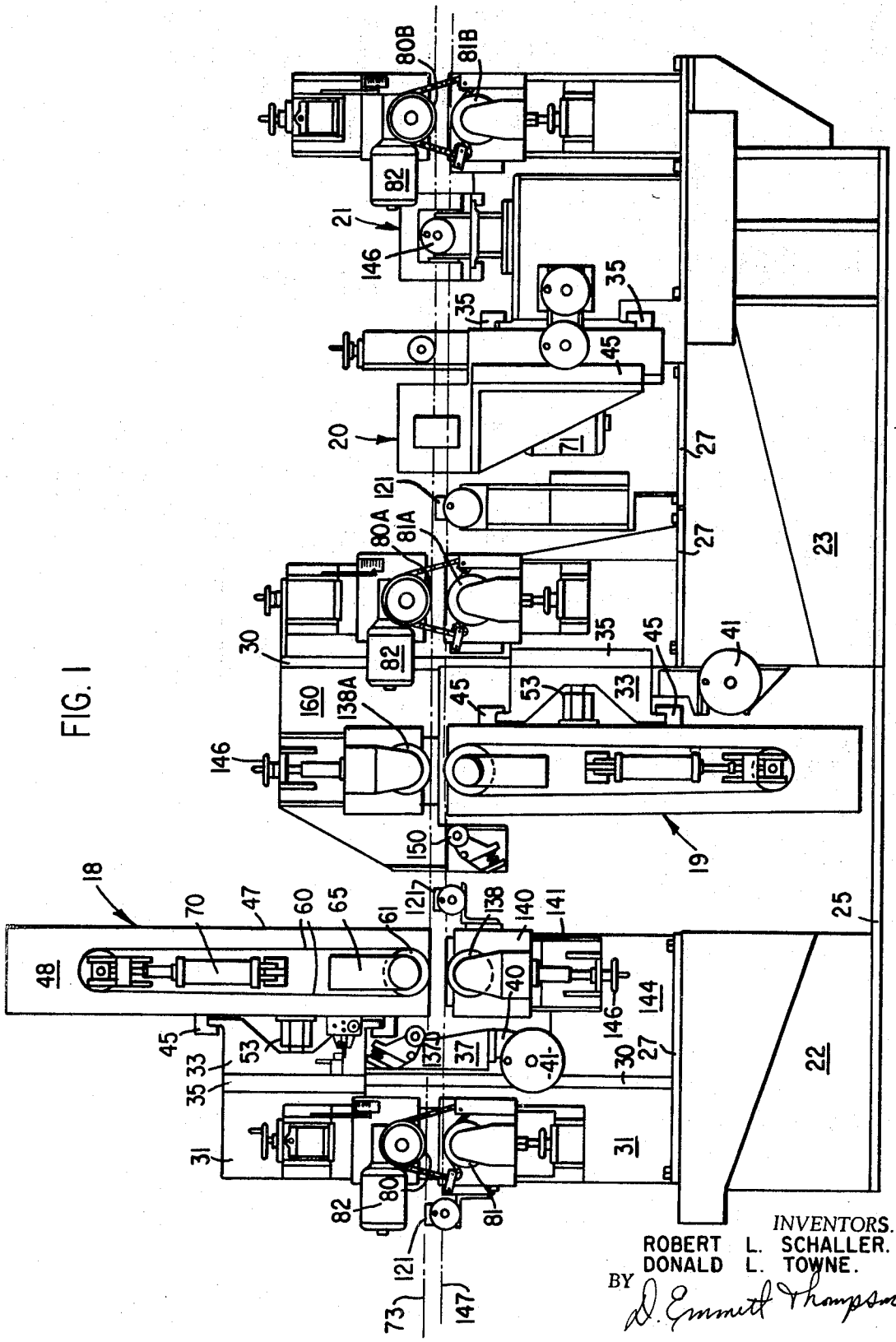
Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 1

FIG. 1



INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.
BY D. Emmett Thompson
ATTORNEY.

Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 2

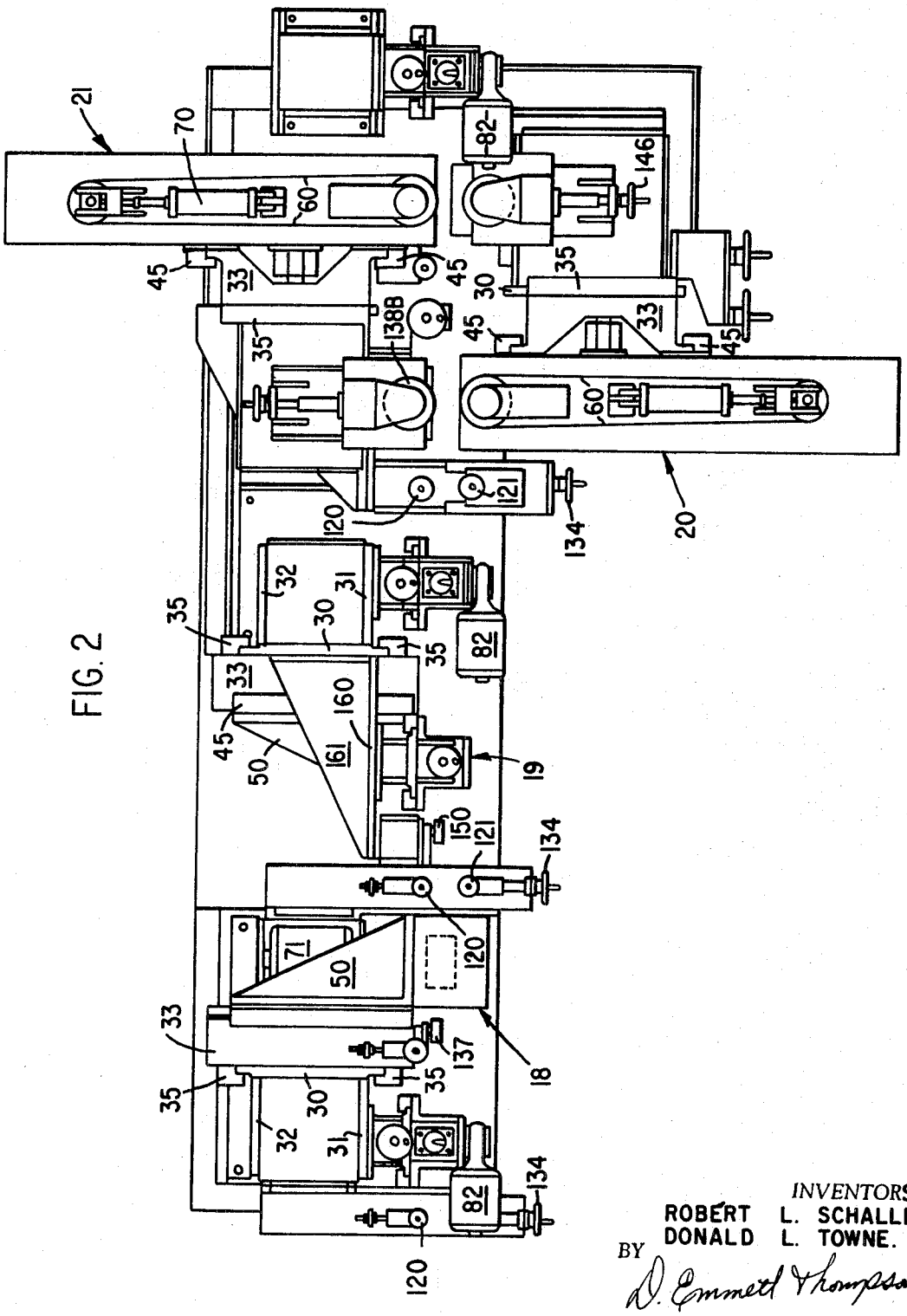


FIG. 2

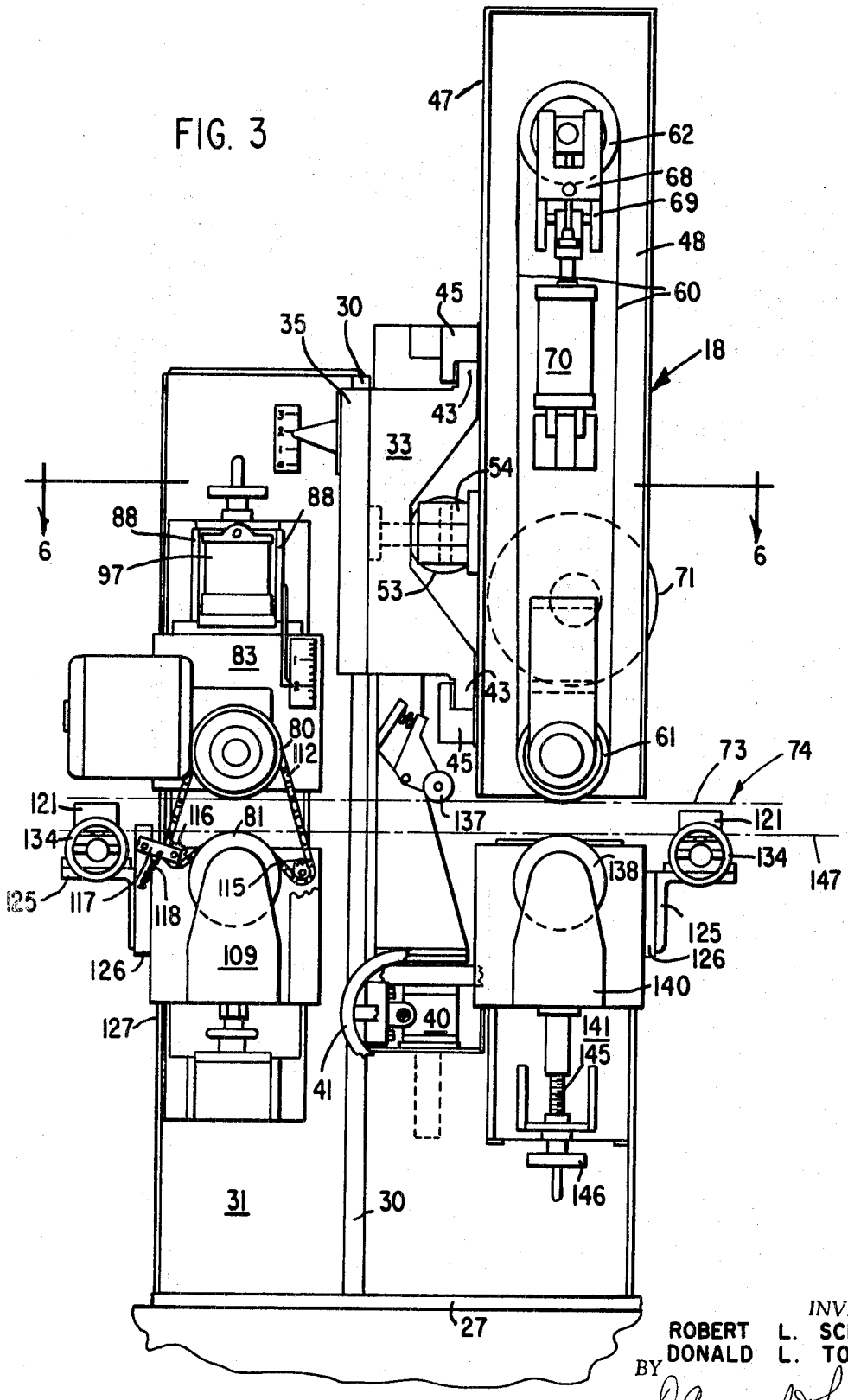
INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.
BY D. Emmett Thompson.
ATTORNEY.

Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 3

FIG. 3



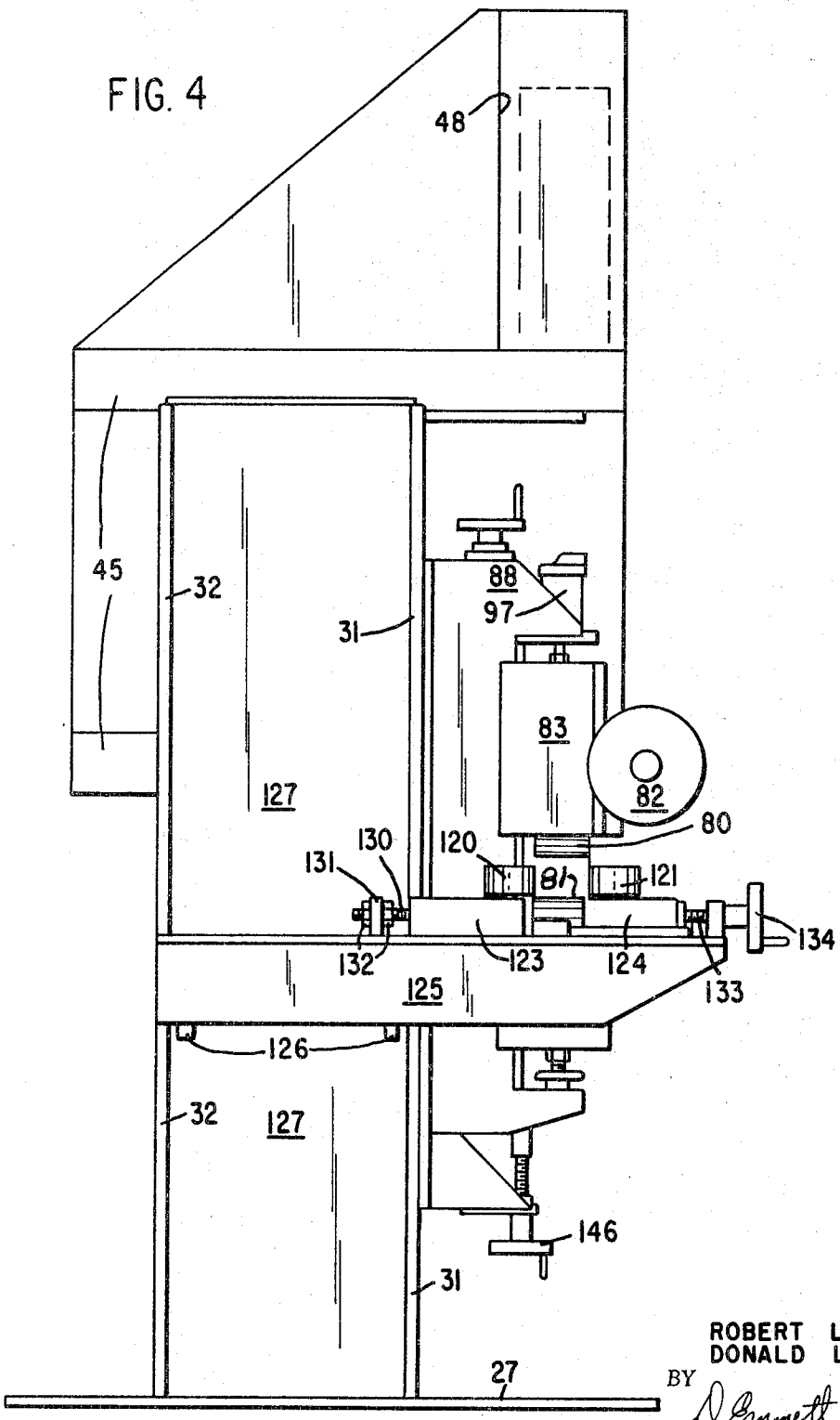
INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.
BY D. Emmett Thompson
ATTORNEY.

Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 4

FIG. 4



INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.

BY D. Emmett Thompson.

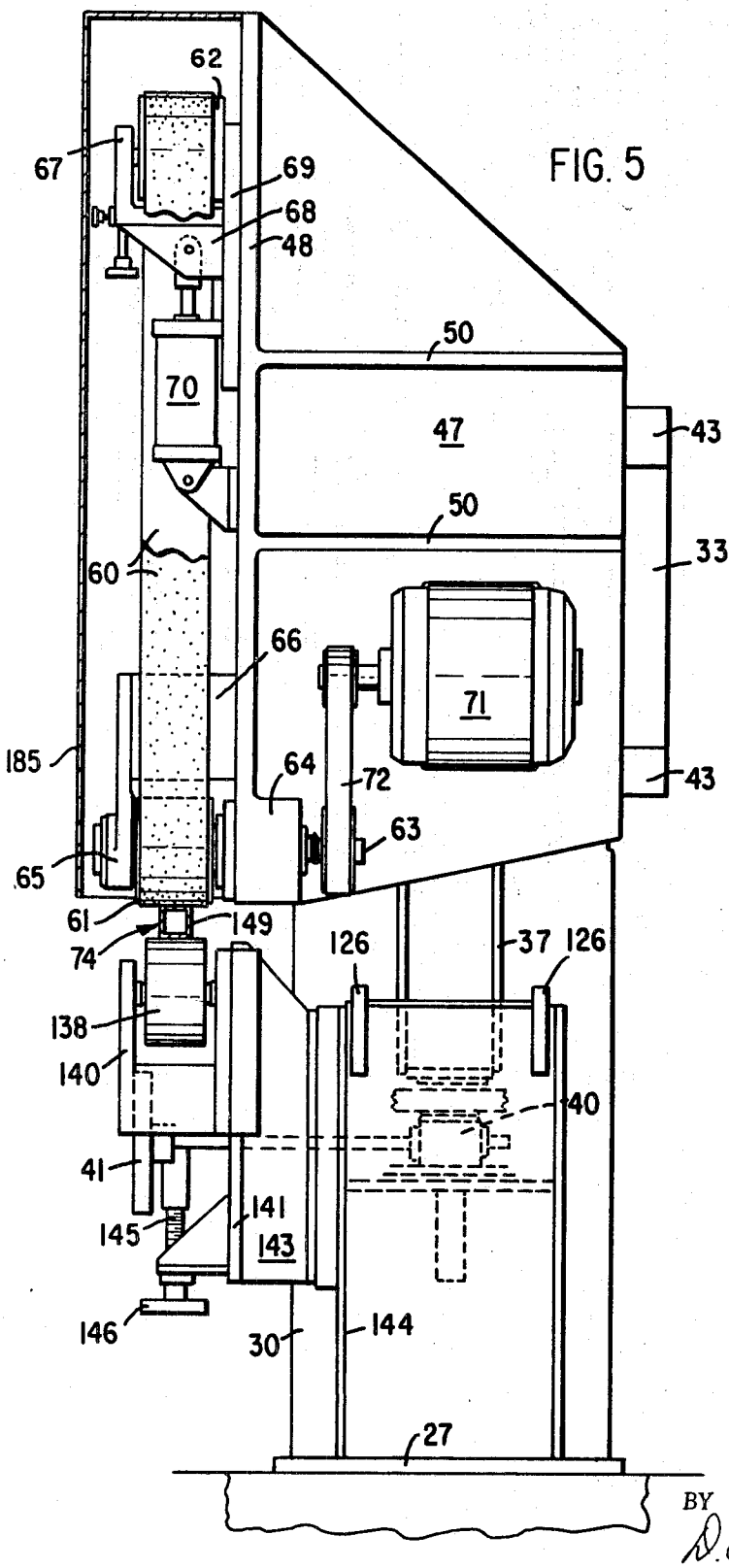
ATTORNEY.

Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 5

FIG. 5



INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.

BY D. Emmett Thompson

ATTORNEY.

Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 6

FIG. 6

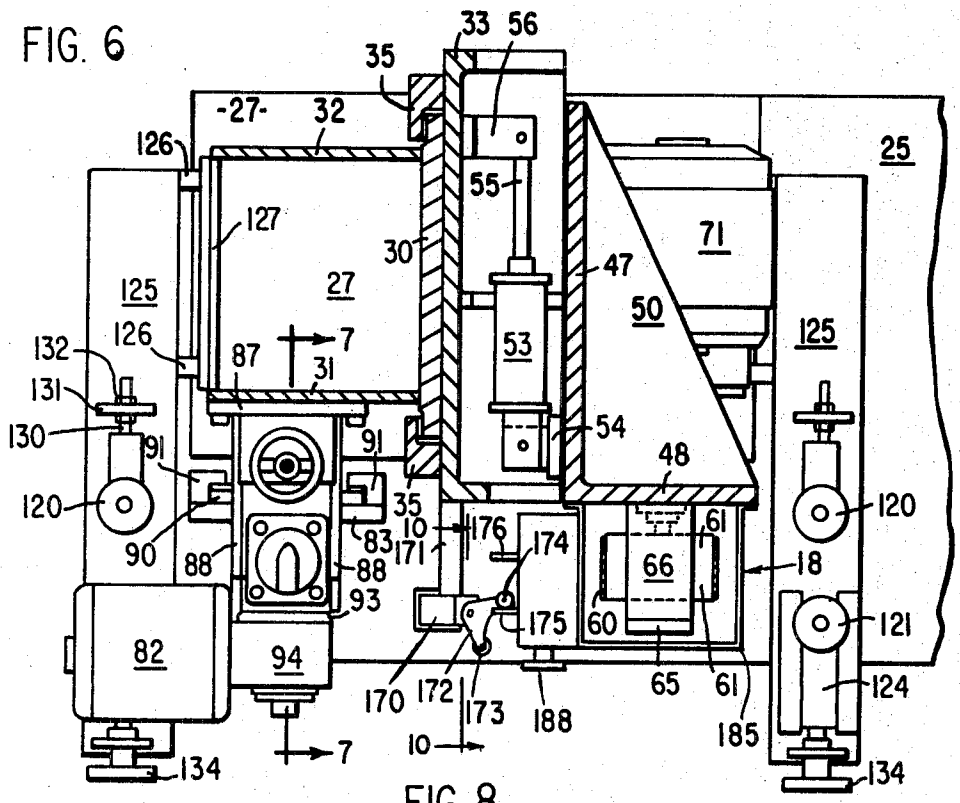


FIG. 8

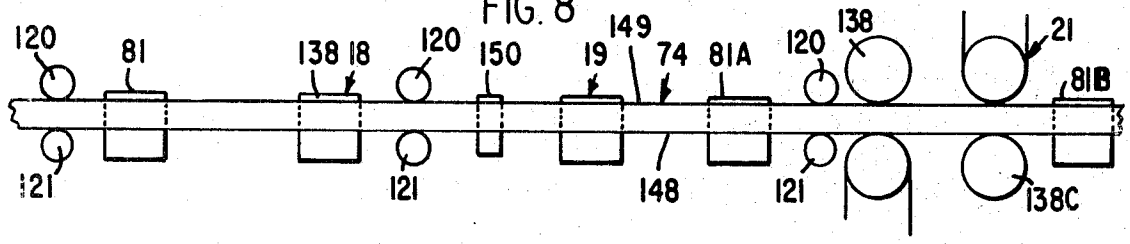
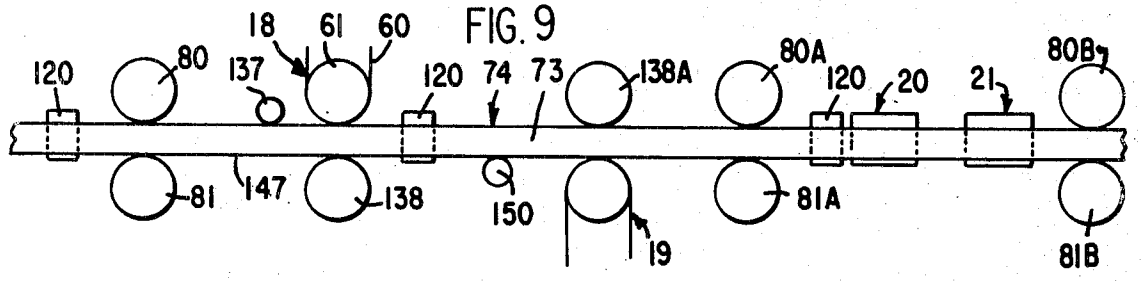


FIG. 9



INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.

BY D. Emmett Thompson.

ATTORNEY.

