Dec. 10, 1940. R. J. CHAMPAYNE 2,224,140

RUBBING MACHINE

Filed May 15, 1939 2 Sheets-Sheet 1

Fig. 1

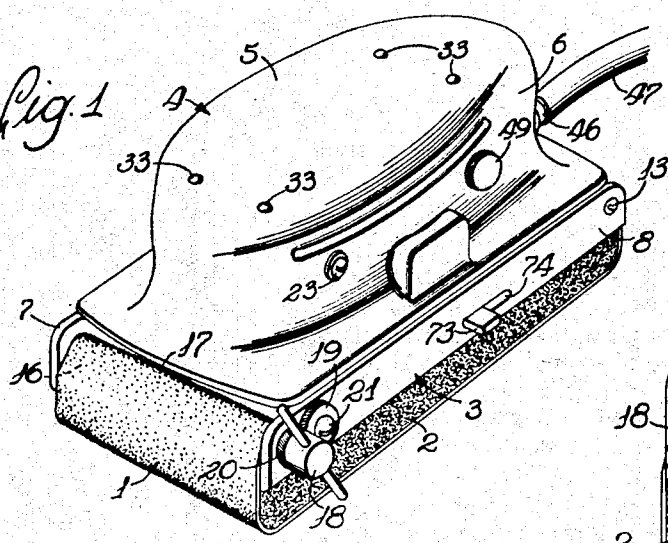


Fig. 5

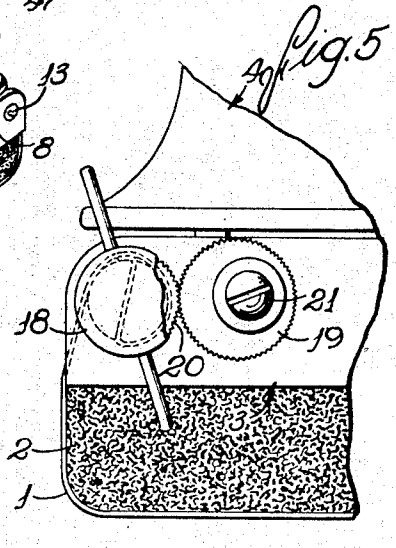


Fig. 2

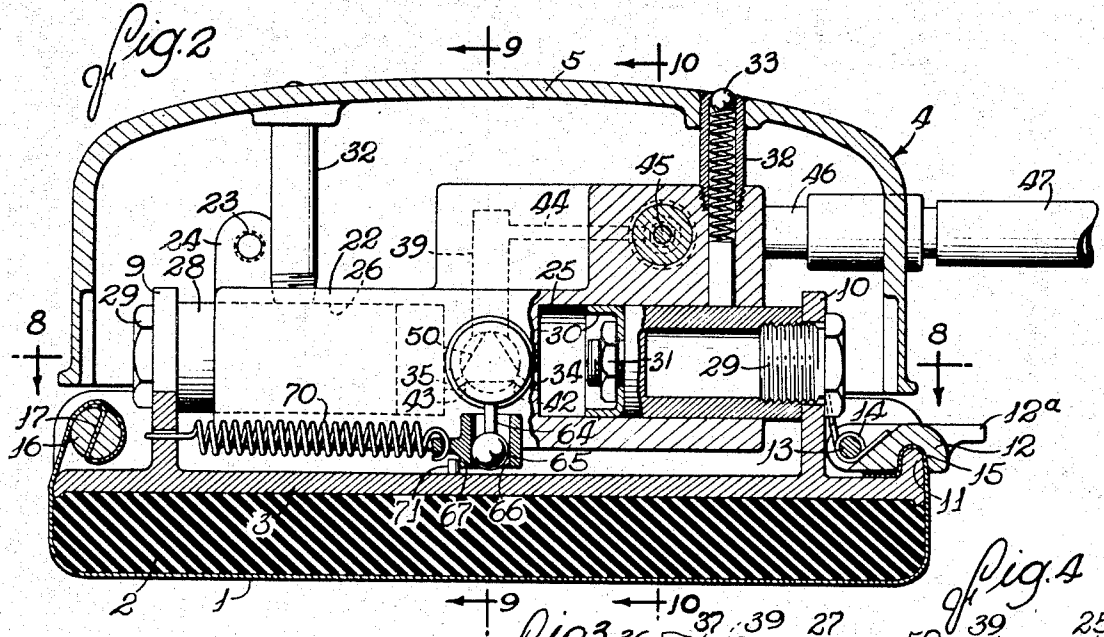


Fig. 3

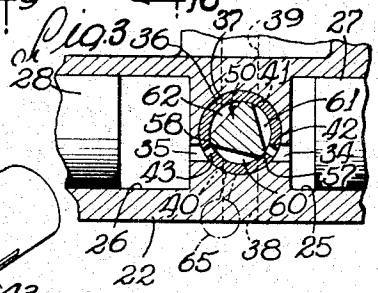


Fig. 4

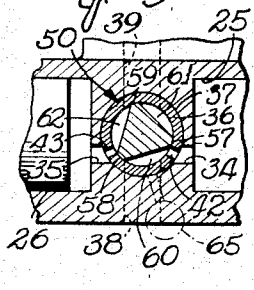


Fig. 6

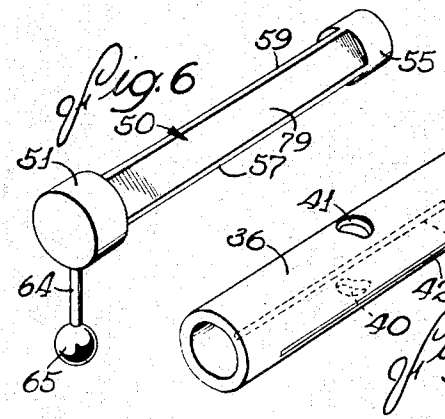


Fig. 7

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Dec. 10, 1940. R. J. CHAMPAYNE 2,224,140

