July 10, 1928. 1,677,112

S. F. ANDERSON

RUBBING MACHINE

Original Filed Sept. 4, 1917 3 Sheets-Sheet 1

Fig 14.

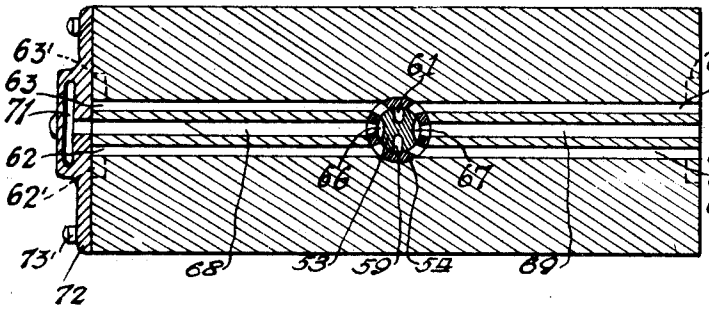


Fig 15.

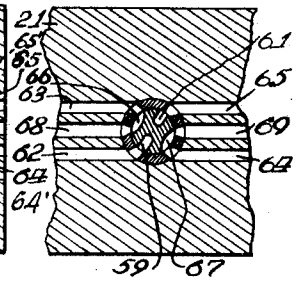


Fig 16.

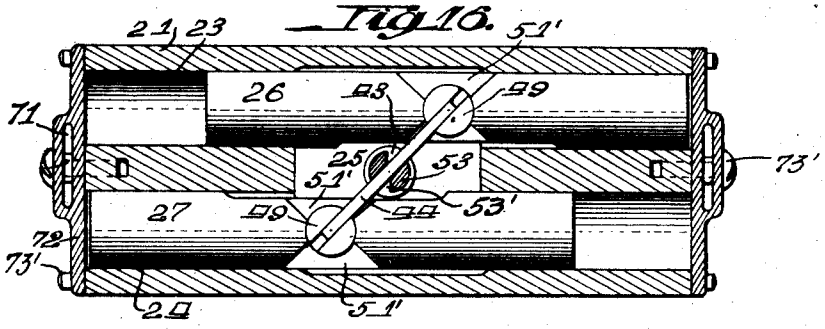


Fig 17.

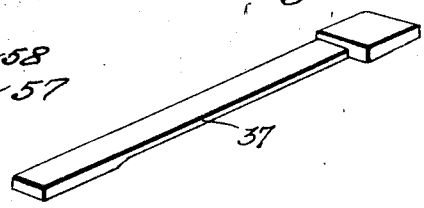


Fig 1.

Inventor:
S. F. Anderson
BY
Ira J. Wilson
ATTORNEY.

July 10, 1928.

1,677,112

S. F. ANDERSON

RUBBING MACHINE

Original Filed Sept. 4, 1917 3 Sheets-Sheet 2

Fig. 2.

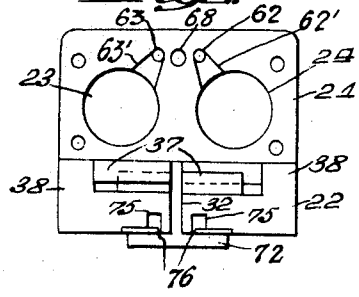


Fig. 3.

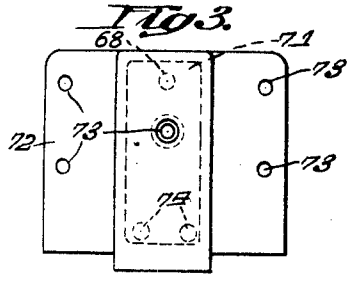


Fig. 4.

