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M. HARDSOCG.

PNEUMATIC HAMMER.

APPLICATION FILED MAR. 11, 1907.

Fig. 1.

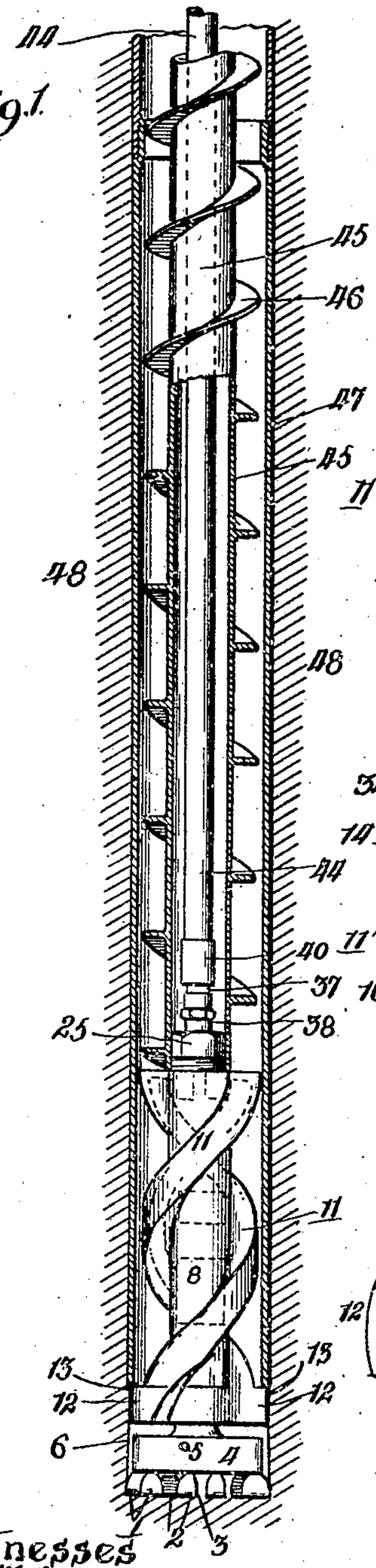


Fig. 3.

Fig. 4

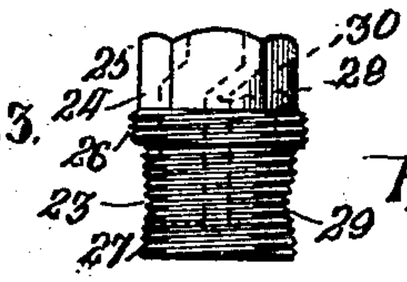


Fig. 5.

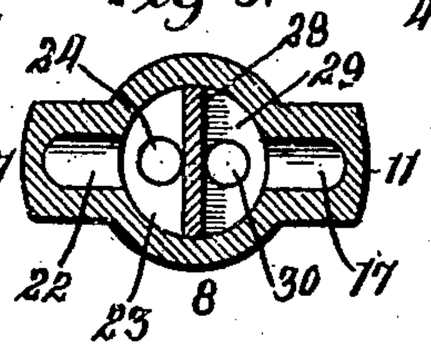


Fig. 6.

