Sept. 10, 1940. E. AHLSKOG 2,214,189

PNEUMATIC POLISHING AND ABRADING MACHINE

Filed Dec. 3, 1938 3 Sheets-Sheet 1

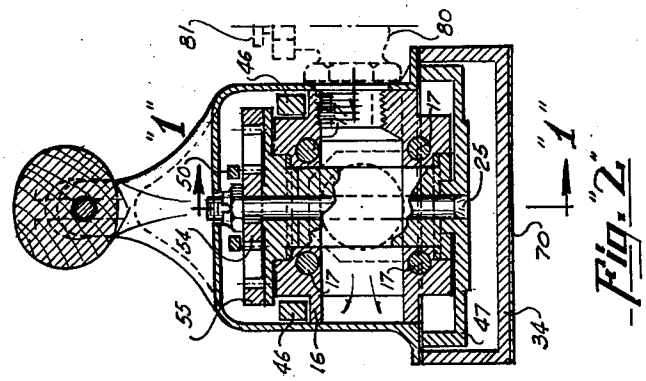


Fig. 2

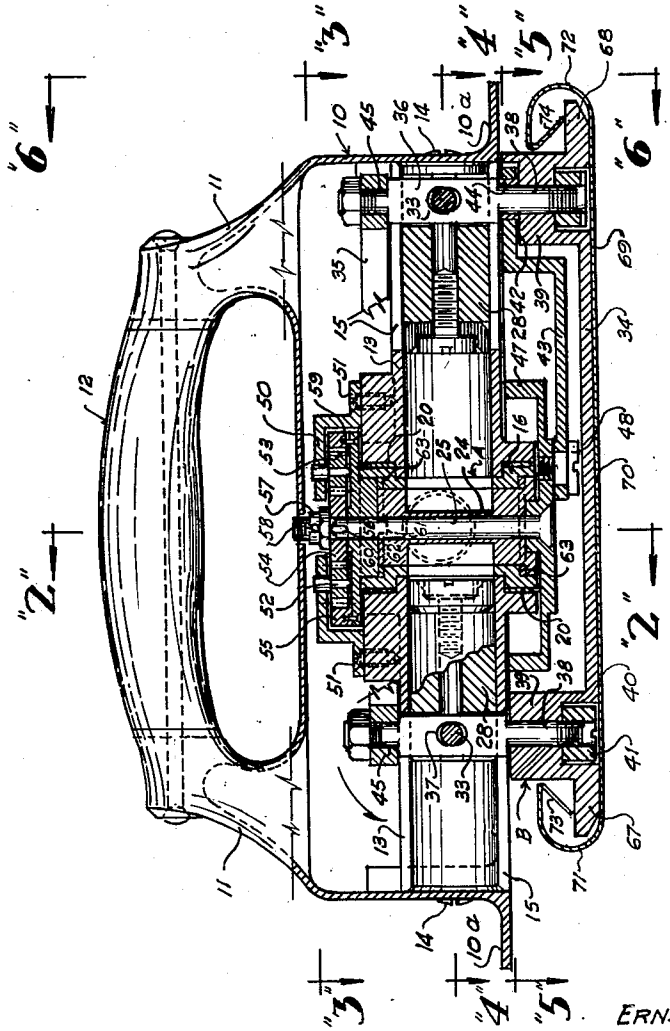


Fig. 1

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PNEUMATIC POLISHING AND ABRADING MACHINE

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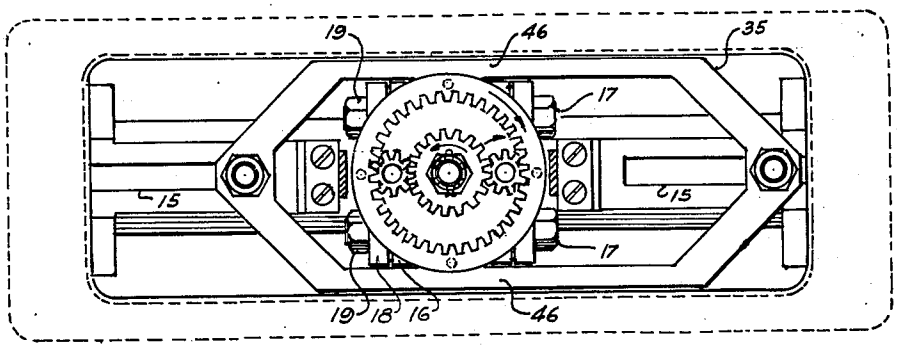


