Dec. 16, 1952 D. A. WALLACE 2,621,445

APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

Filed April 2, 1947 6 Sheets-Sheet 1

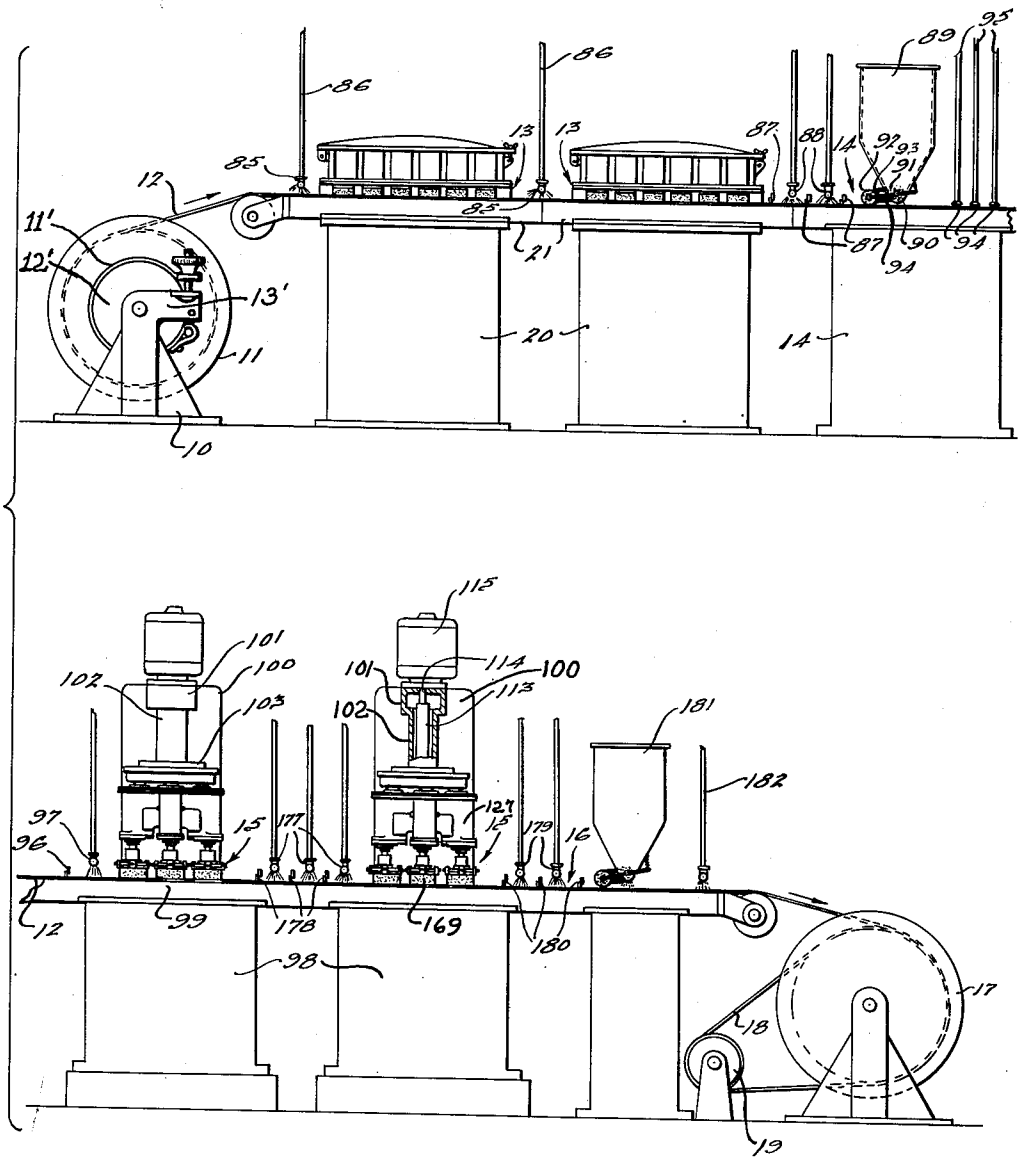

Fig. 1.

INVENTOR.
David A. Wallace.
BY
Harness & Harris
ATTORNEYS.

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APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

