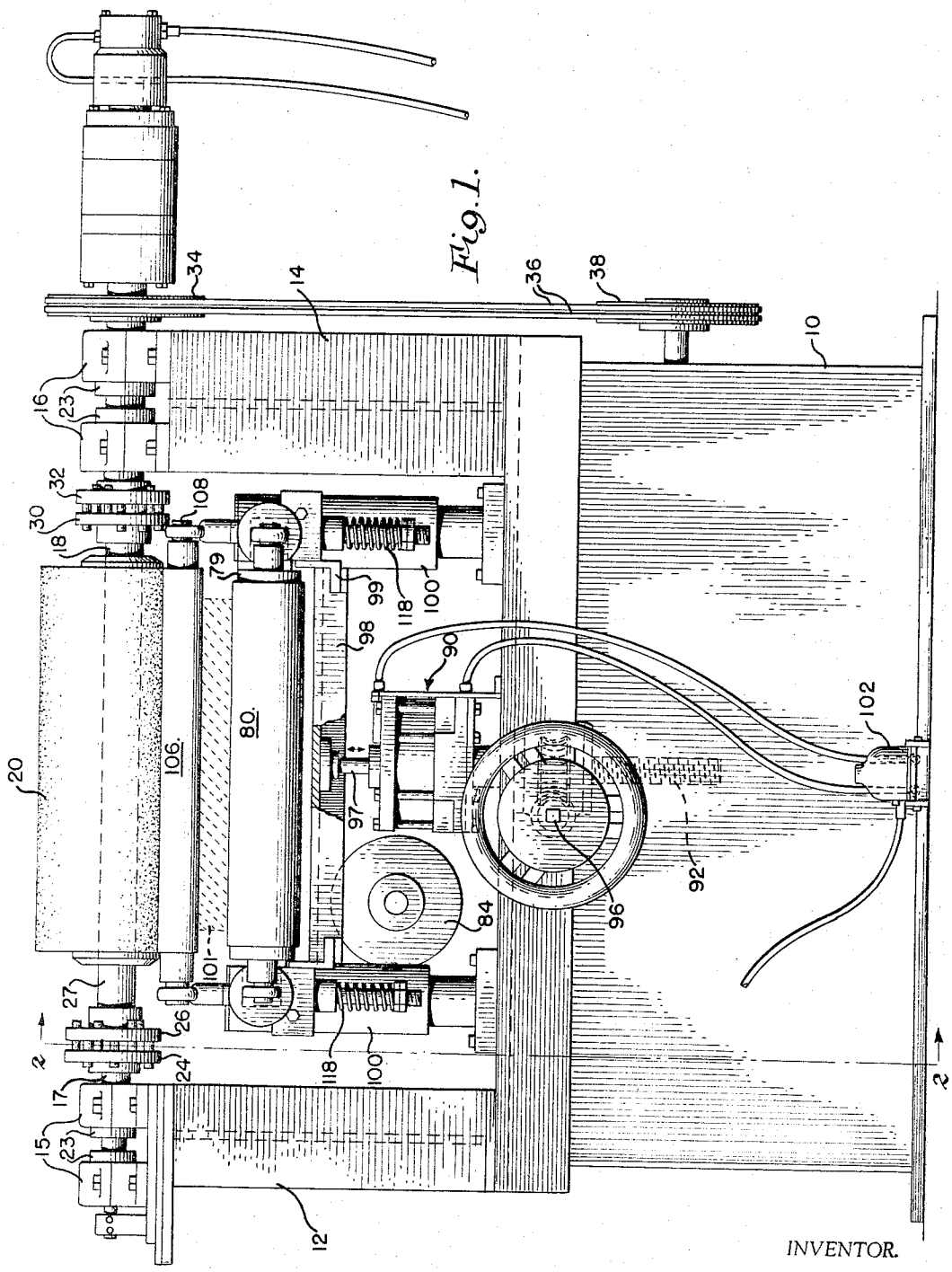
June 20, 1967 W. C. BURT 3,325,947

CONVERTIBLE ROLL-BELT ABRADING MACHINE

Filed Sept. 15, 1964 5 Sheets-Sheet 1

Fig. 1.



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CONVERTIBLE ROLL-BELT ABRADING MACHINE

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Fig. 3.

