To all whom it may concern:

Be it known that I, SAMUEL V. RAWLINGS, a citizen of the United States, and a resident of Calumet, county of Houghton, State of Michigan, have invented certain new and useful Improvements in Power-Hammer Mechanism, of which the following is a full, clear, and exact description.

The invention relates to power hammer mechanism and more particularly to power hammer mechanism such as employed in machines for making and sharpening driving bits. The invention seeks to provide an efficient hammer mechanism with improved controlling means therefor, and consists in the features of improvement hereinafter set forth, illustrated in the preferred form in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is an elevation of the improved hammer mechanism. Fig. 4 is a top view of the foot pedal control mechanism. Fig. 2 is a detail section on the line 2—2 of Fig. 1. Fig. 3 is a longitudinal section through the horizontal hammer mechanism taken on the line 3—3 of Fig. 4. Fig. 4 is a partial plan view of the parts shown in Fig. 3, with parts in section on the line 4—4 of Fig. 3. Fig. 5 is a sectional view of the starting and stopping valve similar to that shown in Fig. 3, but with the valve shown in shifted position. Fig. 6 is a sectional view of the automatic slide valve similar to that shown in Fig. 4, but with the valve shown in shifted position. Fig. 7 is a view in elevation of the parts being shown in section on the line 7—7 of Fig. 3. Fig. 8 is a similar view with the slide valve shown at the opposite end of its movement. Fig. 9 is a section on the line 9—9 of Fig. 8. Fig. 10 is a view in elevation of the piston. Fig. 11 is an end view thereof. Fig. 12 is a detail view of one end of one of the power cylinder rock shafts.

The frame of the hammer mechanism comprises two cast metal sections. The horizontal base section 1 is mounted upon a base block 2 and is secured thereto by vertical bolts 3, the latter also serving to anchor the machine to the foundation. A vertical section 4 is mounted at the forward end and on one side of the horizontal base section and is bolted thereto, as shown. A horizontally acting, upsetting hammer A is mounted upon one side of the base section 1, and the vertically acting, swaging hammer B is mounted upon the upright frame section 4. As shown, the cylinder 6 of the hammer A is bolted to the rear end of the base section 1, and the cylinder 8 of the hammer B is bolted to the upper end of the vertical frame section. Preferably, the frame sections are hollow and the chambers therein communicate with each other, as shown in Fig. 2, to thereby form a reservoir for the compressed air. In the form shown, the compressed air supply pipe 7 is connected to the rear end of the base section 1. Preferably, the upper end of the upright section 4 is provided with a tapped opening so that it, instead of the lower base section, may be connected to the air supply pipe, if desired. If the supply pipe is connected to the base section, as shown, the opening at the upper end of the vertical section is closed by a plug 8. The rear lower portion of the base section is also provided with a blow-off pipe 9. Oil, dirt and the like are separated from the compressed air within the reservoir thus formed, so that clean air is supplied to the hammer cylinders. Oil, dirt and the like collected in the reservoir can be blown off from time to time through the pipe 9. In this way, the frame not only serves to support the hammers, but also acts as a supply reservoir for furnishing clean air to the power cylinder.

The construction and arrangement of each of the cylinders is the same. At the outer end of each is bolted a casing 10 for the starting and stopping valve, and these casings are connected to the supply reservoir within the frame by pipes 11. Throttling cut-off valves 12 are interposed in the pipes 11 and are actuated by handles 13 so that the supply to the power hammers may be regulated, as desired.