RUBBING MACHINE

Filed May 15, 1939 2 Sheets-Sheet 2

Fig. 8

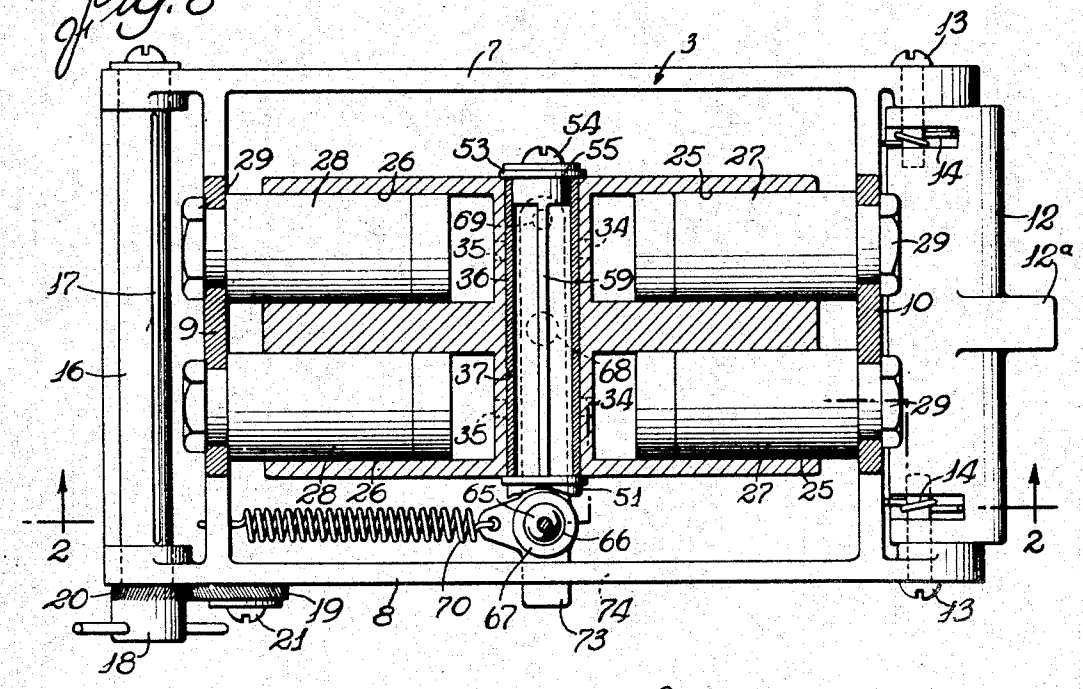


Fig. 9

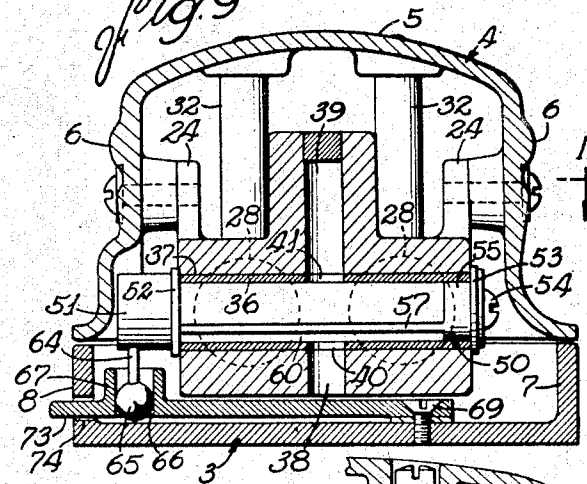


Fig. 10

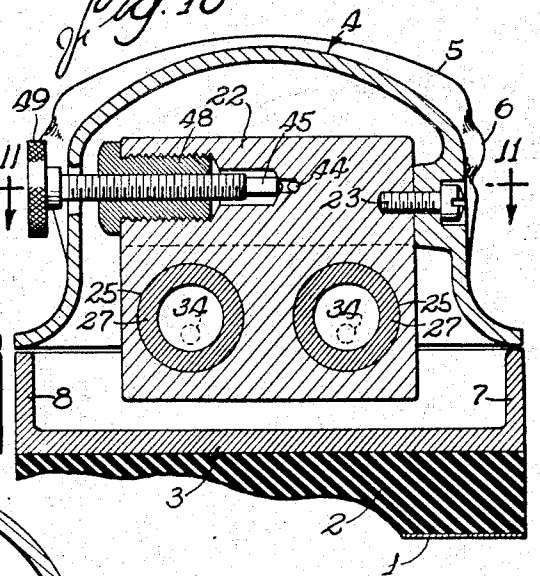
