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P. HAIG

2,366,523

DRIVE MECHANISM

Original Filed Feb. 16, 1942

4 Sheets-Sheet 1

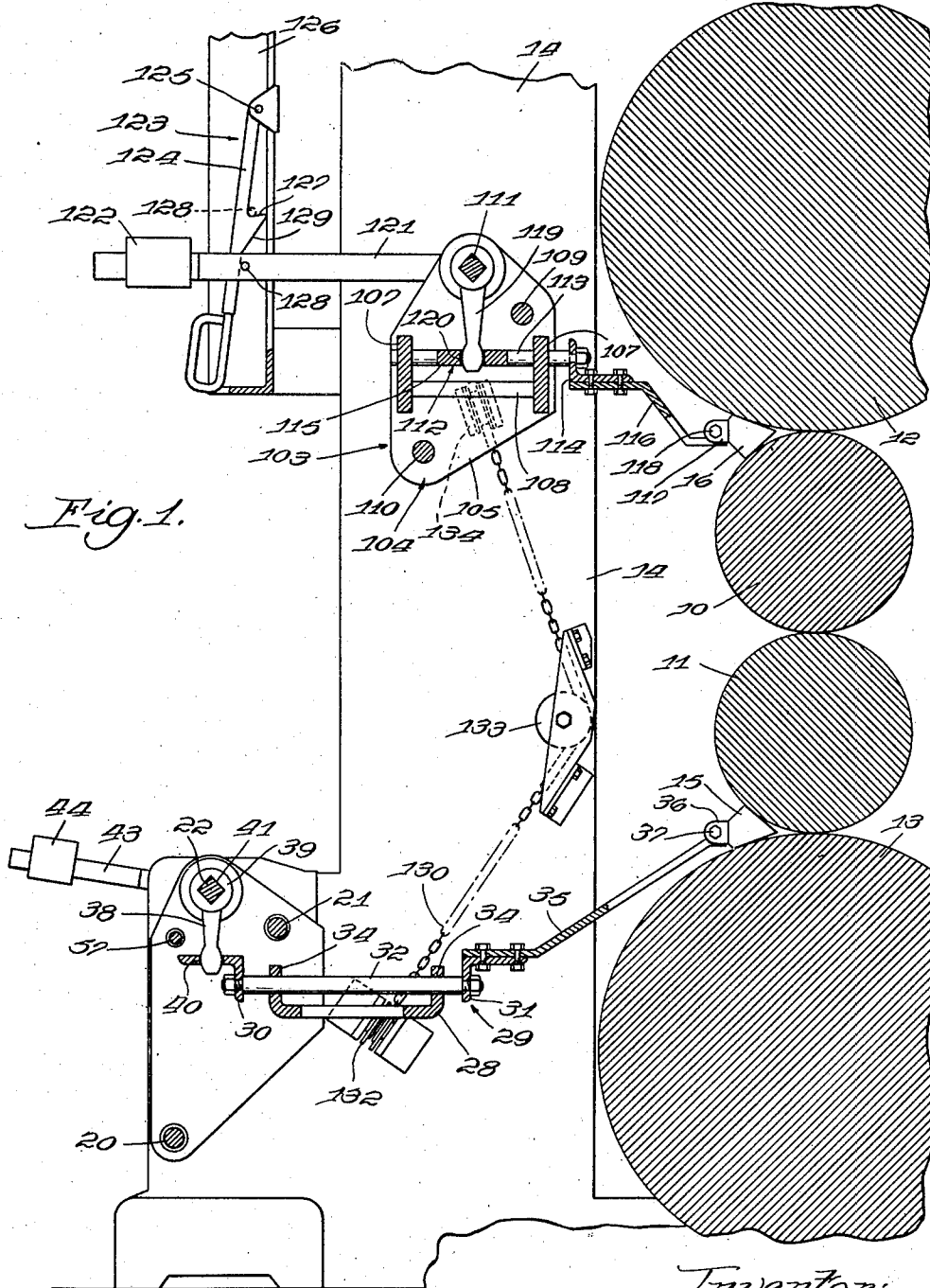


Fig. 1.