Filed April 2, 1947 6 Sheets-Sheet 2

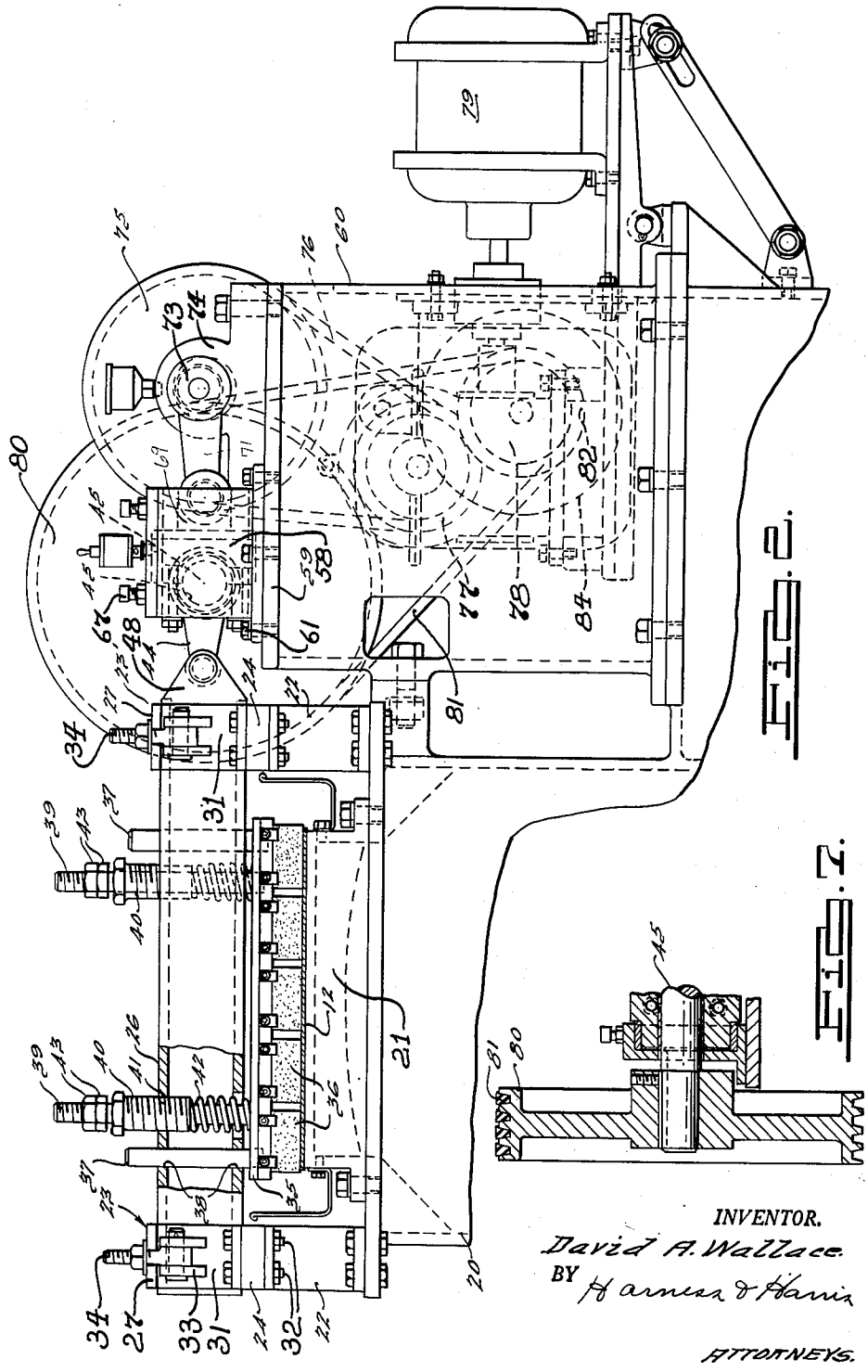

Fig. 2.

Fig. 7.

INVENTOR.
David A. Wallace.
BY Harness & Harris
ATTORNEYS.

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APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

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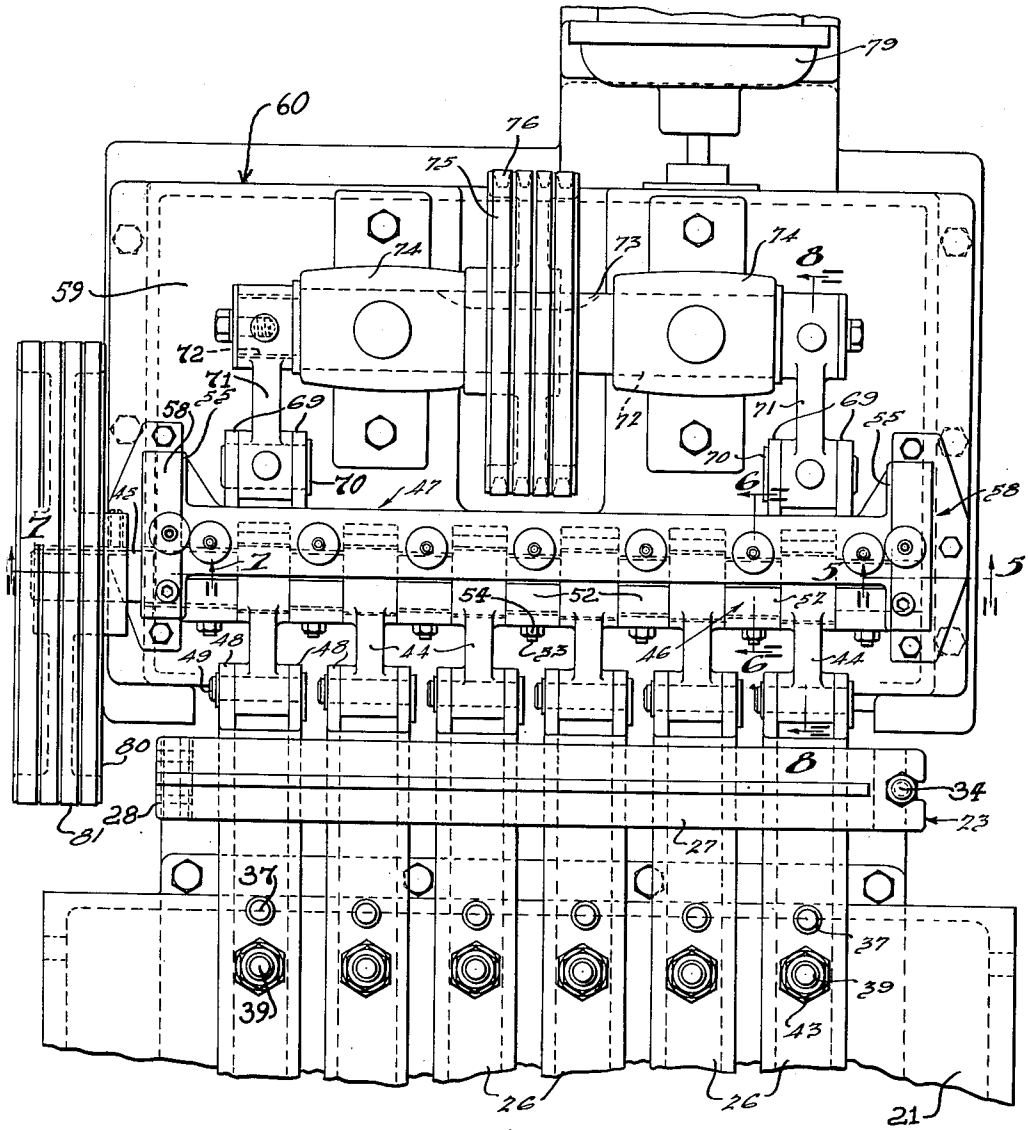

FIG. 3.

INVENTOR.
David A. Wallace.
BY
Harris & Harris.
ATTORNEYS.