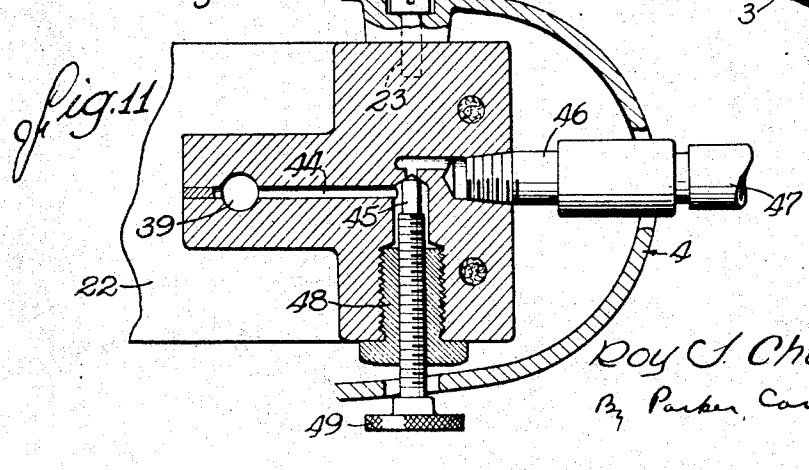


Fig. 11



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UNITED STATES PATENT OFFICE

2,224,140

RUBBING MACHINE

Roy J. Champayne, Rockford, Ill.