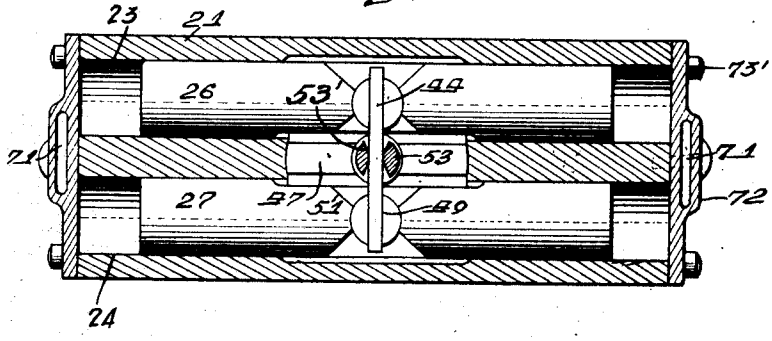
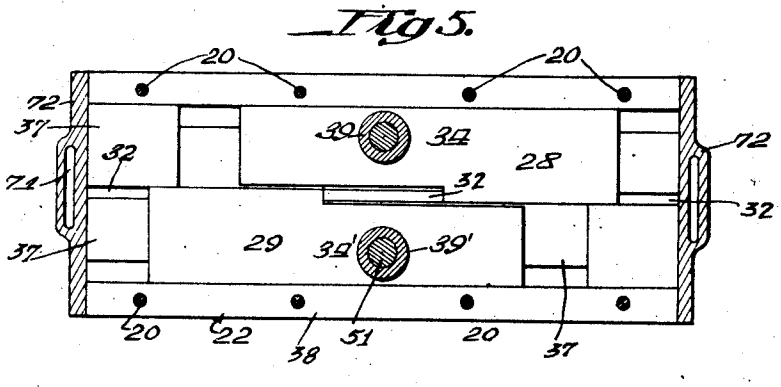


Fig. 5.



Swan F. Anderson INVENTOR.

BY Ira J. Wilson

ATTORNEY.

July 10, 1928.

1,677,112

S. F. ANDERSON

RUBBING MACHINE

Original Filed Sept. 4, 1917 3 Sheets-Sheet 3

Fig 7.

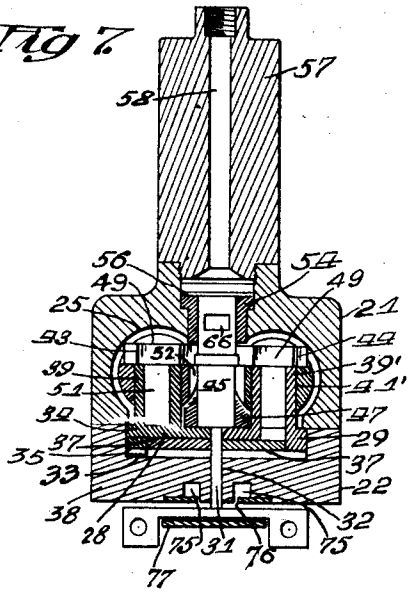


Fig 6.

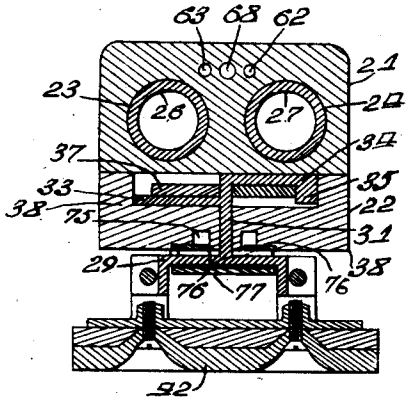


Fig 11.

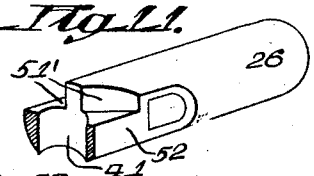


Fig 8.

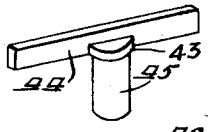


Fig 10.



Fig 13.

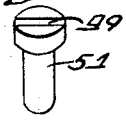


Fig 9.

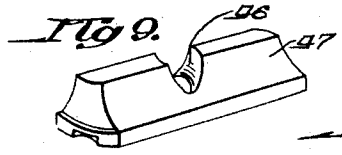
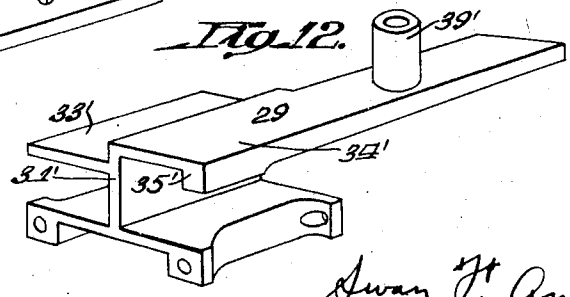


Fig 12.



Swan J. Anderson INVENTOR.

BY Ira J. Wilson

ATTORNEY.

Patented July 10, 1928. 1,677,112

UNITED STATES PATENT OFFICE.

