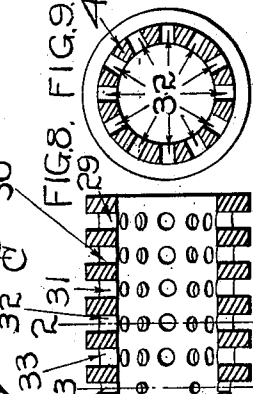
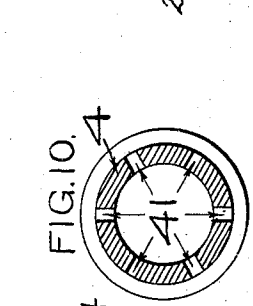
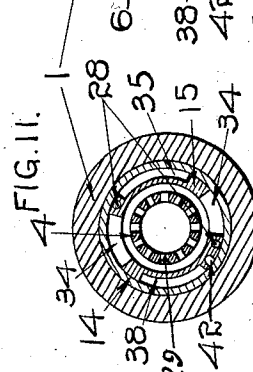
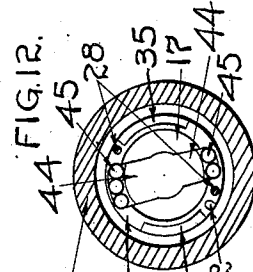
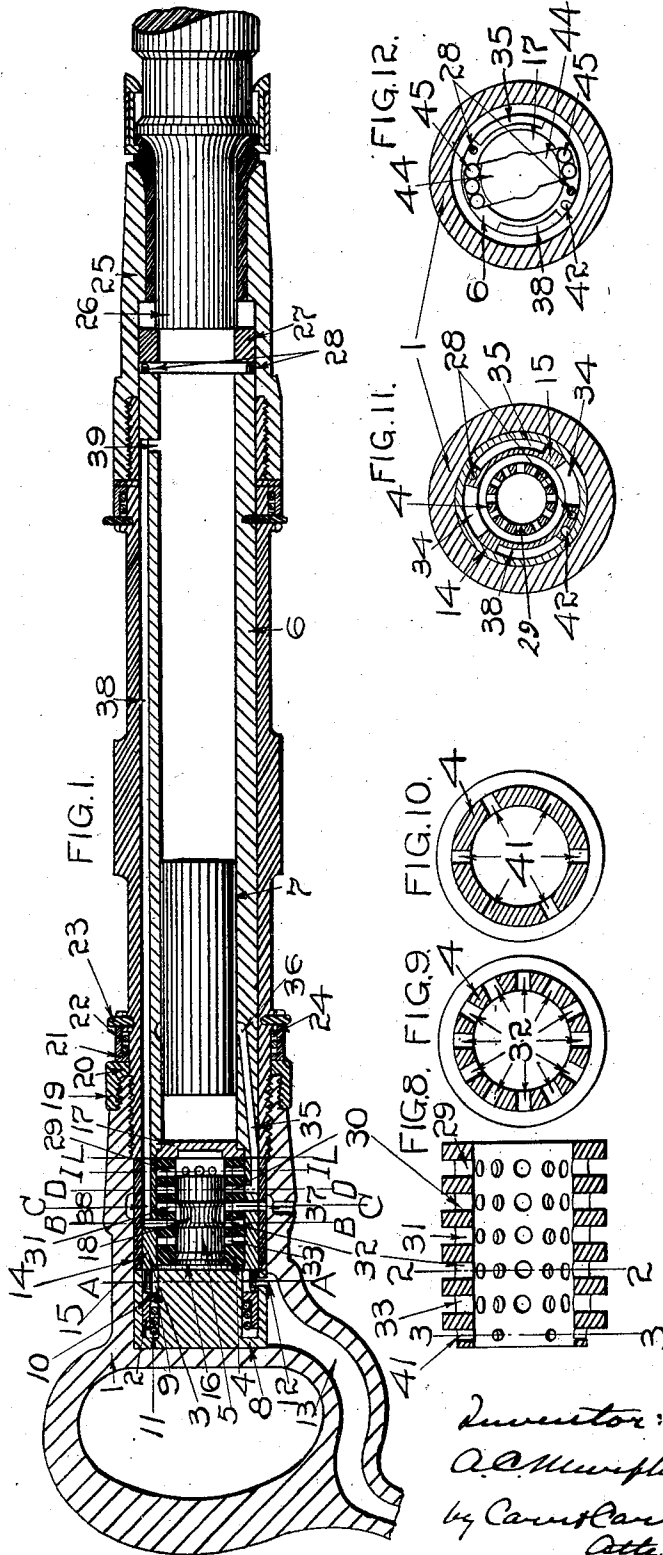
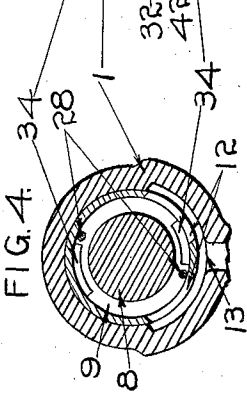
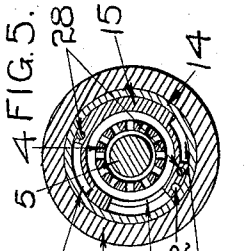
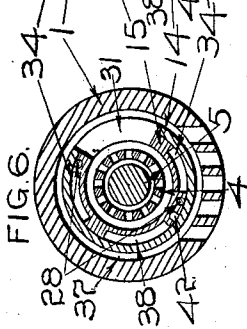
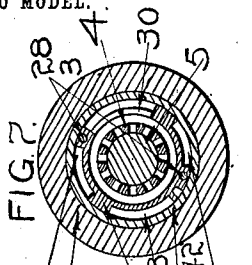


