A. J. DOUGHTY.

PNEUMATIC HAMMER.

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912,234.

Patented Feb. 9, 1909.

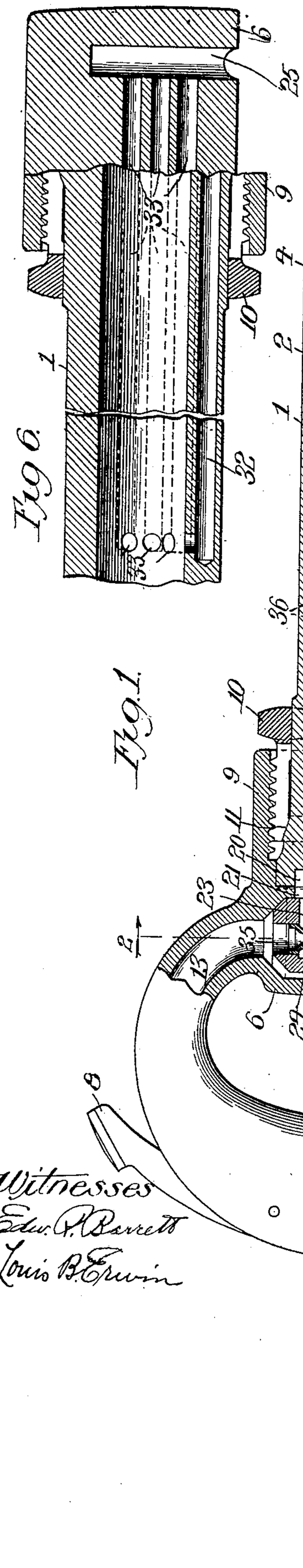

Fig 6.

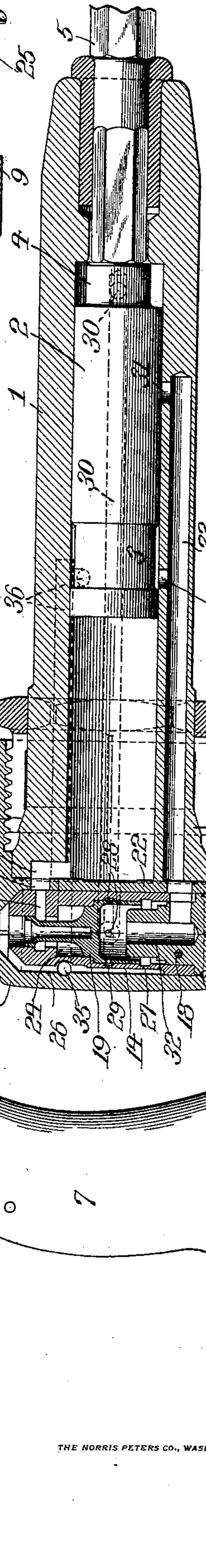

Fig 1.

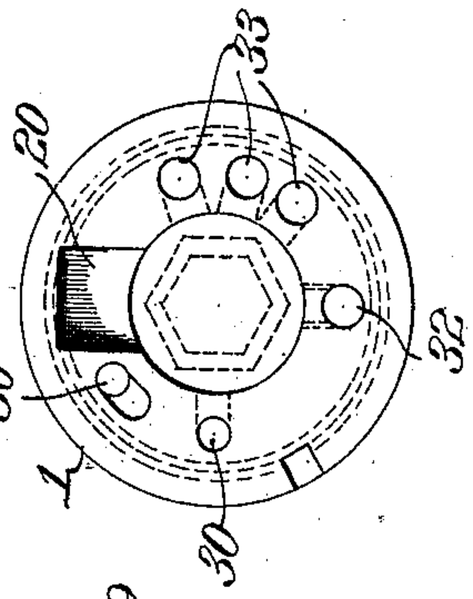

Fig 3.

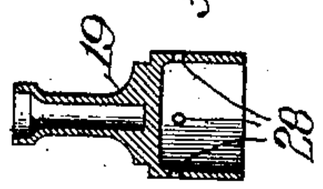

Fig 5.