Fig. "3"

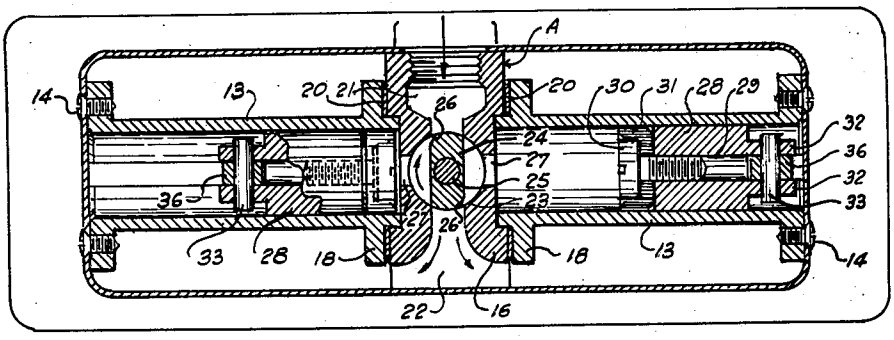


Fig "4"

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PNEUMATIC POLISHING AND ABRADING MACHINE

Filed Dec. 3, 1938 3 Sheets-Sheet 3

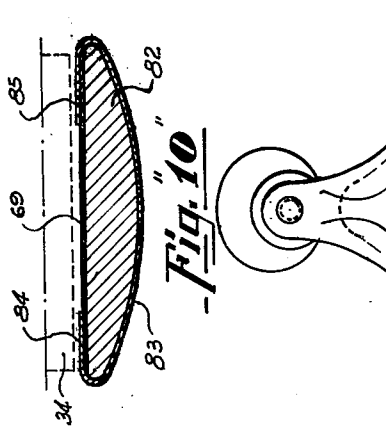
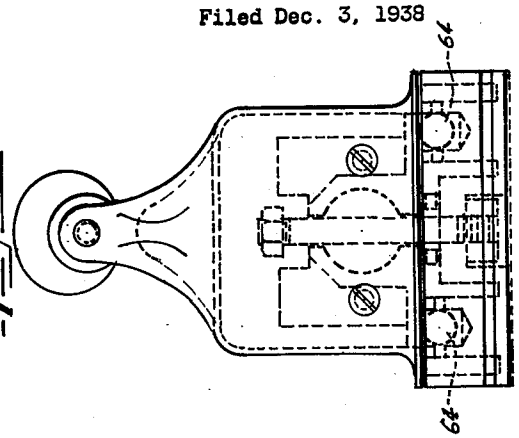


