April 14, 1959 R. W. MOORE ET AL 2,881,570

ROTARY SMOOTHER AND DESMUDGER

Filed June 18, 1957 6 Sheets-Sheet 1

Fig. 1.

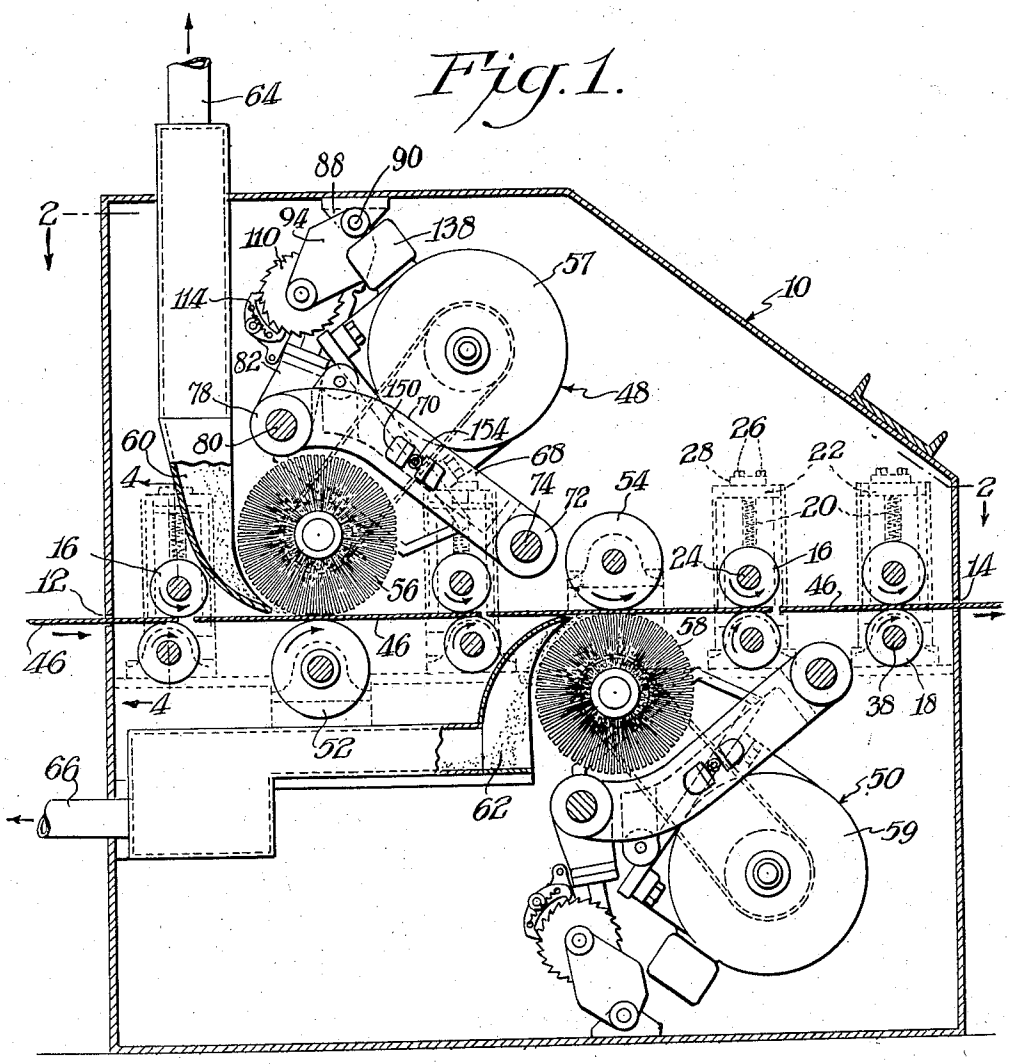
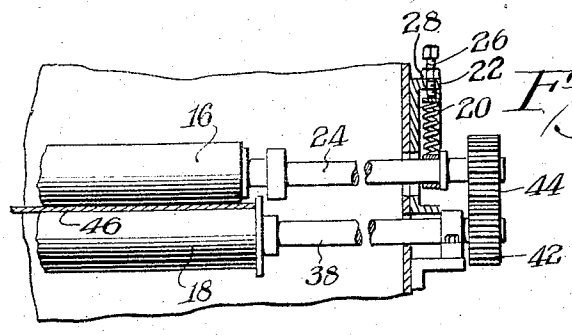


Fig. 4.



INVENTORS
Ralph W. Moore &
BY Charles H. Bradley, Jr.
Connolly and Hutz
ATTORNEYS

