No. 890,978. PATENTED JUNE 16, 1908.

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PNEUMATIC DRILL.

APPLICATION FILED APR. 13, 1907.

Fig. 1.

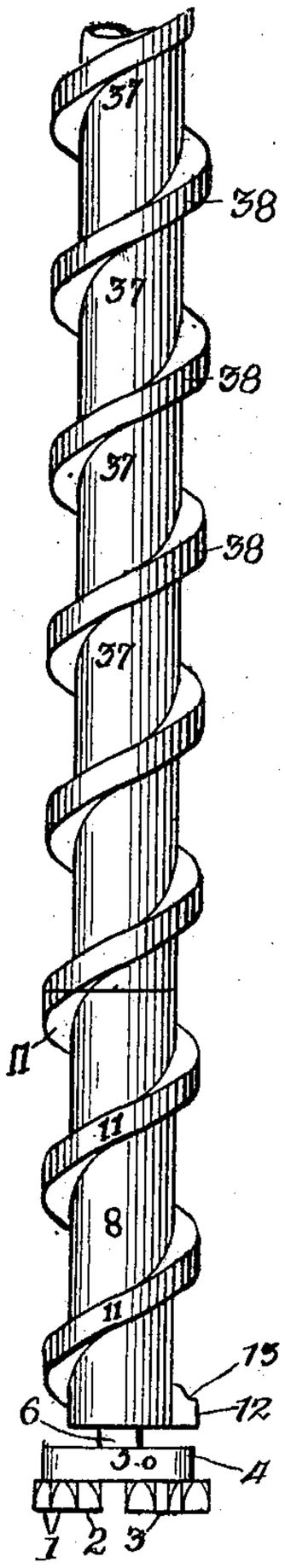


Fig. 5.

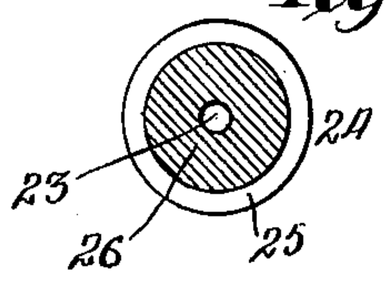


Fig. 4.

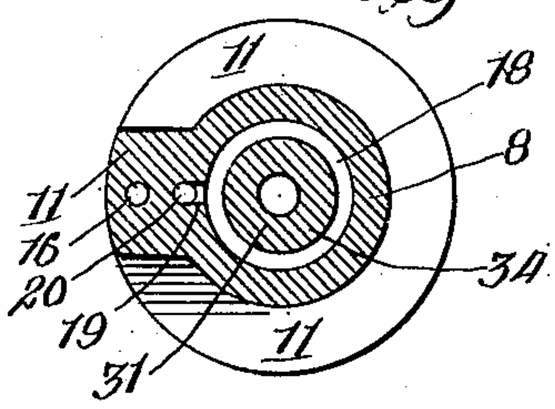


Fig. 3.