Application May 15, 1939, Serial No. 273,701

11 Claims. (Cl. 51—170)

The invention relates to portable power actuated rubbing machines for sanding, polishing, burnishing, or otherwise treating surfaces of metal or wood, and has more particular reference to rubbing machines actuated by pressure fluid.

A general object is to provide a pressure fluid actuated rubbing machine which is simpler in construction, which is less expensive to manufacture and service, and which reciprocates at substantially higher speed than similar machines heretofore used.

Another object is to support the rubbing shoe in a novel manner from the pistons of the fluid motors by which it is reciprocated.

A further object is to provide a simplified and novel valve mechanism for controlling the application of pressure fluid to the shoe actuators.

The invention also resides in the novel arrangement of the cylinders of the fluid actuators, the passages leading to and from the valve mechanism, and the manner of holding an abrasive sheet to the rubbing shoe.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of a rubbing machine embodying the novel features of the present invention.

Fig. 2 is a longitudinal section taken along the line 2—2 of Fig. 8.

Figs. 3 and 4 are fragmentary sectional views showing different positions of the valve shown in Fig. 2.

Fig. 5 is a fragmentary side elevational view.

Figs. 6 and 7 are perspective views of different parts of the valve mechanism.

Fig. 8 is a plan section taken along the line 8—8 of Fig. 2.

Figs. 9 and 10 are sections taken respectively along the lines 9—9 and 10—10 of Fig. 2.

Fig. 11 is a fragmentary plan section taken along the line 11—11 of Fig. 10.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment. It is to be understood that I do not thereby intend to limit the invention by such disclosure, but aim to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In the drawings, the sander shown to illustrate the invention comprises a single abrasive sheet 1 attached to a shoe or carrier 3 mounted for reciprocation by a pneumatic actuator housed within a casing 4 by which the tool may be grasped conveniently and moved about or pressed against the work surface to be treated. For this purpose, the casing preferably has a rounded top 5 and ribbed side surfaces 6 and is of a width such as to fit naturally in the operator's hand with the thumb and fingers gripping opposite sides of the casing.

Herein, the abrasive carrier 3 is disposed immediately below the open bottom of the casing 4 and comprises a generally rectangular casting of light metal such as aluminum made rigid by upstanding side flanges 7 and 8 and front and rear end flanges 9 and 10 integrally connected at opposite ends. A pad 2 of yieldable material such as sponge rubber is attached by suitable adhesive to the flat bottom of the carrier 3. The abrasive sheet extends in the direction of reciprocation of the shoe along the bottom of the pad and its opposite ends are bent upwardly around the ends of the shoe and then firmly clamped thereto. The rear end bends around a transverse rib 11 against which the sheet is held by a latch 12 pivoted on screw pins 13 supported by the side flanges 7 and 8. Torsion springs 14 coiled about the pins press the latch downwardly to clamp the sheet around the rib 11 and against the surface of a slot 15 in the latch. By raising and lowering a rearwardly projecting handle 12a on the latch, the abrasive sheet may be released from or clamped effectually to the carrier.

To tighten the sheet, its other end is wound around a roller 16 journaled in bosses at the forward ends of the side flanges and having an elongated diametrical slot 17 through which the sheet may be threaded. The sheet is tightened by turning a thumb knob 18 on one projecting end of the roller which may be locked in adjusted position by a disk 19 having a periphery roughened by knurling or serrating and mounted on a screw 21 to rotate on an eccentric axis disposed adjacent and extending parallel to the roller. After the abrasive sheet is stretched on the pad 2, the disk is turned to wedge its periphery against serrations or knurling 20 on the knob, and the screw 21 is then tightened to clamp the disk frictionally against the side flange 8. This mode of attachment firmly holds the abrasive sheet in place while facilitating ready removal and replacement of the sheet and the use of a sheet of minimum length. Likewise, any slack that develops by stretching of the sheet in service use may be taken up conveniently by releasing the locking disk and further turning the knob 18.