Fig. 10



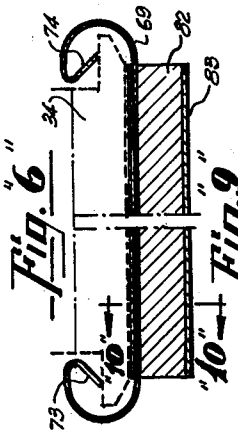


Fig. 6

Fig. 9

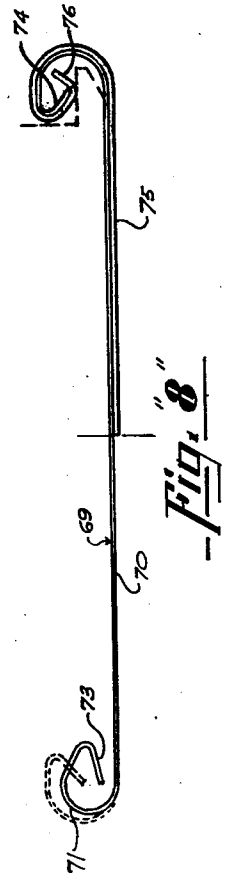


Fig. 8

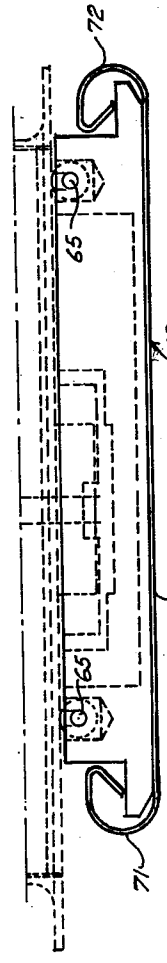


Fig. 7

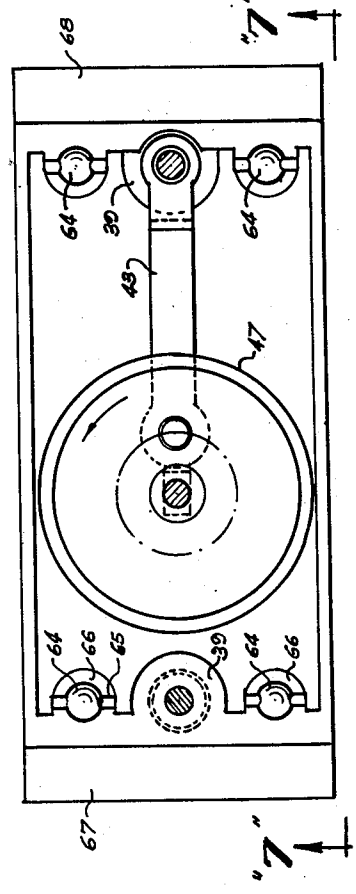


Fig. 5

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UNITED STATES PATENT OFFICE

2,214,189

PNEUMATIC POLISHING AND ABRADING MACHINE

Ernst Ahlskog, Chicago, Ill.

Application December 3, 1938, Serial No. 243,751

8 Claims. (Cl. 121—3)

This invention has to do with a pneumatic tool or the like, and relates particularly to a portable pneumatically operated polishing or abrading machine.

The primary object of the present invention is the provision of an improved machine provided with a reciprocating work member powered by a fluid working medium controlled by a rotary valve of such machine.

A further object of the present invention is the provision of an improved polishing machine operated by a fluid working medium and adapted to exhaust such medium upon a surface undergoing treatment thereby for cleaning the same.

A further object of the present invention is the provision of an improved clamp member for detachably securing a surface-treating sheet upon the work member of the machine.

Other desirable objects of my invention will become apparent when reading the following description in conjunction with the annexed three sheets of drawings constituting a part of this application, and wherein:

Fig. 1 is a vertical sectional view taken through a preferred embodiment of the invention, as indicated on the line 1—1 of Fig. 2;

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

Figs. 3, 4 and 5 are horizontal views taken respectively on the lines 3—3, 4—4 and 5—5 of Fig. 1;

Fig. 6 is an end elevational view taken on the line 6—6 of Fig. 1;

Fig. 7 is a fragmentary side elevation of the machine;

Fig. 8 is a side elevation of a clamp device employed upon the present machine;

Fig. 9 is a view similar to Fig. 8, but illustrating a backing pad for an abrasive or polishing sheet; and

Fig. 10 is a transverse sectional view taken on the line 10—10 of Fig. 9.

The same reference characters where used in several figures of the drawings and hereinafter in the description designate the same respective parts of the machine.

Although the machine herein described is referred to as a polishing machine, it will be conceived that said machine may be used for abrading as well as polishing, or that the work member thereof may be used for performing other services when operably connected with suitable adaptor parts.

Referring now to the drawing and particularly to Figs. 1 to 4, the machine will be seen to comprise a casing 10 which is provided on its upper side with hollow standards 11 for the attachment of a handle member 12. A pair of similar cylinders 13 are axially aligned within the casing 10 to which they are secured at their outer and opposite ends by means of machine screws 14. The cylinders 13 are provided with slots 15 in diametrically opposite sides thereof.

Between the opposed inner ends of the cylinders 13 there is disposed a valve A including a casing 16 which is drilled for receiving bolts 17, Figs. 2 and 3. Bolts 17 also extend through flanges 18 upon the inner ends of the cylinders 13, and when the nuts 19 are threaded onto said bolts the cylinders 13 and the valve chamber 16 are drawn tightly into a unitary assembly. Gasket members 20 may be placed between the ends of the flanges 18 and the valve casing 16 for providing a gas-tight seal between these parts.