Dec. 16, 1952 D. A. WALLACE 2,621,445

APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

Filed April 2, 1947 6 Sheets-Sheet 4

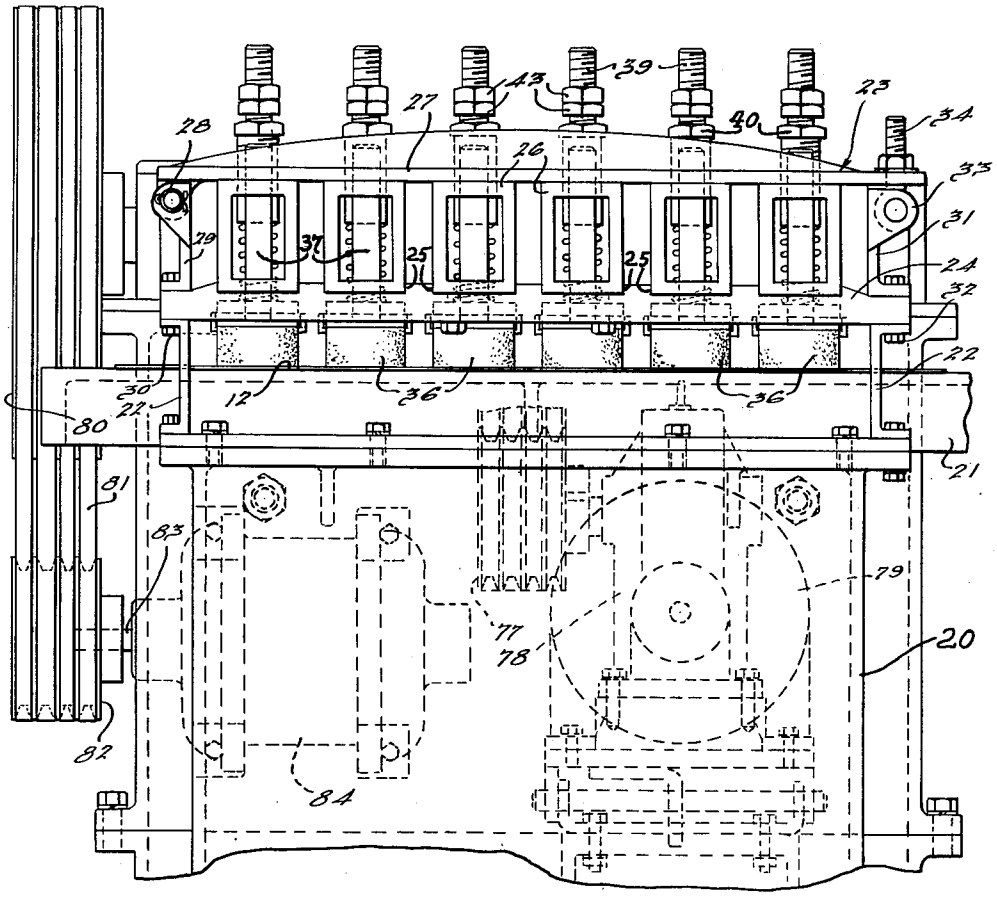

Fig. 4.

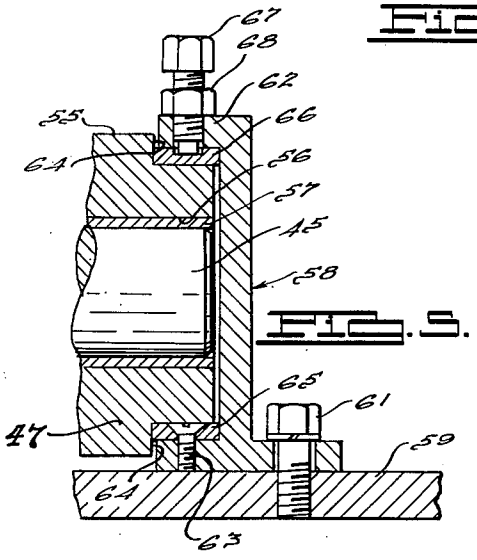

Fig. 5.

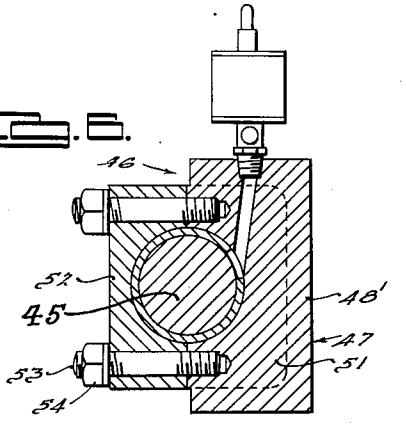

Fig. 6.

INVENTOR.
David A. Wallace.
BY Hamers & Hamers
ATTORNEYS.

Dec. 16, 1952 D. A. WALLACE 2,621,445

APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

Filed April 2, 1947 6 Sheets-Sheet 5

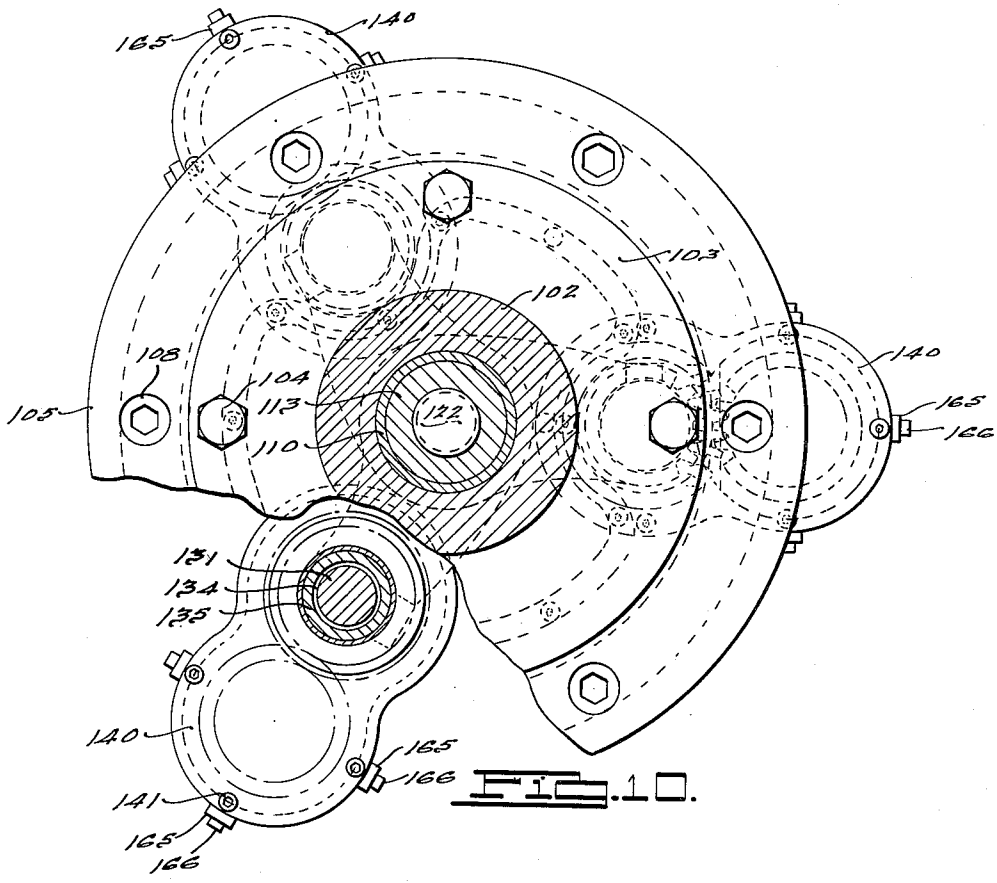

FIG. 1.