The abrasive carrier is supported for reciprocation by a casting 22 which constitutes the body or block of the pneumatic actuators and is housed within the casing 4, being secured to the latter by screws 23 threading into the body or ears 24 thereon. The block is bored at opposed ends to form two pairs of cylinders 25 and 26 disposed in a common horizontal plane with the cylinders of each pair spaced laterally and the corresponding cylinders of different pairs alined longitudinally. Pistons 27 and 28 are slidable in the cylinders and project from the remote ends thereof into abutment with the flanges 10 and 9 to which they are fastened by cap screws 29 threading into the pistons which are preferably made hollow to reduce their weight. Washers 30 of leather or the like are clamped by nuts 31 against the inner ends of the pistons to form an effective seal between the pistons and the cylinder walls. Fluid for lubricating the sliding surfaces is admitted to the cylinders through vertical tubes 32 threading into holes in the block 22 communicating with the cylinders. The upper ends of the tubes project into holes in the top of the casing 4 and are equipped with ball check valves 33 through which fluid may be introduced conveniently.

It will be observed that the cylinders 25 and 26 provide guideways for the reciprocating shoe which ways are of substantial length and laterally spaced so as to provide a rugged four point mounting by which the abrasive shoe is guided accurately and held effectually against tilting relative to the block 22 and the casing 4. The pistons and cylinders also constitute four pneumatic motors for reciprocating the shoe, two operating in one direction and two in the other. To produce one stroke, pressure fluid is admitted through passages 34 to the closed ends of cylinders 25 while passages 35 communicating with the closed ends of the cylinders 26 are open. During the other or reverse stroke, fluid flows into the cylinders 26 through the passages 35 and at the same time, the cylinders 25 are exhausted through the passages 34.

Such flow of the fluid is controlled by a novel valve mechanism actuated by the reciprocating shoe and arranged to serve all four pneumatic actuators. In the present instance, the valve mechanism includes a sleeve 36 fixed in a bore 37 in the block 22 disposed between the adjacent closed ends of the two pairs of cylinders and preferably extends horizontally and transversely of the cylinder axes. The bore communicates with the four passages 34 and 35 with an exhaust passage 38 opening downwardly from the block 22 and with an upwardly extending fluid supply passage 39. Holes 40 and 41 in the sleeve register with the passages 38 and 39 while slots 42 and 43 register with the passages 34 and 35. The supply passage 39 is connected at its upper end with a bore 44 which communicates through a needle valve 45 (Fig. 11) with a passage leading to a fitting 46 projecting through the rear end of the casing 4 and connected to a hose 47 extending to the compressed air supply. The needle valve member threads through a bushing 48 in the motor body 22 and may be adjusted to regulate the air flow to the motors by turning a knob 49 conveniently accessible from the exterior of the casing 4.

Oscillatable within the sleeve 36 is a valve member 50 preferably having an enlarged head 51 at one end projecting from the sleeve and clamped by a washer 52 against the sleeve end. The other end of the sleeve is closed by a washer 53 clamped against the sleeve by a screw 54 in this instance threading into a head 55 on the other end of the valve member 50. Intermediate its ends, the valve member is herein milled to a generally triangular cross-section to form equally spaced longitudinally extending lands 56, 57, and 58 bearing against the inner wall of the sleeve. The sides 79 of the member between the lands cooperate with the interior of the sleeve to form longitudinally extending passages 60, 61, and 62. The passage 60 is separated from the others by the lands 57 and 58 while the passages 61 and 62 are connected at all times through the hole 41 owing to the narrow width of the land 59. The lands 57 and 58 are slightly wider and longer than the slots 42 and 43 so as to cover the slots in the dead center position of the member (Fig. 2).