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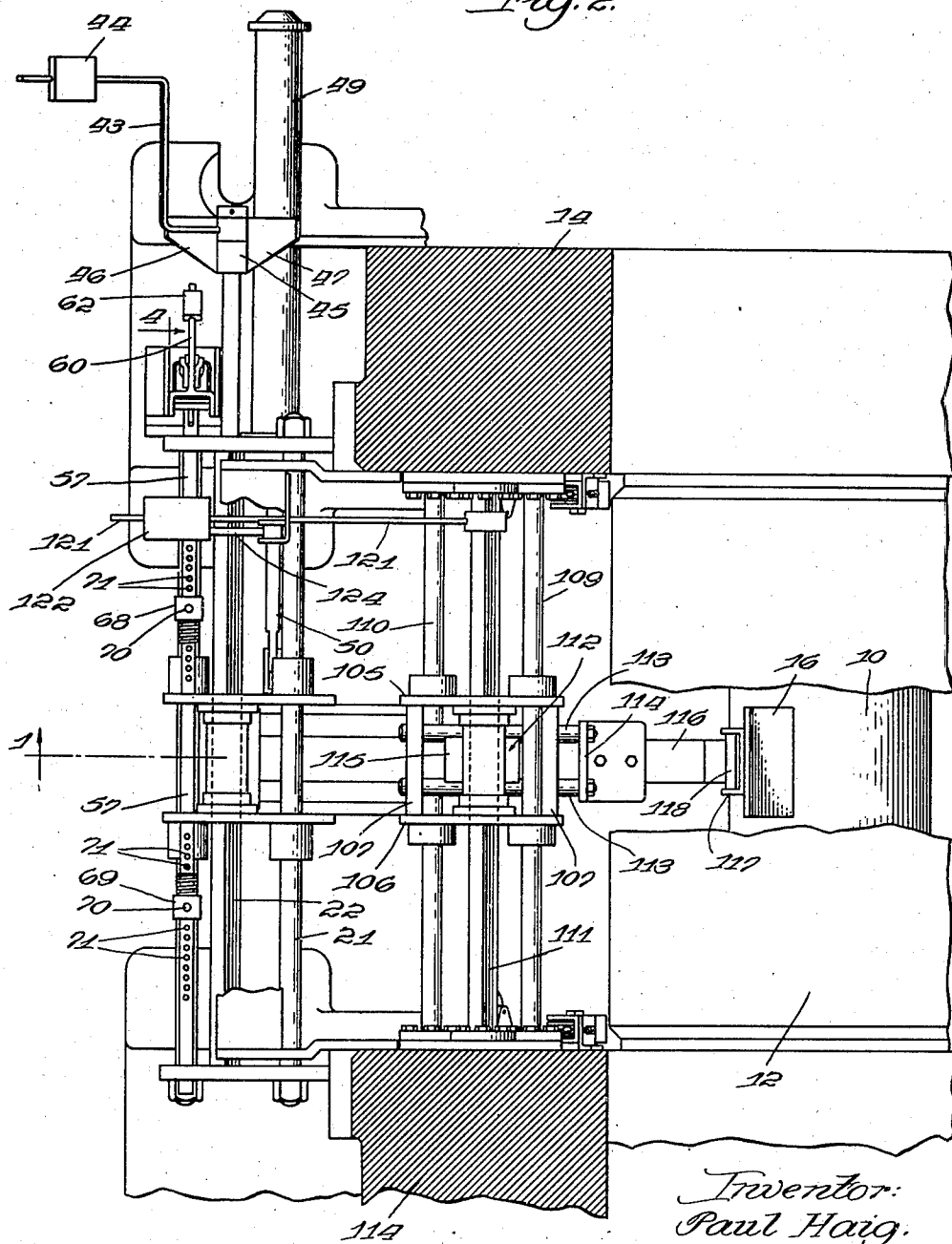
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Fig. 2.