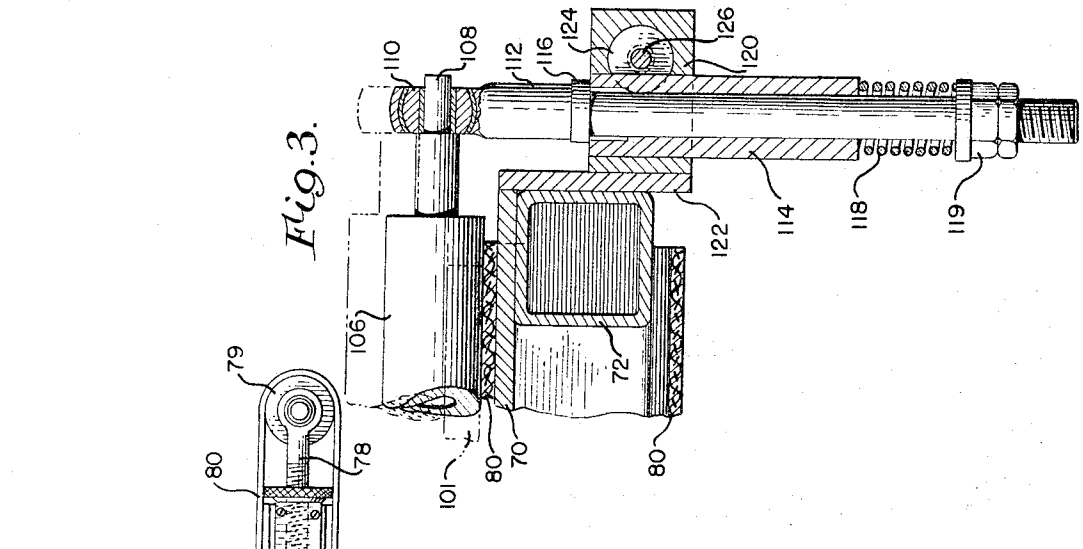
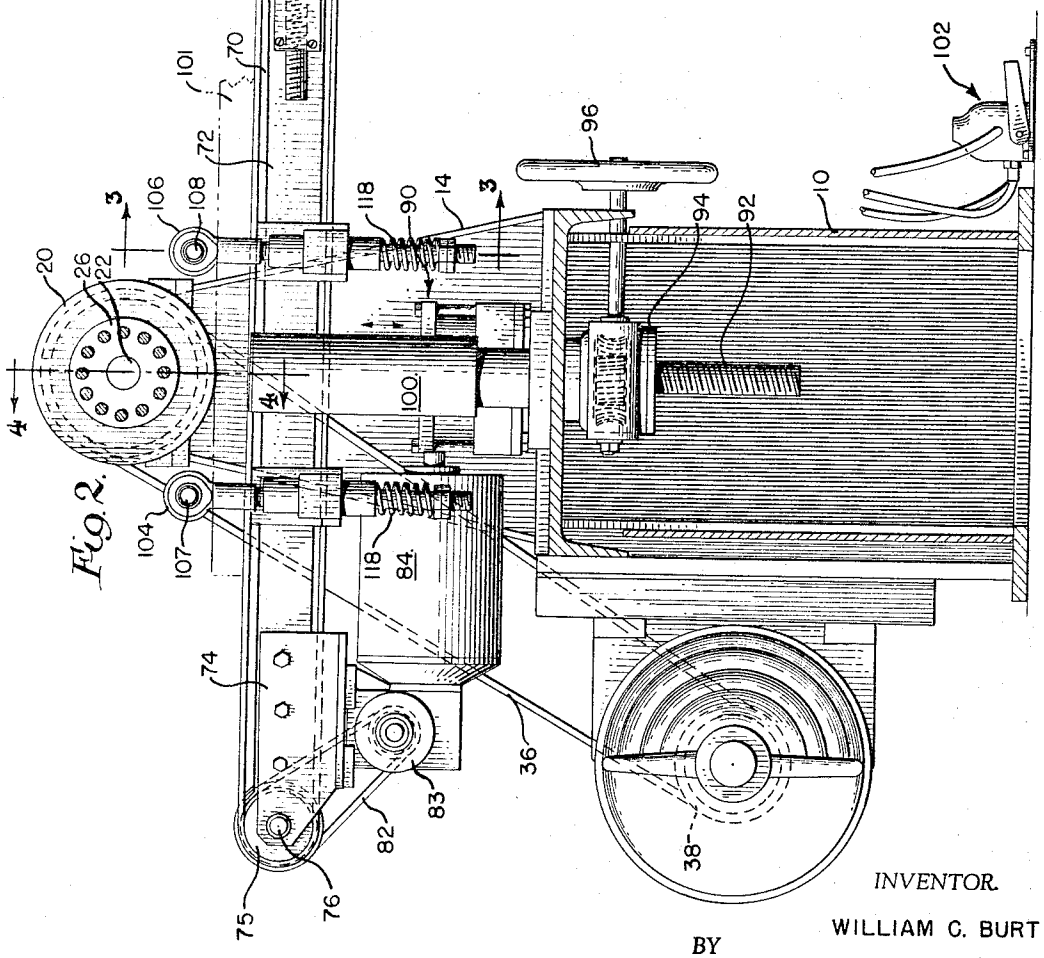


Fig. 2.



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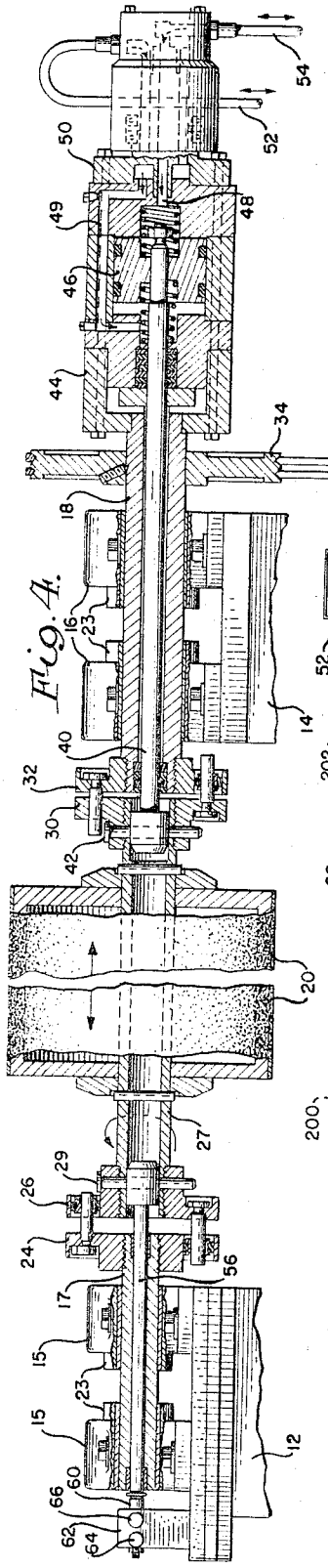


Fig. 4.