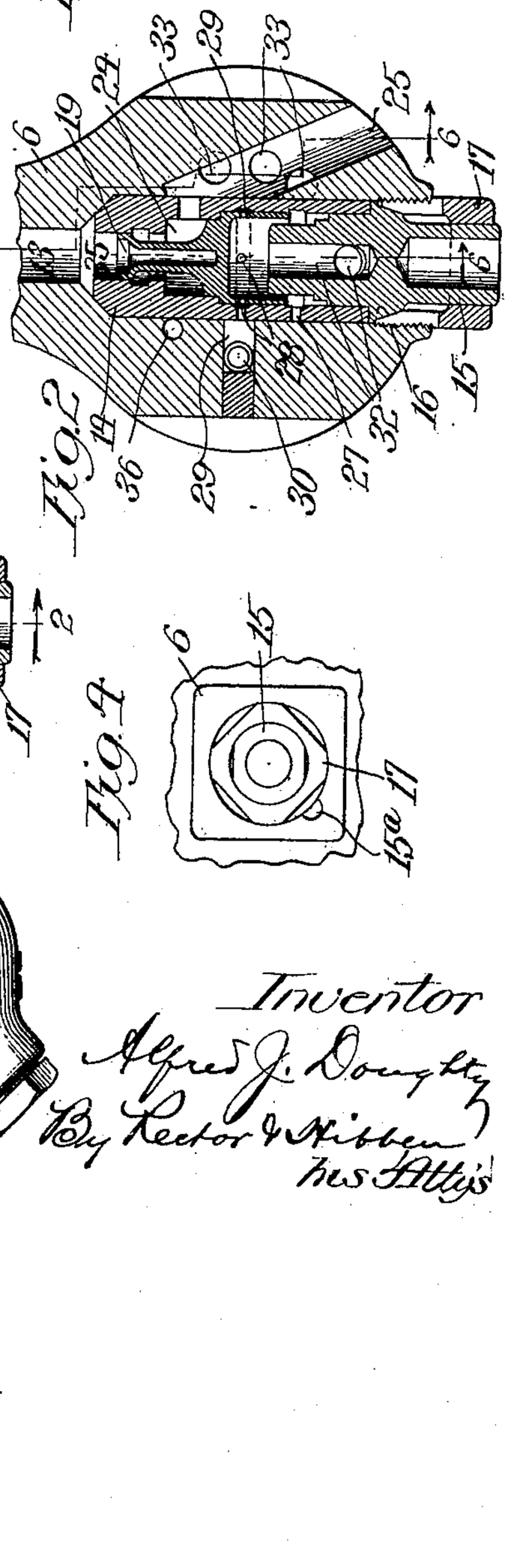

Fig 2.

Fig 4.

Witnesses

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PNEUMATIC HAMMER.

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To all whom it may concern:

Be it known that I, ALFRED J. DOUGHTY, a citizen of the United States, residing at Detroit, Wayne county, Michigan, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a specification.

My invention relates to that class of tools commonly known as pneumatic hammers in which a reciprocating piston is caused to deliver blows upon a working tool arranged in the forward part of the cylinder or body of the tool or hammer, and the object of my invention is to provide a novel and efficient construction of valve for controlling admission of motive fluid pressure to the cylinder and its exhaust therefrom and also to provide a novel and advantageous construction and arrangement of such valve within a valve case in such manner that the entire case and its contained valve may be bodily removed from the tool or hammer without uncoupling the cylinder from the handle and indeed without disturbing any of the other parts of the hammer in any manner whatsoever, with the result that such parts may be easily and readily removed for purposes of inspection or repairs or for the purpose of substituting another valve.

My invention also contemplates novel and efficient means for clamping or coupling the cylinder to the handle or head-block in such manner as to prevent uncoupling of these parts by the jarring incident to the impact of the piston upon the working tool.

The various features of advantage and utility of my improvements will be apparent from the description hereinafter given.

In the accompanying drawing Figure 1 is the central longitudinal section of a hammer embodying my improvements, the grasping handle being in elevation; Fig. 2 a section on the line 2—2 of Fig. 1; Fig. 3 an elevation of the rear end of the cylinder showing the ports and passages opening on such end of the cylinder; Fig. 4 is a detailed view the same being a bottom plan of the fastening screw and the plug which holds the valve case in position within the head-block; Fig. 5 a detailed view of the valve alone; and Fig. 6 a section on the line 6—6 of Fig. 2.

Although my invention in its broader aspect, may partake of different forms, I prefer the form of construction and arrangement illustrated in the drawing and I will now proceed to describe the same without intention of limitation to specific details unless the claims expressly specify them.