SWAN F. ANDERSON, OF ROCKFORD, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO C. PAUL PARKER, TRUSTEE, OF CHICAGO, ILLINOIS.

RUBBING MACHINE.

Original application filed September 4, 1917, Serial No. 189,563. Divided and this application filed August 4, 1920. Serial No. 401,232.

This invention pertaining in general to portable, pneumatically operated rubbing or polishing machines, is a division of my application, Serial No. 189,563, Patent 1,492,659, May 6, 1924, and has reference more particularly to the principles of motor construction and operation disclosed in said application.

The chief object of this invention is to provide a pneumatically operated motor of novel construction for reciprocating a plurality of rubbing or polishing devices in opposite directions, which motor shall be so embodied in the frame structure of the machine as to constitute a component part of the structure carried by and portable with the rubbing devices.

One of the primary objects of this invention is to provide in a pneumatic rubbing machine, an organization of pistons, valve mechanism and co-operating parts of such simple, compact and novel construction and arrangement as to obtain most efficient and economical operation throughout a long period of usage, and to permit of manufacture at a comparatively low cost. To this end my invention contemplates, generally stated, the provision in a rubbing machine of the character in mind, of a pair of parallel laterally spaced pistons, preferably of the double-end type, connected by a device pivoted intermediate and between the ends of the pistons, which device maintains the pistons in co-operative relation throughout their reciprocation in opposite directions, and in the provision of a valve structure operated preferably by oscillation of said piston-connecting device. Another object in this regard is to provide an oscillatory valve in co-axial relation with and actuated by said device, thus securing a most direct and compact relation of parts which function very efficiently for the purpose in mind; and a further object is to provide a lost motion connection between the valve and said device whereby to control the length of stroke of the pistons.

I have also aimed to provide in combination with a rubbing machine of the character described, an upstanding handle co-axial with the oscillatory valve and removable from the body to permit access to the valve and valve chamber.

Other objects and attendant advantages will be appreciated by those familiar with this art as the invention becomes better understood by reference to the following description when considered in connection with the accompanying drawings, in which—

Figure 1 is a vertical longitudinal sectional view taken centrally through a rubbing machine embodying my invention, with one of the rubbing pads removed from its respective pad holder;

Fig. 2, an end view of the cylinder and slide-inclosing structure, with the end plate removed;

Fig. 3, a face view of the removed end plate;

Figs. 4 and 5, horizontal sectional views taken on the lines 4—4 and 5—5, respectively of Fig. 1;

Fig. 6, a cross sectional view through the machine taken substantially on line 6—6 of Fig. 1;

Fig. 7, a similar cross sectional view taken substantially on the line 7—7 of Fig. 1, with the rubbing pad removed;

Figs. 8 and 9, detail perspective views of the piston-connecting member and its bridge-supporting member, respectively;

Fig. 10, a vertical sectional view of the oscillating valve;

Fig. 11, a perspective view in section of one of the pistons;

Fig. 12, a perspective view of one of the pad holder slides;

Fig. 13, a perspective view of a guide pin which serves to connect the slides to the equalizing device;

Fig. 14, a horizontal sectional view taken substantially along the line 14—14 of Fig. 1;

Fig. 15, a similar but fragmentary sectional view showing the valve moved from neutral to an operative position; and

Fig. 16, a horizontal sectional view similar to Fig. 4, but showing the pistons moved in accordance with the position of the valve shown in Fig. 15.

Fig. 17, a perspective view of one of the members forming part of each side of the slide enclosing structure.

Inasmuch as the present invention has reference primarily to the principles of motor construction and operation referred to above, it should be understood that these may be employed for reciprocating devices of any suitable or preferred construction. For the

purpose of clarity and to enable better appreciation of the objects of my invention, I have deemed it advisable to show and describe a complete working example of a rubbing machine, which in this instance is of that type wherein the pad holders reciprocate in the same plane toward and from each other. Hence in the following description it will be borne in mind that the details of construction referred to are simply for purpose of illustrating a single application of the motor. The body comprising a cylinder portion 21 and a slide-inclosing portion 22, is preferably so shaped that the metal incorporated in its structure gives the machine the weight requisite to increase the effect of the abrasive means and facilitate the operation. Suitable means may be employed such as bolts 20, for securing the body portions rigidly together. The body portion 21 contains two cylinders 23 and 24 arranged in parallel relation and extending entirely through the body. Provision is made centrally between the ends of the body for the disposal of operating parts, by coring out this portion, as indicated, to form the chamber 25, which, it will be noted, intersects the central portion of the cylinders and in fact divides each cylinder into a double or opposed cylinder. Double-end pistons 26 and 27 slidable in the cylinders 23 and 24 respectively, are of the double acting type adapted to take air pressure at both ends. The construction of the pistons and the means by which they are pneumatically operated will be described later on following a description of the slides and pad holders which are operated directly by the pistons.