As the valve member is turned clockwise toward the limit position shown in Fig. 3, communication is established between the slot 42 and the fluid inlet 41 and this slot is separated from the exhaust port by the land 57. At the same time, the slot 43 is uncovered and connected to the exhaust port 40. With the valve thus positioned, compressed air flows from the supply passage 39 through the port 41, the passage 61, the slot 42, and the passages 34 to the cylinders 25 causing the abrasive carrier to be shifted to the right as viewed in Figs. 2 and 3. In this movement, air is forced out of the cylinders 26 through the passages 35, the slot 43, and the exhaust outlet 38.

In the reverse oscillation of the valve member toward the counter-clockwise limit (Fig. 4), the slot 43 is connected to the supply port 41 to admit compressed air to the cylinders 26 and cause the carrier to be shifted to the left. Air from the cylinders 25 is, during this movement, exhausted through the passages 34, the slot 42, and the port 40.

In case means, other than the lands themselves, are provided for supporting the valve member within the sleeve 36, it will be apparent that the land 59 may be omitted. The valve passages 61 and 62 would thus be combined into one.

Automatic shifting of the valve member between its limit positions (Figs. 3 and 4) is effected in the present instance by an arm 64 rigid with and projecting downwardly from the head 51 beyond the end of the sleeve 36. The lower ball-shaped end 65 of the arm is received snugly in a socket 66 formed by a tube 67 which herein is on the free end of an arm 68 extending transversely of the direction of reciprocation of the shoe between the castings 3 and 22 and pivoted on a screw 69 threading into the carrier 3. During normal operation, the socket 66 is fixed relative to the carrier by a spring 70 stretched between the arm 68 and the flange 9 to hold the arm against a stop lug 71 on the carrier. By virtue of this direct mechanical connection, the valve member is shifted clockwise within the sleeve 36 as the carrier moves to the left as viewed in Fig. 2 and counter-clockwise during reverse movement.

In spite of the fact that one part of the motion transmitting connection is yieldable to permit movement of the valve member independently of the abrasive shoe, the connection is direct and normally non-yieldable in either direction. That is to say, there is no lost motion between the motion transmitting parts. Nor does the valve movement snap over-center and dwell in a limit posi-

tion while the direction of motion of the carrier is being reversed as is commonly the case in prior pneumatic tools of the present character. On the contrary, the valve member follows all movements of the carrier in normal operation. Thus, after the member has been shifted to its clockwise limit (Fig. 3) to initiate movement of the carrier to the right, the valve member reverses immediately and the lands **57** and **58** start to cover the slots **42** and **43** respectively and decrease the fluid flow to the cylinders **25**. This flow is cut off completely by the time the carrier makes its mid-position (Fig. 2), and as the member is carried beyond this position by the momentum of the parts, air is admitted gradually to the cylinders **26** in which the pressure builds up to cushion the right hand stroke and initiate the left stroke. Then, the reverse action occurs, pressure fluid flowing into the cylinders **26** through slot **43** and the passages **35** and the air in the cylinders **25** being exhausted through the passages **34** and the slot **42**. As a result, the abrasive carrier reciprocates through a very short range which is sufficient nevertheless to produce effective abrading action. However, due to the direct connection to the valve member, there is no dwelling of the latter in either limit position so that the period of reciprocation is reduced substantially as compared to prior devices of like character. In fact, reciprocation of the carrier occurs so rapidly that the vibration is not objectionable.