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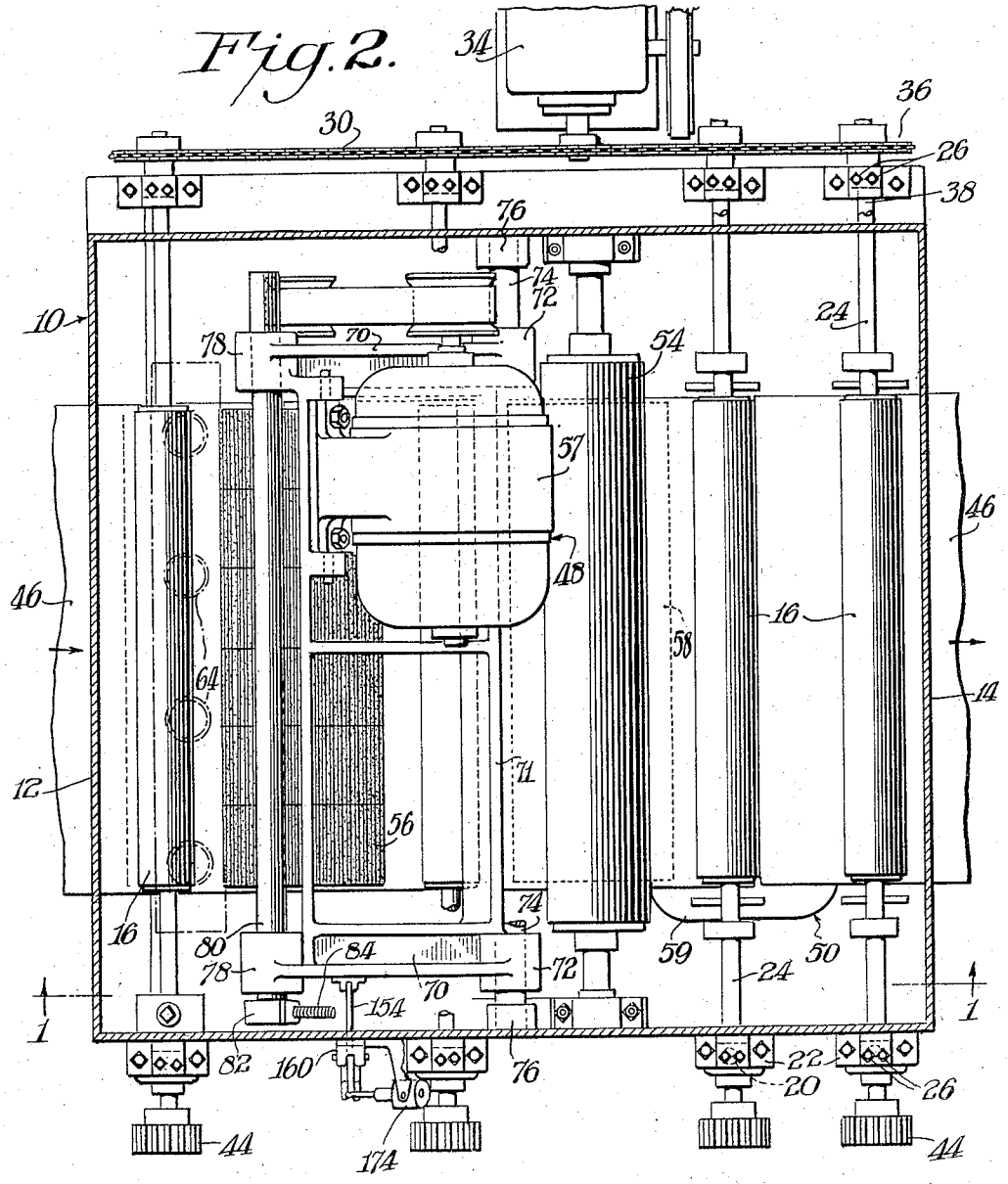
ROTARY SMOOTHER AND DESMUDGER

Filed June 18, 1957 6 Sheets-Sheet 2

Fig. 2.



INVENTOR.
Ralph W. Moore &
Charles H. Bradley, Jr.
BY
Connolly and Hutz
ATTORNEYS.

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ROTARY SMOOTHER AND DESMUDGER

Filed June 18, 1957 6 Sheets-Sheet 3

Fig. 10.

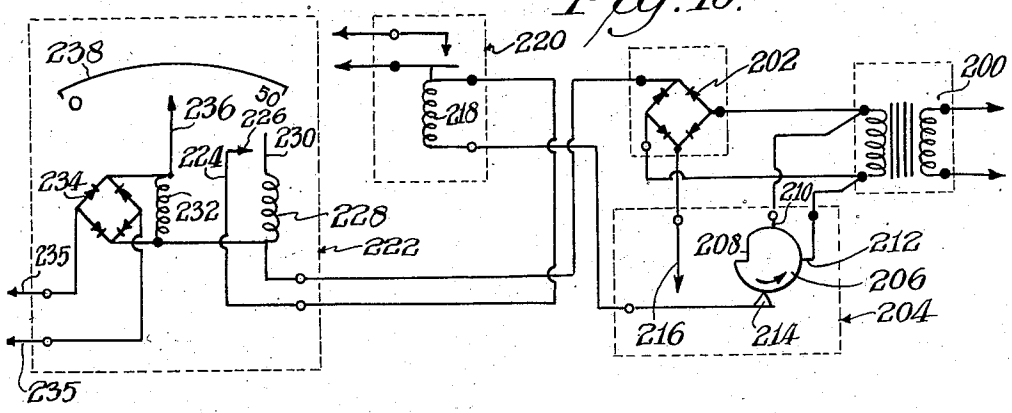
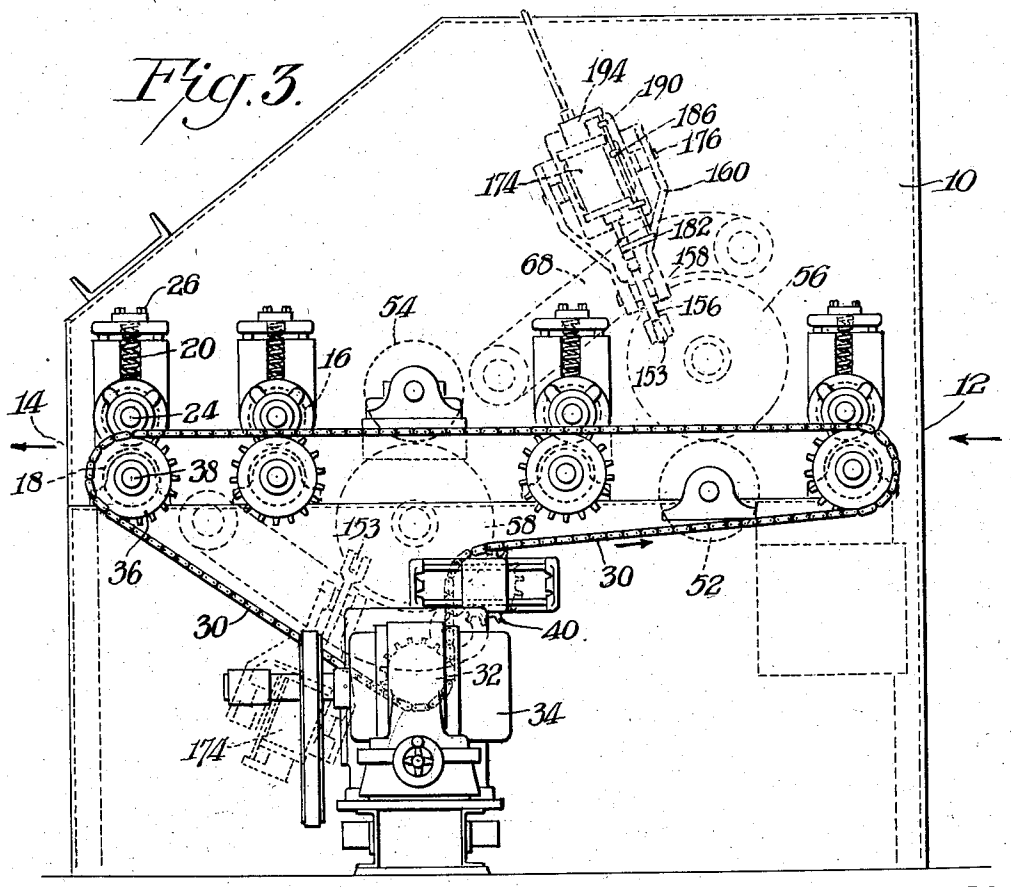