Assuming now that the pistons are adapted to be reciprocated rapidly in opposite directions, I have made provision for connecting a burnishing pad or rubbing tool as directly as possible to each piston in order that the power may be applied in a most efficient manner. In so doing, however, due regard must be had to the fact that because of the high speed at which the parts reciprocate, wearing surfaces or guideways of large area must be provided for the pad-holder slides, and that it is also desirable to prevent the admission of foreign matter or particles of pumice, etc., into the operating parts during usage. The slides, designated generally by reference characters 28 and 29 comprise respectively central upright portions 31 and 31′ slidably engaged in a central slotway or guideway 32 extending throughout the length of the slide enclosing portion 22 and in reality dividing the latter into two separate side portions, and laterally projecting slides 33 and 34 and 33′ and 34′ in offset planes as illustrated clearly in Fig. 12. The portions 31, 33 and 34 and 31′, 33′ and 34′ slidably engage in correspondingly shaped ways in the body portion of the tool and by reason of the substantial length of these surfaces or portions a considerable area of bearing surface is provided. Referring to Figs. 5 and 12, it will be noted that the lateral slide portion or wing 34′ of the slide 29 is of a length nearly equal to the length of its respective piston, while the opposite lateral wing 33′ is only about half the length of the wing 34′. It will also be noted that by arranging the slides 28 and 29 so that they are in overlapping or telescoping relation, it is possible to obtain the relatively long bearing surface desired. In order to further guide the sides against lateral displacement the outer end of the wing portions 34 and 34′ are provided with depending flanges 35 and 35′ respectively which fits in correspondingly shaped grooves or ways in opposite sides of the body portion 22. In further reference to the telescoping relation of the slides 28 and 29 it will be noted that the long wing portions 34 and 34′ are on opposite sides of the central slotway 32, and bear on their upper surfaces against the under surface of the cylinder body portion 21, and that the wing portions 33 and 33′ of shorter length are disposed in a plane below that of the wing portions 34 and 34′ and consequently operating in spaced relation below the wing portions 34′ and 34 of opposite slides. This will be observed particularly by reference to Figure 7, which shows the wing portion 33′ of the slide 29 disposed below the wing portion 34 of the slide 28. The body portion 22 which incloses the slides just described may be formed at each side of two parts 37 and 38 suitably and rigidly secured together and shaped to provide the proper slideways and inclosure for the lateral wings of both slides.

The direct connection spoken of between the slides and their respective pistons is clearly illustrated in Figs. 7 and 12 from which it will be observed that the slides 28 and 29 are respectively provided with integral upstanding trunnions 39 or 39′ fittingly engaged in apertures 41 and 41′ in their respective pistons centrally between the ends thereof. The central portion 31 or 31′ of each slide is shaped beneath the machine body for attachment to the pad holder which carries the burnishing pad or other abrasive means employed in the rubbing operation. From the foregoing it will be manifest that when air pressure is applied to opposite ends of the pistons (in a manner to be described hereinafter) they will be reciprocated rapidly in opposite directions and will in turn directly reciprocate the pad-holder slides. The rubbing or polishing elements designated generally by 42 may be of any suitable construction and description is deemed unnecessary.

