Dec. 19, 1933. C. F. OVERLY 1,940,143

PNEUMATIC TOOL

Filed Nov. 13, 1930

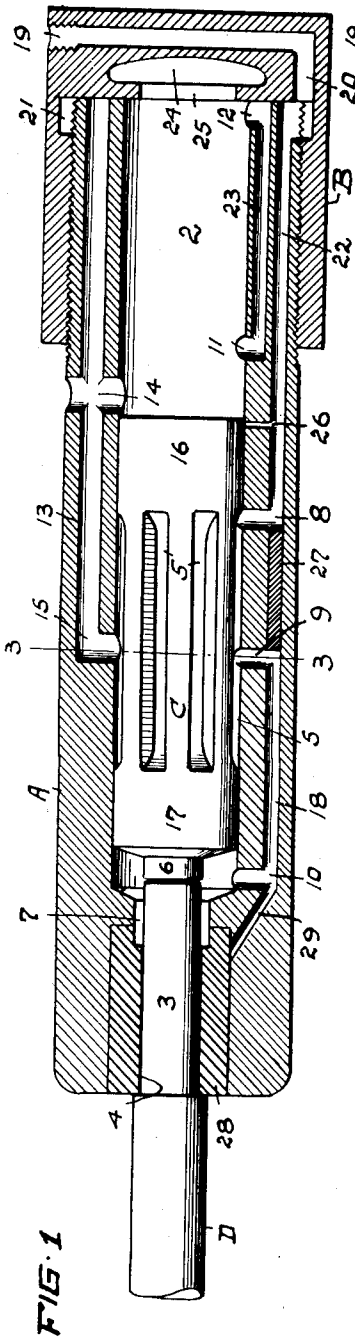


FIG. 1

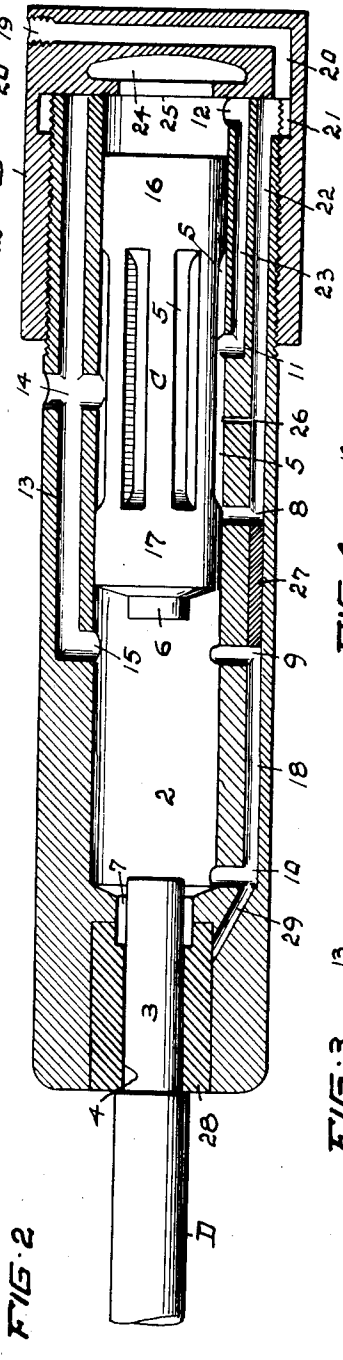


FIG. 2

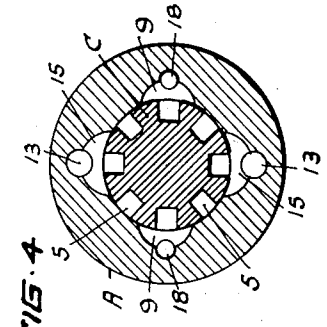


FIG. 4

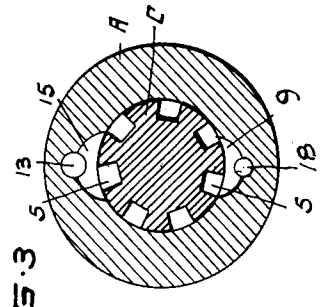


FIG. 3

INVENTOR

CHARLES F. OVERLY

BY

Fisher, Moser & Moore.