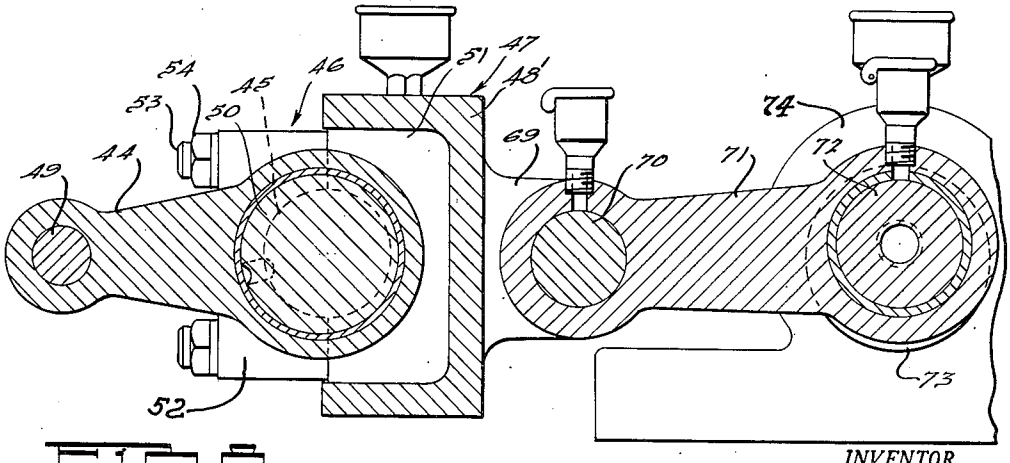

FIG. 5.

INVENTOR.
David A. Wallace.
BY
Harness & Harris
ATTORNEYS.

Dec. 16, 1952 D. A. WALLACE 2,621,445

APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

Filed April 2, 1947 6 Sheets-Sheet 6

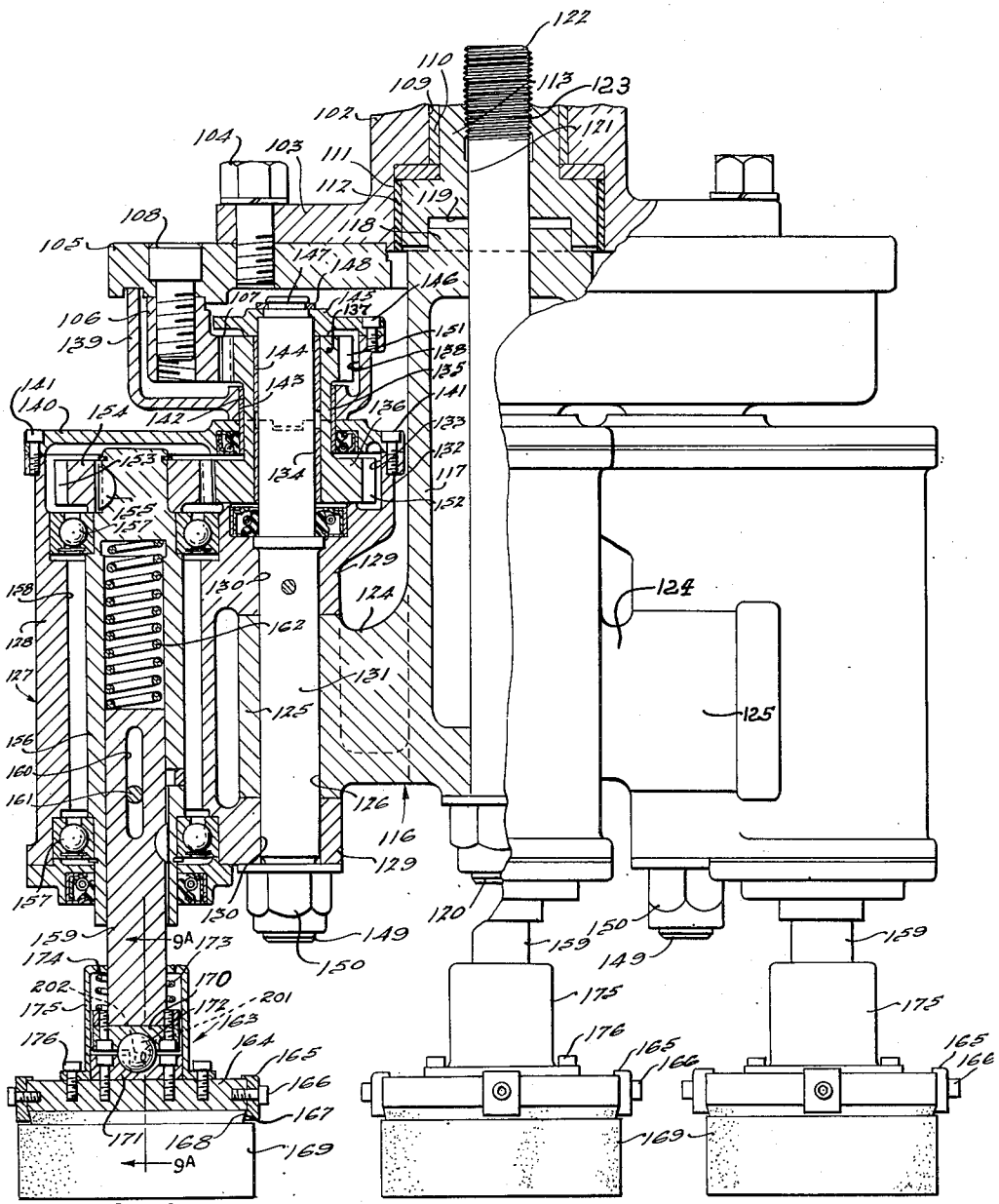

Fig. 9.

Fig. 9A.

INVENTOR.
David A. Wallace.
BY
Harness & Harris
ATTORNEYS.

Patented Dec. 16, 1952

2,621,445

UNITED STATES PATENT OFFICE

2,621,445

APPARATUS FOR POLISHING CONTINUOUS STRIP MATERIAL

David A. Wallace, Grosse Pointe Farms, Mich., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application April 2, 1947, Serial No. 738,769

4 Claims. (Cl. 51—5)

1

This invention relates to an improved apparatus and process for polishing a continuous strip of sheet metal such as stainless steel.

More particularly the invention pertains to an apparatus and process of this kind by which a lustrous finish is provided on a ribbonlike strip of stainless steel during progressive movement of successive increments of the strip.

One of the main objects of the invention is to provide in apparatus of this kind successive abrading stations at which a surface of a sheet metal strip is subjected to one or more rough abrading and fine abrading actions during continuous movement of the strip relative to the apparatus.

Another object of the invention is to provide in a machine of this kind a plurality of rough and fine abrading stations which are predetermined in number with respect to the rate of movement of the strip operated upon to produce a surface finish of selected smoothness.

A further object of the invention is to provide at the rough abrading stations of the apparatus a plurality of relative rectilinear movements in diverse directions between the strip operated upon and the rough abrading elements and a plurality of relative circular movements about diverse centers between the strip and other abrading elements at the fine abrading stations.