A. C. MURPHY.  
PNEUMATIC HAMMER.

APPLICATION FILED SEPT. 16, 1901. RENEWED NOV. 2, 1903

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses:  
Jola Tucker.  
J. W. Taylor

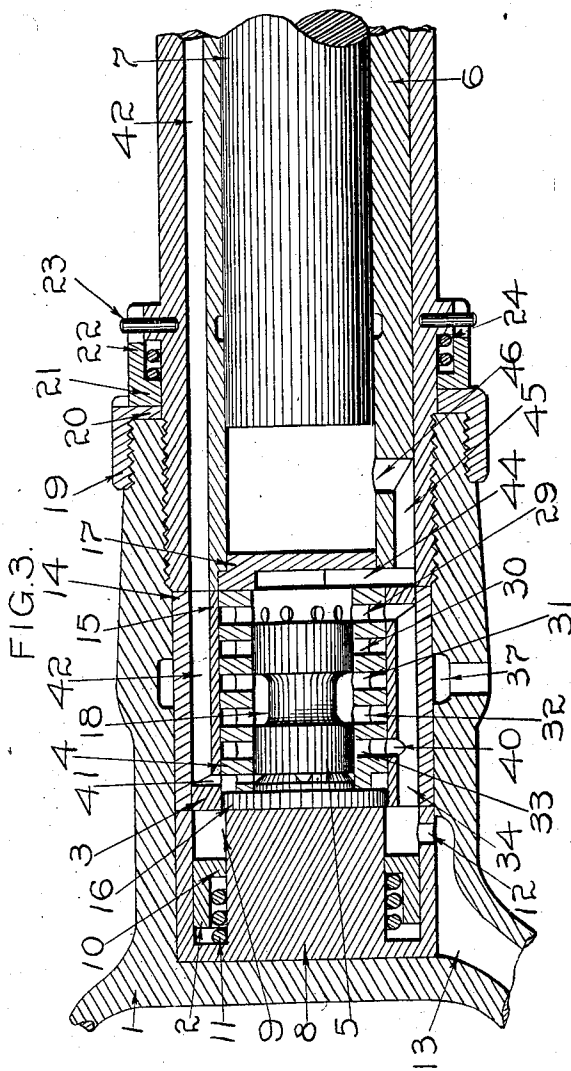
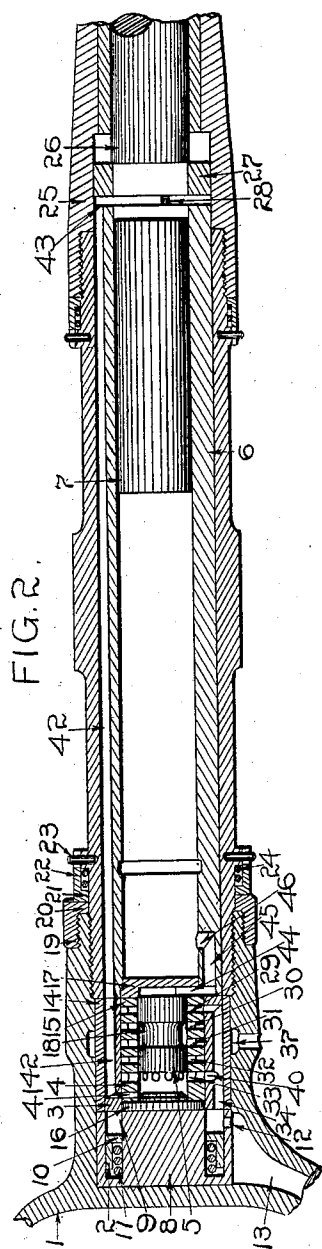
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NO MODEL.