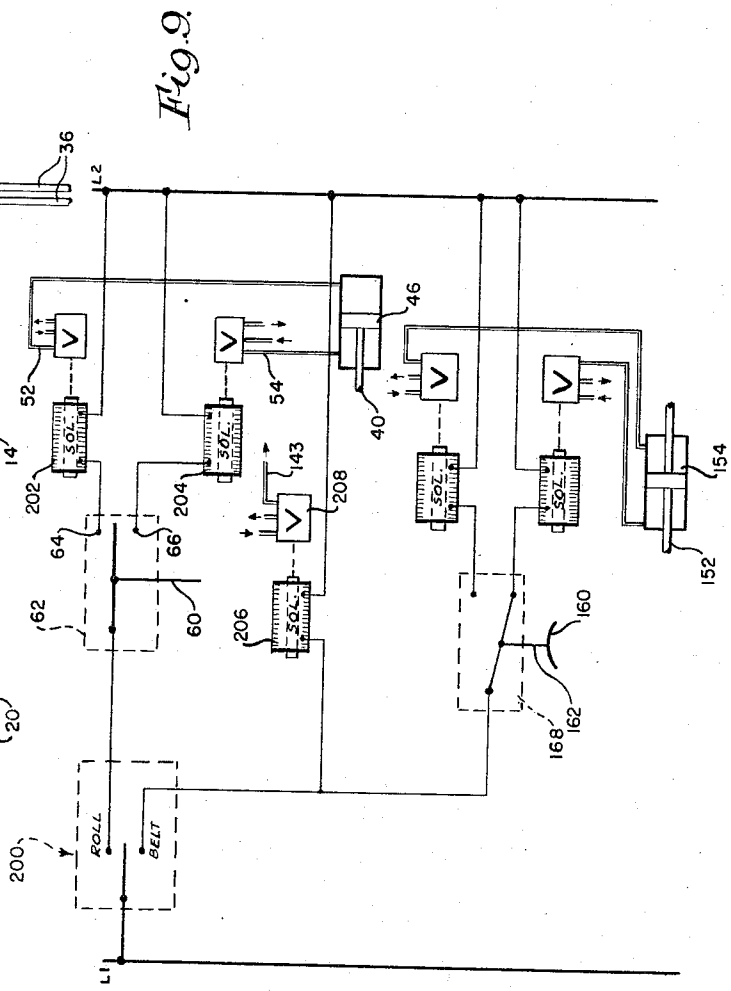


Fig. 9.

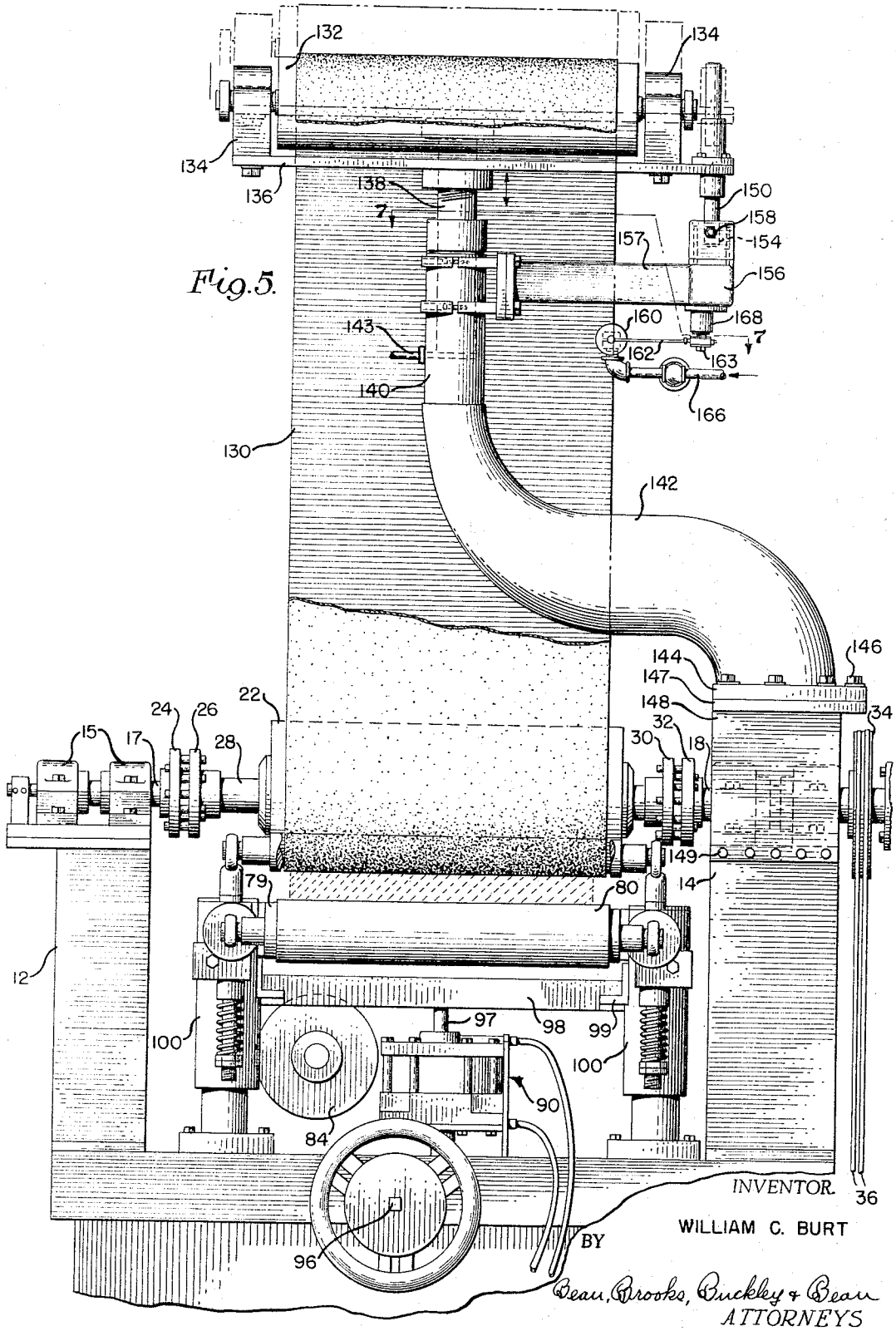
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CONVERTIBLE ROLL-BELT ABRADING MACHINE