A still further object of the invention is to provide means in polishing apparatus of this kind for applying a lubricating coolant to the surface of the strip operated upon during the rough and fine abrading operations and means for effectively removing abrading grit, metal particles and coolant from the strip between the rough and fine abrading actions as well as after the fine abrading operation.

Another object of the invention is to provide means in polishing apparatus of this kind for longitudinally moving a relatively continuous strip-like sheet of work in one direction and reciprocating in unison a plurality of abrading members in abrading contact with the strip transversely of the movement of the strip while simultaneously reciprocating such abrading members relative to each other in said transverse direction.

A further object of the invention is to provide unitary reciprocative movement of the abrading members which is of a slower rate and longer stroke than the rate and stroke respectively of the reciprocative movement of the abrading members relative to each other.

Another object of the invention is to provide

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an improved rotary type of fine abrading apparatus which can be radially adjusted to adapt it for finishing of strip-like work of diverse widths.

An additional object of the invention is to provide a combination of abrading actions for successively polishing a relatively continuous strip of stainless steel at a rapid rate.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which:

Fig. 1 is an interrupted elevational view of an abrading machine embodying the invention.

Fig. 2 is a fragmentary elevational end view of a rough abrading unit of the improved machine.

Fig. 3 is a fragmentary plan view of the rough abrading unit shown in Fig. 2.

Fig. 4 is a fragmentary side elevational view of the rough abrading unit shown in Figs. 2 and 3.

Fig. 5 is a fragmentary vertical sectional view taken on line 5—5 of Fig. 3.

Fig. 6 is a fragmentary vertical sectional view taken on line 6—6 of Fig. 3.

Fig. 7 is a fragmentary vertical sectional view taken on line 7—7 of Fig. 3.

Fig. 8 is a fragmentary vertical sectional view taken on line 8—8 of Fig. 3.

Fig. 9 is an elevational view, partly in section of a fine abrading unit of the abrading machine illustrated in Fig. 1.

Fig. 9A is a view, partly in section, taken on the line 9A—9A of Fig. 9.

Fig. 10 is a plan view of the fine abrading unit shown in Fig. 9.

In the form of the invention shown in the drawings the improved polishing apparatus includes a support 10 for a reel 11 on which is wrapped an elongated ribbon or strip 12 of sheet metal such as stainless steel. The sheet metal strip 12 extends through a pair of rough finishing units 13, through a washing unit 14 and through a pair of fine finishing units 15 in the sequence recited. After the strip leaves the last fine finishing unit 15 it passes through a cleaning station generally designated by the numeral 16, and is wrapped upon a reel 17 which is preferably driven by a belt 18. The belt 18 extends around the driving pulley 19 which is rotated by a motor or other suitable means (not shown). Rotation of the reel 11 is retarded by a brake band 11' which acts on a brake drum 12' on the reel 11 in order to controllably tension and stretch the sheet 12 during the finishing operations. The brake band 11' is mounted on an arm 13' carried by the support 10.

The rough finishing units 13 are identical, and

the construction of one thereof is shown in Figs. 2 to 7 of the drawings. Each rough finishing unit 13 includes a base 20 on which is mounted a work support 21. Abrading apparatus is disposed above the work support 21. This abrading apparatus comprises two pairs of spaced supports 22 extending upwardly from the base member 20, as viewed in Fig. 2, on which are mounted stationary guide members generally designated by the numerals 23 and 23' disposed beyond the opposite longitudinal edges of the strip 12, respectively. The stationary guide members 23 and 23' are substantially identical and each includes a guide plate 24 having rectangular grooves 25 in its upper surfaces in each of which is reciprocably mounted a tubular bar 26. The guide plates 24 are parallel to each other and extend in the general direction of the travel of the sheet metal strip 12 which is illustrated in Figs. 1 and 4. In the apparatus shown, there are six reciprocable tubular bars 26 each of which are held against upward movement from the guide plates 24 by cover plates 27. Each cover plate 27 is pivotally mounted at 28 to an upstanding support 29 which is fixed to one end of each guide plate 24 and to a support 22 by bolts 30. A similar upstanding support 31 is provided at the other end of each guide plate 24 and fixed to the end thereof and to the associated support 22 by bolts 32. The upstanding supports 31 are provided with ears 33 on which is pivoted a locking bolt 34 by which the cover plates 27 may be releasably held in superimposed relation with respect to the tubular bars 26 to retain the latter in place.

Vertically shiftably mounted on each tubular bar 26 is a plate 35 on which are fixed a plurality of blocks 36 of abrading material or other suitable abrading elements. Each abrading element carrying plate 35 is provided with a pair of upstanding guide pins 37 which are slidably received in registering apertures 38 formed in the upper and lower side walls of each tubular bar 26. The abrading element carrying plates are also provided with a pair of upstanding threaded stems 39. Each stem 39 is shiftably mounted in a sleeve 40 which is threaded in an aperture 41 formed in the upper wall of the bar 26. A coil spring 42 surrounds the lower portion of each threaded stem 39 and bears between the lower end of the sleeve 40 and the abrading element carrying plate 35 so as to urge the abrading elements against the sheet metal strip 12 during operation of the apparatus. The threaded sleeve 40 may be adjustably positioned in the threaded openings 41 to predetermine the compression of the springs 42 in order to predetermine the pressure with which the abrading elements are urged against the sheet metal strip 12. A pair of nuts 43 are threaded on the upper ends of the stems 39, the lowermost nut being spaced from the upper end of the sleeve 40 as shown in Fig. 2. These nuts serve to prevent separation of the stems 39 from the sleeves 40 in which they are slidably received and thus retain the apparatus in an assembled state and also limit the downward movement of the abrading elements 36 by the springs 42. Each of the six tubular bars 26 are similarly provided with a row of abrading elements which move as a unit in a manner hereinafter set forth.

The right end of each of the shiftable tubular bars 26 which carry the abrading elements 36 is connected by a connecting rod 44 with a crankshaft member 45. The crankshaft member 45 extends substantially parallel to the path of movement of the sheet metal strip 12 and is shiftably supported by and journaled in bearings generally designated by the numeral 46 in Figs. 3 and 6 which are carried by a shiftable carriage generally designated by the numeral 47. Each tubular bar 26 has a pair of ears 48 which extend from the right end thereof, as viewed in Fig. 2, to which the left end of a connecting rod 44 is pivoted by a pin 49. The other end of each connecting rod embraces an eccentric portion 50 on the crankshaft 45.