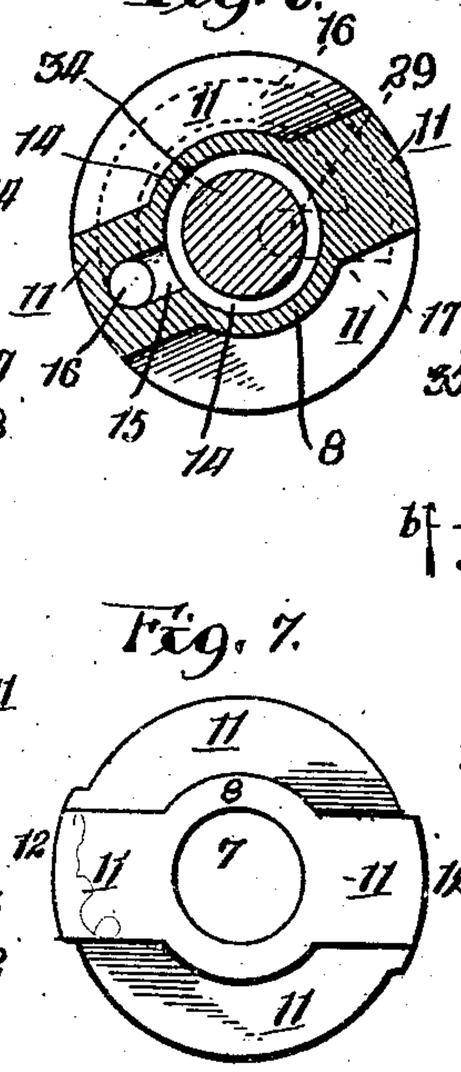
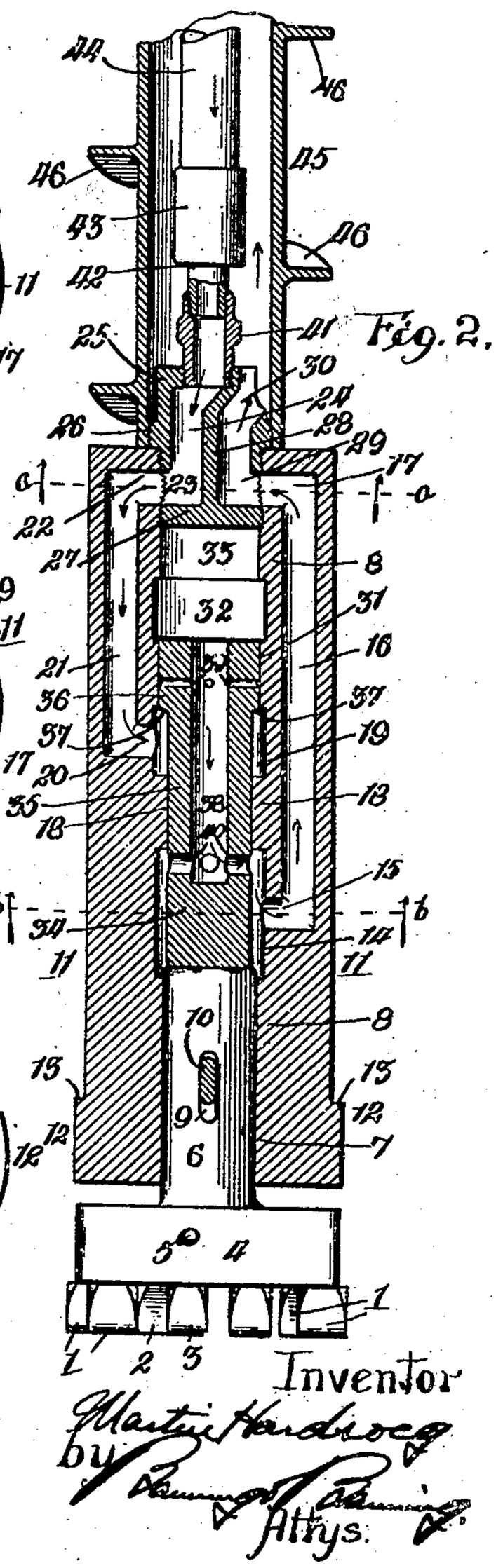


Fig. 7.

Fig. 2.



Witnesses

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PNEUMATIC HAMMER.

No. 884,152. Specification of Letters Patent. Patented April 7, 1908.

Application filed March 11, 1907. Serial No. 361,705.

To all whom it may concern:

Be it known that I, MARTIN HARDSOCG, a citizen of the United States, residing at Ottumwa, in the county of Wapello and State of Iowa, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a specification.

The present invention relates more particularly to the construction and arrangement of the frame and its relation to the head carrying the operating tool, such as the bits or cutters of a pneumatic drill, and a conveyer or flight for removing the cuttings, dust and fine particles; and is especially designed for use with pneumatic drills and other cutting instruments or tools in deep cutting, drilling or boring, but can be used in cutting, drilling and boring generally.

