April 7, 1970 R. D. RUTT 3,504,458

GRINDING MACHINE

Filed July 19, 1967 2 Sheets-Sheet 1

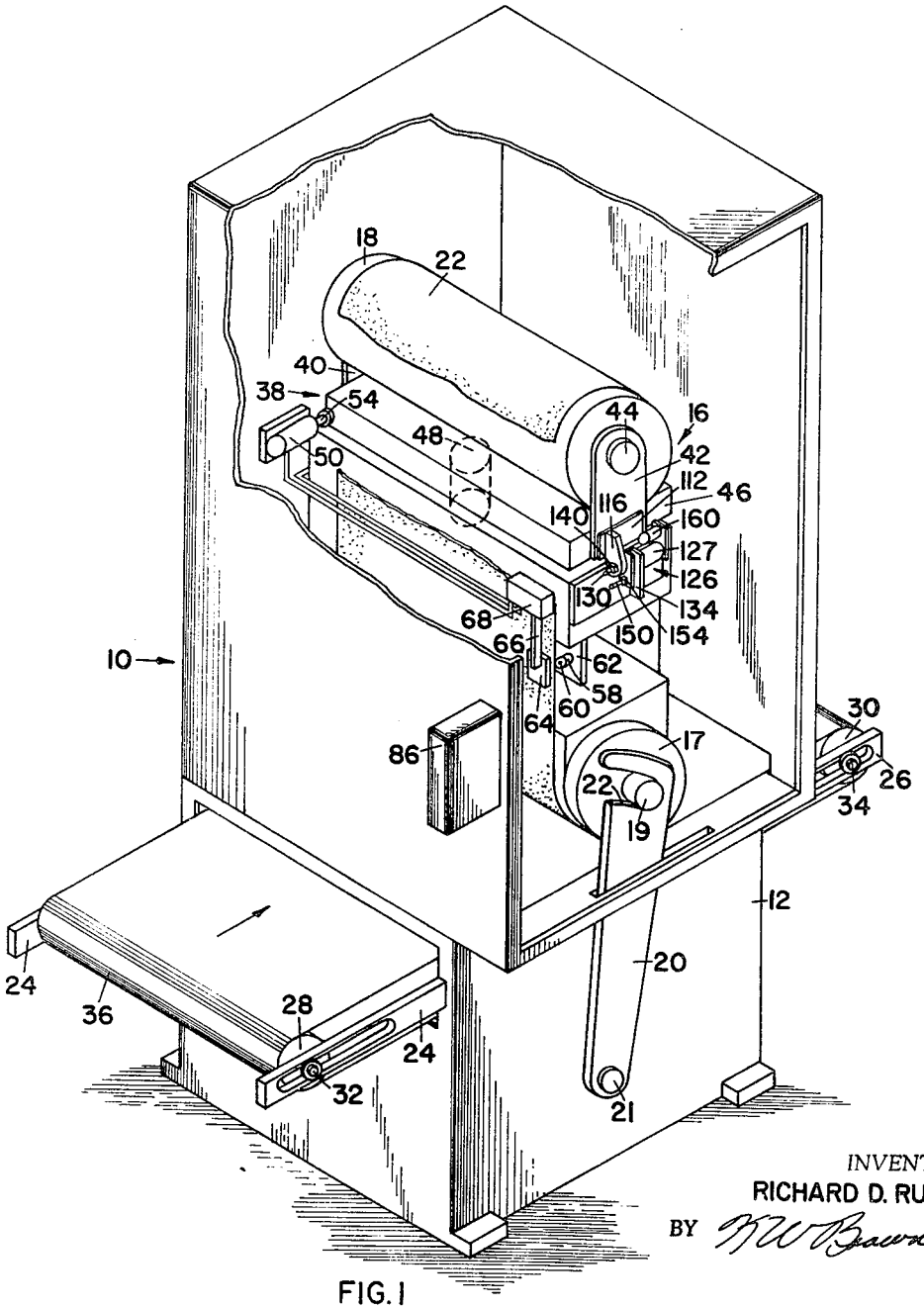


FIG. 1

INVENTOR.
RICHARD D. RUTT
BY

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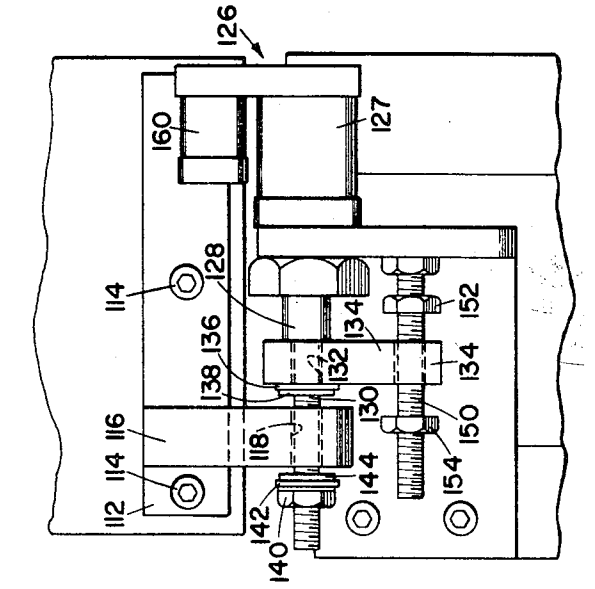


FIG. 2

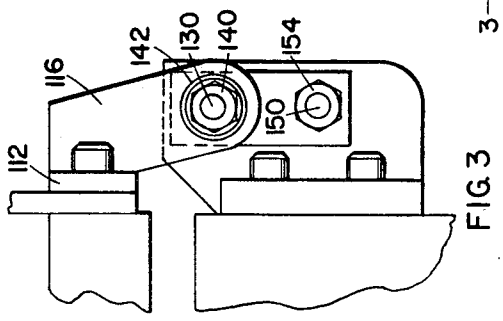


