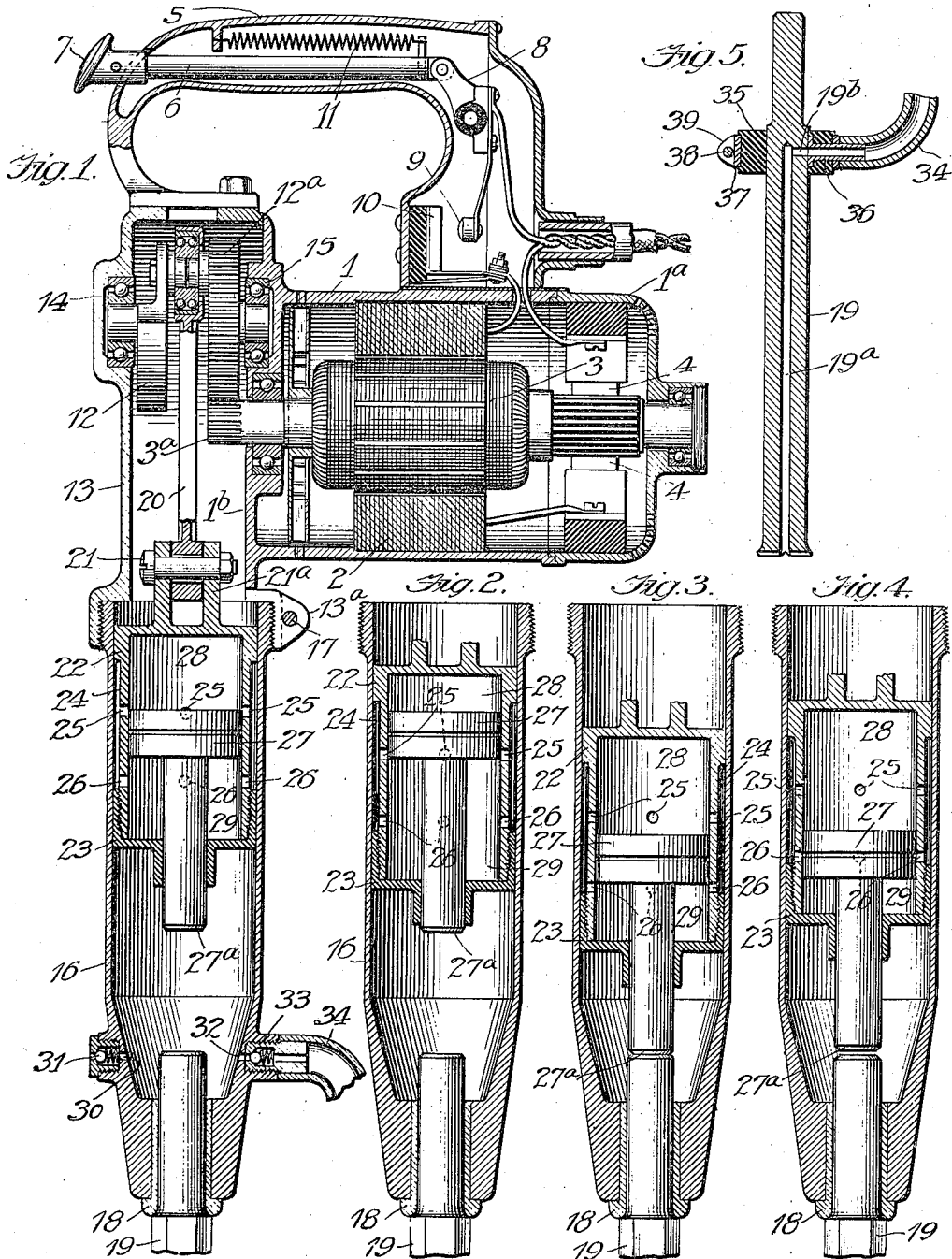


C. B. COATES.
POWER HAMMER.
APPLICATION FILED NOV. 9, 1914.

1,191,948.

Patented July 25, 1916.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 10.

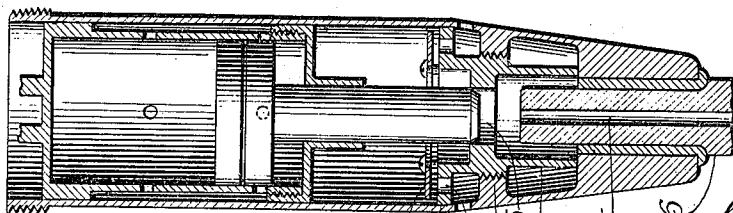


Fig. 9.

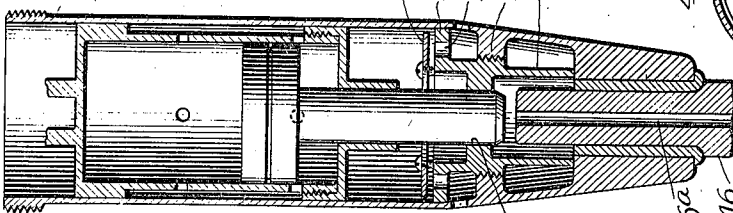


Fig. 8.

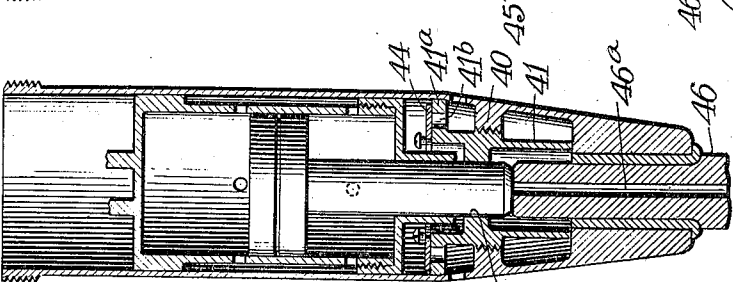


Fig. 7.