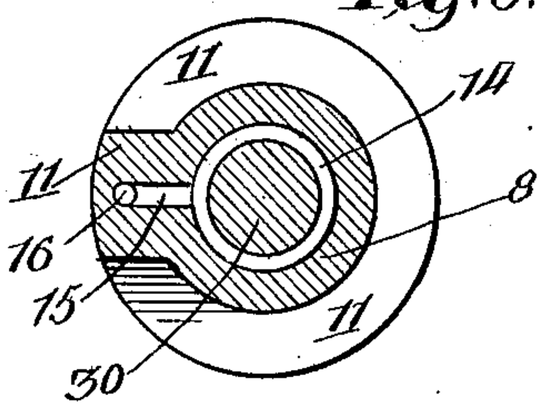
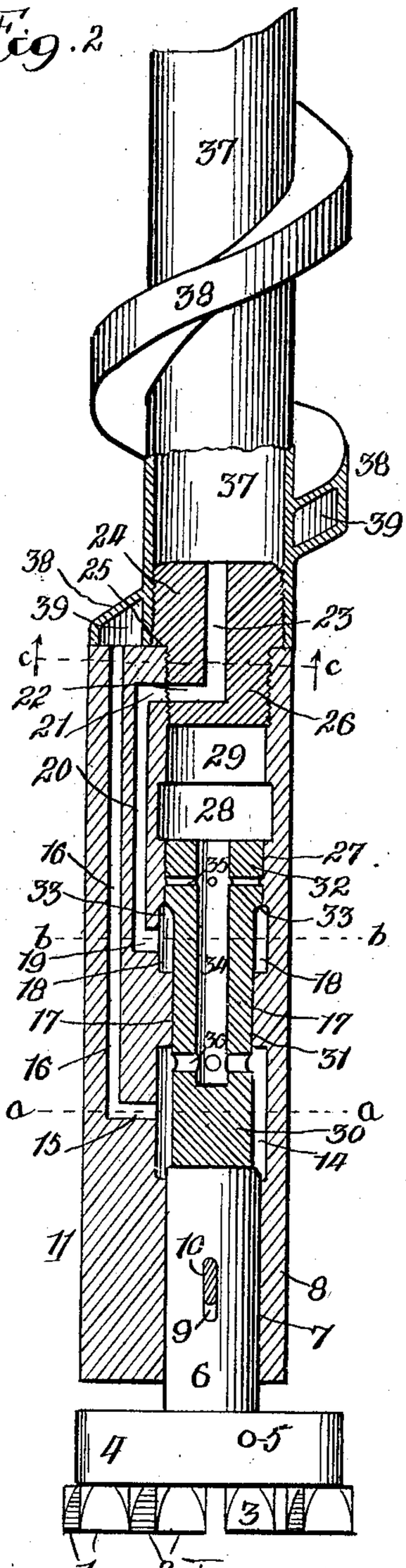


Fig. 2.



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UNITED STATES PATENT OFFICE.

MARTIN HARDSOCG, OF OTTUMWA, IOWA.

PNEUMATIC DRILL.

No. 890,978. Specification of Letters Patent. Patented June 16, 1908.

Application filed April 13, 1907. Serial No. 367,942.

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 Drills, of which the following is a specification.

The present invention relates more particularly to the construction and arrangement of the hammer frame and the cross head carrying the operating tool, such as the bit or cutter of a pneumatic drill, so as to have the hammer frame coact with a conveyer or flight for removing the cuttings, dust and fine particles produced by the operation of the tool.

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 rearwardly discharged to maintain a perfect clearance in front of the hammer for each forward thrust or blow of the hammer; to construct a frame for a pneumatic hammer so as to provide a barrel, with a chamber for the hammer and for the shank or stem of the cross head of the tool, and having passages for admitting air, or other medium under pressure, to reciprocate the hammer, and to discharge the air, or other medium under pressure, rearward from in front of the hammer; to construct a frame having a central barrel with a hammer therein and having, circumferentially around the barrel, a spiral flange with passages and ports for admitting compressed air, or other medium under pressure, to the chamber of the barrel, and discharging the air, or other medium under pressure, rearwardly from the front of the hammer head; to furnish a frame with a central chamber, and with side passages and ports for admitting and discharging compressed air, or other medium under pressure, into and from the chamber; to furnish a frame having a central chamber with induction and eduction passages therefor, and a plug having an induction passage in communication with the induction passage of the frame, and closing the end of the chamber, for admitting compressed air, or other medium under pressure, to the chamber; to furnish a frame consisting of a barrel and a spiral flange encircling the frame and extending the full length of the frame and having induction and eduction passages, both in communication with the chamber of the barrel; to furnish a hammer frame having a barrel and a spiral flange encircling the barrel and acting as a conveyer to coöperate with a spiral flange serving as a conveyer and encircling the tube carrying the hammer frame; and to improve generally the construction and operation of the frame and the co-related conveyers or flights entering into the formation of the pneumatic drill 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 side elevation showing the hammer frame, the supply pipe, and the spiral flanges on the frame and pipe, serving as a conveyer or flight for removing the cuttings, dust and fine particles from in front of the tool; Fig. 2 a sectional elevation of the hammer frame, with the spiral flange unfolded in order to clearly illustrate the induction and eduction passages in the spiral flange, and with the fluid supply pipe or tube and its flange partly in section and partly in full elevation; Fig. 3 a cross section on line *a*—*a* of Fig. 2; Fig. 4 a cross section on line *b*—*b* of Fig. 2; and Fig. 5 a cross section of the closing plug for the end of the barrel chamber on line *c*—*c* of Fig. 2, looking in the direction of the arrow.