As shown in the drawing the cylinder 1 is provided as usual with a longitudinal piston chamber in which travels the piston 2 which is solid and of uniform diameter throughout with the exception of the reduced portion 3 and the striking point 4 which is adapted to impact or strike the inner end of the tool blank such as the chisel 5. At its rearward end the cylinder is connected or coupled, in a manner to be described, to the handle which grasps the head-block 6 and the grasping portion or handle proper marked 7, within which grasping handle is arranged the usual throttle valve (not shown) operated in the well-known way by the thumb lever 8. The forward end of the head-block is extended to form a cylindrical socket piece or portion 9 which is adapted to receive the rearward end of the cylinder 1 in a manner to be described. The socket portion 9 is of such diameter as to receive the rearward end of the cylinder and is internally screw threaded to receive the external screw threads of a coupling sleeve 10 which is preferably split and whose outer end is made angular so that a wrench may be applied thereto for screwing the same in and out of such socket portion. This coupling sleeve fits over the cylinder and its inner rearward corners are cut away or beveled to form the inclined annular surface 11 which is arranged to coöperate with a complementary annular and inclined surface 12 formed on the outer surface of the cylinder 1. These inclined surfaces coöperate with each other in such manner that when the coupling sleeve 10 is screwed inwardly that is rearwardly of the cylinder and to the left in Fig. 1 the cylinder and the handle or socket portion thereof are securely and effectually clamped through the medium of the coupling sleeve 10 which causes a wedging action between such socket portion and the cylinder. When the coupling sleeve is screwed outwardly the parts are relieved of this wedging action so that when the sleeve is entirely unscrewed, the cylinder may be uncoupled, or entirely detached from the handle or socket piece.

Referring next to the valve and its case, the same are arranged entirely within the head-block in a transverse or diametrical

bore, the upper end of which is in constant communication with the supply passage 13 extending through the handle. The valve case together with its valve is arranged to be bodily removable and to this end such case which is a substantially cylindrical shell 14 is held or confined within the bore in the head-block in a removable manner by means of the removable plug 15 whose flange 16 formed intermediate its length is arranged to bear against the lower end of the valve case. The plug is in turn held removably against the valve case by means of a fastening screw 17 screwing upwardly in the bore of the head-block and bearing against the inclined lower edge of the annular flange 16 of the plug, the latter, in the present instance, passing as to its lower end through a central opening in the screw 17 which is preferably split and made angular as indicated in Fig. 4. The plug 15 may be termed an extracting plug inasmuch as it not only serves to hold the valve case in place when the fastening screw is in position but also to extract such case whenever desired. To this end the plug is removably secured to the valve case so that the latter may be withdrawn bodily with the plug, a means for securing the parts together being, in the present instance, a pin 18 passing through the plug and the opposite walls of the valve case. In the present instance and by preference the upper end of the valve case is formed with an inclined surface arranged to bear against a correspondingly inclined surface at the inner or upper end of the bore in the head-block as clearly indicated in Figs. 1 and 2. The case is maintained against displacement rotarily by the key 15[a], Fig. 4.

The valve case is formed with differential chambers in order to accommodate the valve which is itself differential. This valve marked 19 is of the piston type with its lower end formed with a lower or cylindrical extension or head arranged to fit over the inwardly projecting end of the plug 15 and with its upper end or piston head exposed constantly to the live motive fluid admitted through the passage 13 of the grasping handle. The upper end of the valve constitutes the smaller pressure area and the lower end thereof constitutes the larger pressure area, the smaller area being constantly exposed to live motive fluid, as just stated, while the larger pressure area is intermittently exposed to pressure controlled in a manner hereinafter described.