FIG. 3

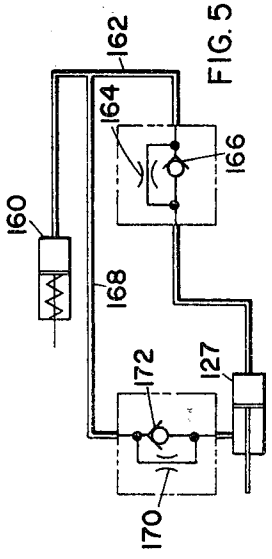


FIG. 5

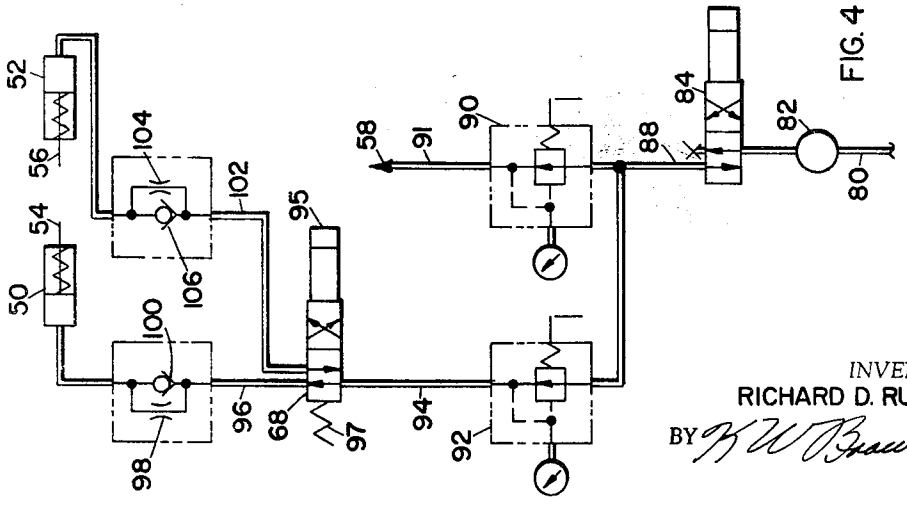


FIG. 4

INVENTOR.
RICHARD D. RUTT
BY

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3,504,458

GRINDING MACHINE

Richard D. Rutt, Wilson, N.Y., assignor to The Carborundum Company, Niagara Falls, N.Y.