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 7

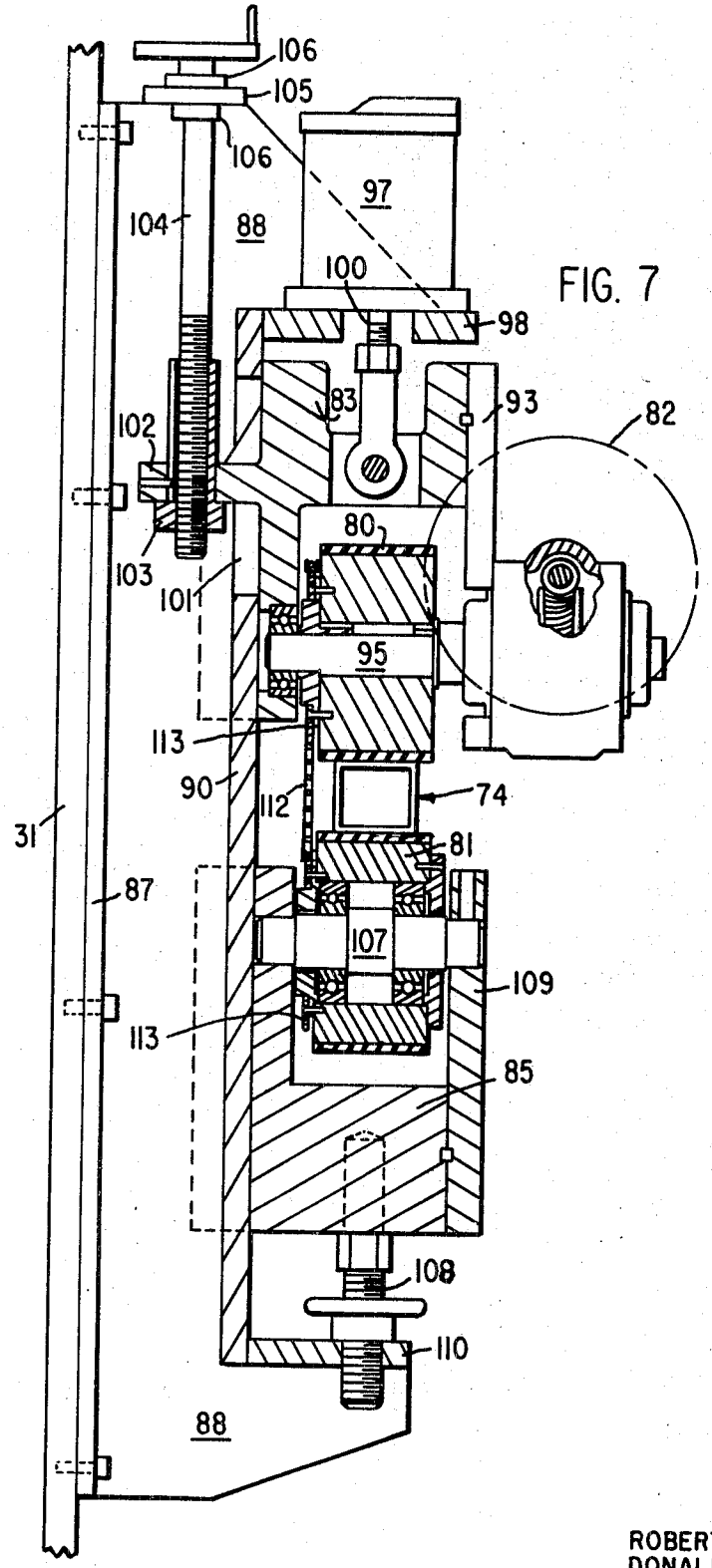


FIG. 7

INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.
BY
D. Emmett Thompson
ATTORNEY.