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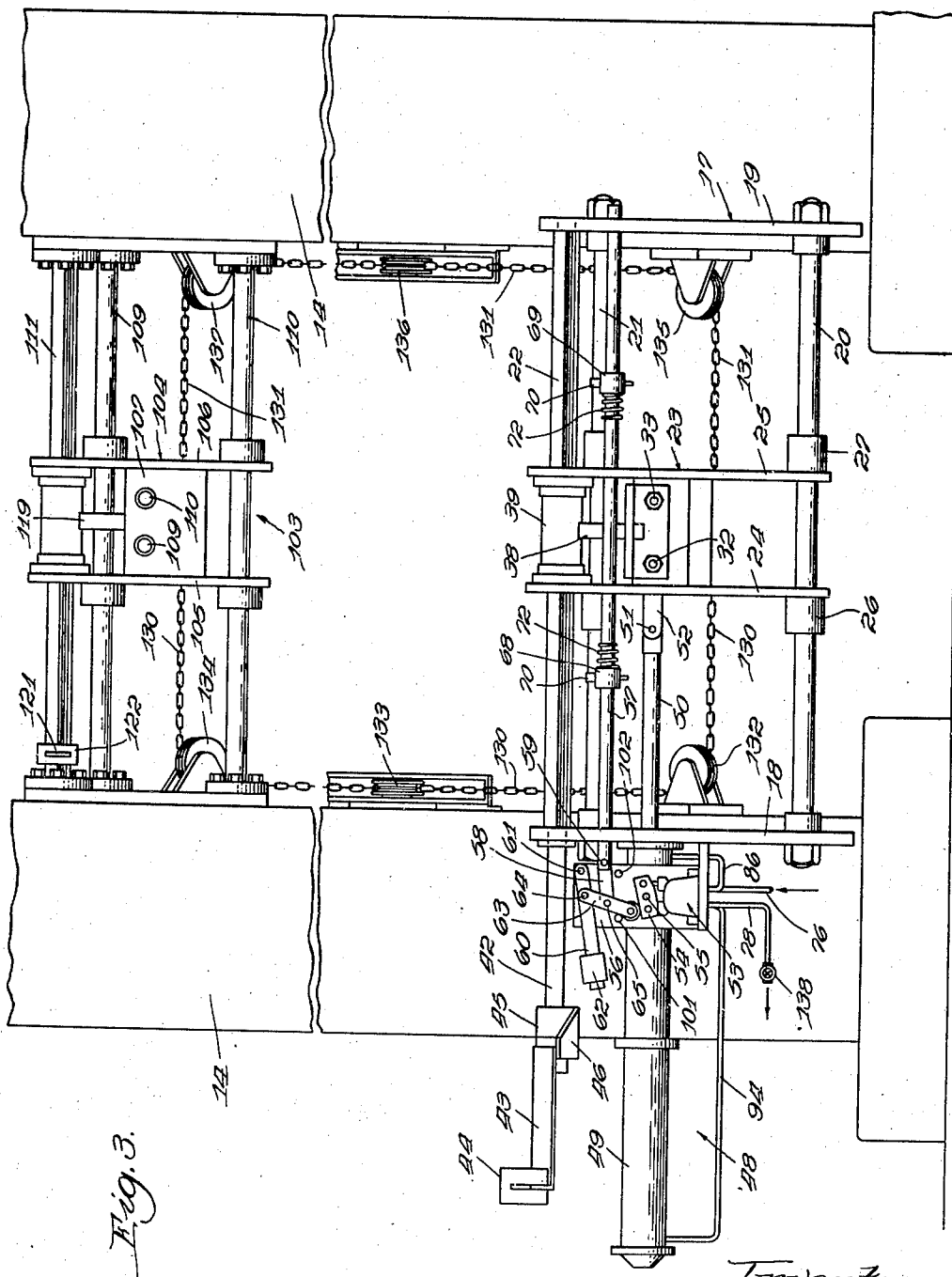
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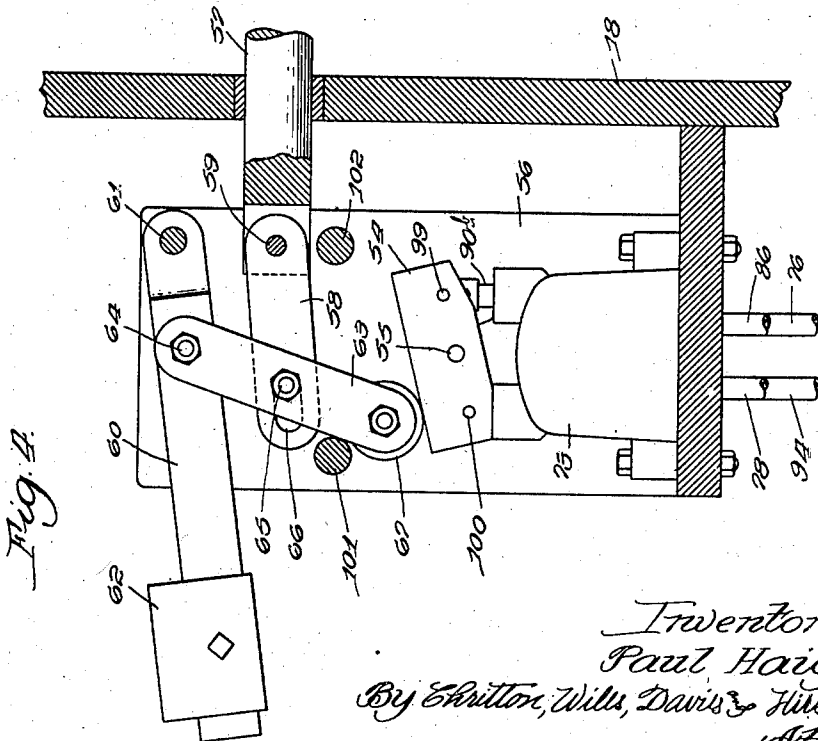