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Int. Cl. B24b 21/18
U.S. Cl. 51—135 6 Claims

ABSTRACT OF THE DISCLOSURE

A grinding machine having a tracking roll pivotable about an axis perpendicular to the longitudinal axis of the roll. An extension arm is provided at the end of the roll and is moveable back and forth between a pair of spaced stops for limiting the oscillating movement of the roll. A double acting hydraulic cylinder is provided for adjusting the oscillation range of the roll by moving the stops in unison when the extension arm tends to dwell against one of the stops.

This invention relates to grinding machines and, more particularly, to means for controlling the tracking of an abrasive belt on a grinding head.

In grinding machines of the type employing abrasive belts, it is generally known to provide a grinding head having a tracking roll and a contact roll about which an endless abrasive belt is trained for movement in an orbital path. Because of fabrication problems and varying stretch characteristics of an abrasive belt, the belt defines an orbital path that is not a true cylinder and tends to move axially off the rolls. Accordingly, means are provided for controlling oscillation of the belt on the rolls to retain the belt thereon. These means may assume various forms but a common expedient is to provide control means responsive to lateral movement of the belt to move the tracking roll about an axis substantially perpendicular to the longitudinal axis of the tracking roll to steer the belt in the direction desired. The end of the tracking roll is provided with an extension which is disposed between a pair of spaced stop nuts for mechanically limiting arcuate movement of the end of the tracking roll. The stop nuts are mounted on a screw which is manually rotated through means of a worm connection. Due to the change in the geometry of an abrasive belt in use, it will not oscillate uniformly causing the extension to dwell against one of the stop nuts. The operator rotates the screw to laterally move the stop nuts in unison until the belt against oscillates uniformly.

A major problem experienced with these manually operable devices is that the operator's attention is constantly required to adjust the stop nuts to maintain uniform belt oscillation. In the event an operator fails to notice, and correct for, a change in oscillation uniformity, the tracking pulley extension arm will dwell against one of the stop nuts for an increasing period of time. The edge of the belt will quickly move in one direction and slowly return until the changing belt geometry requires stop adjustment beyond the manually imposed limitation, at which time the belt continues in one direction even though pressure is being applied to direct the belt in the other direction. This may result in a broken belt which impairs efficiency and represents excessive costs.

The tracking control means of the present invention, as hereinafter described, provides a solution to the above

problem by providing control means for correcting non-uniformity of belt oscillation by automatically moving the stops laterally when the tracking roll extension tends to dwell against one of the stops.

It is, therefore, an object of the present invention to provide a new and improved grinding machine.

It is another object of the present invention to provide a new and improved grinding machine having novel means for controlling belt tracking.

It is a further object of the present invention to provide a new and improved grinding machine having novel means for automatically maintaining uniformity of belt oscillation on a grinding head.

It is still another object of the present invention to provide a new and improved grinding machine being novel belt tracking control means which is capable of relatively trouble-free operation, requires little maintenance and has a minimum of moving parts.

These and other objects of this invention will become more apparent upon consideration of the following detailed description thereof when taken in conjunction with the following drawings, in which:

FIG. 1 is an isometric view of a grinding machine in which a preferred illustrative embodiment of the invention is incorporated;

FIG. 2 is an enlarged, fragmentary, end elevational view of the belt tracking means for controlling uniformity of belt oscillation constructed in accordance with the principles of this invention;

FIG. 3 is an enlarged, fragmentary view of the belt tracking control means looking in the direction of the arrow 3–3 of FIG. 2;

FIG. 4 is a diagrammatic view illustrating the fluid circuit for the tracking roll; and

FIG. 5 is a diagrammatic view illustrating the fluid circuit for the tracking control means.

Referring to the drawings, and particularly to FIG. 1, it will be observed that a preferred embodiment of the invention constructed in accordance with the principles of this invention is incorporated in a grinding machine, generally designated **10**, having a frame **12** suitably supported on a ground surface. Frame **12** contains a grinding head, generally desginated **16**, having a tracking roll **18** and a contact roll (not shown). An endless abrasive belt **22** is trained about both rolls for movement in an orbital path. Although preferably the contact roll is driven by any suitable power means (not shown), tracking roll **18** may be driven instead within the purview of the present invention. The shaft of the contact roll is journalled at one end in a bearing block **17** having a lug **19** extending therefrom. An elongated arm **20** is pivotally mouted on frame **12** about a horizontal pivot **21** and is provided with a slot **22** for receiving the lug **19** and retaining the contact roll in the proper position relative to the workpiece support.