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Fig. 5.



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CONVERTIBLE ROLL-BELT ABRADING MACHINE

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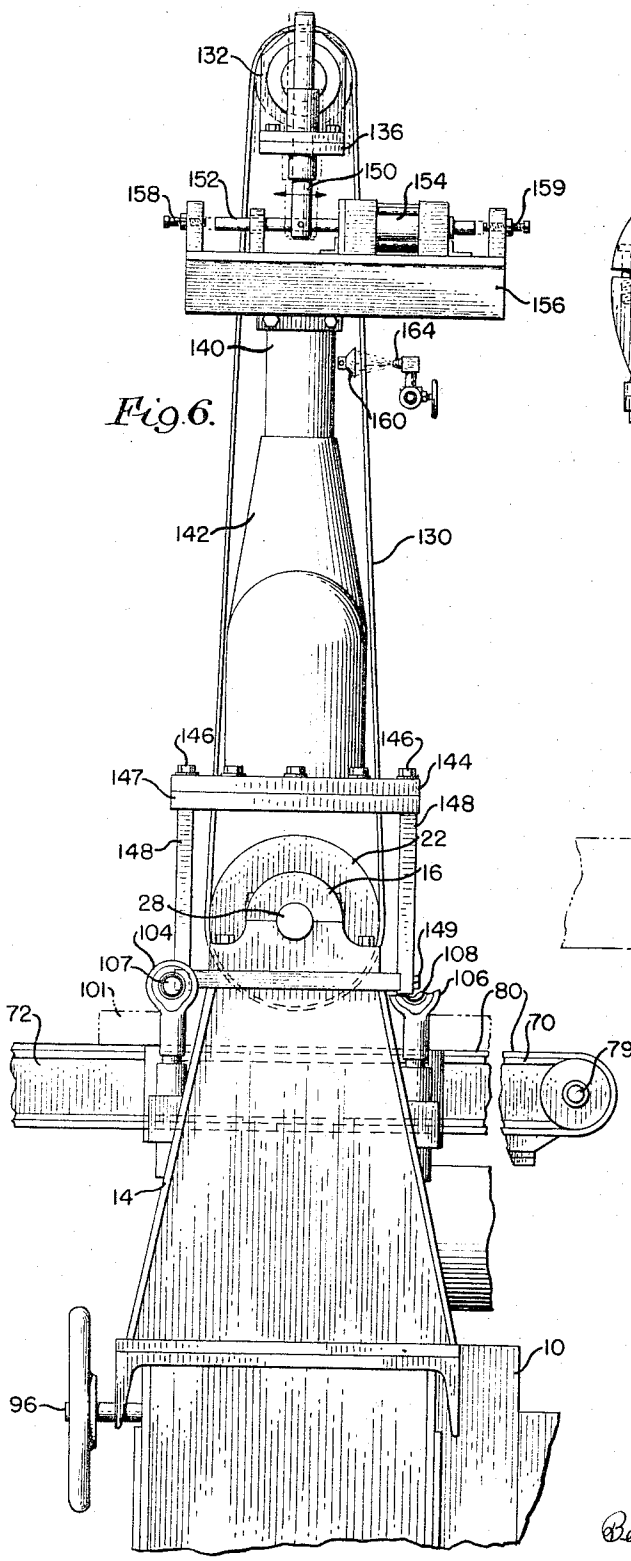


Fig. 6.

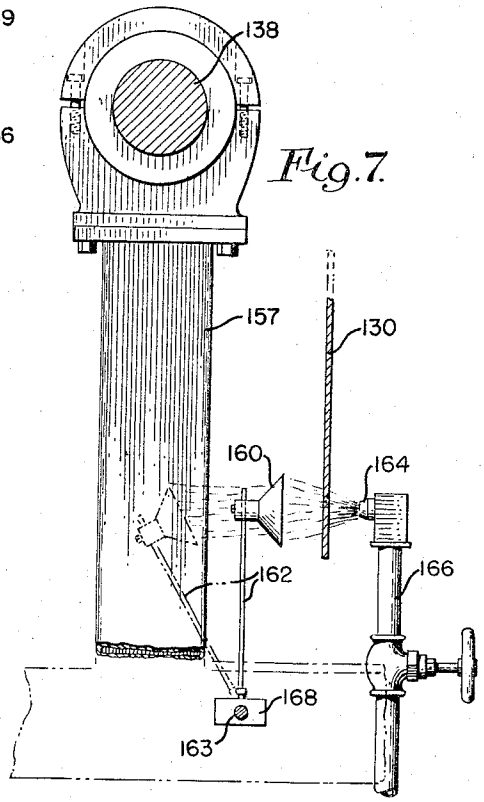


Fig. 7.