Each cylinder is provided with a piston 14 having a piston rod 15 connected at its outer end to a hammer head 16. The hammer head 16 is rectangular in section and is arranged to reciprocate within a U-shaped guide 17 bolted to the frame, so that the hammer and piston are held against oscillating movement.
The hammer cylinder is provided with a front head 18, at its forward end, and at its rear end with a back head 19, valve chest 20 and back head cover 21. The back head 19 abuts against the rear end flange 22 of the cylinder and is preferably provided with a projecting portion 23 which fits within the enlarged rear end of the cylinder bore. The valve chest 20 is held in place between the back head and the back head cover. The meeting faces of these parts are machined to form a snug fit and the parts are secured together and to the rear end flange 22 of the cylinder by bolts 24. The bolts 24 are arranged on opposite sides of and above the axis of the cylinder. A pair of heavier bolts 25 are arranged on opposite sides of the cylinder and substantially in the plane of its axis. The rear ends of these bolts extend through the parts connected by the bolts 24 and their forward ends extend through lugs 26 on the forward end of the cylinder and lugs 27 on the front head 18. The front head is preferably provided with a sleeve or ring 28 which surrounds the piston rod. A flanged ring 29 fits within the outer end of the cylinder bore and is held in place by the front head 18. This ring serves to hold the packing 30 in place about the piston rod 15.

The piston 14 is of considerable length. At its forward end it is provided with a suitable packing ring 31. The rear end of the cylinder is provided with an axial bore 32 which extends a valve operating rock shaft 33. This rock shaft extends through the back head 19 of the cylinder and its rear end is keyed to a hub 34 which is mounted in a suitable seat formed in the back head 19, valve chest 20 and cover 21, as most clearly shown in Fig. 3. The forward end of the rock shaft is provided with laterally projecting lugs 35 which engage radial cam slots 36 formed in the rear portion of the piston 14. At its ends, the slots 36 are provided with longitudinally extending portions 37 and 38 having radial side walls. The walls of the main portion of the slot between the straight, longitudinal portions 37 and 38 are substantially helicoidal surfaces, and the lugs 35 on the forward end of the rock shaft are also provided with longitudinal and inclined surfaces, as shown in Fig. 12, for engaging the corresponding portions of the slots. The valve operating rock shaft 33, which is held against longitudinal movement, is thus oscillated back and forth as the piston 14 is reciprocated. At the opposite ends of the movement of the piston, the rock shaft is held stationary.

The hub 34 at the rear end of the rock shaft is provided with a valve operating crank arm 39 which is provided at its upper ends with oppositely disposed lugs 40 and 41. These lugs are arranged to engage a pin 42 on the back of a slide valve 43. The valve is arranged to slide transversely between suitable guides 44 and 45 formed in the upper forward portion of the valve chest and is provided with cavities a and b on its forward face. The upper portion of the rear face of the back head 19 forms a seat for the slide valve 43 and is provided with a series of ports or passages d, e, f and g, which are controlled by the slide valve. It should be noted that the space between the lugs 40 and 41 on the valve operating crank arm 39 is greater than the diameter of the pin 42 on the back of the valve 43, so that there is a lost-motion connection between the valve and its operating crank arm.

The starting and stopping valve casing 10 is provided with an oscillating valve 16 having a cavity h in its lower side and arranged to control a series of three ports j, k and l. The upper portion of the cylinder is cored to form the ports or passages m, n, o and p, and the upper portion of the back head 19 is cored to form an exhaust port r. The exhaust port r communicates with the ports r and f controlled by the slide valve 43. The port or passage d leads to the passage p in the cylinder and the latter communicates with the head end of the cylinder bore. The port or passage g of the back head communicates with the passage a that leads to the central port k of the starting valve and the passage m of the cylinder leads from the right hand port l of the starting valve to the front end of the cylinder bore. The left hand port j of the starting valve communicates with the passage a and the latter communicates with a passage s which extends through the back head into the space within the valve chest. The back head cover is provided at its upper portion with a transverse recess 47 that increases the capacity of the space within the valve chest.

The starting and stopping valve is provided with a crank arm 48 by which it may be shifted to start and stop the operation of the hammer. The valve is shown in its idling or non-working position in Fig. 3, and in its operative or working position in Fig. 5. In the first position, as shown, the cavity h connects the ports j and k and the port l is connected to the space within the starting valve casing. In its operative position, the cavity h connects the ports k and l, and the port j is connected to the supply within the valve casing.