Fig. 3.



INVENTORS
Ralph W. Moore &
Charles H. Bradley, Jr.

BY
Connolly and Hutz
ATTORNEYS

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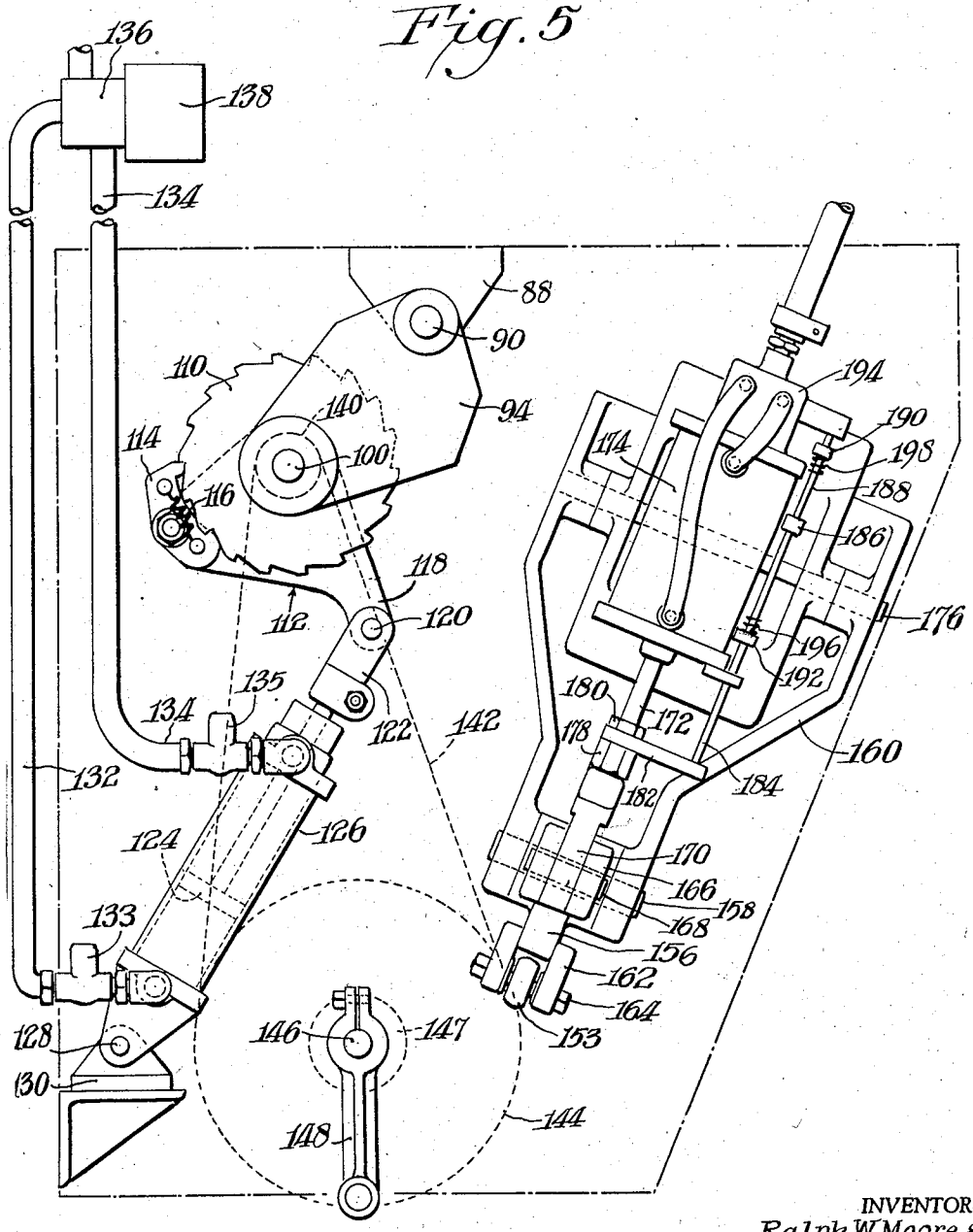
ROTARY SMOOTHER AND DESMUDGER

Filed June 18, 1957 6 Sheets-Sheet 4

Fig. 5



INVENTORS
Ralph W. Moore &
Charles H. Bradley, Jr.

BY Connolly and Hutz

ATTORNEYS

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ROTARY SMOOTHER AND DESMUDGER

Filed June 18, 1957 6 Sheets-Sheet 5

Fig. 6.