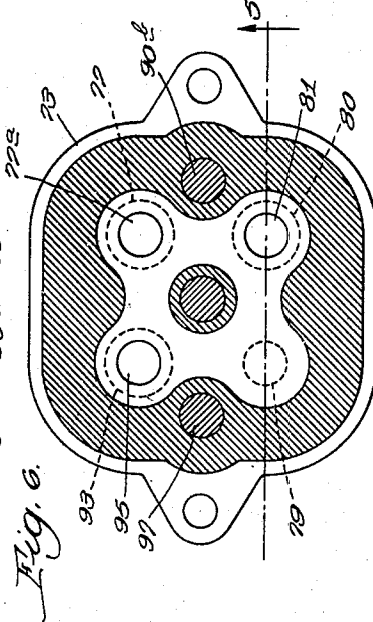
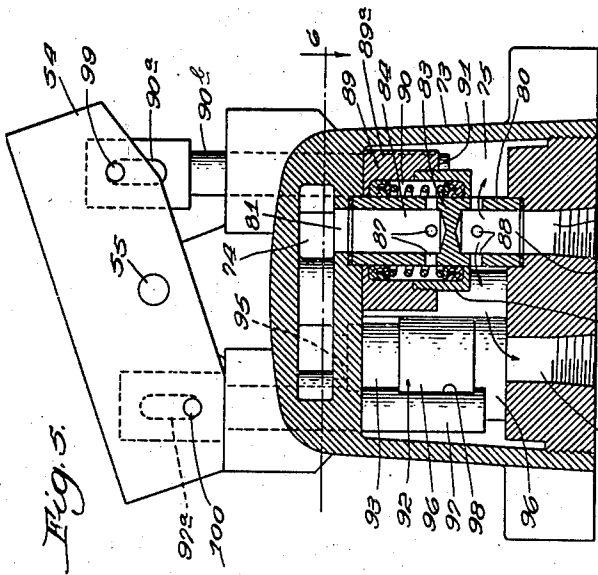
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DRIVE MECHANISM