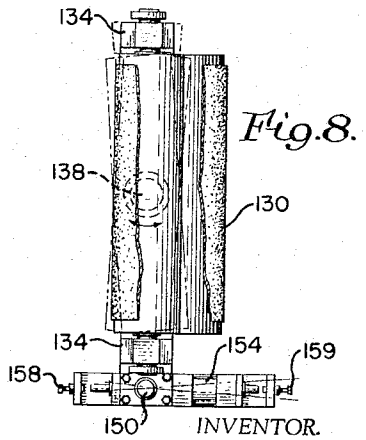


Fig. 8.

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United States Patent Office 3,325,947
Patented June 20, 1967

3,325,947

CONVERTIBLE ROLL-BELT ABRADING MACHINE

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Filed Sept. 15, 1964, Ser. No. 396,644
2 Claims. (Cl. 51—138)

This invention relates to surface finishing machines, and more particularly to improvements in machines such as are especially adapted to grind, bore, clean, abrade, rough, delustre, brush, polish, glaze, buff, "sand," or otherwise finish a sheet, plate, strip, coil or any other type stock pieces. More particularly, the invention relates to a novel machine for the above stated purposes, which provides facilities for both abrasive belt and abrasive roll processings of the work pieces.

It is a primary object of the present invention to provide a machine as aforesaid which is characterized by its overall compactness, and simplicity and ruggedness of construction; while being at the same time particularly suited for efficient and speedy change-over adjustments and overall processing of the work pieces.

Another object of this invention is to provide an improved machine as aforesaid which includes a fixed elevation buffing or polishing or other processing roll and, interchangeable therewith an abrasive roller; and cooperable therewith, a vertically adjustable table mounting a work piece carrying conveyor for effecting the feeding of stockpieces through the machine. Another object is to provide an improved machine as aforesaid wherein the vertically movable table is biased vertically by air cylinder means, so that the processing roll or belt engages the work under predetermined uniform pressure conditions.

Another object of the invention is to provide an improved machine as aforesaid including pinch roll means operable to hold the work pieces down against the conveyor means in improved manner.

A further object of this invention is to provide an improved processing roll and belt drum mounting and driving arrangement, whereby the parts are readily accessible for changeover purposes, and whereby improved means are provided for reciprocating the work abrading means relative to the work pieces passing through the machine.

It is another object of the invention to provide a machine as aforesaid which is of improved versatility in that it can be readily arranged to process a variety of thicknesses of strip or sheet stockpieces.

Another object of the invention is to provide a machine as aforesaid which is adapted to operate with improved facility to fully finish flat stock sheets or strips from the leading edges to trailing edges thereof while avoiding undesirably fast pick-ups of the work pieces by the abrading means and/or "scooting" of the stockpieces through the machine.

Other objects and advantages of the invention will appear from the specificaiton hereinafter which shows one example of a machine of the present invention as illustrated in the accompanying drawings, wherein:

FIG. 1 is a front elevational view of a machine according to the present invention, in its buffing or polishing roll mode of operation;

FIG. 2 is a section taken on line 2—2 of FIG. 1;

FIG. 3 is an enlarged scale sectional view taken along line 3—3 of FIG. 2, through a portion of the work piece hold-down;

FIG. 4 is an enlarged scale fragmentary sectional view taken as suggested by line 4—4 of FIG. 2;

FIG. 5 is a fragmentary, enlarged scale, front end elevational view with portions broken away, of the machine when changed-over to the abrasive belt mode;

FIG. 6 is a right hand end view of the mechanism of FIG. 5;

FIG. 7 is a fragmentary enlarged scale sectional view taken as suggested by line 7—7 of FIG. 5;

FIG. 8 is a top plan view of the mechanism of FIGS. 5–7, illustrating the abrasive belt oscillation action; and

FIG. 9 is a diagram of the electrical control circuit for the machine.

As shown in the drawing herewith, the machine may be constructed to include a base **10** supporting a pair of upright pedestals **12, 14**, at its opposite sides. The pedestals **12, 14** mount paired bearing blocks **15—15** and **16—16**, which blocks carry hollow horizontally disposed shafts **17, 18** (FIGS. 1, 4, 5, 6) for support of a processing device, such as a buffing roll **20** (FIGS. 1, 2, 4) or an abrasive belt support drum **22** (FIGS. 5, 6) as will be explained more fully hereinafter.

The shafts **17–18** are fixed against axial displacements in the bearing assemblies **15—15** and **16—16** by means of collars **23**. The shaft **17** carries at its inner end a flexible coupling face plate **24**, and the opposite face plate **26** is keyed to the axle or spindle **27** which supports and drives the buffing roll **20** (FIGS. 1, 2, 4) or the spindle **28** which supports and drives the drum **22** (FIGS. 5, 6) as the case may be, by means of key pins or the like as indicated at **29** (FIG. 4). At its other end the spindle **27** or **28** as the case may be, carries a flexible coupling face plate **30**, the opposite face plate **32** of which is carried by the stub shaft **18**. A drive pulley as indicated at **34** is keyed to the shaft **18** for gearing connection as by means of V belts **36** to the machine drive motor pulley **38** (FIG. 1). As shown in FIGS. 1, 4, 5, the parts are so dimensioned that the distance between the face plates carried by the spindles **27–28** is shorter than the space between the face plates **24** and **32**, whereby the processing roll or drum may be axially reciprocated incidental to rotaiton thereof for producing a more smoothly finished product, as will be explained more fully hereinafter.

