March 5, 1957 L. L. HERCIK 2,783,593

CONTROL MECHANISM FOR GRINDING BELT

Filed May 28, 1954

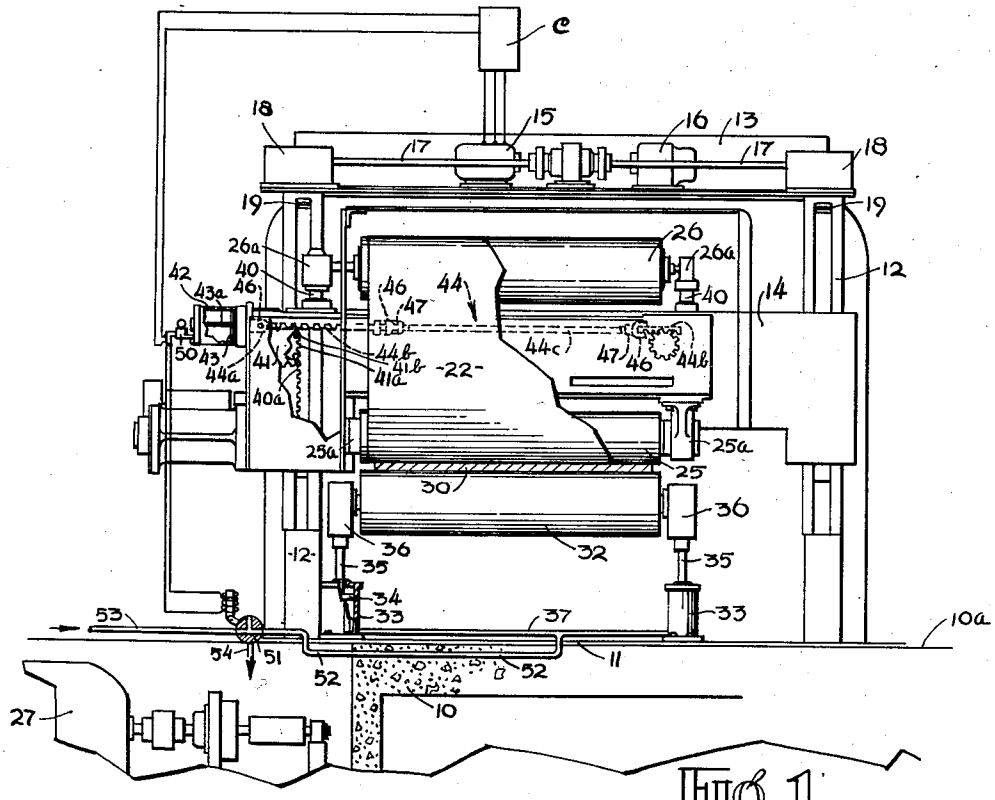


Fig. 1

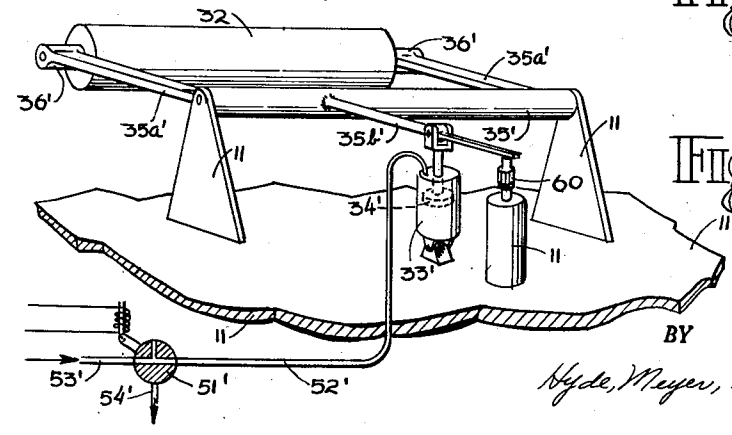


Fig. 2

INVENTOR.
Lad L. Hercik
BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

United States Patent Office 2,783,593 Patented Mar. 5, 1957

2,783,593

CONTROL MECHANISM FOR GRINDING BELT

Lad L. Hercik, Lakewood, Ohio

Application May 28, 1954, Serial No. 433,124

18 Claims. (Cl. 51—135)

This invention relates to improvements in a control mechanism for a belt and more particularly a control mechanism for a grinding belt.

One of the objects of the present invention is to provide a belt for performing an operation, such as a grinding operation, on a workpiece and to provide a means responsive to the breaking of the belt for stopping performance of this operation.