The valve casing 16 is provided with a horizontal intake passage 21 and an exhaust passage 22. These passages 21 and 22 communicate with a cylindrical valve chamber 23 within which there is disposed a rotatable valve member 24. Said valve member is freely rotatable upon a vertical shaft 25. Diametrically opposite corners 26 of the valve member 24 are chamfered to facilitate the admission of gas or other fluid working medium to one of the cylinders 13, and the exhaust of such medium from the other of said cylinder while the valve member is in a centered position as that illustrated in Fig. 4. Lateral passages 27 in opposite sides of the valve casing 16 communicate with the cylinders 13. Said passages 27 permit the admittance and discharge of working medium to and from the cylinders under control of the valve A.

Each of the cylinders 13 contains a piston 28. Said pistons are axially drilled at 29 and threaded for cooperating with the threaded portions of bolts 30 of which the heads serve to hold cup-washers 31 upon the inner ends of the pistons. Said washers 31 may be made of leather and serve the same purpose as conventional piston rings for precluding the escape of fluid past the pistons. Paired apertured ears 32 project outwardly from the outer ends of the pistons 28, there being a pin 33 disposed between and anchored in the apertures of the paired ears upon each of the pistons. The pins 33 are for supporting a reciprocal carriage B comprising a work member 34 and a yoke 35.

The carriage B also comprises vertical cross members 36 of which central sections, containing

oblong apertures 37, are disposed between the apertured ears 32 on the pistons 28. Said apertures 37 receive the pins 33 and thereby connect the carriage B with both of the pistons 28.

The lower end sections 38 of the cross members 36 are threaded and extend through apertured bosses 39 projecting upwardly from opposite ends of the work member 34. Said bosses 39 are countersunk at 40 in their lower sides for receiving nuts 41 which are threaded onto the lower end sections 38 of said cross members. The right-hand boss 39, Fig. 1, has in its upper end a cut-away section 42 which accommodates one end of an off-set connecting rod 43. Said end of the connecting rod is provided with a bushing 44 which is journalled on the lower section 38 of the right-hand cross member 36. This connecting rod is for rotating the valve member 24 during operation of the device in the manner and for the purpose hereinafter fully described.

The upper ends of the cross members project through openings in opposite ends of the yoke 35. Said yoke comprises side pieces 46 which extend along opposite sides of the valve casing 16 as clearly illustrated in Figs. 2 and 3. The upper and lower sides of the carriage B which are respectively formed by the yoke 35 and the work member or shoe 34 is a rigid assembly which is connected with both of the pistons 28, and is movable in unison therewith. During such movement the slots 15 in the upper and lower side walls of cylinders 13 accommodate the vertical cross members 36.

It will be noted that the rotatable valve shaft 25 carries a fly wheel 47 non-rotatively upon its lower end, as illustrated in Figs. 1 and 2. A screw-headed bearing member 48 anchored in the fly wheel 47 serves as a connection for one end of the connecting rod 43 so that during reciprocation of the pistons 28 and the carriage B said connecting rod will be effective for rotating the fly wheel 47 and the valve shaft 25.

A bracket 50 is connected to the upper sides of the cylinders 13 by means of machine screws 51. Said bracket has stub shafts 52 anchored therein for the support of pinions 53. Pinions 53 mesh with a sun gear 54 and also with a ring gear 55 which has a pitch line twice the diameter as that of the sun gear. Sun gear 54 is keyed to the upper end of the shaft 25 by a key 56. A castellated nut 57 prevents the gear 54 moving endwise from said shaft 25. A cotter key 58 locks the nut 57 upon the threaded upper end of shaft 25.

The ring gear 55 is secured by means of screws 59 to a plate 60 which has a downwardly projecting rib 61 which fits into a groove in the upper face of the cylindrical upper end section 62 of the valve member 24. Rings 63 of packing material prevent the leakage of the working medium past the ends of the rotatable valve member 24.

During operation of the device, while the pistons 28 and the shoe 34 are reciprocating, pressure applied to the handle member 12 for forcing said shoe 34 toward a surface being treated is also impressed upon the roller bearings 64, Figs. 5, 6 and 7. Said bearings 64 comprise stem-like extensions 65 which are journalled in the side walls of recessed bosses 66. Said bearing members 64 at the periphery of their spherical surface engage lower outer wall surfaces of the cylinders 13 and roll therealong to diminish frictional resistance to forward and backward movement of the shoe 34 while pressure is applied at the handle 12.