Nov. 24, 1970 R. L. SCHALLER ET AL 3,541,735

ABRADING MACHINE

Filed Aug. 5, 1968 8 Sheets-Sheet 8

FIG. 10

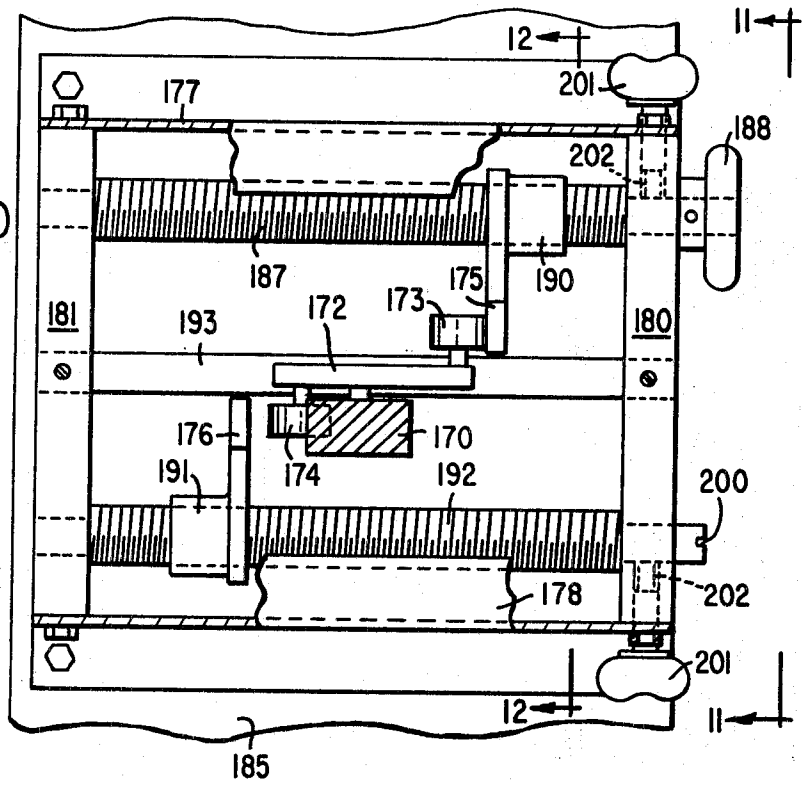


FIG. 11

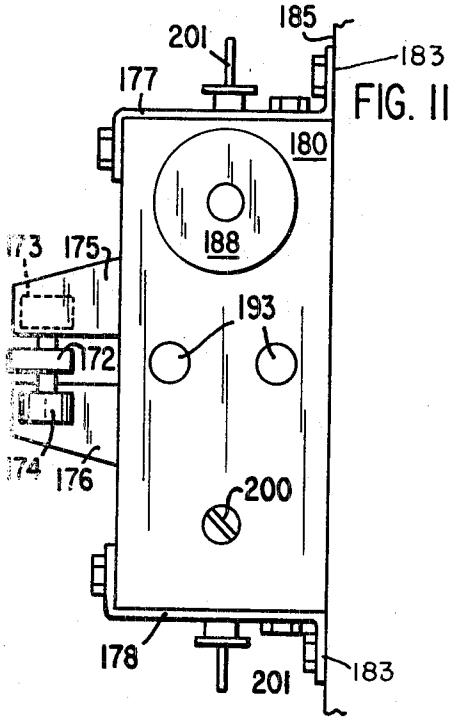
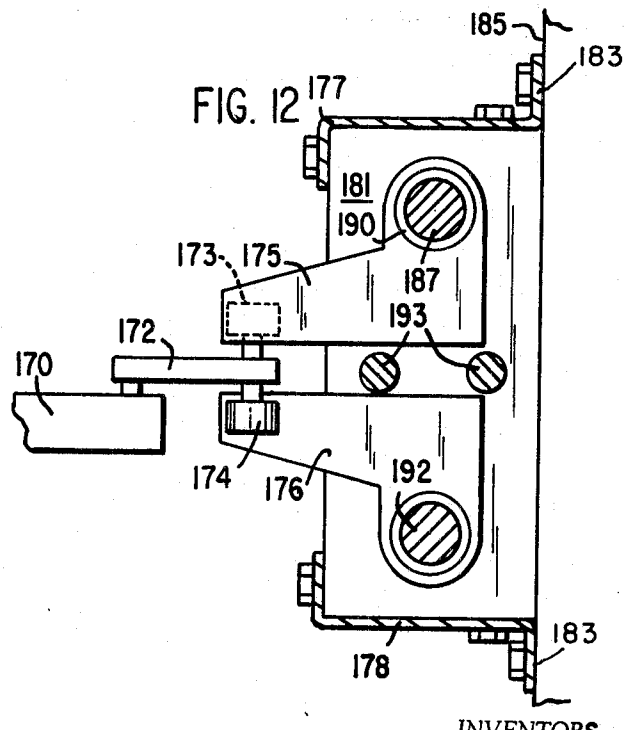


FIG. 12



INVENTORS.
ROBERT L. SCHALLER.
DONALD L. TOWNE.
BY D. Emmett Thompson.

ATTORNEY.

United States Patent Office 3,541,735 Patented Nov. 24, 1970

3,541,735

ABRADING MACHINE

Robert L. Schaller, Camillus, and Donald L. Towne, North Syracuse, N.Y., assignors to Sundstrand-Engelberg, Inc., a corporation of Delaware

Filed Aug. 5, 1968, Ser. No. 750,259
Int. Cl. B24b 7/00, 21/00
U.S. Cl. 51—139 5 Claims

ABSTRACT OF THE DISCLOSURE

An abrading machine for finishing elongated workpieces rectangular in cross section, such as bars and tubes. A fixed pass line is established by a linear series of fixedly positioned rolls which engage two adjacent sides of the workpiece. Other rolls, which engage the opposite two adjacent sides of the workpiece, are adjustable to accommodate workpieces of different cross sectional dimension. The rolls include guide rolls, feed rolls and back-up rolls. There are a plurality of abrading heads spaced along the pass line for abrading the four sides of the workpieces, the heads being reciprocated transversely of the workpiece while abrading the same during its advancement along the pass line.

BACKGROUND OF THE INVENTION

At present, elongated workpieces, rectangular in cross section, are abraded by an abrading head engaging one side of the workpiece and, in some cases, a second abrading head is employed for engaging the opposite side of the workpiece. When the one side, or two sides, have been abraded, the work piece is rotated and passed through the machine again for abrading the other side, or sides, of the workpiece. In finishing abrading of tubular workpieces, it is customary to use only one abrading head, necessitating the tube being passed through the machine four times.

BRIEF SUMMARY OF THE INVENTION

Our machine is provided with at least four abrading heads which function to abrade the four sides of the workpiece during one pass thereof through the machine. The machine is particularly well adapted for abrading thin wall metallic tubing as, for example, stainless steel tubing now used extensively in the fabrication of many articles, such as furniture. The abrading heads are spaced apart along a pre-fixed pass line, the arrangement providing for the dissipation of any heat generated in the workpiece by one head before the heated area of the workpiece reaches the next abrading head which operates on the side of the workpiece opposite to that operated on by the previous abrading head.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front elevational view of an abrading machine embodying our invention.

FIG. 2 is a top plan view of the machine shown in FIG. 1.

FIG. 3 is an enlarged view of the left section of the machine shown in FIG. 1.

FIG. 4 is an end elevational view looking to the right, FIGS. 1, 2 and 3.

FIG. 5 is a view taken on line 5—5, FIG. 1.

FIG. 6 is a view taken on line 6—6, FIG. 3.

FIG. 7 is a view taken on line 7—7, FIG. 6.

FIG. 8 is a schematic view illustrating the arrangement of the guide rolls, feed rolls and back-up rolls, establishing the fixed pass line at the rear side of the workpiece.

FIG. 9 is a view, similar to FIG. 7, showing the roll arrangement establishing the fixed pass line at the lower side of the workpiece.

FIG. 10 is an enlarged view of the mechanism for controlling the magnitude of the reciprocation of the grinder heads, the view being taken on line 10—10, FIG. 6.

FIG. 11 is a top plan view of the mechanism shown in FIG. 10.

FIG. 12 is a view taken on line 12—12, FIG. 11.

DETAILED DESCRIPTION

The machine shown in FIGS. 1 and 2 of the drawings includes four abrading heads 18, 19, 20 and 21, arranged along a fixed pass line for abrading engagement with the top side, bottom side, front side and rear side, respectively, of the workpiece.

The framework includes column structures 22, 23, mounted on a base plate 25. Plates 27 are mounted on the tops of the columns 22, 23, and upwardly extending plate structures are fixed to the plates 27 and serve to support the abrading head and roll structures. The general structural arrangement of the upper framework supporting the abrading heads is similar. However, the configuration varies slightly due to the fact that heads 18 and 19 are mounted vertically, while the heads 20 and 21 are mounted horizontally for engaging the front and rear sides of the workpiece. Accordingly, the structural arrangement for supporting the abrading head 18 and the roll structures, in the left portion of FIGS. 1 and 2, will now be described in detail.

A plate 30 extends upwardly from the plate 27, the plate 30 extending forwardly and rearwardly of the machine, see FIGS. 1, 2, 3 and 6. The plates 31 and 32 are fixed to the plate 30, as by welding, and are likewise fastened to the plate 27. A head supporting slide 33 is slidably mounted upwardly and downwardly on the plate 30, and is provided with gibs 35 for slidably connecting the member 33 to the plate 30. A member 37 is fixedly secured to the slide 33 and depends therefrom for engagement with a screw jack 40 fixed to the plate 30. The screw jack is operated by a hand wheel 41.