2 SHEETS—SHEET 2.



Witnesses:  
 Jola Tucker.  
 J. H. Taylor

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# UNITED STATES PATENT OFFICE.

ALBERT C. MURPHY, OF ST. LOUIS, MISSOURI, ASSIGNOR TO STANDARD RAILWAY EQUIPMENT COMPANY, A CORPORATION OF ILLINOIS.

## PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 747,752, dated December 22, 1903.

Application filed September 16, 1901. Renewed November 2, 1903. Serial No. 179,636. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT C. MURPHY, a citizen of the United States, and a resident of the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a specification.

My invention relates to pneumatic hammers, and has for its principal object to minimize the shock and jar incident to the use of pneumatic tools, to secure a long and powerful stroke of the piston, and to insure the safety and operation of the valve.

My invention consists in the parts and the arrangement and combination of parts hereinafter described and claimed.

In the accompanying drawings, which form part of this specification, and in which like symbols refer to like parts wherever they occur, Figure 1 is a longitudinal sectional view of my pneumatic hammer, showing the position of the parts when the valve is in its rearward position. Fig. 2 is a longitudinal sectional view of my hammer on a different plane from that of Fig. 1 and with the valve in its forward position. Fig. 3 is an enlarged longitudinal sectional view through the valve-block and parts adjacent thereto with the valve in its rearward position. Fig. 4 is a cross-section on the line A A of Fig. 1. Fig. 5 is a cross-section on the line B B of Fig. 1. Fig. 6 is a cross-section on the line C C of Fig. 1. Fig. 7 is a cross-section on the line D D of Fig. 1. Fig. 8 is a longitudinal section of the valve-bushing; and Figs. 9 and 10 are cross-sections of the valve-bushing on the lines 2 2 and 3 3, respectively. Fig. 11 is a cross-section on the line I I of Fig. 1, and Fig. 12 is a cross-section on the line L L of Fig. 1.

The principal elements of my construction are a handle 1, a throttle-valve 2 in the socket thereof, and a main valve-block 3 in said handle, a valve-bushing 4 inclosed in said valve-block, a valve 5 in said handle, a barrel 6 or cylinder clamped to said handle in alinement therewith, and a piston 7 in said cylinder.

The handle comprises a grasping portion and a cylindrical portion having a cylindrical socket extending nearly the full length there-

of. In the bottom of this socket is a cylindrical plug 8, having a deep annular groove 9 arranged longitudinally thereof. In this groove is a shell 2, having a flange 10 on its forward end. In the bottom of the groove is a helical spring 11, which bears against the flange on said shell so as to normally force said shell forward. This shell constitutes the throttle-valve of the hammer, and its flange fits loosely in the annular groove of the plug, so as to allow the air to pass back of said flange and balance the pressure in front thereof. In the outer wall of the throttle-valve plug in position to be covered by the throttle-valve in its normal forward position and to be uncovered when the throttle-valve is in its rearward position is a port 12, which registers with the main supply-duct 13 of the hammer.

Abutting endwise against the throttle-valve plug is a cylindrical valve-block 3, which fits in the socket of the handle. This valve-block is preferably made of an outer cylindrical shell 14 and an inner cylindrical shell 15 fitting therein. The inner shell has longitudinal grooves or channels formed in its outer surface, which grooves when covered by the outer shell constitute air passage-ways, as hereinafter described. Obviously the valve-block may be made of a single piece having said passage-ways bored therein. Inside of the valve-block is the valve-bushing 4, which consists of a tubular cylinder provided in its circumference with five grooves, each having a port opening into the interior of said bushing in position to be controlled by the valve, as hereinafter described. The rear end of this valve-bushing is closed by a plate 16, overlapping the end thereof and having a flange extending forwardly inside of the valve-bushing to constitute a stop for limiting the backward movement of the valve. The front end of the valve-bushing is closed by a plate 17, fitting in the rear end of the cylinder and having an annular rib overlapping the end of the cylinder. Inside of the valve-bushing is a cylindrical valve having an annular groove 18 at the middle portion thereof. The cylinder is preferably composed of two concentric parts, the inner of which has longitudinal grooves or channels in its surface, which are closed by the outer shell and constitute air