The shoe 34 has flanges 67 and 68 at its ends for cooperating with the ends of a clamp member 69, Figs. 1, 7 and 8. Said clamp member has a flat intermediate section 70 and curled resilient end sections 71 and 72. Section 71 has an in-turned flange 73 whereas section 72 has an in-turned flange 74. Flanges 73 and 74 are sufficiently long that the curled end sections 71 and 72 must be resiliently expanded before the shoe flanges as 68 can be inserted as shown in Figs. 1 and 7. The solid lines at the left end of the clamp in Fig. 8 show the normal shape of the device whereas the dotted lines show the shape when the curled end section 71 is expanded to receive the shoe flange 67.

Preparatory to using the machine a polishing cloth or an abrasive bearing sheet or the like 75, Fig. 8, is attached to the shoe by means of the clamp member 69. One end 76 of the sheet 75 is first placed beneath the edge of in-turned flange as 74 and thus clamped to the flange 68. The sheet 75 is then stretched tautly along the outer periphery of the clamp member 69 and the opposite end of said sheet carried beneath and beyond in-turned flange 73 while said in-turned flange is expanded outwardly slightly further than the dotted line position shown in Fig. 8. While holding that section of the sheet 75 in engagement with the edge of inturned flange 73 tightly against said flange, the clamp member 69 is permitted to spring inwardly to the dotted line position, Fig. 8, incident to stretching the sheet more tautly upon the clamping member and clamping this end of the sheet firmly against the upper side of flange 67. The ends of in-turned flanges 73 and 74 bite into the sheet 75, thus holding it firmly in place upon the shoe during operation of the machine.

Compressed air is a suitable working medium for the present machine, such air being introduced through a valve 80 having a control and shut-off member 81, Fig. 2. In Figs. 1, 4 and 5 the machine is shown in a dead center position; that is, with the pistons 28 at the right limit of their reciprocal path of movement and with the connecting rod 43 in direct alignment with the axes of valve shaft 25 and the cross member 36 upon which one end is journaled.

Before starting, when it is in such dead center position, the operator will engage the upper end of valve shaft 25 and manually rotate the same counter-clockwise. In this manner the fly wheel 47 is rotated counter-clockwise to move the connecting rod 43 off center. Thereafter, by manipulating the control member 81 of the valve 80, air under pressure is allowed to pass inwardly through the valve intake passage 21, Fig. 4. At this time the valve member 24 will be rotated clockwise a short distance from the position illustrated, Fig. 4, and the air introduced into the passage 21 will be directed by said valve member 24 through the left passage 27 and into the right end of the left cylinder 13. Pressure of this air upon the left piston 28 will cause said piston to move to the left, and since said piston is connected to the other piston 28 by means of the carriage B comprising the yoke 35 and the shoe 34, all of these parts will be moved to the left. Meanwhile the air in the right cylinder 13 will be forced outwardly through the right passage 27 and exhaust passage 22.

During the movement of the pistons 28 and the

carriage B to the left, the valve member 24 will be rotating clockwise, Fig. 4, and at such a speed that when the pistons 28 reach the limit of their movement to the left said member 24 will be turned 90 degrees from the position shown. Such rotation of the valve member 24 is accomplished in the following manner. While the carriage B is moving to the left, the connecting rod 43 will cause counter-clockwise rotation of the flywheel 47, Fig. 5. Valve shaft 25 and the sun gear 54 which rotate with the flywheel 47 will cause rotation of the fixed pinions 53 whereby clockwise rotation will be imparted to the ring gear 55. Thus the plate 60 and the valve member 24 are rotated clockwise.

Since the pitch line of the sun gear 54 is one-half the diameter as the pitch line of the ring gear 55 of the plate 60 and valve member 24 will be rotated at one-half the speed as the fly wheel 47. When the pistons 28 move from the position shown in Fig. 4 to the opposite extreme limit of their movement the flywheel 47 will be rotated 180 degrees, whereas the valve member 24 will be rotated 90 degrees. Therefore, when the pistons 28 are in their left-most position the valve member 24, Fig. 4, will be in the position where its narrow edges will be aligned with the openings 27 whereby the air under pressure in the passage 21 will be shut off from the left passage 27 and will be connected with the right passage 27 by the chamfered section 26 shown uppermost in Fig. 4. The chamfered section 26 shown lowermost in Fig. 4 will then be in registry with the lower side of the left passage 27 to permit discharge of the air from the left cylinder 13. Air directed from passage 21 into the right cylinder 13 causes movement of the pistons 28 and the carriage B to the right.