ATTORNEY

Patented Dec. 19, 1933 1,940,143

UNITED STATES PATENT OFFICE

1,940,143

PNEUMATIC TOOL

Charles F. Overly, Cleveland, Ohio

Application November 13, 1930. Serial No. 495,455

1 Claim. (Cl. 121—17)

The present invention relates to pneumatic tools in which a reciprocable member is utilized to apply power, for example as in a portable pneumatic hammer, sand rammer or the like, and my object in general is to provide an exceptionally simple and durable pneumatic tool in which the reciprocable member itself will operate to control its own movements with highly efficient results. More specifically my object is to provide a pneumatic hammer or like device in which the reciprocable member is channeled longitudinally and co-acts with air intake and exhaust ports in the cylinder to effect rapid and powerful reciprocable movements of said member. Further objects are embodied in the structural details of the device which permit the same to be composed of a relatively small number of pieces or parts, which facilitate its production at a low cost, and which permit assembly, disassembly, repairs and replacements to be made readily and conveniently, all as hereinafter more concisely set forth.

In the accompanying drawing, Fig. 1 is a sectional view longitudinally through a pneumatic device embodying my invention, and Fig. 2 a similar view showing the reciprocable member in a different operating position therein. Fig. 3 is a cross section of the device on line 3—3 of Fig. 1. Fig. 4 is a cross section of a modification embodying an additional set of inlet and exhaust ports to equalize the pressure on the sides of the reciprocable member.

The device embodies three main pieces or parts separably united together. These parts consist of a cylindrical body A, a removable closure member or head B, and a cylindrical piston or plunger C free to reciprocate within an axial chamber 2 in body A. As shown piston C is also adapted to strike and operate upon the shank end 3 of a separate tool D inserted within the end opening 4 in body A. Tool D may be a rivet set, tamping shaft, chisel or other device, and head B may have a handle fixed thereto. Head B is also provided with a suitable connection for a flexible hose or tube to supply compressed air for operating the device, but the handle and air tube are not shown in the drawing, being old and well known in this art and besides other supporting means may be employed and other ways of coupling the device to a source of compressed air may be used without affecting the present invention which resides in providing a solid piston or reciprocable member C having channels or grooves 5 longitudinally in its cylindrical surface, preferably a series of channels or grooves at uniformly spaced distances radially thereof to always assure open communication with a series of air inlet and outlet ports located at different places within body A. Piston C is relatively long, and the channels 5 likewise, but they terminate a predetermined distance back from each end of the piston body to provide smooth annular sealing areas or zones adapted to operate as slide valves within working chamber 2 in body A. As shown, one end of the piston is reduced in diameter or provided with a short extension 6 adapted to strike the shank end 3 of the tool D during the working stroke of the piston. Extension 6 may be elongated to provide a tamping shaft, or it may be omitted if the shank of the tool is projected into chamber 2 a sufficient distance to be impacted directly by the end of the piston. However, when extension 6 is used the inner end of chamber 2 in body A is counterbored at 7 to receive the same and not limit the movement or blow of the piston, especially when a separate tool is loosely held within and free to move relatively to body A. The piston is free to move back and forth the full length of the working chamber but in operation its stroke is fore-shortened and cushioned by admitting compressed air into the chamber before the piston reaches the end walls of the chamber, thereby also reversing the movement of the piston. The compressed air is caused to flow to opposite ends of the working chamber alternately by the movement of the piston itself, the relatively long channels 5 in the piston being provided to reverse the direction of flow of the compressed air and to exhaust the used air through separate sets of inlet and outlet ports in the side wall of body A. In Figs. 1 and 2 the separate sets of inlet and outlet ports are shown lying in the same plane on opposite sides of working chamber 2 to permit the operation of the device to be more readily understood, but in practice the preferable arrangement is to provide duplicate sets of inlet ports and outlet ports in the quartered pressure-equalizing relation shown in Fig. 4. Each set of ports are arranged as in Figs. 1 to 3, body A being provided at one side of chamber 2 with a row of five air ports 8, 9, 10, 11, and 12, respectively, through which the compressed air passes into or is distributed to chamber 2, and which air after serving its purpose is discharged through two exhaust ports 14 and 15 in another segmental area or side of chamber 2. The main inlet port 8 is located approximately at the middle of chamber 2 and always open to at least one of the channels 5 in piston C when the travel of the piston is restrict-