Coming now to the motor construction and operation, I have given considerable attention to this with the view to obviating certain defects in machines previously marketed. I have aimed primarily to secure simplicity and durability; and to this end I have concluded, after a long series of experimentation, that the various operating parts must be properly balanced and equalized so that there will be no vibration, that the forces be applied as directly as possible, that because of the high speed at which the parts operate maximum bearing surfaces are necessary, and that special provision must be made for preventing any foreign matter aside from the proper lubricants, from entering the operating mechanism and consequently scoring and impairing the bearings. The means employed in the present instance for maintaining the pistons in proper relation at all times consists of an equalizer member designated generally by character 43, shown in detail in Fig. 8, having a cross head 44 secured to a central trunnion or pivot stud 45 rotatable in the bore 46 of a bridge member 47 which spans the chamber 25 intermediate the two pistons and is suitably secured to the body 21 by means of machine screws 48. The ends of the cross head 44 slidably co-operate with the pistons through the agency of slotted guides 49 formed integral with pivot pins 51 rotatable within the studs 39 and 39′ of the slides 28 and 29. To prevent interference between the equalizer arms and pistons the latter are cut away as at 51′. They are also bored to reduce weight and momentum and are cut away centrally at their inner sides 52 to enable a proper mounting of the equalizer intermediate the pistons. From the foregoing it will be manifest that the piston-connecting device, mounted to turn about an axis intermediate the cylinders and the ends thereof, embodies a diametrically disposed guideway which is slidably associated with a part moving with each piston. This device constitutes a very direct and simple means for maintaining the pistons in co-operative relation throughout their reciprocation.

My invention also contemplates the actuation of a valve by and in synchronism with the pistons; and as a direct, practical and efficient means to this end, I have arranged an oscillating valve in co-axial relation to the piston-connecting device and provided a connection whereby said device actuates the valve. The oscillatory valve illustrated in detail in Fig. 10 is adapted to be actuated directly by the equalizing member 43 and consists of a cylindrical portion 53 having a diametrical slotway in its lower end which receives the equalizing member. The valve is revoluble in a bushing 54 fixed in the body 21 in axial alignment with the equalizer and is provided with an annular head 55 seated on top of the bushing to take the heavy down thrust imposed by the air pressure. A steel washer 56 may be interposed between the bushing 54 and the head 55 of the valve and serve effectually as a wear seat therefor. Air under pressure is supplied to the machine from a suitable source as through a handle 57 detachably secured to the body 21 in axial alignment with the valve and having an air passage 58 communicating therewith. Removal of the handle 57 gives access to the valve chamber and permits easy removal of the valve. The air passes downwardly through the passages 59 and 61 (Fig. 10) in the valve and is adapted to enter the passages 62, 63, 64 and 65 at proper intervals as determined by oscillation of the valve for moving the pistons back and forth. It will be noted that the passages 59 and 61 in the valve intersect its periphery at diametrically opposite points and are adapted to register with the ports in the bushing which communicate with the air inlet passages 62 to 65 inclusive. As indicated in Figs. 2 and 14, the air inlet passages communicate with the ends of the cylinders. The valve port, coplanar with the air intake passages and ports, include exhaust ports 66 and 67 adapted to register at proper intervals with both the ports of the intake passages mentioned and the exhaust passages 68 and 69 disposed intermediate the air intake passages. These exhaust passages connect, as shown in Figs. 1 and 15, with passages 71 formed in end plates 72 which entirely cover the ends of the body portions 21 and 22 and consequently close the ends of the cylinders. The end plates may be suitably secured to the body by machine screws 73′ or the like passing through openings 73. The upright passages 71 in the end plates communicate at their lower ends through openings 74 (Fig. 3) with openings 75 arranged from end to end in the body portions 38 in close proximity to and blanking both sides of the central slotway 32. These openings are restricted at their under-sides to provide narrow mouths 76 co-extensive with the length of the slotway 32 and through which the exhaust air will be forced downwardly for the purpose of preventing foreign matter from entering the slotway and working upwardly into the operating mechanism.

Referring again to the valve it will be noted, viewing Figs. 4 and 16, that there is provision made in the connection between the valve and equalizing member for a certain amount of lost motion between these parts, that is, the equalizing member and consequently the pistons may be moved a predetermined distance independently of any movement of the valve for a purpose presently mentioned. This is accomplished in

the present instance by cutting away opposite ends of the slot in the valve, as shown at 53'. A splash guard 77 underlying the machine throughout the length thereof, is secured at its ends to the end plates 72. This guard prevents water and pumice from splashing upwardly into the slotway 32 and serves to deflect the exhaust air outwardly away from the active working faces of the rubbing elements.