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,366,523

DRIVE MECHANISM

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Original application February 16, 1942, Serial No. 431,061, now Patent No. 2,329,530, dated September 14, 1943. Divided and this application July 13, 1942, Serial No. 450,829

2 Claims. (Cl. 121-164)

My invention relates generally to drive mechanism for driving a movable member, such as for example, a member positioned to engage and be reciprocated along the roll or rolls of a mill, as for instance that used in the rolling of steel or other ferrous metals, to clean therefrom objectionable matter such as dirt and metal grit which becomes deposited thereon during the operation of the mill and is required to be removed for the production of the desired product; this application being a division of my Patent 2,329,530, issued September 14, 1943.

One of my objects is to provide a construction of drive mechanism which will operate automatically to produce the desired continuing movement of the member to be driven thereby as for example to reciprocate along a mill a polishing element to clean the roll or rolls thereof, and which will be positive in operation; and other objects as will be manifest from the following description.

Referring to the accompanying drawings:

Figure 1 is a view in vertical sectional elevation of a 4-high mill equipped with apparatus embodying my invention for cleaning the rolls of the mill, the section being taken at the line 1 on Fig. 2 and viewed in the direction of the arrow.

Figure 2 is a plan sectional view of the structure shown in Fig. 1, with certain parts broken away.

Figure 3 is a front view of the structure of Figs. 1 and 2, the structure being viewed from the left in these figures.

Figure 4 is an enlarged section taken at the line 4 on Fig. 2 and viewed in the direction of the arrow.

Figure 5 is a view partly in section and partly in elevation of a valve and valve-controlling mechanism for controlling the operation of the polishing elements of the apparatus, the section being taken at the line 5 on Fig. 6 and viewed in the direction of the arrow; and

Figure 6, a section taken at the line 6 on Fig. 5 and viewed in the direction of the arrow.

I have chosen to illustrate my invention in connection with a 4-high mill, such as is used for rolling steel, the relatively small working rolls thereof, represented at 10 and 11 and the relatively large back-up rolls thereof, represented at 12 and 13, being journaled in the frame 14 of the roll-stand.

In this arrangement provision is made for reciprocating lengthwise of the rolls and in engagement therewith at the nips between the working rolls and the back-up rolls, polishing

elements, such as for example polishing blocks, represented at 15 and 16, respectively, which serve to clean the rolls.

Referring first to the mechanism by which the lower polishing element 15 is operated, it comprises a stationary rigid frame 17 extending lengthwise of the rolls of the mill stand and in front thereof and formed of a pair of spaced apart brackets 18 and 19 secured to the mill frame 14, and tie rods 20 and 21 rigidly connecting the brackets together, a square-shaft 22 extending lengthwise of the frame 14 being journaled in the brackets 18 and 19 and held against lengthwise movement.

Mounted on the tie rods 20 and 21 and the square shaft 22 to be reciprocated lengthwise of the frame 14 is a carriage 23 comprising a pair of spaced apart plates 24 and 25 having bearing extensions 26 and 27, through which the tie rods 20 and 21 and the square shaft 22 extend, the shaft 22 being free to rotate in the carriage 23; a channel plate 28 in the space between the plates 24 and 25 and secured at its ends to these plates; and a slide 29 to which the polishing element 15 is connected, mounted in the flanges of the channel plate 28 and slidable toward and away from the mill stand.

The slide 29 is shown as formed of a pair of spaced apart angle bars 30 and 31 connected together by tie rods 32 and 33 by which the slide is mounted on the carriage 23, the tie rods 32 and 33 extending slidably through openings 34 in the flanges of the channel plate 28, and an arm 35 secured at one end to the angle iron 31 and provided at its other end with a clevis 36 secured to the arm 35 by a horizontal pivot, 37, the polishing element 15 being secured in the clevis 36.