Frame **12** is provided with beams **24** and **26** extending outwardly from both ends thereof and disposed on both sides of the frame for supporting rollers **28** and **30** journalled for rotation in bearings **32** and **34** mounted adjacent the ends of beams **24** and **26**, respectively. An endless conveyor belt **36** is trained about rollers **28** and **30** for the purpose of advancing workpieces beneath abrasive belt **22** in the direction of the arrow shown in FIG. 1. The means for driving the conveyor belt **36** may be of any conventional variety, and since many such arrangements are known in the art, no illustration or further explanation is believed necessary.

The tracking roll **18** is illustrated as being mounted by means of a yoke, generally designated **38**, having upstanding journal members **40** and **42** for receiving the opposite ends of the tracking roll shaft **44** and secured to a base **46** which is suitably mounted to the framework of grinding head **16** for pivotable movement about a vertical pivot **48**.

A pair of fluid power means, such as pneumatic cylinders **50** and **52** containing pistons having piston rods **54** and **56**, respectively, are connected to one end of the base **46** on opposite sides thereof to pivot said base **46** and thereby tracking roll **18** back and forth about the vertical pivot **48**.

For controlling horizontal pivotable movement of the tracking roll **18** and thereby lateral oscillation of the abrasive belt **22** along the roll, an air discharge jet **58**, having a discharge orifice **60** is suitably mounted on a bracket **62**, in turn secured to the grinding head **16**. The air jet impinges against a swingable paddle **64** which is connected to an electrical switch **66**. A solenoid operated air directional valve **68** acts in response to this switch to direct air to cylinder **50** or **52** as will hereinafter be more fully explained.

Referring now to the diagrammatic showing of the pneumatic circuit in FIG. 4, it will be observed that a pressure line **80** is connected to a suitable source of air (not shown) and is provided with a filter **82** for purifying the air before it enters the system. Pressure line **80** is connected to a control valve **84** having a spool valve, the position of which is controlled by a switch on the control panel **86** for directing or exhausting air from a pressure line **88**. Connected to line **88** is a release valve **90** which in turn is connected to the air discharge jet **58** by means of conduit **91**. Also connected to line **88** is a release valve **92** which in turn is connected by means of conduit **94** to a directional valve **68** having a spool valve, the position of which is controlled by a solenoid **95** and a spring **97**.

Leading from directional valve **68** is a conduit **96** connected to cylinder **50**, conduit **96** being provided with a restricted passageway **98** therein to slow the flow of fluid in one direction but may be bypassed in the return direction by a conduit having a check valve **100**. Also leading from directional valve **68** is a conduit **102** connected to cylinder **52**, conduit **102** being provided with a restricted passageway **104** therein to slow the flow of fluid in one direction but may be bypassed in the return direction by a conduit having a check valve **106**.

It will be understood that as the air jet impinges on paddle **64** to swing the same upwardly and activate switch **66**, solenoid **95** is actuated to displace the spool valve within directional valve **68** to connect conduit **94** to conduit **102** and apply pressure to the head end of cylinder **52**. Piston rod **56** is extended and moves the tracking roll in an arcuate counterclockwise direction as shown in FIG. 1 to move the belt **22** laterally toward the discharge orifice **60**. When the discharge orifice **60** is obstructed by the abrasive belt, paddle **64** will fall downwardly by gravity and de-energize solenoid **95** allowing spring **97** to displace the spool valve within directional valve **68** and apply pressure to the head end of cylinder **50** (this is the condition shown in FIG. 4) and exhaust pressure from the head end of cylinder **52** causing the belt to move laterally away from the discharge orifice **60**.

It is well-known by those skilled in the art that the ends of the tracking roll move through an arc and the length of this arc, or the number of degrees of motion, must be mechanically limited. The important feature of this invention is the provision of a tracking control means which provides automatic control for adjusting the mechanical limiting means. With reference to FIGS. 2, 3, and 4, such tracking control means, generally designated **110**, comprises an elongated bracket **112** suitably secured to the yoke **38** by means of suitable bolts **114**. An extension arm **116** extends downwardly from bracket **112** and is provided with a bore **118** adjacent the free end thereof for a reason hereinafter described.