The operation of my improved rubbing and burnishing machine will now be described. In all of the assembled views in the drawings, except Figs. 15 and 16, the parts are shown in neutral position, that is, one in which the air under pressure admitted to the machine will not actuate the pistons until the valve has been moved slightly beyond its dead center position. In the neutral position it will be noted that the pistons 26 and 27 are both centrally disposed in their respective cylinders, as shown in Fig. 4, and that the valve as shown in Fig. 14, precludes the air pressure from entering the cylinders. Upon moving the slides in either direction the valve will be oscillated through the agency of the member 43 as described above, so that the passages 59 and 61 of the valve will register with either the cylinder air passages 62 and 65 or the passages 63 and 64, dependent upon the direction in which the valve is oscillated. As shown in Fig. 15, the valve has been oscillated in a clockwise direction, thus connecting the air supply with the passages 62 and 65 and consequently admitting the air to the lower left hand piston and upper right hand piston shown in Fig. 16, whereupon the pistons will be forced by the air pressure to the opposite ends of the cylinders. The piston action is very rapid and in order that the stroke may be accomplished before the valve reverses the air supply to the opposite end of the cylinders to effect the reverse piston action, a lost motion is provided between the valve and the member 43. This permits the pistons to move independently of the valve and acquire sufficient momentum to carry them to the end of their stroke before the valve is oscillated to admit the reverse air supply. This action will be plainly seen by reference to Fig. 16 from which it will be noted that the pistons may move nearly half the length of their stroke before the valve will be oscillated by the member 51 in a counter-clockwise direction. By changing the amount of lost motion between the valve and member 43, the length of the piston stroke may be varied. While the cylinders are taking air through the intake passages 62 and 65 as just mentioned, the opposed supply passages 63 and 64 will be connected thru the valve ports 66 and 67 with the exhaust passages 68 and 69 respectively, so that as the pistons are driven in one direction the exhaust air of the opposed cylinders will be simultaneously expelled from their respective cylinders and forced down through the passages 71, and out of the long narrow mouths 76 at the underside of the machine. The valve action just described takes place automatically, that is, reverses automatically, due to the alternating action of the opposed cylinders. As a consequence of this action the pistons will reciprocate very rapidly at a speed dependent, of course, on the air pressure and upon the resistance to the rubbing tools due to the nature of the work being performed. In view of the rapidity of this operation the exhaust air will be substantially continuous and consequently, will be forced into the openings 75 from both ends and discharged downwardly through the narrow mouths 76 throughout the length of the machine. This downwardly discharging exhaust air will strike the top of the splash guard 77 and will be deflected laterally with such force and continuity as to prevent any foreign particles arising, or splashing up during the rubbing action from entering the slotway 32 and consequently working up into the operating parts of the mechanism. By utilizing the exhaust air in this manner a very effectual means is provided for keeping the operating mechanism clean and in good working condition; and in this regard it will be especially noted that the exhaust air is not passed through the operating mechanism, such as through the slide bearings, etc., but is conveyed in passages entirely separate from these and is then applied at the desired points of use. Consequently, the bearing surfaces are not subjected to the blast of exhaust air and there is no danger of foreign particles being carried through the slotway to said surfaces, with consequent injury thereto.

From the foregoing, it will be observed that I have provided a motor construction peculiarly and advantageously adapted for reciprocating a pair of rubbing or polishing devices, especially in that the few parts are equally balanced and are very compactly arranged and the forces are transmitted most directly and efficiently. Thus, vibration is eliminated and the machine is smooth-running, regardless of the high speed at which it operates; consequently the wear is reduced to a minimum. The arrangement also promotes economy in manufacture and enables comparatively quick and easy assembling and disassembling. It will also be manifest that neither the construction, number, nor arrangement of the pad-holder slides or devices are material to the present invention, which relates primarily to the motor.

It is believed that the foregoing conveys a clear understanding to those familiar with this art, of the objects prefaced above, and while I have illustrated but a single working

embodiment of my invention, it should be understood that considerable change might be made in the construction without departing from the spirit and scope of the invention as expressed in the appended claims.

I claim:

1. In a machine of the character disclosed, the combination of a pair of cylinders, separate pistons therefor, an oscillatory valve adapted to govern pressure fluid to both cylinders for reciprocating the pistons in opposite directions, passages between said valve and said cylinders, and a single means coaxial with said valve and in continuous direct engagement with said pistons intermediate their ends for actuating said valve.

2. In a machine of the character disclosed, the combination of a pair of cylinders in parallel laterally spaced relation, a double-end piston reciprocable in each cylinder, means pivotal about an axis intermediate and between the ends of the pistons and connected with the latter for maintaining them in co-operative relation during and throughout their reciprocation in opposite directions, and valve mechanism operated by movement of said pivotal means for controlling the delivery of fluid under pressure to the cylinders.