ed by the admission of compressed air or air trapped in opposite ends of chamber 2, and the compressed air delivered through port 8 passes through channel 5 in the piston to either one or the other of the two transfer ports 9 or 11 respectively, dependent upon the position of the piston at the moment in respect to these three ports. Thus, in Fig. 1, piston C is about at the end of its striking or working stroke with port 8 open to at least one channel 5 in the piston and with port 9 also in open communication with channel 5. In this position of the piston, port 11 is cut off from main inlet port 8 by the annular sealing area or valve end 16 of the piston, and exhaust port 14 is uncovered and open to the atmosphere, thus relieving the piston of pressure at that end while the compressed air is being directed to its opposite or front end through port 9, a duct 18, and port 10. The compressed air is fed into the device through a transverse passage 19 and a right-angled extension 20 of this passage in head B, and thence into an annular groove 21 internally of the head which is always open to one end of a longitudinal duct 22 in one side wall of body A. Main inlet port 8 opens into this duct 22, so that the piston and at least one channel 5 therein is always exposed to the compressed air, assuming the air line is open to the source of supply and not cut off by the valve which is customarily used in the air line to control the supply. As a result, when the piston reaches the end of its forward stroke, about as shown in Fig. 1, its front end 17 will be exposed to the compressed air entering chamber 2 through port 10 and the piston will be forced to return to the rear or opposite end of chamber 2, say to the position shown in Fig. 2 where exhaust port 15 has been uncovered by this movement of the piston and the admission of compressed air through main inlet port 8 to the front end of chamber 2 cut off by the smooth annular front area or valve end 17 of the piston. The used air in front of the piston having escaped to the atmosphere through exhaust port 15 and a duct 13 which opens into the cross port 14, the said piston is now relieved of pressure at its front end and may be moved freely forward by the compressed air now passing through the main inlet port 8 into one of the channels 5 in piston C and thence through port 11 into a second side duct 23 which extends toward head B where it terminates at side port 12 located contiguous to head B. In this position of the piston the cross exhaust port 14 is closed by the valve end 16 of the piston, and this exhaust port 14 is not opened until the piston has been forced forwardly approximately half its length and is under sufficient momentum and pressure to travel beyond port 14 to deliver the requisite power or blow on the operating tool D. Ports 14 and 11 are also staggered or offset in respect to each other, and the length of channel 5 may be such that port 11 will be closed by the valve end 16 of the piston before the exhaust port 14 is uncovered and opened. Thus, the charge of compressed air trapped for a short interval of time in the rear end of chamber 2 may be permitted to expand to drive the piston forward before exhausting the charge. Then as the piston continues its stroke the compressed air will be directed into the front end of chamber 2 to cushion its final movement and to reverse the movement of the piston as first described.

To promote cushioning results and reversing movements of the piston at the outer or head end B of the tool, head B is provided with an enlarged air pocket or chamber 24 to trap a predetermined amount of air. The entrance or opening 25 to this pocket 24 is of smaller diameter than working chamber 2 and axially coextensive therewith. To promote starting of the piston when the piston is seated against head B a small starting port 26 may be provided intermediate the main inlet port 8 and by-pass port 11. However this starting port 26 may be omitted in a tool having a reciprocable piston loosely confined within chamber 2, as in that case sufficient clearance space is present to permit compressed air to work its way past the piston toward head B in starting operations should the main inlet port 8 be covered by the valve end 17 of the piston. To facilitate production of the tool, the air intake and exhaust ducts are drilled longitudinally in body A from the head end toward the operating end, and the several ports in the side walls of working chamber 2 are each milled therein on a radius large enough to provide a slot of suitable length approximately equal to the combined width of one of the channels 5 and the rib or uncut stock between the next parallel channel. Hence, either one or two channels or grooves 5 in piston C will always register or have open communication with the ports, regardless of any rotatable change in position of the piston within working chamber 2. As a result a piston may be used which is free to turn as well as reciprocate within chamber 2, and the wear thereon and on the striking and bearing surfaces uniformly distributed. Production and assembly of the parts is also thereby simplified, and in that connection the two ducts 18 and 22, respectively, are preferably formed in one drilling operation, and a plug 27 then inserted between the two ports 8 and 9, respectively. A removable sleeve or bushing 28 is also preferably provided to receive tool D, and a clean-out passage 29 for duct 18 drilled at an inclination in the recessed end of body A at one side of bushing 28 which clean-out opening is normally closed when the removable sleeve or bushing 28 is in place.

What I claim, is:

In a fluid pressure tool, a cylinder of uniform diameter throughout its length having oppositely arranged inlets intermediate its ends, distributing conduits in the wall of said cylinder on opposite sides of said inlet and communicating with their opposite ends with said cylinder, a small starting port intermediate said inlets and the inner end of one of said distributing ports, each of said conduits having one end communicating with said cylinder at one end wall thereof, a longitudinally grooved piston of uniform diameter having its grooved portion terminating at points substantially spaced from the respective ends of said piston, and exhaust openings one for each end of said cylinder arranged in a transverse plane adjacent the inner ends of said distributing conduits.

CHARLES F. OVERLY.