This reciprocation may be attained by means of a push-pull rod **40** (FIG. 4) which extends through the hollow stub shaft **18** and connects at one end by means of a pin **42** to the face plate and spindle which drives the roll **20** or drum **22**, as the case may be. At its other end the push-pull rod **40** extends into a cylinder **44** which is carried by and rotates with stub shaft **18**; the cylinder **44** having disposed therein a piston **46** to which the rod **40** is fixedly connected. The cylinder **44** includes separate compressed air passageways **48, 49** which enter the cylinder through means of a rotary union **50** and connect therethrough with corresponding conduits **52, 54** which in turn lead to a solenoid controlled valve as indicated at **55** (FIG. 9). The valve **55** may be of any four-way standard valve type adapted to deliver air under pressure either to the conduit **52** or the conduit **54**, depending upon adjustment of the valve armature as by means of solenoids indicated at A, B. A similar control rod **56** (FIG. 4) is disposed to extend through the hollow stub shaft **17** and is connected at one end by means of the pin **29** to the roll or drum spindle so as to reciprocate axially therewith. At its other end the rod **56** is provided with an insulating ring **58** and with an electrical conducting ring **60**, and this end portion of the rod **56** is rotatably mounted in axially slidable relation within a bearing block **62** into which extend paired electrical contact brushes as indicated at **64, 66**, respectively.

Thus, it will be appreciated that reciprocation of the roll or drum in axial direction will be accompanied by equal reciprocation of the conductor ring **60** relative to the contact brushes **64, 66**, whereby as shown diagrammatically in FIG. 9, the conductor ring **60** will alternate-

ly interconnect the brushes **64**, **64**, or the brushes **66**, **66**; thereby alternately completing circuits to solenoid A and B, respectively. The solenoids A, B, are oppositely directed to alternately displace the armature of the valve **55** in opposite directions, thereby causing the valve to deliver compressed air alternately through the conduits **52**, **54** into the cylinder **44** at opposite ends of the piston **46** therein. Hence, the reciprocation control system functions automatically and without interference with the driving rotation of the roll or drum. Processing roll changes are conveniently effected simply by first removing the pins **29**, **42**, and then moving the left hand bearing block unit to the left relative to the pedestal **12** as viewed in FIGS. 1, 4. This disconnects the assembly at the flexible coupling **24**, **26**, whereupon the processing roll spindle may be similarly displaced toward the left to free it from the coupling face plate **32**. Replacement of another processing roll or an abrasive belt drum thereon is effected by simply reversing the procedure.

The workpiece support and drive mechanism comprises essentially a table over which trains the upper strand of an endless conveyor belt which slides upon the top surface of the table and which in turn carries the workpieces to pass under the processing roll or the abrasive belt, as the case may be. As shown herein the table structure may be fabricated to comprise a top plate **70** (FIGS. 2, 6) supported by frame members **72**. At one end the table frame structure includes brackets **74** (FIG. 2) at opposite sides of the table for mounting the conveyor drive pulley **75** as by means of shaft as indicated at **76**. At the opposite end of the table and at opposite sides thereof screw thread adjustable arms **78** are provided to extend from the table structure to mount the conveyor idler pulley **79**. The conveyor belt is illustrated at **80** and the conveyor drive is shown to be provided by means of a belt and pulley system **82**, **83** geared to an electric motor **84**.

The table structure is vertically supported by means of a centrally located pneumatic piston-cylinder unit as indicated generally at **90** (FIGS. 1, 2, 5). The bottom end of the cylinder **90** is fitted with a downwardly extending screw threaded post **92** which is engaged by a nut-bearing **94** mounted on the base portion **10** of the machine. The threaded nut is driven by means of a worm gear carried by a hand wheel shaft **96** whereby it will be appreciated that manual rotation of the hand wheel shaft will cause the post **92** to raise or lower. The piston rod portion **97** of the unit (FIGS. 1, 5) extends upwardly into supporting connection with a cross bar **98** which is fixed at its opposite ends to the side rails **72**, as by means of angles **99**. Thus, it will be appreciated that operation of the piston relative to the cylinder **90** will either raise or lower the conveyor table; the vertical position of the cylinder as adjusted manually by the hand wheel **96** determining the datum for the piston-cylinder operation. The table is stabilized throughout the range of its vertical adjustment by means of a pair of vertically standing telescopic bearing units **100—100** located at opposite sides of the table structure.

Thus it will be appreciated that a workpiece such as indicated at **101** (FIGS. 1, 2, 4) may be placed upon the top strand of the conveyor belt **80** whereby it will be driven to pass under the roll **20** or the belt drum **22**, as the case may be; either in the manner of a single pass or repeated straight line passes, or reciprocally back and forth under the process roll, as may be preferred. Depending upon the thickness of the workpiece to be processed, the spindle will first be vertically adjusted by means of the hand wheel **96** to such a position that when compressed air is delivered to the cylinder under control of treadle valve **102** (FIGS. 1, 2) the piston thereof will extend the table upwardly so as to press the workpiece against the processing member with the desired degree of pressure. Thus, although the table will be "mechanically" adjusted vertically in the first place to different workpiece thicknesses, in all cases after the initial adjustment the

working pressure against the processing roll will be determined and maintained by the air pressure within the cylinder **90**. Inasmuch as this is of a resilient nature a substantially uniform pressure will be exerted between the processing member and the workpiece throughout the entire extent of the operation.