Because of the direct valve actuating connection above referred to, the abrasave carrier will, as an incident to cutting off the air supply, always stop with the valve member **50** centered (Fig. 2). In this position of the valve, the pneumatic motors will not start again automatically when the needle valve is opened to admit compressed air, and it is difficult to shift the carrier sufficiently to move the valve. To facilitate starting under this condition, the free end **73** of the arm is projected outwardly through a hole **74** in the side flange **8** (Figs. 1 and 8) so as to be accessible for manual actuation of the arm against the action of the spring **70**. By pulling backwardly on the handle **73**, the arm is thus shifted relative to the carrier **3** in a direction away from the lug **71** thereby moving the valve member to the position shown in Fig. 4 to start the motors. When the handle is released, the spring reestablishes the normal fixed relation between the shoe and valve.

I claim as my invention:

1. A rubbing machine having, in combination, a pair of cylinders arranged end to end, pistons reciprocable in said cylinders and projecting from the remote ends thereof, a rubbing shoe disposed below said cylinders and supported from the projecting ends of said pistons, a pressure fluid supply passage, a valve disposed between the adjacent ends of said cylinders and having a member oscillatable about a substantially horizontal axis extending transversely of said cylinders to connect said supply passage to the inner ends first of one cylinder and then the other, an arm rigid with said member and depending therefrom, means pivotally connecting said shoe and the free end of said arm whereby said member is oscillated back and forth during reciprocation of said shoe.

2. A rubbing machine having, in combination, a pair of cylinders arranged end to end, pistons reciprocable in said cylinders, a rubbing shoe supported from said pistons, a bore disposed between the adjacent ends of said cylinders, fluid inlet and exhaust outlet passages communicating with said bore, ports opening into said bore, each disposed between said inlet and exhaust passages and communicating with the closed end of one cylinder, and a valve member rotatable in said bore and oscillated back and forth in timed relation to the reciprocation of said shoe, said member having lands thereon angularly spaced to close said ports when the member is in centered position, to connect one of said ports to said inlet and outlet respectively when the member is moved in opposite directions away from such positions and simultaneously connect the other passage to said outlet and inlet respectively.

3. A rubbing machine having, in combination, a pair of cylinders arranged end to end and closed at adjacent ends and open at their remote ends, pistons reciprocable in said cylinders and projecting from said remote ends, a rubbing shoe disposed below said cylinders and supported from the projecting ends of said pistons, a bore disposed between the adjacent ends of said cylinders and extending parallel to the plane of reciprocation of said shoe, a fluid inlet and an exhaust outlet communicating with said bore on the upper and lower sides thereof, ports in opposite sides of said bore each disposed between said inlet and outlet and respectively communicating with the closed ends of said cylinders, and a valve member rotatable in said bore and oscillated back and forth in timed relation to the reciprocation of said shoe, said member coacting with the wall of said bore to provide two passages, one in constant communication with said exhaust passage and connected to said ports alternately in the oscillation of said member, the other passage being in constant communication with said inlet and connected to said ports alternately in the oscillation of said member.

4. A rubbing machine having, in combination, four cylinders arranged in pairs with the cylinders of the different pairs arranged end to end, pistons reciprocable in said cylinders and projecting from the remote ends thereof, a rubbing shoe disposed below said cylinders and supported by said pistons, a bore disposed between the adjacent ends of said cylinders and extending across the cylinder axes, a fluid inlet and an exhaust outlet communicating with said bore, ports opening into said bore on opposite sides thereof between said inlet and exhaust passages and respectively communicating with the closed ends of one pair of cylinders, and rotary valve members rotatable in said bore and oscillated back and forth in synchronism with the reciprocation of said shoe to connect said inlet alternately to the ports of the different pairs of cylinders and simultaneously connect said other ports to said outlet.

5. A rubbing machine having, in combination, four cylinders arranged in pairs with the cylinders of each pair spaced laterally and the corresponding cylinders of the pairs arranged end to end, pistons reciprocable in said cylinders and projecting from the outer end of each cylinder, a pad holder disposed below said cylinders and rigidly secured to the projecting ends of said pistons, whereby said cylinders constitute guideways slidably supporting said holder at points spaced both longitudinally and laterally of the direction of reciprocation, and valve means actuated automatically in response to reciprocation of said holder to admit pressure fluid first to the inner ends of the cylinders of one pair and then

to the inner ends of the cylinders of the other pair.