The objects of the invention are to improve the construction of the frame of a pneumatic hammer so as to enable air, or other medium under pressure, to act and operate the hammer, and to be discharged, after operating the hammer, so as to flow back or discharge and not interfere with the operation of the next supply of compressed air, or other medium under pressure, in driving the hammer; to construct a frame of a pneumatic hammer with an interior chamber for the driving hammer and the driven stem, and with exterior flanges rearwardly extending around the barrel and the hammer, and furnishing spiral pathways of travel for removing the cuttings, dust and fine particles produced by the operation of the drill or other tool or instrument; to construct the frame of a pneumatic hammer so as to provide a central straight barrel, with a chamber for the hammer and for the shank or stem of the tool head, and with passages for admitting air, or other medium under pressure, to reciprocate the hammer, and after driving the hammer, allow the air, or other medium under pressure, to be discharged so as to leave a perfect clearance in the chamber in advance of the hammer; to construct a frame for a pneumatic hammer, having a central straight barrel with a hammer therein, and having circumferentially around the barrel oppositely running spiral flanges, with a passage and ports in one flange for admitting compressed air, or other medium under pressure, to the hammer chamber for driving the hammer forward, and with a passage and ports in the other flange for discharging the air, or other medium under pressure, at the forward or striking end of the hammer; to provide the frame with a central chamber and ports leading therefrom for the ports to coöperate, in one instance, with a side passage for inducting fluid, and in the other instance, with a side passage for educting fluid, the inducting and educting passages being formed in spiral flanges circumferentially around the barrel and running in opposite directions on the barrel; to furnish a frame having a straight central chamber to coact with induction and eduction passages in spiral flanges around the chamber, one flange having the induction passage and the other flange having the eduction passage, and a plug having an induction passage in communication with the induction passage of a spiral flange, and an eduction passage in communication with the eduction passage of a spiral flange, the plug also closing the end of the hammer chamber, for admitting compressed air, or other medium under pressure to the chamber; to furnish, by the spiral flanges, circumferentially around the barrel of the hammer a spiral screw for positively and effectually removing the cuttings, dust and fine particles produced by the operation or action of the bits or cutters, or other tool; to furnish a conveyer or flight connected with the frame of the hammer at the rear end thereof and coacting with the spiral screw on the exterior of the hammer, for positively and effectually removing the cuttings, dust and fine particles produced by the operation or action of the bits or cutters, or other tool; and to improve generally the construction and operation of the frame, the spiral or screw around the exterior thereof, and the conveyer or flight, entering into the formation and operation of the tool as a whole.

The invention consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings Figure 1 is a sectional elevation of the exterior casing or tube through which the hammer and the conveyer or flight are operated, with the conveyer or flight partly in section, and with the pneumatic hammer and the drill head, with its bits or cutters, in full elevation; Fig. 2 a sectional elevation of the pneumatic hammer and the conveyer or flight, showing the construction for the hammer as if the spiral flanges were unfolded, in order to clearly illustrate the induction and eduction passages in the spiral

flanges; Fig. 3 an end elevation of the plug for closing the rear end of the hammer frame and chamber; Fig. 4 a side elevation of the plug of Fig. 3, showing, by dotted lines, the induction and eduction passages of the plug; Fig. 5 a cross section on line *a*—*a* of Fig. 2; Fig. 6 a cross section on line *b*—*b* of Fig. 2; and Fig. 7 an end elevation of the hammer frame.

The drill shown, has a head with a plurality of bits or cutters, but other forms of bits or cutters could be used, and other forms of tools or instruments than drills are capable of use with the frame. The arrangement has, at each end of the drill head, an outer or end bit or cutter 1, with an intermediate bit or cutter 2, and an intermediate bit or cutter 3 carried by the head. The head 4 is of a shape, as to length and width, to receive the bits or cutters; and, as shown, the head has a cross hole 5 to facilitate the removal from the head of the bit or cutter in line with the shank or stem of the head.