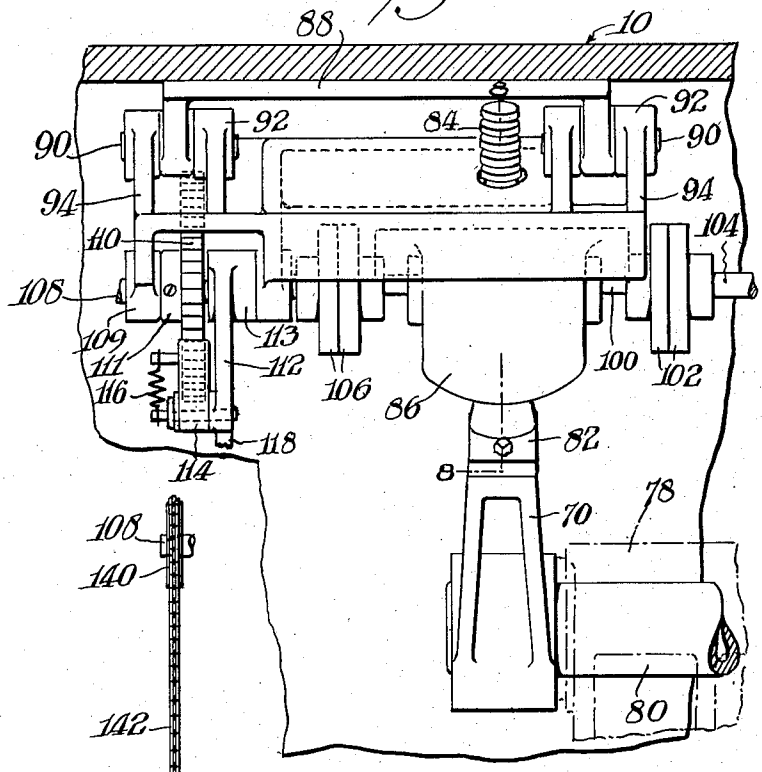


Fig. 7

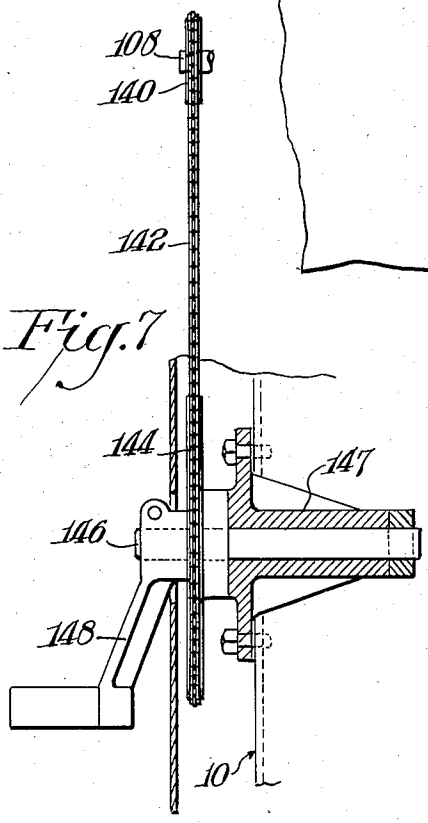
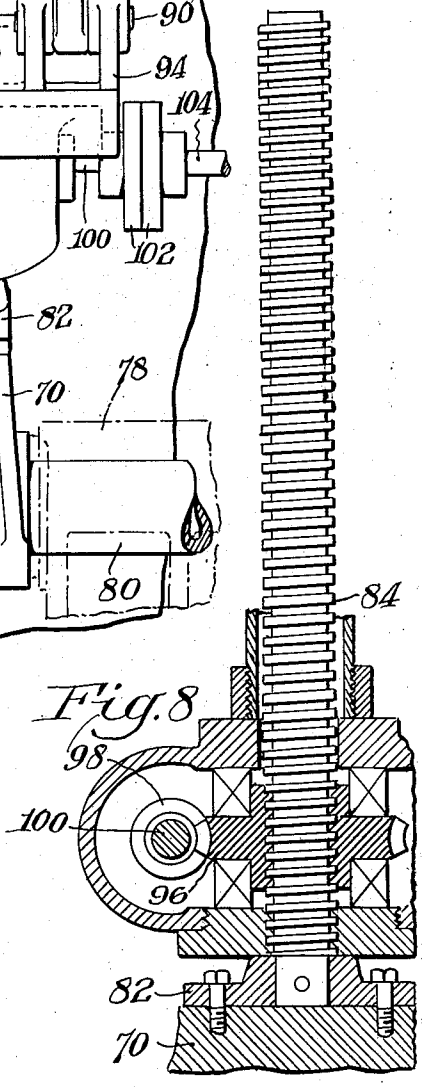


Fig. 8



INVENTORS:
Ralph W. Moore &
BY Charles H. Bradley, Jr.
Connolly and Hutz
ATTORNEYS