3. In a machine of the character disclosed, the combination of a pair of parallel laterally spaced cylinders, a piston reciprocable in each cylinder, a member pivoted intermediate the pistons and between the ends thereof and having a slidable connection with each piston, whereby to maintain the pistons in co-operative relation throughout their reciprocation, and a valve actuated by said pivoted member for controlling the delivery of fluid under pressure to the cylinders.

4. In a machine of the character disclosed, the combination of a body formed with a pair of cylinders, pistons therefor, an oscillatory valve adapted to govern pressure fluid to both cylinders for reciprocating the pistons in opposite directions, passages between said valve and said cylinders, and a single means coaxial with said valve for operating the latter and operable by the reciprocation of said pistons, said last mentioned means being enclosed within said body and having a lost motion connection with said valve.

5. In a machine of the character described, the combination of a body having a pair of parallel laterally spaced cylinders and having an opening in its top wall between and intermediate the ends of said cylinders, two pistons one of which is mounted in each cylinder, an oscillatory valve member in said opening for controlling the pressure fluid to said cylinders, said valve member being freely removable from said opening, and an upstanding handle detachably mounted on said body, said handle closing said opening and having a conduit through which the fluid under pressure is directed to said valve member.

6. In a machine of the character disclosed, the combination of a pair of parallel laterally spaced cylinders, a double-end piston in each cylinder, means providing a connection between the pistons whereby to maintain them in co-operative relation throughout their reciprocation, said means being pivotal about an axis intermediate and between the ends of the pistons and having an oscillatory connection with each piston about a fixed axis thereon, and a valve actuated by oscillation of said means for controlling the delivery of fluid under pressure to the pistons for reciprocating them in opposite directions.

7. In a machine of the character disclosed, the combination of a pair of cylinders, a double-end piston reciprocable in each cylinder, a member pivotal about an axis between and intermediate the ends of the pistons and having a diametrically disposed guide, means on each piston slidably associated with said guide whereby to maintain the pistons in co-operative relation throughout their reciprocation in opposite directions, an oscillatory valve co-axial with said member and actuated by oscillation thereof, and passages between said valve and the cylinders whereby the valve controls the delivery of fluid under pressure to the cylinders for reciprocating the pistons in opposite directions.

8. In a machine of the character disclosed, the combination of a pair of cylinders, a double-end piston in each cylinder, a pivotal member operating between the pistons to maintain them in co-operative relation throughout their reciprocation, and a valve having a lost motion connection with and actuated by said member for governing the delivery of fluid under pressure to the cylinders.

9. In a machine of the character disclosed, the combination of a pair of cylinders, a piston in each cylinder, a member operable between the pistons for maintaining them in co-operative relation throughout their reciprocation, and an oscillatory valve having a lost motion connection with said member and adapted to be actuated thereby for governing the delivery of fluid under pressure to the cylinders.

10. The combination of a closed body having a plurality of cylinders, a pair of pistons in said cylinders, a member having a central bearing hub pivotally mounted in said body for movement in a single plane and having a cross head whose ends are slidably associated with the pistons whereby to maintain them in co-operative relation

throughout their reciprocation, and a valve actuated by movement of said pistons for controlling the delivery of fluid under pressure to the cylinders.

11. The combination of a body having a pair of cylinders, a piston in each cylinder, a member having a central bearing hub pivotally mounted between the pistons and having a cross head whose ends are slidably associated with the pistons whereby to maintain them in co-operative relation throughout their reciprocation, and an oscillatory valve co-axial with said piston-connected member and actuated thereby for controlling the delivery of fluid under pressure to the cylinders.

12. The combination of a body having a pair of cylinders, a piston in each cyinder, a member having a central bearing hub pivotally mounted between the cylinders and having a cross head whose ends are slidably associated with the pistons whereby to maintain them in co-operative relation throughout their reciprocation, an oscillatory valve co-axial with said member and having a bifurcated end for the reception thereof, and passages providing communication between the valve and the cylinders.

13. The combination of a body having a pair of cylinders, a piston in each cylinder, a slide adapted to be reciprocated by each piston and having an upstanding cylindrical part fitting in a bearing in its respective piston, a bearing pin co-axially mounted in each upstanding part and having a diametrical guideway therein, a member pivotally mounted between the pistons and having diametrically opposed parts slidably fitting in the guideways in said pins, thereby establishing a connection between the pistons serving to maintain them in co-operative relation throughout their reciprocation, and valve means controlling the admission of pressure fluid to and from said cylinders to reciprocate the pistons.