Means are provided to actuate the slide 29 to move the polishing element 15 into and out of operative position, and to cause the polishing element to exert, when in operating position, a steady predetermined pressure against the rolls. The means shown for this purpose comprise a lever 38 which floats, at a hub portion 39 thereon, on the square shaft 22 and extends at its outer end into an opening 40 in the angle-bar 30 of the slide 29, the hub portion 39 of the lever 38 having a square hole 41 which matches the square shaft 22 and through which the latter extends, whereby the lever 38 is oscillated responsive to the rotation of the square shaft 22. On the extended end 42 of the square shaft 22 a lever 43, having a slidably adjustable weight 44 thereon, is journaled. The extended end 42 of the shaft 22 lies within a hub 45 keyed to the shaft 22 and

having lugs or wings 46 and 47 extending in opposite directions and into the path of movement of the lever 43 in the swinging thereof in opposite directions.

When the lever 43 is thrown away from the mill it bears against the lug 46 and rotates the shaft 22 in a direction to move the slide 29 and polishing element 15 toward the mill to the position shown in the drawings, the force exerted by the lever 43 in this position causing the polishing element 15 to press steadily and with predetermined force against the rolls; such force being regulated by the adjustable weight 44. When the lever 43 is thrown toward the mill it engages the lug 47 and rotates the shaft 22 in a direction to move the slide 29 and polishing element 15 away from the mill.

The means shown for reciprocating the carriage 23 and with it the polishing element 15, comprises a fluid-pressure-operated piston and cylinder mechanism 48 (the fluid pressure used by way of example and preferably being compressed air) formed of a stationarily supported cylinder 49 and a piston (not shown) operating therein and having a piston rod 50 pivotally connected at 51 with lugs 52 on the carriage 23. These means also comprise mechanism for controlling the supplying of operating fluid to the cylinder 49 and the exhausting of the spent fluid therefrom to effect the automatic reciprocation of the carriage 23 and polishing element 15. The mechanism shown for this purpose comprises a valve device 53 operative in one position to supply fluid pressure to one end of the cylinder 49 and open the other end thereof to exhaust, to move the carriage 23 and polishing element 15 in one direction and in its other position to cause the fluid and exhaust to reverse to move the carriage and the polishing element in the opposite direction. This mechanism also comprises a bridge element 54 pivotally supported at 55 on a standard 56 and controlling the valve device 53; a slide or floating rod 57 slidable in the frames 17 and 18 relative to which the carriage 23 is slidable; a link 58 pivoted at one end, as represented at 59, to the rod 57; a lever 60 pivoted at 61 to the standard 56 and carrying a weight 62 slidably adjustable thereon; and a link 63 pivoted at its upper end, as indicated at 64, to the lever 60 and between its ends, to the link 58, by a pivot pin 65 on the link 63 extending into a slot 66 in the link 58, the lower end of the link 63 having a roller 67 bearing downwardly on the bridge member 54. The slidable rod 57 is provided at opposite sides of the carriage 23 with stops 68 and 69, in the form of collars slidably adjustable thereon and adapted to be set in any desired position lengthwise of the rod 57, by means of pins 70 which may be inserted into holes in the stops 68 and 69 and selectively into holes 71 in the rod 57 to regulate the stroke of the piston and cylinder mechanism and therefore the stroke at the carriage 23, coil springs 72 surrounding the rod 57 being interposed between the carriage 23 and the stops 68 and 69.

Any suitable construction of valve device for controlling the supplying of fluid pressure to the cylinder 49 and the exhaust of the spent fluid therefrom may be employed. That shown at 53 is of a well known 4-way type and the following general description thereof will therefore suffice. It comprises a valve casing 73 affording an upper inlet chamber 74 and a lower exhaust chamber 75, a pipe 76, which leads from a suit-

able source (not shown) of operating fluid pressure, opening through the bottom of the lower chamber 75 into a tube 77 communicating with the upper chamber 74 through an opening 77a in the bottom of the chamber 74. An exhaust pipe 78 opens into the lower exhaust chamber 75 through an opening 79 in the bottom thereof. A tube 80 opens at its opposite ends into openings 81 and 82 in the top and bottom walls of the lower chamber 75, and has a solid partition 83 between its ends dividing the space within the tube into upper and lower chambers 84 and 85, respectively, these chambers being open to the inlet chamber 74 and the opening 82 in the bottom of the chamber 75, respectively, from which opening a pipe 86 opens into the right hand end of cylinder 49, the side wall of the tube 80 above and below the partition 83 being ported as represented at 87 and 88, respectively.