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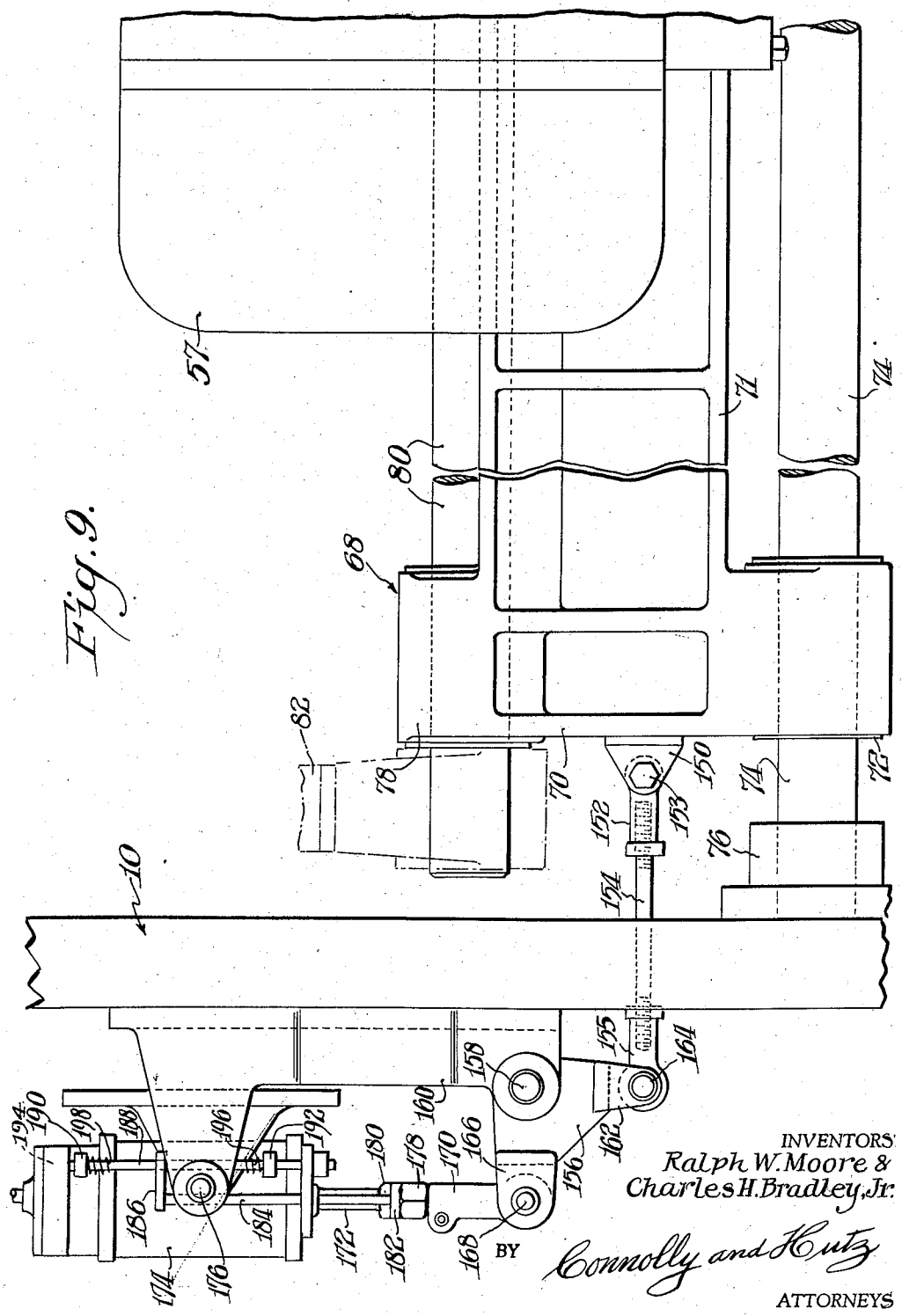
ROTARY SMOOTHER AND DESMUDGER

Filed June 18, 1957 6 Sheets-Sheet 6

Fig. 9.



INVENTORS
Ralph W. Moore &
Charles H. Bradley, Jr.

BY Connolly and Hutz

ATTORNEYS

United States Patent Office 2,881,570 Patented Apr. 14, 1959

2,881,570

ROTARY SMOOTHER AND DESMUDGER

Ralph W. Moore and Charles H. Bradley, Jr., Hagerstown, Md., assignors to Pangborn Corporation, a corporation of Maryland

Application June 18, 1957, Serial No. 666,401

14 Claims. (Cl. 51—87)

This invention relates to a cleaning device for removing smudge from the surface of flat metal sheets, plates or billets which have been blasted with abrasive. It is understood the word "sheets" as used in the specifications and description includes all flat surface metals, such as sheets, plates, billets, etc., that have been descaled.

It is the general practice today to remove the scale from hot-rolled sheets of steel or similar metals by blasting the surfaces of the sheets with an abrasive material such as steel shot or the like. This is often preferable to the much more expensive "pickling method."

After the sheet has been blasted with the abrasive, the abrasive particles are blown from the surfaces of the sheet before it leaves the machine. However, a deposit of a very fine dustlike material called "smudge" remains on the surfaces. This smudge apparently consists of very minute particles of material which have been removed from the sheet and of broken particles of abrasive. Such smudge may not be too objectionable in some operations, but in others, as, for example, in the manufacture of automobile rims and bumpers, it is highly objectionable and must be removed. Furthermore, even in those operations which do not absolutely require the elimination of the smudge, it is a known fact that if this smudge could be removed economically it would greatly benefit the operation since the very minute particles of the smudge create wear in the dies used during the pressing and forming operations. If this smudge could be eliminated, therefore, the life of such dies would be greatly increased.

It is, consequently, one object of the present invention to provide a device which can quickly and easily remove the smudge from blasted metal sheets.

Another object of the present invention is to provide a device which is capable of removing the smudge from blasted sheets economically and automatically.

Another object of the present invention is to provide a device for removing the smudge from blasted sheets which is adapted to be used in mass production methods.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a side view, partly in section and partly in elevation, of a device embodying the present invention, taken on the line 1—1 of Fig. 2;

Fig. 2 is a plan view taken on the line 2—2 of Fig. 1;

Fig. 3 is a side elevational view showing the driving mechanism of the device of Fig. 1;

Fig. 4 is an enlarged detailed view, partly in elevation and partly in section, of one pair of coacting rollers, shown in Fig. 1, this view being taken on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged detailed side-elevational view similar to Fig. 1, of the wear-compensating operating mechanism and of the wear-distributing operating mechanism used in the machine of Fig. 1;

Fig. 6 is an enlarged detailed view, partly in section and partly in elevation from the right-hand side of Fig. 1, of the wear-compensating mechanism used in the machine of Fig. 1;

Fig. 7 is an enlarged detailed view, partly in section and partly in elevation, of the hand-operating means for resetting the wear-compensating mechanism;

Fig. 8 is an enlarged, sectional view taken along line 8—8 of the jack mechanism of Fig. 6;

Fig. 9 is an elevational view, partly broken away, of the wear-distributing mechanism used in the machine of Fig. 1; and

Fig. 10 is a schematic view of the timer mechanism.

Briefly, the machine which embodies the present invention comprises a system of upper and lower feed rolls which feed the sheets past oppositely-disposed desmudging means, one of which acts upon one surface of the sheets and the other of which acts upon the opposite surface of the sheets. Each desmudging means preferably comprises an abrasive wheel made up of a plurality of fabric-backed abrasive strips, each strip being connected at its radially inner end to a hub and extending radially outward so that its outer edge forms a portion of the wheel periphery. Although such an abrasive wheel is preferable, it is possible to use other desmudging means such as heat-treated wire brushes and the like.