Counter-clockwise rotation of the fly wheel 47 continues, wherefore, during this reverse movement of said pistons and carriage, the valve member 24 will continue clockwise rotation so that when the pistons 28 are returned to the position shown in Fig. 4 the valve member 24 will have been rotated 180 degrees. And since the valve member 24 is symmetrical in shape it will now be conditioned for a succeeding reciprocal cycle of the pistons 28. So long as the compressed air is admitted to chamber 21 the pistons 28 will continue reciprocation and the valve member 24 will be rotated in timed relation therewith for directing the air or working medium into the cylinders 13 at the proper times.

Speed of the machine may be controlled by manipulating valve control member 81 to vary the amount of air introduced into passage 21. The more air admitted the faster will be the operation of the machine.

Air exhausted through the port 22 passes over the edges of the shoe 34 where it is directed by the casing flange 10a against the surface being treated to keep such surface free of loose abrasive particles or the like which would interfere with the polishing process.

In Figs. 9 and 10 a different type of polishing member is connected to the shoe 34 by means of the clamp 69. The surface treating sheet 83 of said member instead of extending the full length of the clamp 69 to hook beneath the inturned flanges 73 and 74, has its edges projected between opposite longitudinal edge sections of said clamp and the lower face of the shoe. This sheet 83 is wrapped about a pad 82 which may be of sponge rubber to adapt the sheet to conform to slightly irregular surfaces which are to be treated. Said pad 82 and the surface treating sheet 83 may be attached together into a unitary assembly by means of an adhesive layer between their contiguous surfaces. The lower edge sections of the shoe 34 and the upper longitudinal edge sections of the clamp member 69 may be roughened so as to bite into the edge portions 84 and 85 of the sheet 83 so that the latter will be held firmly in position upon the shoe.

I claim:

1. A polishing machine comprising a portable casing, a motor in said casing including axially aligned cylinders secured to said casing, there being axially extending slots in side wall portions of said cylinders, valve means rotatable between said cylinders to alternately admit a working medium thereinto, a member rotatable to transmit driving force to said valve means, pistons in said cylinders, a work member, means projecting through a slot in each of said cylinders for operatively connecting said pistons with said work member, and a connecting rod connected with said pistons for reciprocal movement therewith and connected eccentrically with said rotatable member to impart rotative movement thereto during reciproeal movement of the pistons.

2. In a polishing machine, the combination of paired axially aligned cylinders, pistons respectively in said cylinders, a valve member between said cylinders and continuously rotatable in one direction to alternately direct a working medium into said cylinders to cause reciprocal movement of the pistons, a work member attached to both of said pistons and movable in unison therewith, and means propelled by said pistons for imparting such continuous rotative movement to said valve member.

3. In a machine of the class described, the combination of paired axially aligned cylinders, pistons respectively in said cylinders, a valve casing comprising a cylindrical valve chamber between said cylinders and having diametrically opposite cylinder ports respectively communicating with said cylinders, said valve casing also having diametrically oppositely disposed intake and exhaust openings each spaced 90 degrees from said ports, a valve core within and rotatable coaxially of said chamber, said valve core having diametrically opposite faces conforming to and adapted to sweep about the cylindrical wall of the chamber during such rotation, said faces being of substantially the same dimensions circumferentially of said wall as said ports and said openings, said valve core being so adjusted with respect to said pistons that the said diametrically opposite faces are substantially aligned with said openings while said pistons are at one reciprocal limit, and means driven by said pistons and operable to rotate said valve core through 90 degrees during each movement of the pistons from each reciprocal limit to the other.

4. In a machine of the class described, the combination of a cylinder, a piston reciprocally in said cylinder, a valve casing adjacent to said cylinder and including a cylindrical valve chamber having passages for conducting a piston propelling medium to and from said cylinder, a valve core within and rotatable coaxially of said chamber for directing such medium into and from said passages to reciprocally propel said piston, rotatable inertia means connected with said valve core, and means driven by said piston for rotating said inertia means and said valve core in selected time relation therewith.