The valve case is provided with ports and passages communicating with the live motive fluid, with the atmosphere and with the cylinder which ports are controlled by the valve in its reciprocations in the following manner: When the parts are in the relative position illustrated in Fig. 1 the piston 2 has just delivered its blow to the working tool and the valve has just been shifted so as to exhaust the pressure in the rear of the piston and to admit pressure to the cylinder at a point in front of the piston so that the latter is now about to start on its rearward or return stroke. At this time the rear of the piston chamber is at exhaust through the side opening 20 at the end of the cylinder, Figs. 1 and 3, through the port 21 in the partition or diaphragm 22 of the head-block, through passage 23 in the valve case, past the reduced portion or neck of the valve and into the chamber 24 which is always at exhaust inasmuch as it is at all times in communication with the main exhaust passage 25, Fig. 2. At the same time the live motive fluid is admitted through the passage 26 extending longitudinally of the valve case as seen in Fig. 1 and communicating with the space below the valve through the port or ports 27 extending transversely through the valve case and uncovered, at this time, by the lower end of the lower shell portion of the valve. The live motive fluid flows from this space through the series of holes of ports 28 extending through the shell portion of the valve and into an annular groove 29 in the inner surface of the valve case. This annular groove communicates, as seen in Figs. 1 and 2, with the passage 30 extending from the head-block and longitudinally through the cylinder to the lower or forward end of the piston chamber, with the result that when the parts are in the relative position now being described, the live motive fluid is admitted to the front end of the piston to move the same rearwardly. After a partial rearward movement of the piston, the front end thereof will uncover the port 31 which communicates through the longitudinal passage 32 with the space or chamber within the shell portion of the valve, such passage 32 continuing beyond the rear end of the cylinder and through the plug 15 and terminating at the top of the upper end of such plug as seen in Figs. 1 and 2. When the piston thus passes and uncovers the port 31 on its rearward stroke the pressure below the valve within the shell portion thereof will be exhausted or rarefied by the release of the motive fluid therefrom through the passage 32 into the front end of the cylinder which is at this particular time at exhaust to atmosphere through the series of exhaust ports 33 which are uncovered by the piston at the same time that the port 31 is uncovered. These exhaust ports, one or more, extend longitudinally through the cylinder and through the head-block so as to communicate with the main exhaust passage 25 as seen in Figs. 2 and 6. The result of the exhaust or rarefaction of the motive fluid through the passage 32 permits the valve to be moved downwardly by the pressure of

the live motive fluid which is constantly pressing against the upper or smaller pressure area thereof, it being understood that the passage 32 which exhausts the pressure from below the valve is of greater carrying capacity than the small ports 27 so that the described movement of the valve is possible. As soon as the valve moves downwardly, as just described, the live motive fluid is admitted to the rear end of the cylinder through the central port and passage 35 in the valve case, which is opened at its lower end by the shifting of the valve, and through the ports and passages 23, 21 and 20, with the result that the piston will be driven forwardly to deliver its blow to the working tool. However just previous to the end of its forward stroke, the groove or reduced portion 3 of the piston connects the passage 32 through its port 34 with the live air port and passage 36 which latter passage is always in communication with the supply of motive fluid, the same in the present instance communicating with such motive fluid in the groove or channel 26 and extending longitudinally of the cylinder, and emerging in the piston chamber thereof at such a point as to be connected with the passage 32 by the groove 3 of the piston in the manner just explained. The result of this admission of the live air to the passage 32 through the medium of the piston is to force the valve upwardly to the position indicated in Fig. 1 inasmuch as the pressure exerted on the larger pressure area of the valve will preponderate the pressure constantly bearing against the upper or smaller pressure area thereof. The supply of motive fluid to the rear end of the piston chamber will now be cut off and such end of the chamber will be exhausted through the passages 20, 21, 23, chamber 24 and main exhaust passage 25 as already explained, while the motive fluid will be supplied to the front end of the piston chamber through the ports and passages 27, 28, 29, and 30, even after the port 34 has been closed by the piston in its rearward movement and before the exhaust ports and passages 33 have been uncovered thereby. This completes a cycle of operation the movements and operations continuing in the manner described so long as the throttle valve is held open.

The described construction and arrangement of hammer not only provides a novel and efficient construction of valve but also affords ready and convenient access to the valve and permits the same together with its case to be bodily withdrawn and replaced without in any manner disturbing any of the other parts of the hammer. Moreover the valve is comparatively light, its form permitting it to be made of the minimum diameter where the air is admitted into the piston cylinder and the same is also cushioned at both ends, inasmuch as it moves upwardly against the constant pressure of the air and moves downwardly against the air which is trapped below its lower edges in the space between the vertical sides of the inner end of the plug and the inner wall of the valve case. Furthermore the coupling device constitutes a practical and efficient arrangement which is capable not only of convenient operation but of securely clamping or coupling the cylinder and handle together.

I claim:

1. In a pneumatic hammer, the combination of the cylinder and the handle thereof comprising the grasping portion, socket and a head block located at the base of such socket and in the rear of the cylinder, said head block having a transverse diametrical bore which communicates directly at its upper end with the motive fluid passage in the handle and which extends to the outer surface of the head block at its other or lower end, a valve arranged in said bore in the head block to control the admission and exhaust of the motive fluid to and from the opposite ends of the cylinder, a removable plug device adapted to close said lower end of the bore, and a coupling device for coupling the cylinder and the handle without interfering with the removability of said plug device.