The back end of the cylinder bore is thus always connected by the passage p to the port d which opens into the valve chest and which is controlled by the slide valve 43 and, in the working position of the starting and
stopping valve, the head end of the cylinder is connected to the valve chest through the medium of the passage m, port l, cavity k of the starting and stopping valve, port k, passage n and port q. In this working position, the compressed air supply is connected to the valve chest through the valve casing, port j, and passages p and e.

With the starting and stopping valve in the working position shown in Fig. 5, the operation will be as follows: With the piston at the back end of its movement, as shown in Fig. 3, the automatic slide valve 43 will be in the position shown in Figs. 4 and 7. The front end of the cylinder will thus be connected to the exhaust port e through the cavity b of the slide valve which then connects the ports f and g, and the back end of the cylinder bore will be directly connected to the space within the valve chest, since the slide valve in this position uncovers the port d. Air under pressure will thereby be supplied to the back end of the cylinder bore and the piston 14 and hammer 16 will be projected forwardly to strike the blow. As the piston moves forwardly, the lugs 35 of the rock shaft 33 pass through the inclined or helicoidal portions 36 of the slots in the piston and the rock shaft and crank arm 39 thereon are oscillated in the direction indicated by the arrow in Fig. 7. This movement first takes up the lost motion between the lug 41 and the pin 42 of the slide valve, but, as the piston approaches the end of its forward stroke, these parts are brought into engagement and the valve is shifted to the position shown in Figs. 6 and 8. The rear end of the cylinder bore will then be in communication with the exhaust, since the cavity e of the slide valve then connects the ports d and e, and the front end of the cylinder bore will be connected to the supply, since the slide valve uncovers the port g. This shift of the valve is effected slightly before the piston reaches the end of its forward movement to cushion the same and prevent the piston from striking violently against the front head. The valve mechanism is so arranged that this shift of the valve does not take place soon enough to cushion the blow of the hammer. The piston is then moved rearwardly and the movement of the valve operating crank arm 39 is reversed and is then shifted in the direction indicated by the arrow in Fig. 8. As the piston approaches the rear end of its movement, the lug 40 of the crank arm engages the pin 42 and shifts the valve back to the position shown in Figs. 4 and 7. This shift of the valve takes place in time to effectively cushion the return movement of the piston.

When the starting and stopping valve 46 is in the idle position shown in Fig. 3, the front end of the cylinder is cut off from the valve chest and is placed in direct communication with the source of supply, since the passages m and f then communicate with the interior of the valve casing 10. The front end of the cylinder bore is then connected to the source of supply and the piston is held in its rearward position shown in Fig. 3. At this time, the valve 43 is in the position shown in Fig. 4, and the rear end of the cylinder is connected to the valve chest, but, at this time, the source of supply of compressed air to the valve chest through the ports and passages i, o and s is then cut off, and communication is established between the valve chest and the exhaust, as follows: through the passages s and o, port j, cavity k of the starting and stopping valve, port k, passage n, port g and cavity b of the sliding valve. Thus, in this position of the starting and stopping valve, the space within the valve chest and the rear end of the cylinder bore are connected to the exhaust and, since as stated, the front end of the cylinder is connected to the source of supply, the piston is permanently held in its withdrawn position until the starting and stopping valve is shifted. As soon as this occurs, however, the valve chest and the exhaust end of the cylinder are connected to the supply and the front end of the cylinder to the exhaust, so that the piston at once commences its forward stroke. Thus, through the medium of the valve 46, the starting and stopping of the hammer can be very quickly controlled and when the hammer is stopped, it is in its withdrawn position with the piston at the rear or outer end of the cylinder.