5. In a machine of the class described, the combination of a cylinder, a piston reciprocally in said cylinder, a valve casing adjacent to said cylinder and including a cylindrical valve chamber having passages for conducting a piston propelling medium to and from said cylinder, a valve core within and rotatable coaxially of said chamber for directing such medium into and from said passages to reciprocally propel said piston, a valve shaft extending axially through said valve core, a sun gear upon said shaft adjacent to one end of the valve core, a ring gear about said sun gear and drivingly connected with said core, idler gears meshed with said sun and ring gears, and means driven by said piston for rotating said shaft, said driven means engaging said shaft adjacent to the opposite end of the valve care, and the pitch line of said sun gear being one-half the radius of that of the ring gear whereby the valve core is driven at one-half the speed of the valve shaft.

6. In a machine of the class described, the combination of paired axially aligned cylinders, pistons respectively in said cylinders, a valve casing comprising a cylindrical valve chamber between said cylinders and having diametrically opposite cylinder ports respectively communicating with said cylinders, said valve casing also having diametrically oppositely disposed intake and exhaust openings each spaced 90 degrees from said ports, an axially bored valve core within and rotatable coaxially of said chamber, said valve core having diametrically opposite faces conforming to and adapted to sweep about the cylindrical wall of the chamber during such rotation, said faces being of substantially the same dimensions circumferentially of said wall as said ports and said openings, said valve core being so adjusted with respect to said pistons that the said diametrically opposite faces are substantially aligned with said openings while said pistons are at one reciprocal limit, a valve shaft extending through the bore in said valve core, a sun gear upon said shaft adjacent to one end of the valve core, a ring gear about said sun gear and drivingly connected with said core, idler gears meshed with said sun and ring gears, and means driven by said pistons for rotating said valve shaft 180 degrees during each movement of the pistons from each reciprocal limit to the other, and the pitch line of said sun gear being one-half that of the ring gear whereby the valve core is driven at one-half the speed of the valve shaft.

7. In a machine of the class described, the combination of paired axially aligned cylinders each having a pair of diametrically opposite axially extending slots in side wall portions thereof, pistons in said cylinders, a cross-member on each of said pistons and having end portions projecting outwardly of the cylinder walls through said slots, a yoke at one side of the cylinders and connected with projecting end portions of said cross-members, a work member at the opposite side of the cylinders and connected with the opposite end portions of said cross-members, a valve casing comprising a cylindrical valve chamber between said cylinders and having diametrically opposite cylinder ports respectively communicating with said cylinders, said valve casing also having diametrically oppositely disposed intake and exhaust openings each spaced 90 degrees from said ports, a valve core within and rotatable coaxially of said chamber, said valve core having diametrically opposite faces conforming to and adapted to sweep about the cylindrical wall of the chamber during such rotation, said faces being of substantially the same dimensions circumferentially of said wall as said ports and said openings, said valve core being so adjusted with respect to said pistons that the said diametrically opposite faces are substantially aligned with said openings while said pistons are at one reciprocal limit, and means driven by said pistons and operable to rotate said valve core through 90 degrees during each movement of the pistons from each reciprocal limit to the other.

8. In a machine of the class described, the combination of paired axially aligned cylinders each having a pair of diametrically opposite axially extending slots in side wall portions thereof, pistons in said cylinders, a cross-member on each of said pistons and having end portions projecting outwardly of the cylinder walls through said slots, a yoke at one side of the cylinders and connected with projecting end portions of said cross-members, a work member at the opposite side of the cylinders and connected with the opposite end portions of said cross-members, a valve casing comprising a cylindrical valve chamber between said cylinders and having diametrically opposite cylinder ports respectively communicating with said cylinders, said valve casing also having diametrically oppositely disposed intake and exhaust openings each spaced 90 degrees from said ports, an axially bored valve core within and rotatable coaxially of said chamber, said valve core having diametrically opposite faces conforming to and adapted to sweep about the cylindrical wall of the chamber during such rotation, said faces being of substantially the same dimensions circumferentially of said wall as said ports and said openings, said valve core being so adjusted with respect to said pistons that the said diametrically opposite faces are substantially aligned with said openings while said pistons are at one reciprocal limit, a valve shaft extending through the bore in said valve core and through said casing, a sun gear upon said shaft at one side of the casing, a ring gear about the sun gear and drivingly connected with the valve core, idler gears meshing with said sun and ring gears, and means driven by said pistons for rotating said valve shaft 180 degrees during each movement of the pistons from each reciprocal limit to the other, and the pitch line of said sun gear being one-half that of the ring gear whereby the valve core is driven at one-half the speed of the valve shaft.

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