A further object of the present invention is to provide a mechanism for preventing jamming of a grinding belt between a supporting roll for said belt and the workpiece.

Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of this invention will be apparent from the accompanying drawings and description and the essential features will be set forth in the appended claims.

In the drawings,

Fig. 1 is a front elevational view, partially broken away, of a grinding machine embodying the principles of the present invention; while

Fig. 2 is a schematic view of a modified form of construction for supporting the billy roll.

Those familiar with this art will recognize that my invention may be applied in many ways, but I have chosen to illustrate the same in connection with a control mechanism for a grinding belt.

When an endless grinding belt is used for grinding a workpiece, problems occur. Slack must be removed from this belt and the belt tensioned at all times. Also, if the belt should break, it may jam between one of the belt supporting rolls and the workpiece so as to spoil the workpiece. Any damage to the workpiece at this stage of manufacture may be very expensive because grinding generally occurs in a final stage of manufacture after much expensive labor has been performed on the workpiece. Hence, elimination of workpiece spoilage is very important.

It should be clearly understood that the word "grinding," as used in the claims and specification, includes grinding, polishing, and any other type of operation involving the use of abrasives.

Fig. 1 discloses a grinding apparatus of considerable size supported by a firm foundation **10** with a ground line **10***a*, but the principles of the present invention apply with equal force to any size apparatus. The apparatus frame and the foundation includes a base **11** having secured thereto and upwardly extending therefrom a pair of parallel columns **12**, **12** connected together at the top by a connecting head **13** to form a rigid frame. A horizontally extending slide **14** is slidably connected at opposite ends to the columns **12**, **12** and is adapted to move vertically thereon.

A slide elevating mechanism is provided to perform this vertical movement on slide **14** so as to accommodate different working conditions, such as different size work pieces. This elevating mechanism includes motors **15**, **16** operatively connected to a drive shaft **17**, bevel type reduction gear boxes **18**, **18**, and elevating screws **19**, **19** in columns **12**, **12** to raise or lower the slide **14** by having nuts therein coacting with the screws **19**. One motor **15** is for rapidly changing elevation and the other motor **16** is for final accurate adjustment.

In the presently disclosed grinding machine, an endless belt **22** carries abrasive on its periphery or outer surface to serve as a grinding belt, and is adapted to be driven on spaced apart rolls **25** and **26**. The lower roll **25** is rotatably mounted in bearings **25***a*, **25***a* fixed to the slide **14** and is rotatably driven by a motor **27** and a belt with the driving belt omitted from Fig. 1 for clarity. The upper roll **26** is an idler roll while the driver roll **25** is called a contact roll since it drives and backs up the grinding belt **22** during the grinding operation.

Means is provided for urging a workpiece into driving contact with grinding belt **22**. The workpiece may take the form of a plate, sheet or any other suitable object with the workpiece shown herein at **30** in Fig. 1. In the illustrated construction, a billy roll **32** is normally urged upwardly toward the bottom of the contact roll **25** with the workpiece member **30** sandwiched between the grinding belt **22** and the billy roll **32**. In Fig. 1, this urging means takes the form of a pair of cylinders **33**, **33** fixed to the machine base **11** with each having a fluid pressure actuated piston **34** therein with an upwardly extending piston rod **35** secured to a bearing housing **36** for rotatably mounting the billy roll **32** therebetween. When fluid pressure is admitted from a source through inlet conduit **53**, normally open valve **51**, and conduits **52** and **37** to the lower side of the pistons **34**, the billy roll **32** is moved upwardly toward the contact roll **25** until the workpiece member **30** is sandwiched between the billy roll **32** and the outer abrasive carrying surface of the grinding belt **22** for performing the grinding operation. The workpiece member **30** may either travel through or remain stationary in the machine during the grinding operation.

The fluid pressure cylinders **33** are connected by a conduit **37** to equalize the fluid pressure in these cylinders so as to move the bearing housing **36** upwardly and downwardly together and to apply equal pressure on the workpiece member **30** across the full width of the contact roll **32**. The cylinders **33** and pistons **34** are constructed so that the longitudinal axis of the roll **32** reciprocates up and down in a vertical plane coplanar with the longitudinal axis of the contact roll **25** in the Fig. 1 construction.

It should be clearly understood that the workpiece member **30** may be pushed against a contact roll **25** by other back-up members besides the billy roll **32**. For example, this back-up member may take the form of the work table in my copending U. S. patent application entitled "Work Table Support" Serial No. 433,126 filed on May 28, 1954. This work table support is especially useful in grinding a taper, bevel, or other inclined surface on a sheet, plate, or other object.