The arm 48 of the starting and stopping valve on the horizontal upsetting hammer is connected by a link 49 to a crank arm 50 on one end of a transverse rock shaft 51 which extends horizontally through the lower portion of the base section 1. At its opposite end, the shaft 51 is provided with a crank arm 52 which is connected by a link 53 to a bell crank 54. The latter is connected to the frame by a pivot pin 55. The arm 48 of the starting and stopping valve of the vertical swaging hammer is connected by a link 56 to a bell crank 57 also mounted on the pivot pin 55. The bell cranks 54 and 57 are connected, respectively, by a pair of links 58 and 59 to a pair of rock arms 60 at 58. The rock arm 61 is fixed to a sleeve 62 which is mounted in the base section 53 on a base plate 64, and the opposite end of the sleeve is provided with a foot pedal 65. The crank arm 60 is connected to the shaft 66 which extends through the sleeve 62 and is connected at its opposite end to a foot pedal 67. The front end of the base section of the frame forms an
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The hammer head and block are adapted to be provided with suitable dies for shaping the wings of a drill bit. The adjacent portion 59 of the anvil (see Fig. 31) is provided with a suitable support 70 for holding the drill bit during the swaging operation. The swaging is effected by a suitable dolly 71 mounted in a guide 72 on the base section of the frame and adapted to be struck by the head 16 of the horizontal swaging hammer.

In the normal or central position of the foot pedals, indicated in Fig. 1, they are in alignment and the starting and stopping valves of both cylinders are held in the central idle position shown in Fig. 3 and both hammers are idle and held in retracted position. By oscillating either foot pedal the corresponding starting and stopping valve is shifted to throw the corresponding hammer into and out of operation, but the controlling devices are so arranged that the foot pedals must be shifted in opposite directions from normal central position to start the corresponding hammers. Hence, if the foot pedals are shifted together in one direction, one of the starting and stopping valves will be shifted to the working position shown in full lines in Fig. 3, while the other valve will be shifted to its extreme idle position, indicated by dotted lines in Fig. 3, and one of the hammers will be thrown into operation while the other is held retracted and idle. If the foot pedals are shifted together in the opposite direction, the hammer first in operation is stopped and held retracted and the other hammer is thrown into operation. The foot pedals are similarly arranged in normal idle position closely adjacent each other, so that they can be conveniently controlled by one foot of the operator and the hammers alternate started and stopped as is frequently desirable in finishing the drill. But if the operator desires to control but one of the hammers he can do so by placing his foot only on the corresponding pedal and then in stopping such hammer he need not be careful to arrest the foot pedal in central position since the return movement thereof beyond central position will not start the other hammer. The construction thus provides simple and effective means for controlling the alternate starting and stopping of both hammers or the starting and stopping of one hammer and also insures that when one hammer is in operation the other cannot be readily operated. It should also be noted that the connections between the foot pedals and starting and stopping valves are such that both the starting and stopping movements are positively imparted to the valves by the foot pedals and connections and it is not necessary to provide fluid pressure means for shifting the starting and stopping valves in either direction.

It is obvious that numerous changes may be made in the details set forth without departure from the essentials of the invention as defined in the claims. It should also be noted that while compressed air is preferably used as the motive fluid, the hammer mechanism can be operated by steam.

I claim as my invention:

1. In power hammer mechanism, the combination of a hollow frame forming a supply reservoir for motive fluid, a hammer operating motor cylinder mounted on said frame and connected to the supply reservoir therein, and controlling valve mechanism for said motor cylinder.

2. In power hammer mechanism for drill shaping machines, the combination of a frame comprising connected horizontal and vertical sections having communicating chambers formed therein and constituting a supply reservoir for fluid under pressure, horizontally and vertically acting hammers having motor cylinders secured respectively to the outer end of said horizontal frame section and the upper end of said vertical section, said cylinders communicating with said reservoir, and controlling valves interposed in the communications between said reservoir and said cylinders.

3. In power hammer mechanism, the combination of a hollow cast metal frame forming a supply reservoir for motive fluid, a hammer operating motor cylinder mounted on said frame, supply and blow-off pipes connected to said reservoir, a pipe connecting the reservoir of said frame to said cylinder, and a controlling valve interposed in said pipe.