2. In a pneumatic hammer, the combination of the cylinder and the handle thereof comprising the grasping portion, socket and a head block located at the base of such socket and in the rear of the cylinder, said head block having a transverse diametrical bore which communicates directly at its upper end with the motive fluid passage in the handle and which extends to the outer surface of the head block at its other or lower end, a valve case removably arranged in said bore in the head block, a valve arranged in said case to control the admission and exhaust of the motive fluid to and from the opposite ends of the cylinder, a removable plug device adapted to close said lower end of the bore and to clamp said case in position, said valve, valve case and plug device being removable without disturbing the other parts of the hammer and without disconnecting the cylinder, and removable means for holding said plug device in place.

3. In a pneumatic hammer, the combination of the cylinder and the handle thereof comprising the grasping portion, socket and a head block located at the base of such socket and in the rear of the cylinder, said head block having a transverse diametrical bore which communicates directly at its upper end with the motive fluid passage in the handle and which extends to the outer surface of the head block at its other or lower end, a valve case removably arranged in said bore in the head block, a valve arranged in said case to control the admission and ex-

haust of the motive fluid to and from the opposite ends of the cylinder, a plug fitting into and closing the lower end of said bore and secured to and removable with the valve case, and a screw or nut screwing into said lower end of the bore and coöperating with the plug to hold the latter and the valve case within the bore.

4. In a pneumatic hammer, the combination of the cylinder and the handle thereof comprising the grasping portion, socket and a head block located at the base of such socket and in the rear of the cylinder, said head block having a transverse diametrical bore which communicates directly at its upper end with the motive fluid passage in the handle and which extends to the outer surface of the head block at its other or lower end, a valve case removably arranged in said bore in the head block, a valve arranged in said case to control the admission and exhaust of the motive fluid to and from the opposite ends of the cylinder, a plug fitting into and closing the lower end of said bore and secured to and removable with the valve case, and a screw or nut screwing into said lower end of the bore and coöperating with the plug to hold the latter and the valve case within the bore, said plug and nut having complementary inclined surfaces whereby the plug and valve case are held clamped in position.

5. In a pneumatic hammer, the combination, with the cylinder and the head-block arranged to be connected together, said head-block having a transverse or diametrical bore communicating at one end with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder, said valve being differential with its smaller pressure area constantly exposed to live motive fluid and its larger pressure area, which is formed as a hollow portion, exposed to intermittent pressure, and a removable plug closing the other end of said bore and arranged to enter the hollow portion of the valve the inner end of said bore adjacent the supply of fluid pressure forming a seat for the inner end of said valve case.

6. In a pneumatic hammer, the combination, with the cylinder and the head-block arranged to be connected together, said head-block having a transverse or diametrical bore communicating at one end with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder, a removable plug arranged in the other end of said bore to confine the valve case therein, and a fastening nut or screw located at such latter end of the bore and arranged to hold the plug in place.

7. In a pneumatic hammer, the combination, with the cylinder and the head-block arranged to be connected together, said head-block having a transverse bore communicating at one end with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder, a removable plug arranged in the other end of said bore and bearing against the outer edge of the valve case, and a fastening nut or screw screwing into said bore and bearing against the plug to hold the same in place.

8. In a pneumatic hammer, the combination, with the cylinder and the head-block arranged to be connected together, said head-block having a transverse bore communicating at one end with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder, a removable plug arranged in the other end of said bore and having an annular flange bearing against the outer edge of the valve case, and a fastening screw screwing into said bore and against the under or outer side of said flange.

9. In a pneumatic hammer, the combination, with the cylinder and the head-block arranged to be connected together, said head-block having a transverse bore communicating at one end with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder, and a removable plug arranged in the outer end of such bore to hold the valve case in place, the plug and valve case being detachably secured together.

10. In a pneumatic hammer, the combination, with the cylinder and the head-block arranged to be connected together, said head-block having a transverse bore communicating at one end with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder a removable plug arranged in the outer end of such bore to hold the valve case in place, and a pin passing through the plug and valve case to detachably secure such parts together.

11. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a valve arranged in a transverse bore in the head-block for controlling the motive fluid to and from the cylinder, and having a hollow or shell portion at one end, and a removable plug closing the outer end of said bore and arranged to enter said shell portion of the valve one end of the valve cushioning on live air and the other or shell portion end cushioning on air trapped in said plug.