The slide 33 is formed with flanges 43 to slidably receive gibs 45 fixed to a flat side 47 of a head casting formed with a second flat side 48 extending at right angles to the sides 47. There are gussets 50 formed integral with the sides 47, 48, of the head casting. A cylinder 53 is pivotally mounted at one end to a bracket 54 secured to the side 47 of the head casting. The piston rod 55 is connected to a bracket 56 fixed to the slide 33, see FIG. 6. The purpose of the cylinder 53 is to effect reciprocation of the head casting on the ways 43 of the slide 33.

The abrading heads are of the belt type employing an abrasive belt 60 trained over a driving roll 61, and an upper idler roll 62. The roll 61 is mounted on a shaft 63 journalled in bearings mounted in a boss 64 formed in the side wall 48 of the casting and in an outboard support 65 attached to a block 66 mounted on the side wall 48, see FIGS. 5 and 6.

The upper idler roll 62 is mounted on a shaft journalled in a yoke 67 mounted on a slide 68 for movement toward and from the driving roll 61 along ways 69 formed on the plate 48. A cylinder 70 is connected to the slide 68 for maintaining tension on the belt 60, see FIG. 5. Shaft 63 is driven by motor 71 through belt 72.

The head structure 18, just described, is positioned for abrading engagement with the top side 73 of the work piece 74. The work piece is advanced by three pairs of power-operated feed rolls 80, 81, 80A, 81A, and 80B, 81B, rotated by variable speed motors 82. The feed roll 80 is journalled in a slide 83, and the lower feed roll 81 is journalled in a slide 85, see FIG. 7. The slides 83, 85, are mounted for vertical sliding movement in a bracket fixed to the vertical plate 31. The bracket consists of a

back plate 87 and side plates 88, see FIGS. 6 and 7. A plate 90 is fixed to the forward edges of the plates 88. The slide 83 is formed with gibs 91 overlapping the sides of the plate 90. The slide 83 includes an outer plate 93 to which a gear housing 94 is attached and to which the driving motor 82 is fixed. The output shaft 95 from the gear box has affixed thereto the upper feed roll 80, see FIG. 7, the inner end of the shaft being supported in a bearing 96 mounted in slide 83.

A cylinder 97 is fixed to a plate 98 fixedly secured to the upper end of the plate 90. The piston rod 100 is connected to the slide 83. The plate 90 is formed with a slot 101. An arm 102 extends from slide 83 through slot 101, and is apertured to receive a nut 103 threaded on a rod 104, the upper end of which is journalled in a plate 105 fixed to the upper ends of the plates 88 and restrained against axial movement by collars 106. Fluid is supplied to the upper end of the cylinder 97 to yieldingly urge the roll 80 into engagement with the top side surface 73 of the work piece 74, downward movement of the slide 83 and roll 80 being limited by nut 103 and rod 104.

The lower feed roll 81 of each pair is journalled on a shaft 107, one end of which is fixed in the slide 85, and the opposite end in an outer plate 109 fixed to the slide. The slide 85 is adjusted vertically by a jack screw 108, the lower end of which is journalled in a plate 110 secured to extensions at the bottom ends of the plates 88. The feed rolls 80, 81, are rotated in unison by a chain 112 trained over sprockets 113 fixed to the inner ends of the rolls. The chain 112 is wrapped over the upper portion of the sprocket 113 on the lower roll 81 and is trained over idler rolls 115, 116. The idler roll 116 is journalled on a pivoted arm 117 urged downwardly by tension spring 118, see FIG. 3. Feed roll structures 80A, 81A, 80B, 81B, involve the same general arrangement as rolls 80, 81.

Referring to FIGS. 3 and 4, the portion of the machine shown therein is provided with pairs of guide rolls 120, 121. These rolls are journalled for rotation about a vertical axis and engage the rear and front sides of the work piece. The rolls 120 are journalled on blocks 123. The rolls 121 are journalled on blicks 124. The blocks 123, 124, are mounted for sliding movement on an angle bracket 125 fixed to spacers 126 carried by a plate 127 extending vertically from plate 27 and welded to plates 31, 32. The block 123 has affixed to its inner end a rod 130 extending through a bracket 131 and provided with nuts 132. This provides for adjustment of block 123 to position the roller 120 for engagement with the rear side of the work piece. These rolls 120, together with other rolls in the machine, are initially aligned for engagement with the rear side of the workpiece to establish a pass line along which the workpiece is advanced by the pairs of feed rolls 80, 81.

The slides 124, on which the guide rolls 121 are journalled, are movable by a jack screw 133 provided with a hand wheel 134. The rolls 121 are adjusted toward and from the rolls 120 to accommodate workpieces of different cross sectional dimension. There are two additional sets of the guide rolls 120, 121, see FIGS. 1 and 2.

As the workpiece 73 is advanced by the feed rolls 80, 81, at the left end of the machine, the top side 73 of the workpiece is engaged by a downwardly spring pressed roll 137 which serves to make certain that the lower side of the workpiece engages the pre-positioned back-up roll 138 located immediately below the drive roll 61 of the abrading head 18. The roll 138 is journalled in a slide yoke 140 having gibs engaging the side edges of a plate 141 mounted on a plate fixed to a bracket 143 fixedly mounted on a plate 144 extending upwardly from plate 27. The back-up roll supporting yoke 140 is adjusted vertically by a screw 145 having a hand wheel 146, see FIGS. 1 and 5.

As the workpiece is advanced by the first pair of feed rolls 80, 81, between the abrasive belt trained over pulley 61 and the back-up roll 138, the workpiece passes between the second pair of guide rolls 120, 121, and the bottom side 147 of the workpiece is engaged by an upwardly spring pressed roll 150, similar to the roll 137, to press the top surface 73 of the workpiece against the back-up roll 138A, which is mounted above the abrasive belt driving roll in the abrading head 19. The abrading head 19 abrades the lower or bottom side surface 147 of the workpiece, as will be apparent. Thereafter, the work piece is engaged by the second pair of feed rolls 80A, 81A, and is advanced between the third pair of guide rolls 120, 121. The next successive engagement of the workpiece is by the back-up roll 138B, which engaged the rear surface 149 of the workpiece, and the front side 148 of the workpiece is engaged by the abrasive belt in the abrading unit 20.

The workpiece is advanced from the grinding head 20 to the grinding head 21, and is engaged by the feed rolls 80B, 81B, for discharge of the finished workpiece.