The head has a shank 6 to enter the chamber 7 of the barrel 8 of the frame, which shank constitutes a driven stem or shank; and, as shown, the driven shank or stem, has a slot 9, through which passes a bar or key 10, secured in the wall of the barrel, and by which slot and bar the head has a limited end movement for operating the bits or cutters.

The frame has circumferentially extending therearound, two spiral flanges 11, with the run of the spirals in opposite directions, so as to furnish a double spiral pathway of travel around the barrel; and each spiral flange 11, at the forward end of the frame, has a projection 12 which forms a shoulder 13, which shoulder furnishes a rest for the encircling tube, as shown in Fig. 1. The chamber 7 terminates in a chamber 14 of a greater diameter in cross section than the chamber 7, and from this chamber 14, on one side, a port 15 leads. The port 15 communicates with a longitudinal spiral passage 16 formed in one of the flanges 11, and opening at its rear end into a port 17, laterally leading from the end of the passage 16, as shown in Fig. 2.

The barrel 8 has an interior circumferential wall 18, located between the chamber 14 and a chamber 19, and from the chamber 19, on one side, a port 20 leads. The port 20 is in communication with a longitudinal spiral passage 21, formed in the other spiral flange of the frame; and the spiral passage 21, at its rear or receiving end, has a port 22 inwardly leading therefrom.

The port 22 communicates with a port or cross passage 23, with which a longitudinal passage 24 communicates, and the cross passage 23 and longitudinal passage 24 are formed in a head 25, having a circumferential flange 26 with an exterior screw thread, and a neck 27, with an exterior screw thread for entering the neck into the end wall of the frame and barrel, as shown in Fig. 2, so that the passages 23 and 24, in the head and neck, furnish a conduit or passage for supplying compressed air, or other medium under pressure, to the spiral passage 21 of the frame. The head 25 and neck 27 have a wall or partition 28, separating the passages 23 and 24 from a cross passage or port 29, and a longitudinal passage 30, which opens to the exterior of the head 25 on one side, as shown in Fig. 2. The port 17 is in communication with the cross passage or port 29, so that fluid inducted from the chamber 14, forward of the acting end of the hammer, will flow through the port 15 and passage 16 and discharge through the passage 30 at the mouth or opening of said passage, thereby preventing the discharged fluid from passing outside of the body of the hammer frame.

The barrel has an interior circumferential wall 31, located between the chamber 19 and a chamber 32, which chamber 32 is continued as a chamber or hole 33, which receives the neck 27 of the closing plug, as shown in Fig. 2, so that the chamber of the barrel, as a whole, is closed at the outer or rear end by the plug.

The barrel has located in the chamber thereof, rearward of the shank or driven stem 6, a hammer having a driving end or head 34 continued as a body 35, guided and held between the circumferential wall 18, and terminating at its rear end with an enlarged portion or head 36, and guided and held in the circumferential wall 31, and forming an abutment or face 37 against which the compressed air, or other medium under pressure, admitted to the chamber 19 from the spiral passage 21 through the port 20, acts to recede or force back the hammer as a whole. The body 35 of the hammer has a central passage 38 extending longitudinally therein, and opening at its rear end through the head 36, from which passage 38 lateral ports or passages 39 lead through the head 36, so that when the hammer is receded communication is established with the chamber 32, admitting compressed air, or other medium under pressure, to the passage 38 for the air, or other medium under pressure, to act and thrust or drive forward the hammer as a whole. The passage 38, adjacent to its forward end, has leading therefrom, lateral passages or ports 40, to furnish communication between the passage 38 and the chamber 14 for compressed air, or other medium under pressure, to flow from the passage 38 through the port 15 into the spiral passage 16, and be discharged at the port 17 into the cross passage 29 and longitudinal passage 30, to flow out, at the rear end of the plug 25, into a conductor or tube for final discharge into the atmosphere or otherwise.