passage-ways. The rear end of the cylinder is threaded and screws into the handle-socket, which is likewise threaded to cooperate therewith. In order to prevent the cylinder from turning, the outer surface of the socket of the handle is screw-threaded to cooperate with a threaded sleeve 19, mounted on the cylinder. The forward end of this sleeve 19 has a flange 20 overlapping the end of the handle and has teeth formed to cooperate with detents 21 on the cylinder. These detents consist of teeth formed on the surface of a ring or collar, which is free to slide upon the cylinder and has arms or lugs 22 extending forwardly to engage studs 23, arranged radially on the surface of the cylinder to interlock therewith and prevent rotation thereof. The detents are normally held in engagement with the teeth of the locking-sleeve by a helical spring 24, which bears at one end against a collar provided therefor on the cylinder and at the other end against said ring. The teeth on the sleeve and of the detents are preferably beveled, so as to permit the tightening of the sleeve, but prevent its unscrewing. In the front end of the cylinder is a nosing 25, adapted to receive the shank 26 of a button-set or other tool. In the front end of the cylinder in position to be moved by the shank of the tool is a tappet-ring 27. This ring is of sufficient thickness to bear against tappet-rods 28, which extend through passages provided therefor in the cylinder-wall and abut at their rear ends against the front side of the throttle-valve 2. In order to permit the insertion of the tappet-ring, the front end of the cylinder is made separate from the main portion of the cylinder and is fastened thereto by a locking device similar to that hereinbefore described as at the rear end. By this arrangement the normal position of the throttle-valve is forward, in which position it closes the port 12, and thereby cuts off communication with the source of pressure. When a tool is inserted in the nosing and pressure is exerted thereon, the shank of the tool forces the tappet-ring backwardly, and the backward movement of the tappet-ring is transmitted by the tappet-rods and the throttle-valve, which is opened against the pressure of its spring. Thus the throttle-valve automatically opens when the hammer is held to its work and closes when it is removed therefrom.

As hereinbefore stated, the valve-bushing comprises a tubular cylinder provided in its circumference with five grooves, each having a port opening into the interior of said bushing in position to be controlled by the valve. The valve consists of a piston fitting in the bore of the bushing and of a length to cover four of said ports, and its circumferential groove 9 is of a width sufficient to bridge two adjacent ports. In the forward position of the valve its front end covers the foremost port 29, while the fifth port 33 is uncovered. In this forward position of the valve its groove 9 registers with the second and third ports

30 and 31, while the fourth port 32 is closed by the valve. In the rearward position of the valve the foremost port 29 is uncovered, while the fifth port 33 is covered by the rear end of the valve. In this position the front end of the valve covers the second port 30, while the groove in the valve registers with the third and fourth ports 31 and 32. By this arrangement the third port 31 is alternately connected to the second and fourth ports 30 and 32, while the first and fifth ports 29 and 33 are alternately opened and closed. The several ports of the valve-bushing communicate through passage-ways, as follows: The foremost port 29 communicates, through a passage-way 34 in the valve-block, with the main supply-duct 13 in the handle of the hammer. The second port 30 communicates, through a passage-way 35 in the valve-block and the shell of the cylinder, with a port 36, which opens into the cylinder near the rear end thereof. The third port 31 communicates with a passage-way 37, which opens directly into the atmosphere. The fourth port 32 communicates with a passage-way 38, which extends through the valve-block and the shell of the cylinder and opens through a port 39 into the cylinder near the front end thereof. The fifth port 33 communicates, through a passage 40 in the valve-block, directly with the supply-duct 13 in the handle of the hammer. By this arrangement the exhaust-port 37 is alternately opened to the front and rear ends of the cylinder, while the spaces in the valve-chamber in front of and behind the valve, respectively, are alternately connected to the source of supply. At the rear end of the valve-bushing is a port 41, extending through the flange of the end plate 16 and communicating with a passage-way 42 in the valve-block, which extends through the shell of the cylinder and opens into said cylinder through a port 43 at the forward end thereof at a point beyond the limit of the piston movement. The port 41 at the rear end of the valve-bushing is beyond the rearward limit of movement of the valve. By this arrangement the space in the valve-chamber back of the valve is in permanent communication with the front end of the cylinder. In like manner the space in the valve-chamber in front of the valve is in permanent communication with the rear end of the cylinder through a port 44, formed in the flange of the plate 17 and opening into a passage-way 45 in the cylinder-wall, which passage-way opens through a port 46 into the cylinder, near the rear end thereof.