The drill, as shown, has a head with a plurality of bits or cutters, but other forms of bits or cutters could be used. The arrangement shown has, at each end of the drill head, an outer or end bit or cutter 1, with an intermediate cutter 2 and an intermediate cutter 3, so that the head has a plurality of bits or cutters. 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 or stem 6 to enter the chamber 7 of the barrel 8 of the frame, and, as shown, the shank or stem 6 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 around the barrel a spiral flange 11, which extends longitudinally of the barrel from end to end, so as to furnish a continuous spiral pathway of travel around the barrel from end to end. The spiral flange

11, at the forward end of the frame, has a projection 12 forming a shoulder 13, which shoulder furnishes a rest for an encircling tube, when used with the drill. 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, which port communicates with a longitudinal spiral passage 16, formed in the spiral flange 11, and opening through the flange at the rear end thereof.

The barrel 8 has an interior circumferential wall 17 located between the chamber 14 and a chamber 18; and from the chamber 18 a port 19 leads, which port is in communication with a longitudinal spiral passage 20, formed in the spiral flange 11, and the spiral passage 20, at its rear or receiving end, has a port 21 leading inwardly therefrom.

The port 21 communicates with a cross passage 22, with which a longitudinal passage 23 communicates, and the cross passage 22 and longitudinal passage 23 are formed in a head 24, having a shoulder 25 and a neck 26, with an exterior screw thread for entering the neck in the end wall of the frame and barrel, as shown in Fig. 2, with the shoulder 25, between the head and neck, closely fitting against the end of the frame and barrel and so that the head with its longitudinal and cross passages will furnish a conduit or passage for supplying compressed air, or other medium under pressure, to the spiral side passage 20 of the flange. The barrel has an interior circumferential wall 27 located between the chamber 18 and a chamber 28, which chamber 28 is continued as a chamber or hole 29, which receives the neck 26 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 head or plug.

The barrel has located therein, rearward of the shank or driven stem 6, a hammer having a driving end or head 30 continued as a body 31, guided and held between the circumferential wall 17, and terminating at its rear end with an enlarged portion or head 32, guided and held in the circumferential wall 27, furnishing an abutment or face 33 against which the compressed air, or other medium under pressure, admitted to the chamber 18 from the spiral passage 20, through the port 19, acts to recede or force back the hammer as a whole. The body 31 of the hammer has a central passage 34 extending longitudinally therein and opening at its rear end through the head 32, from which passage 34, lateral ports or passages 35 lead through the head 32, so that when the hammer is receded, communication is established with the chamber 28, admitting compressed air, or other medium under pressure, back of the rear end of the hammer and to the passage 34, for the air, or other medium under pressure to act and thrust or drive forward the hammer as a whole. The passage 34, adjacent to its forward end, has leading therefrom lateral passages or ports 36, to furnish communication between the passage 34 and the chamber 14, for compressed air, or other medium under pressure, to flow from the passage 34 into the chamber 14, and through the port 15 into the spiral passage 16, to be discharged at the rear end of the passage 16 and at the rear of the hammer frame.

The head or block 24 has an exterior screw thread onto which is entered the forward end of a supply tube 37, for the tube to carry and support the hammer frame and the tool; and the tube 37 has circumferentially thereabout a spiral flange 38, forming a conveyer or flight to coact with the spiral flange circumferentially around the hammer frame and furnish a means for removing the cuttings, dust and fine particles; and the spiral flange 38 is hollow and has a passageway 39 into which the eduction passage 16 opens, when the hammer frame is connected with the pipe or tube 37, so that the educted fluid from the chamber 14, in front of the driving end of the hammer, will escape into the passageway or passage 39 and be discharged at the rear end of the supply and carrying tube, so as not to interfere with the operation of the conveyer or flight in removing the cuttings, dust and fine particles.