Suitably secured onto the relatively stationary structure of the grinding head is a tracking cylinder assembly, generally designated **126**, comprising a double acting cylinder **127**, having a piston and a piston rod **128** secured to said piston. Piston rod **128** has a reduced diameter threaded stem portion **130** that extends through a bore **132** of a stop member **134**. A washer **136** and a second washer **138** of reduced diameter are disposed about the threaded stem portion **130** against the stop member **134**. A stop nut **140** is threaded onto the threaded stem portion **130** and spaced from stop member **134** to provide limited axial movement of arm **116**. A washer **142** and a second washer **144** of reduced diameter are disposed about the threaded stem portion **130** against stop nut **140**.

Suitably secured to and extending from the relatively stationary structure of the grinding head **16** is a threaded stud **150** having a pair of axially spaced stop nuts **152** and **154** for a purpose hereinafter explained.

If, due to the varying stretch characteristics of the abrasive belt whereby the belt does not define a true cylinder and tends to move axially off the rolls and the extension arm **116** dwells against one of the stops, i.e., **134** or **140**, the force exerted on the piston in the double acting cylinder **127** will effect axial movement of the stops **134** and **140** in the direction in which arm **116** is biased to free the same and establish a new range of oscillation for the tracking roll.

Illustrating assembly **126** diagrammatically, it will be seen that the head end of cylinder **127** is connected to the reservoir **160** by means of conduit **162**. A restricted passage **164** is provided in conduit **162** to impede the flow of fluid in one direction but may be bypassed in the return direction by a conduit having a check valve **166**. A conduit **168** leads from conduit **162** through a restricted passage **170** to the piston rod end of cylinder **127** and may be bypassed in the return direction by a conduit having a check valve **172**.

In operation, if extension arm **116** tends to dwell against stop member **134**, for example, pressure will be applied on the piston rod side of the piston in cylinder **127** and force the flow of fluid through passage **164**, conduit **162**, conduit **168**, check valve **172** to the piston rod side of cylinder **127**. Any excess volume will be received by reservoir **160**. Alternatively, if arm **116** tends to dwell against stop **140**, fluid will flow from the piston rod side of cylinder **127**, through passage **170**, conduit **168**, conduit **162**, check valve **166** into the head end of cylinder **127**. Thus, both ends of cylinder **127** are interconnected to effect automatic lateral adjustment of the spaced stop member **134** and stop nut **140** in unison to adjust the oscillation range of the abrasive belt and thereby maintain oscillation uniformity. If desired, nuts **152** and **154** may be adjusted longitudinally of stud **150** to enlarge or restrict the overall oscillation range.

A preferred embodiment of this invention having been described and illustrated, it is to be realized that modifications thereof may be made without departing from the broad spirit and scope of this invention as defined in the appended claims.

I claim:

1. A grinding machine comprising: a frame; a grinding head mounted on said frame and having a drive roll and a tracking roll; an endless abrasive belt carried by said drive roll and said tracking roll for movement in an orbital path; said tracking roll mounted for pivotable movement about a pivot axis perpendicular to the longitudinal axis of said roll; means mounted on said frame for oscillating said tracking roll about said pivot axis to effect axial reciprocation of said abrasive belt on said rolls; means carried by said head for limiting the oscillating movement of said tracking roll within a given range between two positions; and means responsive to said tracking roll dwelling at either of said positions for adjusting

said limiting means for changing the range of oscillating movement of said tracking roll.

2. A grinding machine as defined in claim 1 wherein said means for adjusting said limiting means comprises a pressure fluid means.

3. A grinding machine as defined in claim 2 wherein said pressure fluid means comprises a double acting hydraulic cylinder having a piston, a piston rod connected to said piston, and said piston rod having a threaded stem portion.

4. A grinding machine as defined in claim 3 wherein said limiting means comprises a pair of spaced stops carried by said threaded stem portion of said piston rod.

5. A grinding machine as defined in claim 4 wherein said tracking roll is provided with extension means moveable between said spaced stops.

6. A grinding machine as defined in claim 5 whereby a prolonged dwell of the extension means against one of said stops effects movement of said stops in unison against the bias of said pressure fluid means.

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OTHELL M. SIMPSON, Primary Examiner

U.S. Cl. X.R.

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