12. In a pneumatic hammer, the combination, with the cylinder and head-block there-

of, of a valve arranged in a transverse bore in the head-block for controlling the motive fluid to and from the cylinder and having one end formed as an open shell, said valve having a transverse passage through its shell portion for conducting the live motive fluid through a port and passage passing longitudinally of the cylinder to the front end of the cylinder to move the hammering piston rearwardly.

13. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, said block having a transverse bore communicating directly with the motive fluid passage in the handle, of a differential valve arranged in said bore in the head-block for controlling the motive fluid to and from the cylinder, said valve having a transverse passage through it for conducting live motive fluid from its larger pressure area to the front end of the cylinder to move the hammering piston rearwardly.

14. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a differential valve arranged in the head-block for controlling the motive fluid to and from the cylinder, said valve having a shell portion at its larger pressure area provided with a port or passage through it for conducting live motive fluid to the front end of the cylinder to move the hammering piston rearwardly, said port being alternately opened and closed by the movements of the valve.

15. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a differential piston valve arranged in a transverse bore in said head-block and having a shell portion at its larger pressure area, and a plug closing the end of the bore and having an extension fitting within and closing the shell portion of the valve said plug being reduced in diameter to form an annular cushioning chamber for the end of the shell portion of the valve.

16. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a differential piston valve arranged in a transverse bore in said head-block and having a shell portion at its larger pressure area, a plug closing the end of the bore and extending into the shell portion of the valve, said plug having a passage communicating respectively with the space within the shell portion of the valve and with the cylinder towards the forward end thereof through a port governed by the piston to exhaust the pressure against the larger pressure area of the valve.

17. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a differential piston valve arranged in a transverse bore in said head-block and having a shell portion at its larger pressure area, a port and passage leading from said shell portion of the valve and communicating with the cylinder towards the forward end thereof, and a port communicating between the shell portion of the valve and the live motive fluid but restricted as compared with the first named port and passage.

18. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a differential piston valve arranged in a transverse bore in said head-block and having a shell portion at its larger pressure area, a port governed by said valve and thereby alternately opened and closed to admit or cut off direct supply of live motive fluid to the shell portion of the valve, and an admission port and passage governed by said shell portion of the valve to conduct the motive fluid to the front end of the cylinder to move the hammering piston rearwardly.

19. In a pneumatic hammer, the combination, with the cylinder and head-block thereof, of a differential piston valve arranged in a transverse bore in said head-block and having a shell portion at its larger pressure area, a port communicating with the motive fluid and opening into the shell portion of the valve and uncovered thereby when the slide is in one of its positions, and a port and passage extending through the shell portion of the valve and leading to the front end of the cylinder for supplying motive fluid thereat to move the hammering piston rearwardly.

20. In a pneumatic hammer, the combination, with the cylinder and head-block having a transverse bore, a valve case therein having a longitudinal live air passage 26, a valve therein having its larger pressure area formed as a shell portion, a port 27 communicating, at one position of the valve, between its said larger pressure area and the passage 26, a port 28 in the valve, a groove 29 with which port 28 communicates when the valve is in said position, a port and passage 30 communicating between groove 29 and the front end of the cylinder, and a port 32 and passage communicating respectively with the cylinder and with the larger pressure area of the valve.

21. In a pneumatic hammer, the combination of the handle, the cylinder having an annular inclined projecting surface at its rear end, and a coupling sleeve engaging said handle and having a complementary annular inclined surface arranged to coöperate with said surface of the cylinder for coupling the cylinder to the handle.

22. In a pneumatic hammer, the combination of the cylinder having an annular inclined projecting surface at its rear end, a handle having a socket piece within which the cylinder fits, and a coupling sleeve having a complementary inclined surface arranged to coöperate with the said surface on the cylinder.

23. In a pneumatic hammer, the combination of the cylinder having an annular inclined projecting surface at its rear end, a

handle having a socket piece within which the cylinder fits, and a coupling sleeve encircling the cylinder and screwing within the socket piece, said sleeve having at its inner end a complementary inclined surface coöperating with the said surface on the cylinder to couple the handle and cylinder together.

24. In a pneumatic hammer, the combination, with the cylinder and the head block arranged to be connected together, said head block having a transverse bore communicating with the supply of motive fluid, of a valve case arranged in such bore, a valve arranged within the case for controlling the motive fluid to and from the cylinder, and a removable plug closing one end of the bore and secured to the valve case, said case, valve and plug being bodily removable as a unit.

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