Means is provided for automatically applying tension to the belt **22** during the grinding operation. In the present disclosure, this takes the form of a fluid pressure actuated mechanism for raising the idler roll **26** until a given belt tension is developed. In the illustrated construction, the idler roll **26** is rotatably mounted at opposite ends in bearing housing **26***a*, **26***a* with each bearing housing secured to the top of a vertically slidable post **40** slidably attached to the slide **14** for vertical movement relative thereto with each post **40** moved vertically by a similar mechanism. Each post **40** has a portion secured thereto and projecting to the left thereof in Fig. 1 with rack teeth **40***a* thereon engaging

with teeth 41*a* of a cluster gear 41 with these details shown most clearly in full line construction on the left in Fig. 1. Each cluster gear 41 is rotatably mounted in a fixed position on slide 14 and is formed from two gear pinions secured together and having gear teeth 41*a* and 41*b* respectively. A cylinder 42, fixed to the slide 14, has a piston 43 therein adapted to move horizontally back and forth with a rod 44 connected thereto. This rod 44 is made up in sections including a link section 44*a*, rack sections 44*b*, 44*b* and turnbuckle type connecting link section 44*c*. This rod 44 is suitably mounted in the slide 14 so that it can reciprocate back and forth relative thereto. The rod sections are connected together by three clevis type pivotal connections 46 with each threadably connected on one side to its associated link section and having a lock nut 47 thereon. Each rack section 44*b* has teeth coacting with the cluster gear teeth 41*b* associated therewith while the left end of the link section 44*a* is connected to the piston 43 so that when fluid pressure is applied against the right-hand side of the piston 43, the rod 44 moves toward the left, rotates the cluster gears 41 counterclockwise, and elevates the posts 40 to apply tension to the driving belts 22 by raising or elevating the idler roll 26. Hence, the grinding belt 22 is always under the correct tension, as determined by the fluid pressure, at all times during the grinding operation and no slack can develop therein. It should be apparent that the supporting structure and gear and rack actuating mechanism for opposite sides of the idler roll 26 is symmetrical about the vertical center line of the machine in Fig. 1.

Means is provided for centering the grinding belt 22 on the rolls 25 and 26 and this is especially important when taper grinding is being performed by the work table support in my copending patent application mentioned heretofore or when any forces tend to shift the grinding belt 22 laterally off its proper centered position on the rolls 25, 26. In the present invention, this takes the form of the turnbuckle type link section 44*c* connecting the rack section 44*b*, 44*b* for raising and lowering the idler roll 26. If the grinding belt 22 is to be properly centered on the idler roll 26, the upward force on idler roll 26 must be exerted by each bearing housing 26*a* at opposite ends of this roll 26 in the proper ratio. The turn buckle type link section 44*c* has right and left-hand threads at opposite ends thereof so that rotating this section about its axis will change the upward force exerted on each post 40. After the proper force is being exerted by each post by means of adjusting the turnbuckle type link section 44*c*, the lock nuts 47, 47 on opposite ends thereof may be tightened in position to assure that the bearing housing 26*a*, 26*a* will always move up and down simultaneously and the force ratio exerted by posts 40 will remain constant. As mentioned previously, the bearing housings 36, 36 of the billy roll 32 move upwardly and downwardly together because of the pressure equalizing effect of the conduit 37 connecting the fluid pressure cylinders 33, 33.

Means responsive to any loss of tension in the grinding belt 22 is provided for deactivating the upward urging of the billy roll 32 so that the workpiece member 30 moves downwardly away from the grinding belt 22 and contact roll 25 and out of grinding contact with said belt. For example, if the grinding belt 22 should break, there will be no restraint upon the upward movement of the idler roll 26 under the influence of the fluid pressure. Then, the fluid under pressure will drive the piston 43 in Fig. 1 toward the left so that a stem 43*a* thereon will actuate a microswitch 50 secured to the cylinder 42. This piston actuating force may be caused either by more fluid under pressure being supplied from a pressure source to cylinder 42 or by the entrapped fluid pressure in cylinder 42 expanding on release of the restraint by belt 22. This actuation of this microswitch 50 completes an electrical circuit to close solenoid operated normally open valve 51 to exhaust the fluid pressure containing cylinders 33 through conduits 37 and 52, closed valve 51, and exhaust port 54. Then, the billy roll 32 will be moved downwardly by gravity to its lowered position because fluid pressure will no longer be exerted upwardly on the lower face of the pistons 34.