Each abrasive wheel is mounted on a swivel mounting by means of a self-aligning roller bearing. This swivel mounting is so positioned that it can both pivot in a vertical direction toward and away from the workpiece and also oscillate or reciprocate laterally of the workpiece. Preferably, a separate electric motor for driving each abrasive wheel is mounted on each swivel mounting; however, the motor or other driving means could obviously be arranged in any other manner desired.

Connected to the swivel mounting is a linkage mechanism including a screw-jack means which is operated by a timing mechanism to swivel the mounting, and the abrasive wheel mounted thereon, toward the workpiece surface in minute steps. This is for the purpose of automatically compensating for the wear on the periphery of the abrasive wheel as well as to control the amount of pressure exerted by the wheel on the sheet so as to minimize the wear on the wheel. Means are also provided for oscillating or reciprocating the entire mounting and abrasive wheel assembly so that the wheel is worn "square" over its entire length.

Referring now in greater detail to the figures of the drawings wherein similar reference characters refer to similar parts, there is shown a housing 10 including a work inlet opening 12 and outlet opening 14 defining the opposite ends of the path of travel of the work. Within the housing 10, above the path of travel of the work, there are provided a plurality of rubber-covered feed rollers 16 and 18. The upper rollers 16 are pinch rollers which are spring-pressed downwardly by individual springs 20 positioned between the upper flange of a bracket 22 on the housing and the roller shaft 24. Adjusting screws 26 coact with a nut 28 to adjust the tension of each spring. Each roller 16 which precedes an abrasive wheel (to be presently described) in the path of work travel is linearly off-set from the corresponding roller 18 (as best seen in Fig. 1). This offset relationship effects a slight bending of the sheet material toward the back-up roller (to be presently described) which is opposed to the abrasive wheel. This keeps the leading edges of the succeeding workpieces from hitting the wheel and adding to the wear on the wheel.

The feed rollers 16 and 18 are driven in opposed synchronism by a sprocket chain 30 (Fig. 3) connected to a sprocket 32 which is, in turn, connected to the drive shaft of an electric motor 34. The motor 34 is the drive

motor for the conveyor of the blasting machine (not shown). In this manner, the conveyor speed of the blasting machine and the conveyor speed of the desmudging machine are synchronized. The drive is, of course, of the variable speed type. The drive chain extends over a driven sprocket 36 at one end of the shaft 38 of each roller 18, and is held in tension by an adjustable idler sprocket 40. At the opposite end of each roller shaft 38 there is provided a gear 42 (Fig. 4) which meshes with a gear 44 on the corresponding roller shaft 24.

By the above mechanism, a series of sheets 46 may be fed through the inlet 12, past the desmudging apparatus, presently to be described, and out of the outlet 14 from where they may be delivered to a further processing station as desired.

In the upper portion of the housing, above the path of travel of the work, there is provided a desmudging assembly, generally indicated at 48, while in the lower portion of the housing, below the path of travel of the work, there is provided a second desmudging assembly 50. The assembly 48 acts on the upper surface of the workpieces while the assembly 50 acts on their lower surfaces. Opposite the assembly 48, on the other side of the path of travel of the work, is a back-up roller 52, while a similar back-up roller 54 is disposed in a similar manner relative to the assembly 50.

The actual desmudging medium in each desmudging apparatus is an abrasive wheel, as indicated at 56 and 58. Each abrasive wheel is driven by a motor which is pivotally mounted on the corresponding swivel mounting, these motors being designated 57 and 59, by appropriate drive belts. The tension of these belts are adjustable by pivoting the motors on the swivel mounting. Adjacent each abrasive wheel is a suction hood, as at 60 and 62. These suction hoods are connected by pipes, as at 64 and 66, to a dust collector, not shown.

Since both the assembly 48 and the assembly 50 are similar and since the description of one will serve as a description of the other, the following detailed description of assembly 48 is intended to also serve as a description of assembly 50. Therefore, taking the assembly 48 in detail, there is shown a swivel mounting 68 comprising an integral casting which includes a pair of oppositely-disposed arms 70 connected by a web portion 71. Each arm 70 (as best shown in Figs. 1, 2 and 9) is provided with a bearing portion 72 at one end to receive a shaft 74 extending between bearings 76 on opposite sides of the housing. In this manner, the mounting 68 is positioned for both pivotal and longitudinal movement on the shaft 74.

At the other end of the mounting 68, the arms 70 are each provided with bearing portions 78 between which is rotatably positioned a shaft 80. Extending up from each arm 70, adjacent its bearing portion 78, is a boss 82 from which extends a threaded shaft 84. This shaft 84 extends through a jack-housing 86 pivotally supported by a hanger 88 depending from the top of the housing 10, the pivotal support being by means of pivot pins 90 extending through the bearings 92 on arms 94. Within the jack-housing 86, an internally-threaded worm wheel 96 is threadedly mounted on the shaft 84 and this worm wheel meshes with a worm 98 on a shaft segment 100 (see Figs. 6 and 8).

The shaft segment 100 is coupled at one end, as by coupling 102, to a connecting shaft segment 104 which is coupled, in like manner, to a similar shaft segment 100 in the jack-housing (not shown) of the other arm 70 of the integral swivel mounting. At its opposite end, the shaft segment 100 is coupled, as by coupling 106, to a shaft segment 108 which is supported by a hub 109. The shaft segments 100, 104 and 108, together with couplings 102 and 106, form what is, in essence, a single, continuous shaft. Mounted on shaft segment 108 is a ratchet wheel 110 having a hub 111 pinned to the shaft segment 108. A bell crank 112, has a hub 113 which is freely mounted on shaft segment 108. The bell crank 112 is provided with a pivoted dog 114. This dog 114 is biased into engagement with the teeth of the ratchet wheel by a spring 116. The bell crank is also provided with an extension 118 which is pivotally connected, as at 120, to the upper end of a plunger 122, the head 124 of which is movable within a cylinder 126. The opposite end of the cylinder 126 is pivotally connected, as at 128, to a bracket 130 mounted on the adjacent wall of the housing. Fluid-pressure lines 132 and 134 lead to and from a source of fluid pressure to opposite sides of the plunger head 124 within the cylinder. The fluid may be either gas or liquid, although air is preferred. Pressure release valves are provided at 133 and 135.