It will be observed, referring to FIGS. 1 and 2, that the abrading heads 18 and 19 are positioned closer together than the heads 19 and 20. This grouping of the heads in spaced pairs results in effective heat dissipation in the workpiece. The head 18 has abrading contact with the top side of the workpiece and while the ground area of the workpiece is moved to the head 19, heat is dissipated therefrom and in addition, head 19 engages the under side of the workpiece remote from the top side previously engaged by the head 18. The larger spacing between the heads 19, 20, permits cooling of the lower or bottom side of the workpiece previous to engagement of the adjacent front side by the head 20. In like manner, the next engagement by the head 21 is on the opposite or rear side of the workpiece. With this positioning of the abrading heads, thin wall tubing can be abraded without warping, or twisting, out of shape.

As previously stated, the mountings for the abrading heads all involve the same parts but are arranged in different planes, depending on whether the heads are mounted vertically, or horizontally. In the drawings, the same reference numerals have been applied to the head structures and their mounting components.

The back-up roll structure 138A, associated with head 19, is mounted on a vertically disposed plate 160, which is attached to the plate 30 and rigidity is imparted to the plate 160 by a web member 161, see FIG. 2. Other than that, the mounting arrangements are of complemental form.

Fluid pressure is applied alternately to the ends of the cylinder 53, at each of the abrading heads 18, 19, 20 and 21, see FIG. 6, through a two-way solenoid valve operated by switch 170 fixed to the head supporting slide 33 by a column 171. The switch is operated by a bell crank actuator 172. The actuator 172 is provided with rolls 173, 174, which are engaged by plates 175, 176, mounted in a housing see FIG. 10 including side plates 177, 178, secured to end plates 180, 181. The side plates 177, 178, are formed with mounting flanges 183 fixed to a sheet metal hood 185 secured to the side wall 48 of the abrading head casting, see FIG. 6.

A screw 187 is journalled at its ends in the plates 180, 181. One end of the screw extends outwardly of the plate 180 and is provided with a knob 188. The plate 175 is fixed to a hub 190 threaded on the screw 187. The plate 176 is fixed to a hub 191 threaded on a second screw 192, likewise journalled at its ends in the plates 180, 181. Guide rods 193 are fixed between the plates 180, 181, and are positioned between the confronting sides of the plates 175, 176, and serve to limit rotation of the plates upon rotation of the screws 187, 192.

The rolls 173, 174, are mounted on opposite sides of the legs of the bell crank member 172, and, upon reciprocation of the abrading head casting in a direction transversely of the workpiece, the rolls are alternately

engaged by the plates **175, 176,** for actuation of switch **170.** The plate **175** engages the roll **173** upon movement of the abrading head toward the pass line established at the rear side of the workpiece, FIG. 6, to oscillate the member **172** for operation of the switch **170** to supply fluid under pressure to the inner or rear end of the cylinder **53** to stop rearward movement of the abrading head **18** across the top side surface **73** of the workpiece **74.**

As the abrading head moves forwardly, the plate **176** engages the roller **174** to move the bell crank member **172** in a clockwise direction, FIG. 6, for application of fluid pressure to the forward end of the cylinder **53** and accordingly, limiting the forward movement of the abrading head.

The reduced end portion of screw **192,** extending through plate **180,** is provided with a slot **200** for the reception of a screwdriver, or like tool, to effect rotation and adjustment of the screw **192.** This adjustment is an initial adjustment to determine the position to which the abrading head is moved relative to the pass line at the rear and bottom side surfaces of the work piece. When so adjusted, the screw is locked in adjusted position by thumb screw **201** acting on a plug **202** pressed against the journal of screw **192.**

Screw **187** is adjusted by knob **188** to position the plate **175** for controlling the extent of movement of the head in the opposite direction. This adjustment will depend upon the cross sectional dimension of the rectangular workpiece. The screw **187** is likewise retained in adjusted position by a thumb screw **201** and a plug **202.** With this arrangement, the magnitude of the reciprocation of the abrading head is controlled according to the cross sectional dimension of the workpiece. It will be understood that each abrading head is equipped with this mechanism for controlling the stroke, or amplitude, of the reciprocating movement of each abrading head.

While the machine disclosed and described is provided with four abrading heads for abrading the four sides of the rectangular workpiece in commercial practice, the machine usually includes three or four of the units shown in the drawings, whereby the entire assembly is equipped with twelve or sixteen heads to provide a mirror, or super-finish, to the workpiece.

What we claim is:

1. An abrading machine for finishing the four side surfaces of elongated workpieces rectangular in cross section comprising a frame, a linear series of rolls fixedly positioned in a pass line for engaging two adjacent side surfaces of a workpiece, additional rolls mounted along said pass line for engaging the opposite adjacent side surfaces of the workpiece, said additional rolls being adjustable toward and from said pass line to accommodate workpieces of different cross sectional dimension, certain of said rolls being power operated feed rolls for advancing the workpieces along said pass line, a plurality of abrading belt heads mounted on said frame and positioned along said pass line for abrading engagement with the four surfaces successively of the workpiece during advancement thereof along said pass line, each of said heads being adjustable toward and from the workpiece and means operable to reciprocate each head in a direction transversely of the side surfaces contacted by said head.

2. An abrading machine as set forth in claim **1** and including means operable to vary the magnitude of the oscillation of said heads.

3. An abrading machine as defined in claim **1,** wherein said power operated feed rolls consist of pairs of rolls engaging opposite side surfaces of the workpiece, each roll of said pairs being adjustable toward and from the workpiece, and a power drive common to both rolls of each pair.

4. An abrading machine as set forth in claim **1,** wherein said power operated feed rolls consist of pairs of rolls, a power drive operatively connected to at least one roll of each pair, one roll of each pair being fixed in adjusted position, and means yieldingly urging the other roll of the pair against the workpiece.

5. An abrading machine as set forth in claim **1,** wherein each abrading head includes a back-up roll for engaging the side of the workpiece opposite to the side engaged by the abrading belt, and means positioned upstream from certain of said abrading heads and operable to yieldingly urge the workpiece against the back-up roll.

References Cited

UNITED STATES PATENTS

3,090,170	5/1961	Slattery	51—140
3,269,065	12/1963	Nylund	51—139

WILLIAM R. ARMSTRONG, Primary Examiner

U.S. Cl. X.R.

51—39, 140, 142