The operation of the device is as follows: When the parts are in the position shown in Fig. 1, air from the source of pressure passing through the throttle-valve passes through the passage-way 34 and port 29 into the front end of the valve-chamber and thence passes through the port 44, passage-way 45, and port 46 and enters the rear end of the cylinder and drives the piston forward. During this for-

ward movement of the piston the front end of the cylinder is open to exhaust through the port 39, passage-way 38, and port 32, which at this time registers with the groove of the valve and through said groove into the main exhaust-port 31, which is always in register with said groove. When the piston traverses the port 39, the air confined in the front end of the cylinder is compressed by the piston, which is at this time moving forwardly with considerable momentum. The air thus compressed is forced back through the port 43, passage-way 42, and port 41 into the rear end of the valve-chamber back of the valve. As the pressure in the front end of the cylinder thus transmitted to the space in the valve-chamber back of the valve is greater per unit of area than the normal pressure from the source of supply and as the front end of the valve-chamber is connected directly to the source of supply and the two ends of the valve are of equal area, the total pressure on the rear end of the valve exceeds the total pressure on the front end of the valve. The excess pressure on the rear end, therefore, causes the valve to move forwardly. The forward movement of the valve uncovers the port 33, which connects the rear end of the valve-chamber directly to the source of pressure, and thus maintains the pressure on the rear end of the valve, so as to hold the valve in its forward position. By this forward position of the valve the port 32, which communicates with the cylinder near its front end and which has been open to exhaust through the groove in the valve, is closed, and the port 30, which communicates with the cylinder near its rear end and which has been closed by the valve, is open to exhaust through the groove in the valve. At the same time the port 29 in the front end of the valve-chamber which communicates with the source of pressure is closed. When the valve is in its forward position, the air entering the rear end of the valve-chamber through the port 23 passes through the port 41, passage-way 42, and port 43 into the cylinder at the front end thereof and forces the piston back. During the backward movement of the piston the rear end of the cylinder is open to the atmosphere through the port 36, passage-way 35, and port 30, valve-groove 9, and exhaust-port 37. When the rear end of the piston passes the port 36, the air at the rear end of the cylinder is trapped therein, and as the piston continues to move rearwardly with considerable momentum the air thus trapped is compressed to a greater degree than the source of supply. The pressure of the air thus trapped is transmitted through the port 46, passage-way 45, and port 44 to the space in the valve-chamber in front of the valve and causes the valve to move rearwardly by reason of the excess of pressure on the front end thereof. While the valve is being shifted into its rearward position the air which has been compressed at

the rear end of the cylinder forces the piston forward, so as to initiate the forward movement of the piston and carry it beyond the port 46, which communicates with the front end of the valve-chamber. Thereupon the air from the source of pressure passing through the port 12, passage-way 34, and port 29 into the front end of the valve-chamber passes therefrom through the port 44 and passage-way 45 and enters the rear end of the cylinder through the port 46 and forces the piston forward to deliver its stroke and operate the valve, as hereinbefore described.

For convenience of description I have referred to the various ports and passage-ways in the singular number. In practice, however, it is preferable to use a plurality of ports and passage-ways having the same operative positions as indicated in the sectional views.

My invention admits of various modifications, and I do not wish to restrict myself to the specific construction hereinbefore described.

What I claim is—

1. A pneumatic hammer having ports for the admission and release of pressure and a piston-valve arranged to control both the admission-ports and the release-ports and having ends of equal area, the ends of the valve-chamber being in communication with the ends of the cylinder respectively beyond the release-ports of the cylinder, substantially as described.

2. A pneumatic hammer having ports for the admission and release of pressure and a piston-valve having ends of equal area, the ends of the valve-chamber being in communication with the cylinder between the release-ports of the cylinder and the ends of said cylinder respectively, whereby the air trapped in the exhausting end of the cylinder moves the valve and initiates the return movement of the piston, substantially as described.