The head or plug 25 has a screw threaded hole at the end of the longitudinal passage 24,

which receives a tube 41, and the tube 41 has entered thereinto a coupling tube 42, on which is threaded a coupling ring 43 of a supply tube 44, leading from a source of compressed air, or other medium under pressure, so as to supply the compressed air, or other medium under pressure, to the passage 24 for the air or other medium under pressure, to enter the spiral passage 21 through the port 22 and be discharged into the chamber 19 through the port 20 to act against the abutment or face 37 of the hammer and force back or recede the hammer as a whole.

The supply tube 44, for compressed air or other medium under pressure, is surrounded by a tube 45 into which the passage 30 discharges, and circumferentially around the tube 45 is a spiral flange 46, so that the tube 45, with its spiral flange, forms a conveyer or flight to coact with the spiral flanges of the hammer frame for removing the cuttings, dust and fine particles produced by the drill or other tool or instrument. The hammer frame, and the conveyer or flight are surrounded by a tube or casing 47, the lower or advance end of which abuts against the shoulders 13 of the hammer frame, as shown in Fig. 1, so that the tube or casing 47 furnishes a conduit for the operation of the hammer frame and the conveyer or flight, and a wall to support the hole formed, in the earth or other material 48, by the action of the drill or other operating tool or instrument. The outer casing or tube 47, with the hammer frame, and the conveyer or flight, all move as one, and all follow the hole produced by the drill or other tool or instrument, for which purpose the drill or other tool or instrument cuts a hole of larger diameter in cross section than the end of the hammer frame and the tool head, so as to leave a sufficient clearance for the admission of the tube or casing in following the drill or other tool or instrument.

The parts are assembled by entering the shank or stem 6 into the chamber 7 of the barrel 8, and securing the shank or stem 6 and the head 4, with the bits or cutters thereon, against dropping out from the chamber, by passing the bar or key 10 through the wall of the barrel and the slot 9 of the shank or stem. The hammer, as a whole, is entered into the chamber of the barrel rearward of the driven stem 6 of the head, and after the hammer is entered the plug or head 25 is entered into the end of the frame and the barrel, so as to close the chamber of the hammer and have the port or passage 23 in communication with the port 22, as shown in Fig. 2. The tube 41 and the coupling tube 42 are entered into position, so as to have the coupling tube receive the coupling ring 43 of the supply tube or pipe 44, and the conveyer or flight is threaded onto the flange 26 at its forward or advance end, completing the connecting up of the parts ready for use or operation of the drill, when the hammer frame, with the operating tool attached thereto and the conveyer or flight, are entered into the casing or tube, as shown in Fig. 1.

In operation, the compressed air, or other medium under pressure, flows through the tube 44 into the passage 24, and, through the port or passage 23, and the port 22, enters the spiral passage 21 to discharge at the port 20 into the chamber 19 and act against the abutment or face 37 to force back or recede the hammer, as a whole, into striking or driving position. The hammer, as a whole, is receded a sufficient distance to carry the abutment or end face 37 clear of the rear face of the wall 31, so that fluid can enter the chamber 32 to act against the end of the hammer, and so that fluid from the chamber 32 can flow through the lateral passages or ports 39 into the central passage 38 and act against the front end of the passage 38 for the pressure against the rear face of the hammer and against the end face of the passage to overcome the pressure against the abutment or end face 37 and drive forward the hammer as a whole, and in such driving forward of the hammer the admitted fluid cannot escape from the passage 38 owing to the closing of the lateral passages or ports 40, with the passing of such passages or ports within the circumferential wall 18 by the recession or forcing back of the hammer as a whole. The forward drive or thrust of the hammer, as a whole, causes its acting end or head 34 to contact the end of the driven stem 6 and drive forward the stem and with it the head 4 and the bits or cutters, or other tool, to act and perform the cutting or drilling operation. The forward throw or thrust of the hammer, as a whole, closes the ports or passages 39 by the wall 31, and opens the ports or passages 40 for communication between the passage 38 and the chamber 14, admitting fluid to the chamber 14 for the fluid to flow through the port 15, spiral passage 16, and port 17, into the cross port or passage 29, and passage 30, for discharge inside of the tube of the conveyer or flight, as shown in Fig. 2. The compressed air, or other medium under pressure, discharged at the front of the hammer, has a free passage rearward through the spiral pathway 16 in the spiral flange 11, which encircles the barrel 8, so that the driving or acting end of the hammer will have the discharged fluid carried away, leaving a clear drive for the hammer for each succeeding operation.