The machine also includes a workpiece hold-down mechanism shown herein to comprise a pair of pinch rolls designated **104**, **106** carried on corresponding idler spindles **107**, **108**. The spindles **107**, **108** are journaled at their opposite ends within spherical bearing blocks as indicated at **110** (FIG. 3); the bearing block **110** being carried within the upper ends of corresponding struts **112**. The struts **112** are telescopically carried within sleeves **114** and include shoulder portions **116** which are biased in each case toward bottomed position in the sleeve **114** as by means of a compression spring **118**, the tension of which is readily adjustable as by means of a lock nut system **119**. As shown in FIG. 3, the sleeves **114** slidably extend vertically through support blocks **120** which are in turn welded or otherwise fixed to stirrup plates **122** carried by the side rail portions **72** of the conveyor table frame.

Thus the support blocks **120** are carried directly by the table frame, and the sleeves **114** are vertically slidable within the blocks **120**. Locking devices of any suitable form are preferably provided for fixing the sleeves **114** in any desired positions of vertical adjustment relative to the blocks **120**. As shown herein the locking devices may consist of shoes **124** and machine screws **126** which when tightened will hold the shoes **124** against the sleeves **114** in frictional engagement therewith so as to lock the sleeves against any movement relative to the blocks **120**. Thus it will be appreciated that to suit the pinch rolls to accommodate workpieces of different thicknesses, the screws **126** will be loosened and the sleeves **114** vertically adjusted relative to the blocks **120**. The screws **126** will then be tightened, and the springs **118** will then supply the requisite resilient pressure forces for holding the workpiece firmly down against the conveyor belt **80** as the latter transports the workpiece through the machine. This not only insures perfect frictional contact between the workpiece and the conveyor belt **80** for smooth and uniform finishing of the workpiece, but it also insures against any accidental "scooting" of the workpiece through the machine under the impetus of the processing member, such as might otherwise occur.

As shown in FIGS. 1, 2, the pneumatic jack **90** is operator-controlled, as by means of the treadle valve **102**; the valve and compressed air supply system being arranged so that whenever the operator steps on the treadle the jack **90** elevated the table so that the workpiece can come into bearing contact with the processing member. Thus, it is the resilient air pressure force exerted by the jack **90** that operates to maintain the workpiece in uniformly pressured relation against the processing roll as the conveyor transports the workpiece relative thereto. Upon completion of a processing operation the operator steps off the control pedal and the table thereupon lowers to a position substantially spaced below the processing roll, thus avoiding undesirable wearing contacts between the processing roll and the empty conveyor belt.

The machine of the invention also features a quick change-over arrangement whereby the machine may be readily convertible from a buffing roll type machine as illustrated by FIGS. 1–4 and as described hereinabove, to an abrasive belt type machine. Thus, as shown by means of FIGS. 5–8, to convert the machine to an abrasive belt "grinder" or polisher or the like, the buffing roll member is simply removed from between the bearing blocks **15**, **16** as explained hereinabove for roll change purposes; and in lieu thereof the abrasive belt drum **22** is mounted between the flexible couplings by means of the drive shaft **28**. Thus, the drum **22** is mounted in opposition to workpieces being carried by the feed conveyor

belt **80**, and an abrasive belt as indicated at **130** is arranged to train around and under the drum **22**.

To support the upper end of the abrasive belt **130**, an idler roll **132** is mounted by means of bearing blocks **134**, **134** carried by a platform **136** which extends transversely between the belt strands just below the idler roll **132**. The platform **136** is centrally supported by means of a post and lock nut device as indicated at **138**; the post **138** being freely rotatable about its vertical axis and vertically slidable as in the manner of a piston within a socketed pedestal **140** extending integally and vertically from an S-shaped arm **142**. A compressed air supply conduit as indicated at **143** (FIG. 5) connects into the chamber under the piston-post **138** for control of its upward thrust, and hence the tension on the abrasive belt. The arm **142** includes a bottom flange **144** which bolts as indicated at **146** to the top plate portion **147** of an inverted U-shaped bracket having side legs **148—148** which detachably mount by means of machine screws **149** to form vertical extensions of the machine pedestal **14**. Thus, the idler roll **132** supporting the upper end of the abrasive belt **130** is supported to be generally parallel to the bottom drum **22** while being swivable about the vertical axis of the support post **138** (FIGS. 5, 8).

To cause the abrasive belt **130** to reciprocate on the drum **22** in directions axially thereof, provision is made for oscillating the idler roll suport platform about its vertical support axis. Thus, as shown in FIGS. 5, 6, 8, the platform **136** is provided with a lateral extension supporting a downwardly extending pin **150** which pivotally connects to the piston rod **152** of an air cylinder **154** which is mounted by a bracket **156** on an arm **157** extending from the stationary support pedestal **14**. Thus, it will be understood that reciprocations of the piston rod **152** relative to the cylinder **154** along a path substantially parallel to workpiece movement will cause the idler control pin **150** to be similarly displaced so as to oscillate the idler roll support about the vertical axis of the post **138** as suggested by broken lines in FIGS. 6, 8. Adjustable stop devices as indicated at **158**, **159** are preferably employed at opposite ends of the piston travel path, to limit the travel of the piston unit, and the speed of reciprocation of the idler roll.