The shiftable carriage 47 includes a channel shaped body portion 48' in which are fixed spaced bearing base portions 51 having bearing caps 52 fixed thereto by threaded studs and nuts 53 and 54 respectively. The channel shaped body portion 48' of the carriage 47 has integral transversely extending blocks 55 at its opposite ends which are provided with openings 56. Bearings 57, shown in Fig. 5, in which the ends of the crankshaft 45 are journaled are disposed in the openings 56. The blocks 55 are shiftably mounted in brackets, generally designated by the numeral 58, which are mounted on and fixed to an upper wall 59 of a housing 60, located rightwardly as viewed in Fig. 2, of the base member 20, by bolts 61. The brackets 58, one of which is located beyond each extremity of the crankshaft 45, are provided with inwardly extending upper and lower flanges 62 and 63 which are received in edge notches 64 formed in the blocks 55. A strip of bearing metal 65, such as bronze or other suitable bearing alloy, is mounted on the upper side of the lower flange 63 of the bracket 58 and a similar bearing strip 66 is disposed adjacent the lower side of the flange 62. The bearing strips 65 are held in place and positioned with respect to the flanges 62 by set bolts 67 which may be fixed in an adjusted position by lock nuts 68. This structure accommodates shifting movement of the carriage 47 and crankshaft 45 mounted thereon and confines such movement to a course extending transversely of the path of movement of the strip 12.

The body portion 48 of the carriage is provided with two pairs of ears 69 which extend rightwardly therefrom, as viewed in Figs. 2 and 8. Pivotally attached to each pair of ears 69 by a pin 70 is a connecting rod 71 which has its right end journaled on an eccentric 72 of a crankshaft 73, respectively. The eccentrics 72 are provided on the opposite extremities of the crankshaft 73 which is journaled in spaced bearings 74 mounted on the top wall 59 of the housing 60.

The shaft 73 is provided, at a location thereon between the bearings 74, with a multiple groove pulley 75 which is driven by belts 76 which are in turn driven by a multiple groove pulley 77. The pulley 77 is driven by reduction gearing, generally designated by the numeral 78, which is in turn driven by a motor 79. The crankshaft 45 is provided with a multiple groove pulley 80 which is driven by belts 81 which is in turn driven by a multiple groove pulley 82. The pulley 82 is mounted on a shaft 83 of a motor 84.

In operation of the rough abrading apparatus, the sheet metal strip 12 is continuously moved at a selected rate predetermined by the amount of abrading to be performed thereon, and the number of rough abrading units employed while the abrading elements 36 of each row of abrading elements carried by each tubular bar 26, are reciprocated transversely of the sheet 12 by the crankshaft 45 and respective connecting rods 44. This reciprocation of the abrading elements is

preferably performed at a relatively high speed and throughout a relatively short stroke, the speed of reciprocation and the length of stroke being predetermined by the speed of the motor 84 and the mechanism by which the drive is transmitted from it to the crankshaft 45. The length of stroke of the reciprocative movement is predetermined by the eccentrics 50 of the crankshaft 45 which are preferably angularly located relative to each other so as to impart relative reciprocative movements to the tubular bars 26. The eccentrics 50 may be of equal eccentricity or they may vary in eccentricity so as to move the respective tubular bars 26 and abrading elements 36 carried thereby throughout strokes of different lengths.

While the aligned rows of abrading elements 36 are reciprocated relative to each other they are also reciprocated in unison with each other by rotation of the crankshaft 73 which is preferably driven at a lower rate of speed than the crankshaft 45 and which has larger eccentrics than those of the latter crankshaft. With this construction the rows of abrading elements are reciprocated relative to each other at a relatively high speed and throughout a relatively short stroke and they are simultaneously reciprocated in unison throughout a comparatively longer stroke at a comparatively slower speed. The multiple reciprocative action coupled with the progressive movement of the sheet metal strip 12 results in uniform abrading action throughout the entire area of the surface operated upon and guards against all possibility of repeated application of localized areas of any one abrading element to the same area of the work. The abrading elements 36 are yieldably urged by the springs 42 against the strip 12 with relatively light pressure, during the foregoing movements of the abrading elements.

Before the sheet metal strip 12 enters each of the rough abrading units 13, a coolant such as oil of suitable viscosity or other suitable material is sprayed upon the surface of the strip to be finished, the oil being discharged by a nozzle spray device mounted on the end of a supply pipe 86 which leads to a source of coolant (not shown). In some instances water may be employed as the coolant. As the strip 12 leaves the last of the series of rough abrading units 13, the surface previously operated upon is subjected to the action of scrapers 87 and a washing liquid is sprayed thereon from nozzles 88. Water may be used as the washing liquid if desired. After the last washing spray, a scraper 87 is applied to the strip 12 and, if desired, a powdered substance such as powdered chalk, talc or other suitable material is deposited upon the strip from a hopper 89. The hopper 89 preferably has an outlet 90 in which is provided suitable dispensing means 91 for evenly distributing the powdered material upon the upper surface of the strip 12 as it passes under the outlet 90. The dispensing mechanism 91 may be propelled by a roller 92 carried by an arm 93 mounted on the hopper, the roller being connected by a belt 94 to a rotatable dispensing mechanism 91. After the application of the powdered material which serves to dry the surface by absorbing any water or other washing fluid previously applied thereto, the surface of the strip 12 is vacuum cleaned by passing under vacuum heads 94 which are connected to pipes 95 leading to a source of vacuum (not shown).

As further shown in Fig. 1, a scraper 96 is applied to the strip 12 after it passes the vacuum cleaner 94 and following the application of the scraper 96 coolant is sprayed from a nozzle 97 upon the surface of the strip immediately before the strip passes under the first of a series of finishing abrading units 15.

Each abrading unit 15 comprises a base portion 98 having a work support platform 99 and a vertically upstanding back member 100. Mounted upon the back member 100 and extending forwardly therefrom, as viewed in Fig. 1 is a fixture 101 having a tubular portion 102 extending downwardly from the fixture 101. Provided on the lower end of the tubular portion 102 is a radial flange 103 on which is secured by bolts 104 a substantially horizontal plate member 105. Mounted on the lower side of the plate member 105 adjacent its outer periphery is a ring gear 106 having internal gear teeth 107. The ring gear 106 is secured to the plate 105 by cap screws 108, as shown in Fig. 9.

The tubular portion 102 of the fixture is provided with a cylindrical bore 109 in which is mounted a bearing 110. The bore 109 has a concentric counterbore 111 in which is mounted a bearing member 112. Journaled in the bearing 110 is a spindle 113 which is drivingly connected to a shaft 114 of a motor 115, the motor being mounted on the top side of the fixture 101 and rigidly secured to it. The lower end portion of the tubular portion 102 and the flange 103 serve as a carriage support on which is mounted a carriage generally designated by the numeral 116. The carriage 116 has a central sleeve portion 117 which is provided at its upper end with a flat sided projection 118 which is receivable in a correspondingly shaped flat sided recess 119 formed in the lower extremity of the spindle 113. A rotative drive is transmitted from the spindle 113 to the carriage 116 by the interfitting engagement of the projection 118 in the recess 119. The carriage 116 is held in assembled relation with respect to the spindle 113 by a bolt 120 extending through the sleeve portion 117 of the carriage and into a central bore 121 of the spindle 113 to which it is attached by threads 122 and 123 on the upper end of the bolt 120 and in the bore 121 of the spindle, respectively.