The cuttings, dust and fine particles, produced by the cutting or boring operation, enter the spiral pathways furnished by the spiral flanges on the exterior of the hammer frame and are carried upward or rearward by such flanges and spiral pathways to be

caught by the conveyer or flight, which acts to raise or carry back the cuttings, dust and fine particles, so that the cuttings, dust and fine particles connot accumulate around the bits or cutters and thereby interfering with the operation of the drill or other tool, and this for the reason that the cuttings, dust and fine particles are positively and effectually removed by the action of the spiral flanges on the exterior of the hammer head and the conveyer or flight coacting with said spiral flanges by which the removal of the cuttings, dust and fine particles will be accomplished as fast as produced.

The frame of the present invention, in connection with the hammer chamber and exterior spirals, and the hammer and cross head having bits or cutters, furnishes a drill by which the frame supplies the air, or other medium under pressure, to operate the hammer and discharges the compressed air, or other medium under pressure, from the forward end of the hammer, so that the acting or forward end of the hammer is maintained against any back pressure from the air, or other medium under pressure, that would interfere with the blow struck by the hammer.

The frame of the present invention, with its straight barrel and exterior spiral flanges, and the conveyer or flight coöperating with the spiral flanges is especially adapted for use in deep drilling or boring, and while the pneumatic hammer, with its exterior flanges coöperating with a conveyer or flight is shown in connection with a tool head carrying drill bits or cutters, it is to be understood that the hammer, with its straight barrel, and spiral exterior flanges for the frame, is intended for use, and can be used, with a tool head of other formation than the one shown, and for other purposes than deep drilling or boring; and that instead of two spiral flanges around the barrel of the frame, a single spiral flange running from end to end and circumferentially around the barrel could be used to coact with the conveyer or flight.

The tube or casing 47, is used in the drilling operation, where it is necessary to support the wall of the hole against crumbling or falling in; and this tube or casing follows the drilled hole and is removable with the frame, the supply tube and the conveyer, when such parts are withdrawn from the hole. When the tube or casing 47 is not used the wall of the hole furnishes the conduit for the passage of the cuttings, dust and fine particles removed by the spiral flanges or flange and the conveyer.

What I claim as new and desire to secure by Letters Patent is:

1. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber to receive the hammer, and one spiral flange having a spiral passage for inducting fluid and the other spiral flange having a spiral passage for educting fluid, with the spiral passages in communication with the chamber of the barrel, substantially as described.

2. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber divided into sections, one section to receive a driven stem and another section to receive a driving hammer, and one spiral flange having a spiral induction passage, and the other spiral flange having a spiral eduction passage for fluid, with the spiral passage of each flange in communication with the chamber of the barrel, for inducting fluid to operate the hammer and educting fluid from in front of the acting end of the hammer, substantially as described.

3. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber provided with a fluid eduction section for discharging fluid and a fluid induction section within which inducted fluid may act to recede and drive forward the hammer, one spiral flange having a spiral passage for fluid in communication with the fluid induction section of the chamber of the barrel and the other spiral flange having a rearwardly extending spiral eduction passage for fluid in communication with the fluid eduction section of the chamber of the barrel, and a driving hammer operative in the chamber of the barrel and against which admitted fluid from the induction passage of the flange acts to recede and drive forward the hammer, substantially as described.

4. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber and one spiral flange having a spiral induction passage for fluid in communication with the chamber of the barrel and the other spiral flange having a rearwardly extending spiral eduction passage for fluid in communication with the chamber of the barrel, a driving hammer operative in the chamber of the barrel and against which admitted fluid from the induction passage of the flange acts to recede and drive forward the hammer, and a driven stem operative in the chamber of the barrel in advance of the hammer, substantially as described.

5. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in

opposite directions on the barrel, the barrel having a central chamber provided with a fluid eduction section for discharging fluid and a fluid induction section within which inducted fluid may act to recede and drive forward the hammer, one spiral flange having a spiral induction passage for fluid in communication with the fluid induction section of the chamber of the barrel and the other spiral flange having a rearwardly extending spiral eduction passage for fluid in communication with the fluid eduction section of the chamber of the barrel, a driving hammer operative in the chamber of the barrel and against which the admitted fluid from the induction passage of the flange acts to recede and drive forward the hammer, and a driven stem operative in the chamber of the barrel in advance of the hammer, substantially as described.

6. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber adapted to receive a driving hammer, one spiral flange having a spiral induction passage for fluid in communication with the chamber of the barrel and the other spiral flange having a rearwardly extending spiral eduction passage for fluid in communication with the chamber of the barrel, a fluid supply tube connected with the rear end of the frame, and a tube encircling the fluid supply tube and attached to the rear end of the frame and having on its exterior a spiral conveyer flight coöperating with the spiral flanges of the barrel, substantially as described.

7. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber, one spiral flange having a spiral induction passage for fluid in communication with the chamber of the barrel and the other spiral flange having a rearwardly extending spiral eduction passage for fluid in communication with the chamber of the barrel, a driving hammer operative in the chamber of the barrel and against which the admitted fluid from the induction passage of the flange acts to recede and drive forward the hammer, a fluid supply tube connected with the rear end of the frame, and a tube encircling the fluid supply tube and attached to the rear end of the frame and having on its exterior a spiral conveyer flight coacting with the spiral flanges of the barrel, substantially as described.

8. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber, one spiral flange having a spiral induction passage for fluid in communication with the chamber of the barrel and the other spiral flange having a rearwardly extending spiral eduction passage for fluid in communication with the chamber of the barrel, a driving hammer operative in the chamber of the barrel and against which the admitted fluid from the induction passage of the flange acts to recede and drive forward the hammer, a driven stem operative in the chamber of the barrel in advance of the hammer, a fluid supply tube connected with the rear end of the frame, and a tube encircling the fluid supply tube and attached to the rear end of the frame and having on its exterior a spiral conveyer flight coacting with the spiral flanges of the barrel, substantially as described.

9. In a pneumatic hammer, the combination of a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, the barrel having a central chamber to receive a driving hammer and a driven stem, a closing plug for the rear end of the frame and the chamber of the barrel, and a conveyer connected with the closing plug, for the spiral flanges on the barrel in connection with the conveyer to act to remove the cuttings, dust and fine particles, substantially as described.

10. In a pneumatic hammer, the combination of a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, and a spiral conveyer connected with the frame for the spiral flanges on the barrel in connection with the spiral conveyer to act and remove cuttings, dust and fine particles, substantially as described.

11. In a pneumatic hammer, the combination of a frame consisting of a straight central barrel and a spiral flange on the barrel and extending from end to end of the barrel, and a spiral conveyer connected with the frame and coöperating with the spiral flange for removing cuttings, dust and fine particles, substantially as described.

12. In a pneumatic hammer, a frame consisting of a straight central barrel and a spiral flange circumferentially on the barrel and running from end to end of the barrel, an operating tool carried by the frame, and a spiral conveyer connected with the frame for the spiral flange on the barrel in connection with the spiral conveyer to act and remove cuttings, dust and fine particles, substantially as described.

13. In a pneumatic hammer, a frame consisting of a straight central barrel and spiral flanges encircling the barrel and running in opposite directions on the barrel, a spiral conveyer, connected with the frame, and a casing surrounding the spiral flanges of the frame

and the spiral conveyer for the spiral flanges on the barrel and in connection with the spiral conveyer to act and remove cuttings, dust and fine particles within the outer casing, substantially as described.

14. In a pneumatic hammer, a frame consisting of a straight central barrel and a spiral flange circumferentially on the barrel and running from end to end of the barrel, a spiral conveyer connected with the frame, and a casing surrounding the spiral flange and the spiral conveyer, for removing cuttings, dust and fine particles within the casing, substantially as described.

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