The parts are assembled by inserting the shank or stem 6 of the cross head into the chamber of the barrel and securing the stem in place by the key and slot, so that the stem with the cross head and tool cannot drop out in operating the drill. The hammer is entered into the chamber of the barrel 8 rearward of the driven shank or stem 6 of the cross head, and after the hammer is entered the neck 26 of the head or plug 24 is threaded into the end of the frame and barrel, so as to close the chamber of the hammer and have the port or passage 22 in communication with the port or passage 21, as shown in Fig. 2. The tube or pipe 37 is coupled onto the plug 24, so as to furnish a means for supplying air, or other medium under pressure, to the chamber of the barrel, and so as to complete the conveyer or flight from the forward end of the hammer frame to the rear end of the tube or pipe 37; and while, as shown, the tube or pipe 37 furnishes the conduit for the compressed air, or other medium under pressure, an independent supply pipe or tube could be entered into the end of the passage 23, for supplying compressed air, or other medium under pressure, to operate the hammer in the chamber of the barrel.

In operation, the compressed air, or other medium under pressure, flows through the passage 23 from the supply tube 37, or independent supply tube, if used, and through the cross passage 22 enters the spiral passage

20 through the port 21, to discharge at the port 19 into the chamber 18 and act against the abutment or end face 33 to force back or recede the hammer, as a whole, into the striking or driving position. The hammer, as a whole, is receded the distance required to carry the abutment or end face 33 beyond the rear face of the wall 27, so that fluid can enter the chamber 28 to act against the rear end of the hammer and flow from such chamber through the lateral passages or ports 35 into the central passage 34, and act against the front end of the passage 34 for the pressure against the rear face of the hammer and against the end face of the passage 34 to overcome the pressure against the abutment or end face 33, and drive forward the hammer, as a whole, and in such driving forward of the hammer the admitted fluid cannot escape from the passage 34 owing to the closing of the lateral passages or ports 36, with the passing of such passages within the circumferential wall 17 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 striking end or head 30 to contact the end of the driven shank or stem 6, and drive forward the stem or shank, and with it the head 4 and the bits or cutters, or other tool carried thereby, causing the bits or cutters, or other tool, to act and perform the cutting or boring operation. The forward throw or thrust of the hammer, as a whole, closes the ports or passages 35 by the wall 27, and opens the ports or passages 36 for communication between the passage 34 and the chamber 14, admitting fluid to the chamber 14 for the fluid to flow through the port 15 and spiral passage 16 and discharge at the rear end of the passage 16, into the passage 39 of the spiral flange 38 to be discharged at the rear end of the spiral flange 38, relieving the striking end of the hammer from any counter or back pressure, and thus giving a clear space for the succeeding thrust or drive of the hammer.

The compressed air, or other medium under pressure, from in front of the driving hammer, has a free passage back through the interior passage of the spiral flange around the barrel and the interior passage of the spiral flange around the supply and supporting tube, so as not to interfere with the removal of the cuttings, dust and fine particles. The cuttings, dust and fine particles, produced by the cutting or boring operation, are received into the exterior spiral pathway furnished by the spiral flange encircling the hammer frame, and are delivered by the exterior spiral pathway around the frame to the exterior spiral pathway furnished by the spiral flange around the supporting tube of the hammer frame, so that the conveyer or flight formed by the spiral flanges on the hammer frame and the supporting tube will carry rearward the cuttings, dust and fine particles from in front of the bit or cutter, or other tool, clearing the bit or cutter, or other tool, from the cuttings, dust and fine particles, and preventing any accumulation of the cuttings, dust and fine particles that would interfere 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 conveyer or flight of the hammer frame and supporting tube, and such removal will be had as fast as the cuttings, dust and fine particles are produced.