Extending outwardly radially from the central sleeve 117 of the carriage 116 are three arms 124. Each arm 124 is provided at its extremity with a tubular element 125 having a bore 126. Pivotally mounted on each tubular portion 125 is a tool holder generally designated by the numeral 127 which comprises a main body portion 128 having spaced flanges 129 provided with registered bores 130 in which is received a pin 131. The pin 131 extends through the bore 126 of the tubular element 125 to pivotally support the tool holder 127, as illustrated in Fig. 9. Formed integral with the upper flange 129 is a casing portion 132 having a recess 133 therein. The pin 131 extends centrally through the recess 133 and that portion of the pin disposed within the recess is provided with a bearing 134 on which is journaled a sleeve 135 having pinions 136 and 137 integrally formed on its lower and upper ends respectively. The pinion 136 is disposed in the recess 133 and the pinion 137 is disposed in a recess 138 provided within a housing 139. The housing 139 is located beneath the plate 105 and is mounted on a cover plate 140 disposed over the body portion 128 of the tool holder 127 and over the recess 133 and is screwed to the body portion 128 by bolts 141. The housing 139 has a bore 142 provided with a bearing 143 in which the sleeve 135 is journaled. The pin 131 extends through the sleeve 135 and is

provided with a bearing 144 disposed between the periphery of the pin and the periphery of the sleeve 135. A cap 145 is fixed by cap screws 146 on the housing 139 and is provided with a central opening through which a reduced section 147 on the upper end of the pin 131 extends. The reduced section 147 is provided with a groove for receiving a C washer 148. The pin 131 is provided at its lower end with threads 149 on which is threaded a nut 150 by which the tool holder may be selectively clamped in a desired position. When the bolt 150 is loosened, the tool holder may be pivotally moved with respect to the tool carriage, as hereafter more clearly set forth.

The pinion portion 137 of the sleeve 135 is provided with teeth 151 which are meshed with the teeth 107 of the ring gear 106. The pinion portion 136 of the sleeve 135 is provided with teeth 152 which mesh with pinion teeth 153 of a pinion 154 which is keyed at 155 to a tubular shaft element 156. The tubular shaft element 156 is journaled by bearings 157 in a bore 158 formed in the body portion 128 of the tool holder 127 in parallel relationship with respect to the pin 131. A plunger element 159 is slidably mounted in telescoping relationship in the lower end portion of the tubular shaft element 156. The plunger element 159 is provided with an elongated slot 160 through which a pin 161 extends in order to accommodate relative longitudinal movement of the tubular shaft element and plunger while holding them against relative rotation. A spring 162 yieldably urges the plunger 159 outwardly with respect to the tubular shaft element 156.

Mounted on the lower end of the plunger 159 is an abrading element holder generally designated by the numeral 163. This holder comprises a disc 164 having spaced cleats 165 mounted on its periphery by cap screws 166 and provided with beveled surfaces 167 which are adapted to cooperate with correspondingly beveled surfaces 168 on an abrading stone, or other equivalent abrading element 169, to clampingly hold the abrading element on the lower side of the disc 164. The disc 164 is universally pivotally mounted on the lower end of the plunger 159 by bearing elements 170 and 171 secured to the plunger and disc respectively. A ball bearing element 172 is disposed between spherical surface portions of the bearing elements 170 and 171. The bearing elements 170 and 171 are held in embracing relationship with respect to the ball bearing 172 by a spring 173 surrounding the lower end portion of the plunger 159 and which bears against the bearing element 170 on the plunger and against an inwardly extending radial flange 174 of a sleeve 175 which is attached by cap screws 176 to the upper side of the disc 164. The bearing elements 170 and 171 are provided with a cooperating slot and key driving connection of the type commonly referred to as a screw driver slot drive for the transmission of torque therebetween as illustrated in Figs. 9 and 9A. A slot 201 is provided in bearing element 171 which receives keys or teeth 202 carried by bearing element 170 so that torque is transmitted thereby while accommodating universal movement of bearing element 171 relative to bearing element 170. In the illustration shown, the carriage 116 is provided with three tool holders 127 and abrading elements 169. More or less abrading tools may be provided on the tool carriage if desired.

In operation of the fine abrading unit shown in Figs. 9 and 10, it will be noted that the ring gear 106 carrying the internal gear teeth 107 remains stationary while the tool carriage 116 is drivingly rotated by the motor 115. Relative rotation of the tool carriage 116 and ring gear 106 causes corresponding rotation of the sleeve 135 as a result of the meshed relationship between the teeth 151 of the pinion portion 137 of this sleeve the teeth of the ring gear 106. The lower pinion portion 136 which has teeth 152 meshed with the teeth 153 of the pinion 154 drivingly rotates the tubular shaft element 156 and plunger 159 in the same direction about the axis of the bore 159 in which the foregoing structure is journaled as the tool carriage 116 is rotated about its axis. Thus the abrading element 169 is simultaneously revolved about the axis of the tool carriage 116 which is coincident with the central axis of the bolt 120 and rotated in the same direction about the axis of the tubular shaft element 156. While each abrading element 169 is undergoing these multiple-rotative movements, it is being urged downwardly against the upper surface of the sheet metal strip 12, as viewed in Fig. 1, by the spring 162. The path of movement of each abrading element 169 may be independently predetermined so as to accommodate the abrading apparatus to operate upon work of different widths by loosening the bolt 150 and turning the tool holder 127 about the axis of the pin 131 to any desired angular position. This can be accomplished without affecting the meshed engagement between the teeth 151 of the pinion 137 and the teeth 107 of the ring gear 106 inasmuch as the movement of the tool holder occurs about the axis of the pinion 137.