Slidable vertically on the tube 80 is a sleeve 89 having an annular groove 90 in its inner surface (Fig. 5) which controls communication between the ports 87 and 88 and between the ports 88 and the exhaust chamber 75, the upper portion 89a of the sleeve being of larger diameter than its lower portion 89b. In the raised position of the sleeve 89, the ports 87 and 88 are out of communication and the ports 88 are open to the exhaust chamber 75 permitting of the driving of the carriage 23 by the piston and cylinder mechanism 48 to the right in Fig. 3 responsive to fluid pressure introduced into the left hand end of cylinder 49. In the lowered position of the sleeve 89 the ports 87 and 88 are in communication and the ports 88 closed to the exhaust chamber 75 permitting actuating fluid pressure to enter the right hand end of the cylinder 49.

The sleeve 89 is reciprocated by means of a plunger 90b vertically slidable in the valve casing 73, and straddling the upper portion 89a of the sleeve at a recess 91 in the plunger, as more clearly shown of the other sleeve and plunger assembly presently to be described.

Control means 92 are also provided for the left hand end of the cylinder 49 of identically the same construction as the control means above described for the right hand end of this cylinder. The partitioned tube of the means 92 and corresponding with the tube 80, is represented at 93 and connects at its lower end with an opening in the bottom wall of the lower exhaust chamber 75, this opening communicating with a pipe 94 which opens into the left hand end of a cylinder 49; the upper end of the tube 93 communicating with an opening 95 in the top wall of this chamber which opens into the upper inlet chamber 74. The sleeve of these means and corresponding with the sleeve 89 is represented at 96 and the actuating plunger therefor, corresponding with the plunger 90b, at 97, the manner in which the sleeve at its upper end is straddled by the plunger at its recess here indicated at 98, being more clearly illustrated.

The plungers 90b and 97 are pivotally connected to the ends of the pivoted bridge 54 at opposite sides of its pivot 55 by pins 99 and 100 on the bridge and extending through slots 90a and 97a in the plungers 90b and 97, respectively, whereby in the position of the bridge 54 as shown in the drawings, the plunger 90b is in raised position, opening the right hand end of the cylinder 49 to exhaust, and the plunger 97 is in lowered position in which position the left hand end of the cylinder 49 is open to the inlet chamber 74 and is closed to exhaust, in which position

of the parts the carriage 23 and polishing element 15 are being driven to the right in Fig. 3. When the bridge 54 is rocked clockwise to its extreme position the plunger 90b is forced to lowermost position and the plunger 97 to uppermost position, thereby reversing the flow of fluid pressure to the cylinder 49 and the exhaust therefrom whereupon the carriage 23 and the polishing block 15 are moved to the left in Fig. 3.

From the above description it will be understood that when the carriage 23 moves in either direction, it first strikes one of the springs 72, causing the link 63 to be pulled or pushed, as the case may be, through the medium of the link 58. As the roller 67 moves along the bridge 54 toward the pivot 55 of the bridge, the engaged one of the springs 72 becomes compressed whereupon, the roller 67, upon reaching the center of the bridge will be caused, by the action of the spring, to snap over dead center and reverse the position of the bridge, thereby preventing the bridge from coming to rest on dead center, the weighted lever 60 being provided to ensure such reversal of the fluid pressure controlling mechanism of the valve device 53 by the downward thrust which it exerts on the link 63. Check pins 101 and 102 on the standard 56 limit the stroke of the roller 67 in different directions.