14. The combination of a pair of parallel laterally spaced cylinders, a double-end piston in each cylinder, devices adapted to be operated by the pistons, means movable about an axis between the pistons and the ends thereof and connected respectively with the pistons for maintaining them in co-operative relation throughout their reciprocation, and valve mechanism actuated by said means for governing the delivery of fluid under pressure to the cylinders for the purpose of reciprocating the pistons in opposite directions.

15. In a machine of the character disclosed, the combination of a pair of double-acting pistons adapted to reciprocate in opposite directions, oscillatory means centrally connecting the pistons for maintaining them in co-operative relation throughout their reciprocation, and means actuated by said first mentioned means for controlling fluid pressure to the pistons for reciprocating the latter.

16. In a machine of the character disclosed, in combination, a body having a pair of laterally spaced cylinders, a piston reciprocable in each cylinder, an oscillatory valve enclosed within said body and movable about an axis intermediate and between the ends of said pistons, inlet passages in said body portion above said cylinders adapted to connect said valve with the outer ends of both cylinders, exhaust passages in said body portion above said cylinders adapted to connect said valve with the exhaust, a pressure fluid supply passage above said valve, and means in said body, and co-axial with said valve positioned between said pistons for actuating said valve to alternately connect said inlet passages and said exhaust passages alternately to opposite ends of said cylinders.

17. In a machine of the character disclosed, in combination, a pair of laterally spaced cylinders, a double end piston reciprocable in each cylinder, a member pivotal about an axis intermediate the ends of and between said pistons and having a diametrically disposed guide, said guide having a sliding and rotary connection with each piston, an oscillatory valve coaxial with said member and actuated by movement thereof, and passages between said valve and said cylinders whereby said valve controls the delivery of fluid under pressure to said cylinders for reciprocating the pistons in opposite directions.

18. A machine of the character disclosed having, in combination, a body having a closed chamber, means extending through said chamber and being formed with a bore intermediate its ends, a pair of spaced cylinders, two pistons one of which is reciprocable in each cylinder, a pivotal member having a central pivot stud bearing in said bore and having a sliding and pivotal connection with each piston to maintain said pistons in cooperative relation throughout their reciprocation in opposite directions, and valve means actuated upon movement of said pistons to control the delivery of fluid under pressure to said cylinders.

19. A machine of the character disclosed having, in combination, a pair of laterally spaced cylinders, a piston reciprocable in each cylinder, a member having a central bearing hub pivotally mounted between the cylinders and having a lateral portion constituting a guide, means carried by said pistons for slidably engaging said guide and oscillating said member upon a reciprocation of said pistons, and an oscillatory valve coaxial with respect to said member and

operable by oscillation of the latter to control the admission of fluid pressure to said cylinders.

20. A machine of the character disclosed comprising, in combination, a body portion having parallel laterally spaced cylinders, pistons mounted in said cylinders for reciprocation in opposite directions, a valve member positioned within said body between said cylinders for controlling the admission of fluid pressure to the latter, means supported in said body portion and engaging said valve member and said pistons, said means acting to maintain the pistons in cooperative relation throughout their reciprocation and to actuate said valve member near the end of the stroke of said pistons, and means for supplying fluid pressure to said valve member.

21. In a machine of the class described, in combination, a closed body formed with cylinders, pistons movably mounted in said cylinders, said body being formed with a central chamber and a bore opening into said chamber, an equalizing member mounted for oscillation in a single plane in said chamber, said member having a pivot stud in said bore and having a sliding and rotary operative connection with each piston to synchronize the movements of said pistons.

22. In a machine of the character described, in combination, a closed cylinder body having a closed central chamber, a pair of pistons movably mounted in said cylinder body, pins carried by said pistons, and an equalizing member rotatably mounted in said chamber and slidably and rotatably associated with each of said pins to cause said pistons to move in synchronism.

SWAN F. ANDERSON.

CERTIFICATE OF CORRECTION.

Patent No. 1,677,112. Granted July 10, 1928, to

SWAN F. ANDERSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 92, after the word "communicate" insert the words "through passage 62' 63' 64' and 65' respectively"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of August, A. D. 1928.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)