The continuous strip finishing apparatus illustrated in Fig. 1 may be provided with as many fine finishing units as required, only two fine finishing units being illustrated in the drawing. Before each successively adjacent part of the strip 12 reaches the first finishing unit a lubricating type of coolant is applied thereto, as previously stated, by the spray nozzle 97. Between each pair of successive fine finishing units of the apparatus, rinse liquid such as water, or other suitable liquid, or a lubricating coolant, such as that conventionally used in finishing operations is sprayed from nozzles 177 upon the upper surface of the sheet 12 and at the location of the spray nozzle 177 scrapers or wipers 178 are preferably applied to the upper surface of the sheet 12 in order to remove grit particles of abrasive or particles of the material of the sheet before the next successive fine finishing operation commences. The last spray nozzle 177 on the extreme right, as viewed in Fig. 1, preferably discharges a lubricating coolant on the surface of the strip to facilitate the final finishing operation which is performed by an apparatus substantially identical to that shown in Fig. 9 although, if desired, final abrading elements may be used in this last abrading operation. After the final abrading operation, the upper surface of the sheet metal strip is again rinsed by fluid such as water sprayed from nozzles 179 and the upper surface of the strip is wiped by wipers 180. The finished surface of the strip may then be dusted with a dry powder by dusting apparatus 181 substantially identical to the dusting apparatus 89, previously described. The strip may then be cleaned by vacuum cleaners 182 which are located at the extreme right end of the apparatus and thereafter the strip is wound upon the reel 17.

It is found that the combination of the multiplicity of reciprocative movements produced between the abrading elements 36 and the sheet

metal strip 12 during the rough finishing operations and the multplicity of circular movements between the abrading elements 169 and the sheet 12 during the fine finishing operations together with the continuous longitudinal movement of the sheet 12 and the precautions taken for cleaning the strip between the successive steps of each of these operations results in formation of a surface free from scratches and having a high degree of smoothness. Since all portions of the sheet metal strip is subjected to uniform abrading action under pressure which can be accurately predetermined, the final finish produced in this continuous manner is found to be substantially uniform throughout.

Although but one specific embodiment of the invention is herein shown and described, it will be understood that various changes in the sequence of operations, steps and materials employed may be made without departing from the spirit of the invention.

I claim:

1. An abrading unit comprising a base structure having a work support, a carriage support mounted on said base structure in spaced relation to said work support, a carriage rotatably mounted on said carriage support disposed between the latter and said work support, a spindle mounted on said carriage in spaced parallel relationship to the rotative axis thereof, a fixture including journal bearing means swingably mounted on said spindle, an abrading tool journaled in said journal bearing means including a pinion fixed thereon and an abrading element having an abrading surface disposed to operate upon work supported on said work support, a ring gear on said carriage support concentric with the path of revolving movement of said tool about the axis of said carriage, a countershaft member journaled on said spindle having teeth meshed with the teeth of said ring gear and pinion respectively for rotating said tool about its axis as said tool is revolved about the axis of said carriage, said fixture being swingably adjustable on said spindle into varying spaced relationship with respect to said rotative axis of said carriage while said ring gear, pinion and gear member are in mesh, and means operatively connected to said fixture and adapted to releasably connect said fixture to said carriage to prevent displacement of the fixture from an adjusted position relative to said carriage.

2. An abrading unit comprising a base structure having a work support, a carriage support mounted on said base structure in spaced relation to said work support, a carriage rotatably mounted on said carriage support disposed between the latter and said work support, a plurality of arcuately spaced spindles mounted on said carriage in parallel relationship to the rotative axis thereof, a fixture swingably mounted on each spindle and including journal bearing means, an abrading tool journaled in the journal bearing means of each of said spindles, each abrading tool having a pinion fixed on one end and an abrading element on its opposite end provided with an abrading surface disposed to operate upon work supported on said work support, a stationary ring gear on said carriage support, a counter shaft member journaled on each of said spindles having a set of gear teeth meshed with said ring gear and an axially spaced set of gear teeth meshed with a pinion of one of said tools respectively, said fixtures being swingably adjustable on said spindles into varying spaced relationship with respect to the rotative axis of said carriage while said ring gear, pinions and sets of gear teeth are retained in mesh, and means operatively connected to each of said fixtures and adapted to releasably connect said fixtures to said carriage to prevent displacement of said fixtures from their respective adjusted positions relative to said carriage.

3. Apparatus for polishing an elongated strip of sheet-like material comprising a work support, feeding mechanism located adjacent one end of said work support and operable to progressively move said sheet-like material along said work support in the direction of its length, a rough abrading unit located adjacent the end portion of said work support along which successive portions of said strip are initially moved, said rough abrading unit including a plurality of abrading members having abrading surfaces engageable with said strip positioned in opposed relationship to said work support and including an individual eccentric drive mechanism for each of said abrading members, said drive mechanisms being operable to reciprocate said abrading members relative to each other transversely of said work support, and said drive mechanisms each being carried by a carriage shiftably mounted for movement transversely of said work support, said rough abrading unit further including an eccentric drive mechanism operable to reciprocate said carriage transversely of said work support to thereby reciprocate said abrading members in unison, and a fine abrading unit spaced from said rough abrading unit in the direction of movement of said strip, said fine abrading unit including a carriage support mounted on said work support, a carriage rotatably mounted on said carriage support in opposed relationship to said work support and rotatable about an axis intersecting the path of said strip, a spindle mounted on said last mentioned carriage in spaced parallel relationship to the rotative axis thereof, a gear drive mechanism operably connecting the carriage of said fine abrading unit and said spindle and a driving mechanism operable to rotate the carriage of said fine abrading unit and through said gear drive mechanism to rotate said spindle and an abrading member engageable with said strip and carried by said spindle in opposed relationship to said support.

4. Apparatus for polishing an elongated strip of sheet-like material comprising a work support, feeding mechanism located adjacent one end of said work support and operable to progressively move said sheet-like material along said work support in the direction of its length, a rough abrading unit located adjacent the end portion of said work support along which successive portions of said strip are initially moved, said rough abrading unit including a plurality of abrading members having abrading surfaces engageable with said strip positioned in opposed relationship to said work support and including an individual eccentric drive mechanism for each of said abrading members, said drive mechanisms being operable to reciprocate said abrading members relative to each other transversely of said work support, and said drive mechanisms each being carried by a carriage shiftably mounted for movement transversely of said work support, said rough abrading unit further including an eccentric drive mechanism operable to reciprocate said carriage transversely of said work support to thereby reciprocate said abrading members in

unison, a liquid spray nozzle positioned above said work support and spaced from said rough abrading unit in the direction of movement of said strip, pipe means connected to said nozzle and adapted to be connected to a source of supply of rinsing liquid, and drying powder dusting apparatus positioned above said work support and spaced from said nozzle in the direction of movement of said strip, said dusting apparatus comprising a hopper having an outlet located above said work support, a rotatable dispensing mechanism located adjacent said opening, a roller located adjacent said work support and adapted to engage said strip to be rotated by movement of said strip and drive transmitting mechanism operatively connecting said roller and said dispensing mechanism whereby movement of the strip imparts rotation to the dispensing mechanism and said powder issues from said outlet and drops by gravity on to said strip.

DAVID A. WALLACE.

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