6. A rubbing machine having, in combination, four cylinders disposed in a common plane and arranged in pairs with the cylinders of each pair spaced laterally and those of different pairs disposed end to end, pistons reciprocable in said cylinders and projecting from the outer ends thereof, an abrasive carrying shoe disposed below said cylinders and having upstanding flanges beyond the outer ends of said cylinders and rigidly secured to the outer ends of said pistons, and valve means controlling the admission of pressure fluid selectively to the inner ends of at least two of the cylinders.

7. A rubbing machine having, in combination, a reciprocably mounted rubbing shoe, a reversible pressure fluid actuator connected to said shoe and operable to move the shoe in opposite directions, a valve having a member movable in opposite directions to reverse the admission of pressure fluid to said actuator, and a motion transmitting connection between said member and said shoe including a spring and a part yieldable against the action of the spring to permit manual actuation of said member independently of the shoe out of neutral position, said spring normally maintaining said connection to cause said member to move in unison with the shoe.

8. A rubbing machine having, in combination, a reciprocably mounted rubbing shoe, a reversible pressure fluid actuator connected to said shoe and operable to move the shoe in opposite directions, a valve having a member movable in opposite directions from a neutral centered position to admit pressure fluid to the actuator, and a motion transmitting connection between said member and said shoe normally operable to maintain a fixed relation between the member and shoe so as to move the member back and forth in unison with the shoe but yieldable to permit manual actuation of said member independently of the shoe out of neutral position whereby to initiate reciprocation of the shoe.

9. A rubbing machine having, in combination, a pair of cylinders arranged end to end, pistons reciprocable in said cylinders, a rubbing shoe supported by said pistons, a bore disposed between the adjacent ends of said cylinders and having a pressure fluid inlet and an exhaust outlet angularly spaced apart and opening into said bore, ports in said bore respectively disposed between said inlet and outlet on different sides of the bore and communicating with the closed ends of the respective cylinders, a valve member rotatable in and having angularly spaced lands closing said ports when the member is disposed in a central position, said member having recesses between said lands connecting said ports to said inlet and outlet respectively when said member is moved out of said position in one direction and connecting the same ports to said outlet and inlet respectively when the member is disposed out of said position in the opposite direction, and means connecting said member and said shoe and normally operable without lost motion to oscillate the member and cause it to follow all reciprocatory movements of said shoe.

10. A rubbing machine having, in combination, a reciprocably mounted rubbing shoe, pressure fluid actuators connected to said shoe and respectively operable to move the shoe in opposite directions, a source of pressure fluid, a valve having a member movable in opposite directions from a neutral central position to admit pressure fluid from said source to the respective actuators, and a direct mechanical motion transmitting connection between said member and said shoe normally operable without lost motion to cause the member to follow all movements of the shoe.

11. A rubbing machine having, in combination, an abrasive carrying shoe, a reversible pneumatic actuator for reciprocating said shoe having two cylinder chambers, and a valve controlling the admission of pressure fluid first to one chamber and then to the other comprising a cylinder having fluid inlet and exhaust ports on diametrically opposite sides thereof, supply ports communicating with the respective cylinder chambers and disposed adjacent but circumferentially spaced from said exhaust port, and a member oscillatable in said cylinder and having lands thereon spaced to connect said supply ports with said inlet and exhaust ports respectively in one angular position of the member and to reverse the connections in another position, said supply ports and said exhaust ports being disposed on one side of a diameter of said cylinder and said inlet port being disposed on the opposite side whereby the pressure of the fluid entering said inlet urges said member against the opposite side of said cylinder to form an effective seal between said supply ports.

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