3. A pneumatic hammer having ports for the admission and release of pressure and a valve for controlling said ports, the ends of the valve-chamber being in communication with the respective ends of the cylinder beyond the release-ports of the cylinder, whereby said valve is operated in both directions by the pressure of air trapped in the exhausting end of the cylinder and compressed in excess of the normal pressure, substantially as described.

4. A pneumatic hammer having ports for the admission and release of pressure and a valve having ends of equal area for controlling said ports, the ends of the valve-chamber being alternately open to the source of pressure through ports in position to be closed by the valve and having ports beyond the limit of movement of the valve in communication with the ends of the cylinder respectively, substantially as described.

5. A pneumatic hammer having ports for

the admission and release of pressure and a valve having ends of equal area for controlling said ports, the ends of the valve-chamber being alternately open to the source of pressure through ports in position to be closed by the valve and having ports beyond the limit of movement of the valve, one of said last-mentioned ports communicating with the cylinder at a point traversed by the piston and the other of said ports communicating with the cylinder at the other end thereof, substantially as described.

6. A pneumatic hammer comprising a valve having cylindrical end portions of equal area and an intermediate groove, said hammer having ports communicating with the source of pressure and opening into the valve-chamber in position to be controlled by the front and rear ends of the valve respectively and having three ports opening into the valve-chamber in position to register with the groove in the valve, the end ports of said three communicating with the cylinder near the front and rear ends thereof respectively and being in position to be alternately closed by the ends of the valve, and the intermediate port being permanently open to the groove of the valve and to the atmosphere, and said hammer having ports opening into the respective ends of the valve-chamber beyond the limit of movement of the valve and communicating with the cylinder nearer the ends thereof than the ports which communicate with the valve-groove, substantially as described.

7. A pneumatic hammer comprising a handle having a socket therein in communication with the source of pressure, and a cylindrical block in said socket, said block having a longitudinal annular groove and a port through the wall thereof, and a spring-actuated shell fitting in said groove and constituting a throttle-valve, and means for operating said shell, substantially as described.

8. A pneumatic hammer having a cylindrical block arranged in a socket in communication with the source of pressure and having a longitudinal annular groove and a port through the wall thereof and a spring-actuated shell fitting in said groove and constituting a throttle-valve, and means for operating said shell, substantially as described.

9. A pneumatic hammer comprising a handle having a socket therein and a cylindrical block in said socket having a longitudinal annular groove and a port through the wall

thereof in communication with the source of pressure, and a spring-actuated shell fitting in said groove and constituting a throttle-valve, a main valve-block abutting against said first-mentioned block and containing the main valve and passage-ways, and a cylinder having its rear end clamped against said main valve-block and having a ring in its front end arranged to be moved by the shank of a tool in said hammer, and tappet-rods extending through channels in said hammer from the shell of the throttle-valve to said ring, substantially as described.

10. In a pneumatic hammer, a valve-block comprising a cylindrical bushing having circumferential grooves and ports therein, and a cylindrical shell fitting over said bushing and having longitudinal passage-ways therein and ports connecting said passage-ways with the grooves of the bushing, substantially as described.

11. In a pneumatic hammer, a valve-block comprising a cylindrical bushing having circumferential grooves and ports therein, and a cylindrical shell fitting over said bushing and having longitudinal grooves therein and ports connecting said longitudinal grooves with the grooves of the bushing, and a cylindrical shell fitting over said last-mentioned shell, substantially as described.

12. In a pneumatic hammer having a cylinder screw-threaded into a socket-piece, a locking device comprising a spring-pressed sleeve having teeth in its face adapted to engage teeth on the shoulder of the socket-piece or a part connected thereto, and having notches adapted to cooperate with studs on the cylinder, substantially as described.

13. In a pneumatic hammer, a handle portion having a socket portion threaded internally and externally and containing the valve and valve-chamber, and a cylinder having its end threaded to fit into said socket, a flanged sleeve threaded to work on the external thread of the socket portion and having teeth in its surface, and a spring-actuated ring having teeth to cooperate with the teeth of said sleeve and having notches arranged to cooperate with studs on the cylinder, substantially as described.

Signed at St. Louis, Missouri, September 14, 1901.

A. C. MURPHY.

Witnesses:

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ZOLA TUCKER.