4. In power hammer mechanism for drill shaping machines, the combination of a frame comprising a longitudinal base section having an anvil portion at its forward end, an upright frame section mounted on and secured to the forward end of said base section, said base and upright sections having communicating chambers formed there, in and constituting a supply reservoir for compressed air, supply and blow-off pipes communicating with said reservoir, horizontally and vertically acting hammers having motor cylinders mounted on and secured respectively to the rear end of said base section and the upper end of said upright section, said cylinders communicating with said reservoir, separate starting and stopping valves interposed in said communications and controlling shifter mechanism for said starting and stopping valves.

5. In power hammer mechanism, the com-
combination with horizontally and vertically acting hammers having motor cylinders, and automatically acting distributing valves for said cylinders, of separate starting and stopping valves for said cylinders operable independently of said distributing valves, each of said starting and stopping valves having a central idle position, and mechanical controlling devices for simultaneously and positively shifting said starting and stopping valves, one to starting position and the other to its extreme idle position.

6. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, of separate starting and stopping devices for said cylinders, a pair of controlling shifters similarly arranged in normal idle position closely adjacent each other and each movable in opposite directions therefrom, and means actuated by said shifters for moving the corresponding starting and stopping devices to working position as said shifters are moved respectively in opposite directions from normal position.

7. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, of separate starting and stopping valves for said cylinders, a pair of controlling foot pedals similarly arranged in normal idle position closely adjacent each other to be operated either simultaneously or independently by the operator's foot, said foot pedals being movable in opposite directions therefrom, and means actuated by said foot pedals for moving the corresponding starting and stopping valves to working position as said pedals are moved in opposite directions from normal position.

8. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, of separate starting and stopping valves for said cylinders, two concentrically mounted rock shafts connected respectively to said starting and stopping valves to move the latter to idle and working positions, adjacent shifters fixed to said rock shafts, said shifters being arranged, when moved in opposite directions, to move the corresponding valves to working position.

9. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, separate starting and stopping valves for said cylinders, an oscillating sleeve, connections between said sleeve and one of said starting and stopping valves, a rock shaft concentrically mounted within said sleeve, connections between said rock shaft and the other of said starting and stopping valves and a pair of adjacent foot pedals mounted on said rock shaft and said sleeve.

10. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, of separate valves for starting and stopping the operation of said motor cylinders, a pair of controlling foot pedals, one for each of said valves, said pedals being similarly arranged in normal idle position closely adjacent each other on a common central axis, and connections between said pedals and said valves arranged to impart starting and stopping movements to each of said valves when the corresponding pedal is oscillated, said pedals being movable in opposite directions therefrom, said pedals and connections being arranged in normal central position to hold both of said valves in idle position and arranged, when shifted in opposite directions, to impart starting movements to the corresponding valves.

11. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, of separate starting and stopping valves for said cylinders, said valves each having a central idle position, a pair of controlling foot pedals similarly arranged in normal idle position closely adjacent each other to be operated either simultaneously or separately by the operator's foot, and mechanical connections between each of said foot pedals and the corresponding valve arranged to positively impart starting and stopping movements to the valve as the foot pedal is oscillated in opposite directions, said pedals and connections being arranged, when shifted in the same direction, to positively move said starting and stopping valves in opposite directions, one to its extreme idle position and the other to its working position.

12. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, separate starting and stopping valves in said cylinders, and a pair of adjacent controlling foot pedals, one for each of said starting and stopping valves, each of said foot pedals being mounted to oscillate in opposite directions to move the corresponding valves to idle and working positions, and said pedals being arranged, when shifted in the same direction, to move said starting and stopping valves in opposite directions, one to idle and the other to working position.

13. In power hammer mechanism, the combination with horizontally and vertically acting hammers having motor cylinders, separate starting and stopping valves for said cylinders, a pair of adjacent, oscillating foot pedals and operating connections between said foot pedals and said starting and stopping valves, each of
said foot pedals being mounted to oscillate in opposite directions to shift the corresponding valves to idle and working positions, and said foot pedals and connections being arranged to shift one of said valves to idle and the other to working position when said foot pedals are moved in the same direction.

Witnesses:

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