Interposed between the lines 132 and 134 and the source of fluid pressure, is a valve mechanism, generally indicated at 136. An adjustable timer mechanism, generally indicated at 138, is operatively connected to the valve to alternately open first the line 132 and then the line 134. There are, thereby, provided a series of impulses, the rate of which is determined by the adjustment of the timer mechanism. The timer mechanism is adjusted in accordance with the speed with which the abrasive wheel 56, rotatably held by the mounting 68, wears down.

In the operation of the ratchet mechanism, the timer 138 first opens the line 132 which supplies pressure fluid behind the plunger head 124. This moves the plunger upwardly and rocks the bell crank 112 on its axis. Then the timer acts to close the line 132 and open the line 134. This forces the plunger down and rocks the crank 112 back to its original position. The dog 114 which is held against the teeth by spring 116, thereupon pulls down on the ratchet wheel 110 and rotates it one step. The step-wise rotation of the ratchet causes a similar rotation of the shaft 100 and, therefore, of worm 98. Worm 98, thereupon, rotates internally-threaded worm wheel 96 which meshes with shaft 84 to move the shaft, and, consequently, the swivel mounting 68 and the abrasive wheel 56, down a step.

In order to make it possible to change from one workpiece thickness to another thickness, a hand crank mechanism is provided, by means of which the abrasive wheel can immediately be brought down to the proper position in relation to the workpiece. This mechanism comprises a sprocket 140 on the shaft 108, and a drive chain 142 connecting this sprocket to a second sprocket 144 mounted on shaft 146 positioned in bearing 147 on the housing 10. A hand crank 148 is connected to shaft 146 externally of the housing.

In order to remove worn-out abrasive wheels, the jack linkage may be disconnected and the swivel mounting 68, which is, thereby, free, may then be raised and lowered by a hoist or the like. In this manner, the worn wheel can be removed and a new one installed.

For the purpose of keeping the wear evenly distributed over the abrasive wheel, an oscillating or reciprocating mechanism is provided for reciprocating the wheel longitudinally of its axis and laterally of the workpieces. This mechanism comprises a clevis 150 connected to one side of the swivel mounting 68 midway between shafts 74 and 80 (Fig. 9), a bearing 152 pivotally connected to the clevis, as at 153, and a shaft 154 having one end threadedly connected within the bearing 152 and its opposite end threaded within a bearing 155. A fluid pressure actuating means is connected to the bearing 155.

The actuating means comprises a bell crank 156 which is pivotally connected, as at 158, to a bracket 160 mounted on the housing. The bell crank includes a clevis 162 pivotally connected to the bearing 155, as at 164. The connections at 153 and 164 are loose enough to permit a small amount of swivelling movement of the swivel mounting 68 on the shaft 74 to take place. Another clevis 166 on the bell crank is connected at 168 to a rod end 170 from which extends the piston rod 172 of a pis-

ton movable within the fluid motor **174**; this fluid motor being connected to the bracket **160** by pins **176**.

Secured between a pair of nuts **178** and **180** on the piston rod **172** is a lateral extension **182** which supports the lower end of an actuating rod **184**. The actuating rod **184** is provided with a bracket **186** at its upper end, and this bracket is slidable along a control rod **188** connected to a slide valve, not shown, within valve housing **194**. The slide valve is connected to a source of fluid pressure and acts to direct the pressure fluid against one side or the other of the piston in the fluid motor. A pair of collars **190** and **192** are provided on the control rod **188** and are adjustable along its length in order to provide a desired stroke. Springs **196** and **198** on the control rod permit actuating rod **184** and control rod **188** to reverse their motion without jamming.

In operation of the valve mechanism, when bracket **186** contacts the spring adjacent either the collar **190** or the collar **192** on the control rod, it exerts a force through the spring to move the control rod in the corresponding direction to reverse the slide valve. The rod **188** then remains stationary until bracket **186** contacts the spring adjacent the other collar thereby moving the rod to again reverse the slide valve.

The timer mechanism **138** which is used to control the ratchet mechanism is schematically illustrated in Fig. 10 and comprises a transformer **200** connected to a source of electrical energy and a valve actuating network which includes a rectifier bridge **202** connected to one side of the transformer and an interrupter circuit **204** connected to the other side of the transformer. The interrupter circuit includes a motor-driven cam **206** having one or more notches **208**. Contacts **210** and **212** connect the cam to the secondary coil of the transformer.

A contact **214** is urged against cam **206** and falls into the notch **208** at each revolution of the cam. When it falls into the notch it engages the contact **216** on the rectifier bridge **202** thereby completing the circuit between the transformer **200** and the solenoid **218** of a relay **220**, this circuit being completed through an adjustable ammeter-relay system **222**. The relay **220**, upon being closed, moves the valve, not shown, away from its normally-biased position opening the conduit **132**, into the opposite position opening the line **134**.

The ammeter-relay system **222** includes a relay **224** comprising a contact **226** connected to the solenoid **218** of relay **220** and a winding **228** connected to rectifier **202**. The winding **228** has a contact **230**. The relay **224** is normally closed so that the valve actuating circuit is operative in normal circumstances. Also in circuit with the relay **224** is a winding **232** and a rectifier bridge **234**. The bridge **234** is connected by leads **235** to the motor circuit, not shown, used to drive the abrasive wheel. The bridge also is connected to the indicator arm **236** of an ammeter **238**.

Normally the relay **224** is in its closed position and this tendency is aided by the current flowing through winding **228**. However, when the current flowing through leads **235**, as measured on the ammeter **238**, exceeds a predetermined amount, the winding **232** will exert a force sufficient to overcome the tendency of the relay **224** to remain in its closed position and the relay will open. This will open the valve control circuit, whereby the ratchet mechanism will cease functioning. When the amperage drops below a predetermined value, the relay **224** will again return to its normally closed position to activate the valve control circuit. The ammeter circuit is adjustable to provide for a predetermined cut-off point.