Microswitch 50 will be actuated not only if belt 22 breaks but also if excess slack develops in the belt after idler roll 26 is near the upward limit of its travel or if the belt 22 stretches beyond a predetermined size during use. In each situation, the microswitch 50 is responsive to the upwardly movement of the idler roll 26 a predetermined distance from the contact roll 25 to take up loss in tension in belt 22. The activation of switch 50 deactivates the urging means for the billy roll 32 to stop performance of the grinding operation on the workpiece 30 by releasing the fluid pressure from the cylinders 33 of the urging means so that the billy roll 32 drops by gravity. Hence, this mechanism is especially designed to prevent pile-up of the grinding belt 22 between the contact roll 25 and the workpiece member 30 when the grinding belt 22 breaks so as to minimize damage to the workpiece.

A modified form of construction is shown in Fig. 2 for urging the billy roll 32 upwardly toward the contact roll 25. Here, billy roll 32 is rotatably supported in bearing housings 36', 36' carried at the outer ends of arms 35*a*', 35*a*' of a bell crank 35' rotatably mounted on the machine base 11. A cylinder 35' is pivotally connected at one end to the machine frame base 11 and has a fluid pressure actuated reciprocating piston 34' therein with its piston rod connected pivotally to the outer end of an arm 35*b*' of the bell crank 35'. Hence, fluid pressure from a source through inlet conduit 53', normally open valve 51' and conduit 52' exerted against the top face of the piston 34' will urge the billy roll 32 upwardly against the bottom of the contact roll 25. When normally open solenoid operated valve 51' is moved to its closed and exhausting position by actuation of the microswitch 50, the fluid pressure in the cylinder 33' will be exhausted through the conduit 52', closed valve 51' and exhaust conduit 54' to lower billy roll 32.

If desired, an adjustable micrometer stop 60 can be provided on the machine frame 11 against which the distal end of the bell crank arm 35*b*' is adapted to bear so as to control the approach distance between the rolls 25 and 32.

Basically, this modification in Fig. 2 functions exactly the same as the construction shown in Fig. 1. However, the Fig. 2 construction has certain advantages. First, the micrometer stop 60 provides an accurate control of the ground thickness on the workpiece member 30. Second, there is no tendency to twist the billy roll 32 or bind the air pistons 34, as may be experienced in the Fig. 1 construction because of a differential in fluid pressure in the two cylinders 33. The cylinder and piston unit 33', 34' in Fig. 2 exerts its force substantially equally on opposite ends of billy roll 32. Third, the single piston and cylinder 33', 34' in Fig. 2 assures more rapid and trouble-free advance to the grinding position and retraction therefrom of the billy roll 32. In the Fig. 1 construction, twisting may occur due to binding of the pistons inside the two cylinders 33, 33. The Fig. 2 construction eliminates this difficulty since only one cylinder 33' is exhausted.

The many advantages of two separate motors 15, 16 should be apparent. The rapid elevation or rapid traverse motor 15 provides fast approach of abrasive belt 22 to the workpiece 30 while the other motor 16 provides final accurate adjustment of the amount of stock removed from the workpiece 30. Rapid traverse motor 15 will raise or lower slide 14 respectively when a controller on the motor control box C is moved to forward or reverse position in a conventional manner. When belt 22 breaks, the closing of switch 50 also establishes

the proper circuit in control box C to rotate rapid traverse motor 15 in the direction to rapidly raise slide 14 to prevent damage by said belt, since it is no longer biased against the workpiece 30.

It should be apparent that the workpiece 30 and belt 22 may be moved out of contact by either rapid traverse motor 15 or exhausting of solenoid actuated valve (51 or 51') or by both these devices, whichever construction is desired.

It should be clearly apparent that any type fluid pressure can be used for operating this grinding machine with this fluid taking the form of air, oil, etc.

This invention also contemplates the inclusion within its scope of a belt for performing any operation, not only a grinding operation, with one or more of the aforementioned belt control means thereon.

Various changes in details and arrangement of parts can be made by one skilled in the art without departing from either the spirit of this invention or the scope of the appended claims.

What I claim is:

1. In combination, a grinding belt, means for urging said belt and a workpiece member toward each other, and means responsive to loss of tension in said belt for deactivating said urging means.

2. In combination, a grinding belt, means for urging said belt and a workpiece member toward each other, and means responsive to the breaking of said belt for deactivating said urging means.