The polishing unit represented at 103 for the upper working and back-up rolls 10 and 12 is of the same general construction as the polishing unit above described. It comprises a carriage 104 shown as formed of spaced plates 105 and 106; webs 107 connecting the plates 105 and 106 together and braced by cross bars, one of which is shown at 108, the carriage 104 being mounted to reciprocate lengthwise of the rolls of the mill, on parallel guide rods 109 and 110 which are secured at their ends to the frame 14 of the mill and extend through the plates 105 and 106; a square shaft 111 extending through the plates 105 and 106 and journaled at its ends in the frame 14 and rotatable in these plates; a slide 112 shown as formed of a pair of rods 113 connected together at one end and between their ends, by cross plates 114 and 115, respectively, the rods 113 being slidably mounted in the webs 107; and an arm 116 connected with the cross plate 114 and provided with a clevis 117 pivoted thereto at 118, in which clevis the polishing element 16 is mounted.

The polishing unit 103 also comprises means for actuating the slide 112 to advance or retract the polishing element 16 relative to the rolls of the mill, these means comprising the square shaft 111; a lever 119 rigid with this shaft and extending at its outer end into an opening 120 in the cross plate 115; a lever 121 provided with an adjustable weight 122, fixed on the shaft 111 and latch means 123 for releasably holding the lever 121 in raised position.

The latch means 123 comprise an arm 124 pivoted at its upper end, as represented at 125 to a stationary bracket 126 on the frame 14 of the mill, and having a shoulder 127, and a pin 128 on the lever 121 which rests on the shoulder 127 when the lever 121 is in upwardly swung position in which position the polishing element 16 is withdrawn from operating position. Upon swinging the arm 124 outwardly the pin 128 releases from the shoulder 127 and the weight of the lever 121 forces the slide 112 and polishing element 16 toward the rolls 10 and 12 pressing the element 16 against them. A bevel surface 129 on

the arm 124 below the shoulder 127, and engageable by the pin 128 on the lever 121 permits of the automatic locking of the lever 121 in raised position upon swinging the latter upwardly.

In this arrangement provision is made for operating both polishing units from the same source of power, viz., the piston and cylinder mechanism 49. To this end connections are made between the carriages 23 and 104 for operating the carriage 104 responsive to the movements of the carriage 23. These connections are shown as comprising two chains 130 and 131, the chain 130 being connected at one end to the plate 24 of carriage 23 and at its other end to the plate 105 of carriage 104, this chain being trained over pulleys 132, 133 and 134, supported on the frame 14 of the mill; the other chain 131 being connected at one end to the plate 25 of carriage 23 and at its other end to the plate 106 of carriage 104 and being trained over pulleys 135, 136 and 137 supported on the frame 14 of the mill.

The polishing elements 15 and 16, shown by way of example as blocks, may be formed of any suitable material and be of any desired form. For example they may be made of wood to which is nailed, or otherwise secured, superposed emery sheets of any desired number; or they may be stones, either stationary or revolving, which may be mounted in the clevises.

A valve 138 in the air exhaust pipe 78 settable to throttle the flow as desired, serves the purpose of regulating the speed of the polishers and also to provide a cushion against shocks and to avoid jerky movement of the mechanism.

If desired, a construction like the lever and latch mechanism of the upper polishing unit may be substituted for the means shown for controlling the positioning of the slide 29 relative to the carriage 23.

While I have illustrated and described a particular embodiment of my invention I do not wish to be understood as intending to limit it thereto as the construction shown may be variously modified and altered and the invention embodied in other forms of structure without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent, is:

1. In combination: a movable member; a fluid pressure operated piston and cylinder mechanism for actuating said member; and automatic valve mechanism for admitting fluid pressure at one end of the cylinder and then the opposite end alternately to reciprocate the piston, including reciprocating plunger valves, a centrally pivoted rock member having lost motion connections with said plunger valves, a movable pivot having means for yieldingly urging the pivot towards the center of said rock member; a swinging link connected to said movable pivot and bearing against said rock member so as to actuate the rock member when the swinging link is oscillated over the pivot of the rock member, and a push rod having a pivoted link making a lost motion connection with said swinging link and provided with a pair of spring abutments disposed for alternate engagement by said movable member to reciprocate said push rod.

2. Apparatus as specified in claim 1, in which the movable pivot is carried by a pivoted lever and the means for urging it towards the rock member includes an adjustable weight mounted on said lever.

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