By means of the above control network, the ammeter registers the amount of power necessary to drive the abrasive wheel. When the pressure of the wheel becomes so great that it requires an amount of power greater than a predetermined amount, the timer becomes inactivated and the ratchet mechanism ceases to function until the pressure of the abrasive wheel falls below the predetermined amount.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A device for removing smudge from blasted sheet metal material comprising a housing, a linear path of travel for workpieces extending through said housing, said path of travel being defined by a workpiece inlet opening at one side of said housing, a workpiece outlet opening at the opposite side of said housing and feed mechanism in said housing between said inlet and outlet openings for moving the workpieces along said path, and a desmudging assembly positioned on each side of said path, each of said desmudging assemblies comprising a swivel mounting positioned for pivotal movement in a plane perpendicular to the plane of said path of travel and for reciprocating movement in a plane transverse to said path of travel, an abrasive wheel rotatably supported by said swivel mounting, drive means operatively connected to said abrasive wheel to rotate said wheel, and a wear-compensating mechanism operatively connected to said swivel mounting for moving said abrasive wheel toward said path of travel in predeterminedly timed steps correlated with the amount of wear on said wheel.

2. The device of claim 1 wherein said wear-compensating mechanism is provided with a cut-off means to interrupt the operation of said mechanism when the pressure on said wheel exceeds a predetermined maximum.

3. The device of claim 1 wherein a wear-distributing mechanism is connected to said swivel mounting to reciprocate said mounting transversely of said path of travel.

4. A cleaning device for blasted sheet metal material comprising a housing, a linear path of workpiece travel through said housing, said path being defined by a workpiece inlet opening at one side of said housing, a workpiece outlet opening at the opposite side of said opening, and workpiece conveying mechanism between said inlet and outlet openings and at least one desmudging device in said housing adjacent said linear path, said desmudging device comprising a support mounted in said housing for pivotal movement in a plane perpendicular to said linear path and for reciprocating movement in a plane transverse of said linear path, a rotary tool mounted on said support, an electric motor pivotally mounted on said support, drive means operatively connecting said motor to said rotary tool, wear-compensating means connected to said support to pivot said support to move said tool toward said linear path in minute steps of predetermined extent, and wear-distributing means to reciprocate said support transversely of said linear path.

5. The device of claim 4 wherein said rotary tool is an abrasive wheel comprising a hub having a plurality of abrasive strips extending radially therefrom.

6. The device of claim 4 wherein said rotary tool is a brush.

7. The device of claim 4 wherein there is a desmudging device on each side of said linear path.

8. A device for removing smudge from blasted sheet metal comprising two opposed series of rollers forming a path of workpiece travel therebetween, the rollers of one series being rotatable contra to the rotation of the rollers of the other series, each roller of said one series being paired with a corresponding roller of said other series to form a feed-pair, a rotary, smudge-removing tool positioned between at least some adjacent feed-pairs, the rollers of the feed-pairs adjacent at least one side of each tool being offset from each other longitudinally of said path, a backing roller opposed to each tool, means to step-wise feed each tool toward said path,

and means to reciprocate said tool transversely of said path.

9. The device of claim 8 wherein the rollers of at least one series are spring-pressed toward said path.

10. The device of claim 8 wherein a suction hood is positioned adjacent each tool, each suction hood having communication with a dust collector.

11. In a desmudging apparatus, a housing, a swivel support for a rotary tool, a rotary tool mounted on said swivel support for rotation relative thereto, said support being mounted for pivoting movement on a fulcrum at one end thereof, a linkage means at the opposite end thereof, and operating means to operate said linkage to step-wise pivot said support on its fulcrum, said operating means comprising a threaded shaft attached at one end to said support, said threaded shaft being threadedly engaged with a worm wheel which meshes with a worm on a cross-shaft, said cross-shaft having a ratchet wheel mounted thereon, a crank mounted on said cross-shaft coaxially with said ratchet wheel, a dog on said crank, said dog being biased into engagement with the teeth of said ratchet wheel, a piston rod connected to said crank, said piston rod having a piston head movable within a cylinder connected to said housing, and fluid-pressure means to operate said piston head in said cylinder to effect an alternate rocking of said crank whereby said dog is moved to rotate said ratchet wheel in steps, said ratchet wheel thereby rotating said cross-shaft and worm to actuate said worm wheel to move said threaded shaft which pivots said support.

12. The apparatus of claim 11 wherein a sprocket is provided on said cross-shaft, a chain connecting said sprocket to a second sprocket on a shaft rotatably mounted on said housing, and a hand crank on said shaft.

13. In a desmudging apparatus, a housing, a swivel support for a rotary tool, a rotary tool mounted on said swivel support for rotation relative thereto, said support being mounted for pivoting movement on a pivot shaft at one end thereof, means to step-wise move said support around said pivot shaft, and reciprocating means to move said support back and forth longitudinally of said pivot shaft, said reciprocating means comprising a fluid-pressure actuated piston in a fluid-pressure cylinder connected to said housing, a crank mechanism connecting said piston to said support, and valve means alternately connecting each cylinder to a source of fluid pressure.

14. A device for removing smudge from blasted sheet metal material comprising a housing, a linear path of travel for workpieces extending through said housing, said path of travel being defined by a workpiece inlet opening at one side of said housing, a workpiece outlet opening at the opposite side of said housing, a feed mechanism in said housing between said inlet and outlet openings for moving the workpieces along said path, and a desmudging assembly positioned on each side of said path, each of said desmudging assemblies comprising an abrasive wheel mounted for rotation on a tool support, said tool support being vertically movable toward and away from said linear path of travel in a plane substantially perpendicular to the plane of said linear path, a wear-compensating mechanism operatively connected to said tool support for moving said tool support and said abrasive wheel toward said linear path in predeterminedly timed steps correlated with the amount of wear on said abrasive wheel, and drive means operatively connected to said abrasive wheel to rotate said wheel.

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