3. In combination, a grinding belt, means for urging said belt and a workpiece member toward each other, means independent of said first mentioned means for applying tension to said belt, and means responsive to loss of tension in said belt for deactivating said urging means.

4. In combination, a grinding belt, means movable in one direction for urging said belt and a workpiece member toward each other, and means for applying tension to said belt and for deactivating said urging means by movement in the opposite direction in response to loss of tension in said belt.

5. In combination, a grinding belt for performing a grinding operation on a workpiece, means movable in one direction for urging said grinding belt and workpiece together into grinding contact, and means responsive to the breaking of said belt for deactivating said urging means by movement in the opposite direction and stopping performance of said grinding operation on said workpiece to minimize damage to said workpiece.

6. In combination, a grinding belt for performing a grinding operation on a workpiece, means for urging said grinding belt and workpiece together into grinding contact, means for automatically applying tension to said belt spaced from said urging force, and means responsive to loss of tension in said belt for deactivating said urging means and stopping performance of said grinding operation on said workpiece.

7. In combination, a grinding belt member for performing a grinding operation on a workpiece member, means for moving at least one of said members in one direction into grinding contact, and means responsive to loss of tension in said belt member for moving said one member in the opposite direction out of grinding contact.

8. In a grinding apparatus, spaced apart rolls, an endless grinding belt adapted to be driven on said rolls, means for normally urging a workpiece member independent of said rolls against said belt, and means responsive to loss of tension in said belt for deactivating said urging means to permit separation of said belt and member.

9. In combination, spaced apart contact and idler rolls, an endless grinding belt adapted to be driven on said rolls, means for normally urging a workpiece member toward said belt and end contact roll, and means responsive to movement of said idler roll a predetermined distance from the contact roll for deactivating said urging means.

10. In a grinding apparatus, spaced apart rolls, an endless grinding belt adapted to be driven on said rolls, another roll, means for normally urging said other roll toward said belt and contact roll with a workpiece member sandwiched therebetween, and means responsive to loss of tension in said belt for deactivating said urging means.

11. In a grinding apparatus, spaced apart rolls, an endless grinding belt adapted to be driven on said rolls, another roll, means for moving said other roll toward said belt and contact roll with a workpiece member sandwiched therebetween, and means responsive to loss of tension in said belt for moving said other roll away from said contact roll.

12. In combination, spaced apart contact and idler rolls, an endless grinding belt adapted to be driven on said rolls, means for normally urging a workpiece member toward said belt, means for tensioning said belt, and means responsive to movement of said idler roll a predetermined distance from the contact roll for deactivating said urging means, said belt tensioning means and urging means being fluid pressure actuated with deactivation releasing said fluid pressure of said urging means.

13. In a grinding apparatus, spaced apart contact and idler rolls, an endless grinding belt adapted to be driven on said rolls, a billy roll, means for supporting said billy roll with a workpiece member sandwiched between said billy roll and said belt and contact roll, a fluid pressure operated piston operatively connected to said idler roll with fluid pressure urging said piston in one direction and restrained by said belt, and means for disabling said billy roll support responsive to movement of said piston in said one direction upon loss of restraint by said belt.

14. In combination, spaced apart rolls, an endless grinding belt adapted to be driven on said rolls, and means for automatically tensioning said belt by moving one of said rolls relative to the other, said belt tensioning means including fluid pressure actuated means for simultaneously moving opposite ends of said one roll away from the other roll and including means for adjusting the belt tensioning force ratio exerted on opposite ends of said one roll, said one roll being of substantial axial length.

15. In the combination, as set forth in claim 6, wherein said last mentioned means includes power operated electric motor driven means for moving said belt away from said member upon deactivation.

16. In the combination set forth in claim 1, wherein said member is located outside the outer surface of said belt.

17. In the combination set forth in claim 1, wherein said member and belt are mounted for relative movement during driving of said belt.

18. In the combination set forth in claim 3, wherein said urging means and tension applying means are effective on spaced apart zones of said belt.

References Cited in the file of this patent

UNITED STATES PATENTS

313,035	Vernon	Feb. 24, 1885
1,150,155	Summer	Aug. 17, 1915
1,179,999	Blevney	Apr. 18, 1916
1,919,477	Nash	July 25, 1933
1,927,203	DeGroot	Sept. 19, 1933
2,311,268	Tannewitz	Feb. 16, 1943
2,500,321	Petersen	Mar. 14, 1950
2,607,373	Crane	Aug. 19, 1952
2,648,176	Zimmerman	Aug. 11, 1953
2,661,780	Morgan	Dec. 8, 1953