The frame of the present invention, in connection with the cross head and bits or cutters carried thereby, furnishes a drill especially adapted for use in horizontal cutting, drilling or boring, and by which the frame supplies the air, or other medium under pressure, to operate the hammer, and furnishes a means for discharging the compressed air, or other medium under pressure, from in front of the hammer head, so as not to create a back pressure that would interfere with the strike or blow of the hammer; and the conveyer or flight, formed by the spiral flange on the hammer frame and the spiral flange on the supporting tube, furnishes a means for removing the cuttings, dust and fine particles from in front of the bit or cutter, for the cuttings, dust and fine particles to be carried away horizontally and not interfere with the operation of the bits or cutters, or other tool.

The frame of the present invention, with its exterior spiral flange, and the supporting tube with its exterior spiral flange, can be used for cutting, boring or drilling vertically as well as horizontally, as the conveyer or flight will operate to carry upward the cuttings, dust and fine particles, when the drill is used vertically; and while the pneumatic hammer is shown in connection with a drill head carrying drill bits or cutters, it is to be understood that the hammer with its spiral exterior flange encircling the barrel, and the supporting tube with its exterior spiral flange, can be used with a tool head of other formation than the one shown, and for other purposes than horizontal cutting, boring or drilling.

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 a spiral flange encircling the barrel from end to end, the barrel having a central chamber to receive the hammer and the spiral flange having a spiral passage, for inducting fluid to operate the hammer, and a spiral passage, for educting fluid rearward from in front of the hammer, with both 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 a spi-

ral flange encircling the barrel from end to end, 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 the spiral flange having a spiral passage for inducting fluid to operate the hammer and a spiral passage for educting fluid rearwardly from in front of the driving hammer, with both spiral passages in communication with the chamber of the barrel, substantially as described.

3. In a pneumatic hammer, a frame consisting of a straight central barrel and a spiral flange encircling the barrel from end to end, 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 the spiral flange having a spiral induction passage for inducting fluid to drive the hammer and a spiral eduction passage for educting fluid rearward from in front of the driving hammer, with both passages in communication with the chamber of the barrel, and with the spiral eduction passage opening through the rear end of the spiral flange, substantially as described.

4. In a pneumatic hammer, a frame consisting of a straight central barrel and a spiral flange encircling the barrel from end to end, the barrel having a central chamber divided into a plurality of sections, providing a section forming a bearing for a driven stem, a section forming an eduction chamber for discharging fluid, a section forming a bearing for a driving hammer, a section forming an induction chamber for fluid to act and recede the hammer, and a section forming a chamber to receive fluid for acting on and driving the hammer, and the spiral flange having a spiral induction passage for fluid in communication with the fluid induction chamber of the barrel, and a spiral eduction passage for fluid, in communication with and leading rearwardly from the eduction chamber of the barrel and discharging at the rear end of the flange, substantially as described.

5. In a pneumatic hammer, a frame consisting of a straight central barrel and a spiral flange encircling the barrel from end to end, the barrel having a central chamber to receive a hammer and a driven stem, and the spiral flange having a spiral passage for inducting fluid and a spiral passage for educting fluid rearwardly leading from in front of the hammer, a supporting tube carrying the frame, and a spiral flange encircling the supporting tube and having a spiral passage therein in communication with the spiral eduction passage of the hammer frame, for discharging fluid at the end of the supporting tube and for the spiral flanges of the hammer frame and the supporting tube to furnish a spiral pathway for positively removing cuttings, dust and fine particles from the front end of the frame, substantially as described.

6. In a pneumatic hammer, a frame consisting of a central barrel and a spiral flange encircling the barrel from end to end, the spiral flange having an eduction passage for fluid, and a supporting tube carrying the frame and having a hollow spiral flange encircling the tube, for educting fluid and furnishing a spiral pathway for positively removing cuttings, dust and fine particles from the front end of the frame, substantially as described.

7. In a pneumatic hammer, a frame consisting of a straight central barrel and a spiral flange encircling the barrel from end to end and having a spiral passage for educting fluid from the chamber of the barrel, and a supply tube for fluid carrying the frame and inducting fluid to the chamber of the barrel for actuating the hammer and having a hollow spiral flange encircling its exterior with the passage of the flange in communication with the eduction passage of the frame for educting fluid from the barrel, and furnishing, by the spiral flanges of the barrel and tube, a spiral pathway for positively removing cuttings, dust and fine particles from the front end of the frame, substantially as described.

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