section (not shown), so that the brake is ineffective while the last named flattened portion of the control rod passes therethrough. Consequently, in this stroke range, due to the reaction force of the grinding belt 43 biased by spring 51, the bell crank 61 is swung clockwise into its mid position in which no grinding of the knife 18 occurs. The lowest portion of the knife is thus not ground for reasons set forth in the introduction of the specification.

As the grinder head 29 moves upwardly from its lower dead center position, then, in a reverse order, the shown mid position is again first maintained and no grinding takes place. Only when the full cross section of the control rod 63 enters the effective range of the brake 67, is the bell crank 61 — at this time in a clockwise direction — swung until the other guide shoe 57 affixed to the pivoting lever 56 deflects the other grinding belt 42 to such an extent that it engages the other, adjacent knife blade face 19 of the knife 18. A grinding of the last-named blade face takes place during the upward stroke as long as a full cross section of the control rod 63 is present in the effective range of the brake 67.

Turning now to FIGS. 6–8, there is shown a second embodiment of the invention, wherein the grinding elements are formed as rotary grinding discs 98 and 99. The grinder head 79 is provided with a clamping means

80 which is identical in structure and function to the clamping device 28 of the previously described embodiment. The bore 81 receiving the lifting rod 27 is disposed with respect to the pressure rod 24 as in the first embodiment. The bell crank 61 is also designed in the same manner, so that the opening 82 provided therein for receiving the control rod 63 has the same relation to the other parts of the grinder head as in the previously described embodiment. The two embodiments differ from one another in that the spring-secured mid position of the bell crank 61 is effected not by the belt tensioning springs 52 and 53 of the grinding belts 43 and 44, but by means of a spring wire rod 83 which is disposed in the grinder head 79, and which extends through a bore 84 provided in an extension 85 of the bell crank 61.

The rotary pin 32, which is secured to the drive shaft 26 by the transversal pin 31, is in this embodiment held in a sleeve 83*a* positioned in the grinder head 79 and carries, at its end projecting from the grinder head, a drive pulley 86 keyed thereto. A further pulley 87 is freely rotatably supported on the sleeve 83*a*. An endless cord 88 is trained about the drive pulley 86, a driven pulley 89, then about the idling pulley 87, and a further driven pulley 90.

The driven pulleys 89 and 90 are keyed to their respective shafts 93 and 94 held in respective swinger arms 91 and 92 pivotable about respective pins 95, 96 secured to the grinder head 79. That end of each swinger arm 91, 92 which is remote from the grinding elements, is pivotally attached to a guiding bar 97. To the center of the latter there is affixed a pin 97*a* which — similarly to the pin 59 of the preceding embodiment — passes through a slot 60 provided in the bell crank 61.

The grinding elements in this embodiment — as indicated hereinabove — are formed of dish-like abrasive members 98 and 99. In the embodiment according to FIGS. 6–7, the adjusting screw 78 is inserted into the opening 82 of the pin 62 in an opposite direction as compared to the adjusting screw 64 of the previously described embodiment.

The grinder head 79 attached to the lifting rod 27 cooperates with the control rod 63 — brakably guided in the opening 82 — in a manner identical to that in the previously described embodiment.

The desirable interchangeability of the grinder heads 29 and 79 is ensured by the fact that both grinder heads have identically arranged openings and connecting elements for the lifting rod 27, the drive shaft 26 and control rod 63.

Turning now to FIG. 5, there is illustrated a stepless adjusting means for further increasing the possibilities of varying the location of connection between the bell crank 61 and the control rod 63. Accordingly, the lower end of the control rod 63 carries, between a collar 74 and a nut 75, a sleeve 76 which is secured against axial motion and which is provided at its outer lateral face with a helical groove 77. Into the latter there extends the pin of an adjusting screw 78. After loosening the screw 78, the height position of the control rod 63 with respect to the parts moving thereon may be changed in a stepless manner by rotating the sleeve 76. The latter may be immobilized in the selected position by tightening the screw 78.

It is thus seen that in the aforedescribed grinding structures, by selecting the position and length of those portions of the control rod 63 which remain unaffected by the brake 67, the length and the location of the knife blade portions ground by the abrasive elements may be determined. This feature, among others, ensures a penetration of constant, uniform extent into the foot plate that glides under the material to be cut. By changing the point of engagement between the control rod 63 and the bell crank lever 61, the ground and unground portions of the knife may be arbitrarily selected between wide limits for matching them with the condition and configuration of the lower knife end which, as it is well known, substantially changes due to the repeated grinding operations.

That which is claimed is:

1. In a knife grinding device associated with a cutting tool having a knife including two blade faces, said device being of the type having (a) a grinder head reciprocably mounted on said tool, (b) means for causing a reciprocating motion of said grinder head, (c) grinding elements supported by said grinder head and disposed at either side of said knife, (d) swinger arms supported by said grinder head and associated with each grinding element to alternately urge the latter into grinding engagement with one and the other knife blade face during reciprocation of said grinder head, and (e) spring means urging said swinger arms in a mid position in which each grinding element is in a spaced, inoperative position with respect to said knife blade faces, the improvement comprising

A. control rod means affixed to said grinder head to reciprocate therewith; said control rod means having determined brakable and non-brakable portions,

B. linkage means establishing a connection between said control rod means and said swinger arms,

C. brake means operatively associated with said control rod means for frictionally engaging said determined brakable portions of said control rod means to hinder its passage through said brake means during said reciprocating motion and

D. means for causing a swinger arm-actuating displacement of said linkage means when said control rod means is hindered by said brake means to effect said grinding engagement.

2. An improvement as defined in claim 1, including means for connecting said linkage means to said control rod means at any selected one of a plurality of locations along said control rod means.

3. An improvement as defined in claim 1, including

A. a rotatable sleeve axially fixedly held on said control rod means; said sleeve having a helical groove provided in its outer lateral face,

B. pin means mounted on said linkage means and extending into said helical groove at any selected location along said sleeve and

C. means for immobilizing said pin means with respect to said sleeve in said selected location.

4. An improvement as defined in claim 1, including means for interchangeably securing said grinder head to said cutting tool.

* * * * *