To control the cylinder **154** a belt tracking detector device is provided, which for example may be as shown in the drawing herewith to comprise a cup-shaped baffle **160** carried at one end of arm **162** which is pivotally mounted as indicated at **163** upon the stationary bracket **156**. The pivot device **163** includes a spring (not shown) operable to urge the arm and baffle unit toward the solid line poistion thereof shown in FIG. 7. The parts are so dimensioned and arranged that when the baffle **160** stands in the solid line position thereof shown in FIG. 7, it is shielded behind the abrasive belt **130**, provided that the latter is then tracking on its rollers at that side of its prescribed oscillating tracking path. A pneumatic jet device as indicated at **164** supplied by a compressed air supply conduit **166** is arranged in such manner that the jet blast is directed toward the baffle **160**, as shown in FIG. 7.

However, whenever the abrasive belt **130** tracks over so that the edge of the belt shields the baffle **160** from the air jet, the pivot spring action then moves the baffle arm **162** to the solid line position thereof as shown in FIG. 7. This actuates a two-way control switch **168** for delivering air under pressure to one end or the other of the cylinder **154** (see FIG. 9) thereby shifting the piston rod unit thereof so as to swing the idler roll carriage about its vertical axis as illustrated diagrammatically in FIG. 8. This canting of the idler roll causes the abrasive belt to shift its tracking path, both on the drum **22** and on the idler roll **132**, and in such manner that the shielding edge portion of the abrasive belt moves away from masking position relative to the baffle **160**. The parts are so dimensioned and arranged that when the belt has reached the desired alternative tracking path, the baffle **160** is uncovered and the air blast from the nozzle **164** operates to swing the baffle arm back to its broken line position as shown in FIG. 7. This action actuates the switch mechanism **168** so as to now direct compressed air into the opposite end of the cylinder **154**, whereby the piston rod unit is propelled to cause the idler carriage to swing back again in the opposite direction.

Thus it will be appreciated that the mechanism will automatically provide for back and forth oscillations of the idler roll carriage about its vertical support axis, which in turn will induce corresponding tracking oscillations of the abrasive belt **130** on the drum **22** in directions axially thereof. Thus, the abrasive belt media reciprocates laterally relative to the workpiece which is being processed, so as to prevent formation of "scratch" or other uneven abraded appearances on the surface of the finished workpiece.

As shown in FIG. 9, the control system of the machine may include power supply lines **L1**, **L2** and a "master" selector switch is indicated at **200**. When the master switch is manually thrown to the "roll" position power is supplied to the roll oscillation switch **62** (FIG. 4) whereby each axial shifting of the roll shaft **40** will eventually cause energization of one of the solenoids **202**, **204**; thereby alternately actuating the valves controlling the passage of compressed air through conduits **52**, **54**. Thus the roll **20** is caused to reciprocate as explained hereinabove in order to obtain a smoothly finished workpiece when being processed by a buffing roll or the like mounted on shaft **27**. When the machine is to be used in the "abrasive belt" mode of operation the master switch **200** is thrown to "belt" position as indicated in FIG. 9, and a solenoid **206** is thereby energized to open a valve **208** which supplies compressed air pressure through conduit **143** to the belt tensioning piston-cylinder unit **138–140** described hereinabove. Simultaneously therewith, the circuit to the belt track sensor switch **168** is energized, so that whenever the belt moves on the idler drum to expose the paddle **160** to be blown aside, the switch **168** will operate to change the direction of air flow into cylinder **154** until such time as the belt moves back again into paddle-shielding position. The mechanism then reverses, and thus it will be seen that the belt is caused to automatically shift back and forth on the roll **22** as explained hereinabove.

It will of course be appreciated that although only one form of machine embodying the invention has been illustrated and described in detail hereinabove, various changes may be made therein without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A surface finishing machine comprising, in combination.

a supporting frame, a table supported by said frame and means on said table for translating a workpiece over said table,

a drive roller journalled on said frame in spaced parallelism above said table and means for driving said drive roller,

a pedestal mounted on said frame to one side of said drive roller and including an upper end portion disposed above said drive roller, said upper end portion of the pedestal defining a cylinder, a piston received in said cylinder and projecting upwardly from said upper end of the pedestal, means for supplying fluid under pressure to said cylinder to extend said piston,

a platform carried by the upper end of said piston for oscillation about the axis of said piston,

a tracking roller journalled on said platform about an axis contained within a plane parallel to a plane containing the axis of said drive roller,

an endless abrasive belt trained about said drive and tracking rollers and defining spaced vertical flights lying on opposite sides of said upper end portion of the pedestal,

an arm fixed to the upper end portion of said pedestal and projecting laterally therefrom to extend outwardly from between said flights,

a rod reciprocably carried by the far end portion of said arm for movement along a path substantially parallel to workpiece movement, a pin connected to said rod and extending radially therefrom,

a collar fixed to said platform and slidably receiving said pin, and

means for reciprocating said rod to oscillate said platform.

2. The surface finishing machine according to claim 1 including a sensing assembly carried by said arm and extending from adjacent the outer free end thereof to a position between said flights for sensing the presence of the abrasive belt edge thereadjacent, said sensing device being connected to said means for reciprocating said rod.

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