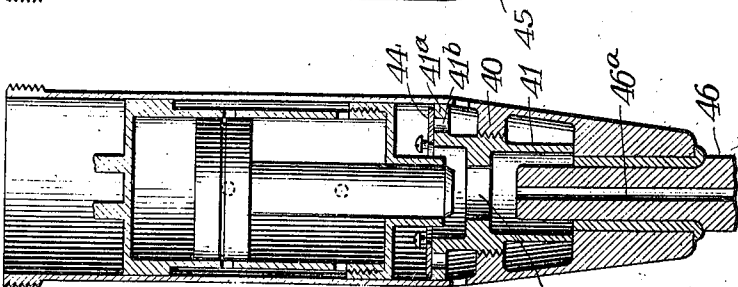


Fig. 6.

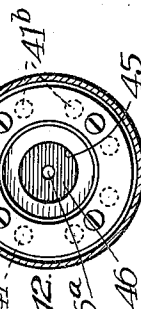
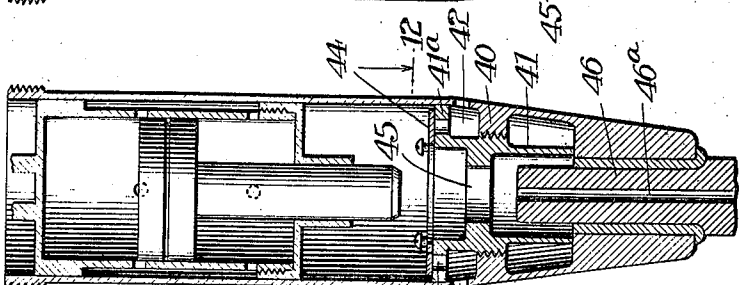


Fig. 12.

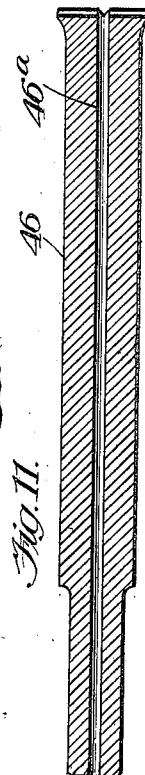


Fig. 11.

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POWER-HAMMER.

1,191,948.

Specification of Letters Patent.

Patented July 25, 1916.

Application filed November 9, 1914. Serial No. 870,986.

To all whom it may concern:

Be it known that I, CHARLES B. COATES, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Power-Hammers, of which the following is a specification.

My invention relates to a power hammer preferably, though not necessarily, operated by an electric motor as the prime mover and adapted to hammering purposes such as chipping, drilling or riveting by means of a chisel, drill, rivet set, or the like, to one end of which the striking member of the drill imparts its blow.

The object of my invention is to provide a simple, efficient and reliable machine of this character, characterized more particularly by the employment of a hollow cylinder directly reciprocated by the electric or other type of motor and containing the hammering piston, the construction and arrangement of the parts being such as to cause such piston to deliver quick, snappy and powerful blows upon the inner end of the shank of the working tool inserted into the front end of the barrel within which the hollow cylinder is reciprocated.

Another object of my invention is to provide simple and efficient means for blowing out the cuttings, etc., in a hole being drilled, such means being adapted to pump or force air from the front end of the barrel into and through the hollow working tool. I also provide means whereby this pumping mechanism is compelled to draw its supply of air direct from the atmosphere and prevent it from drawing it through the working tool which is objectionable owing to the fact that such air would be charged with the dust and dirt created by the drilling operation.

Other features of advantage and utility in my power hammer will be apparent from the description hereinafter given.

In the drawings Figure 1 is a central sectional elevation of my power hammer; Figs. 2, 3 and 4 sections of the barrel and contained parts showing the hollow cylinder and the piston in its different positions; Fig. 5 a longitudinal section of the working tool shown in the foregoing figures; Fig. 6 a sectional elevation of a modified form of construction of barrel showing a different means for blowing out the hole and employing the working tool with a bore extending

the full length; Figs. 7, 8, 9 and 10 views similar to Fig. 6 but showing the hollow cylinder and piston in their different positions occupied during a cycle of operation; Fig. 11 a longitudinal section of the working tool shown in Figs. 6 to 10 and Fig. 12 a section on the line 12—12 of Fig. 6.

My hammer is a power hammer operated preferably directly by a prime mover located in the hammer structure itself and while any suitable motor may be employed as such prime mover, I prefer an electric motor because it is the most convenient and compact and also the most desirable because electric current which is available everywhere can be supplied thereto at any distance through cables. My invention will therefore be described in connection with an electric motor located in the hammer structure itself as the prime mover without intention or limitation thereto.

Referring first to the construction illustrated in Figs. 1 to 5, the machine comprises essentially the motor structure and its housing or casing at the upper or rearward end of the tool and a barrel connected therewith and containing the working parts, one of which is operated directly by the motor, the barrel also being adapted to receive the working tool at its lower or forward end. Referring to the details of the construction shown, the motor which is here an electric motor of any desired type is provided with a casing or housing 1 in which are contained and supported the usual electric motor elements such as the stator or field structure 2, the rotor or armature 3 and the brushes 4, (as in the case of a direct current or a single phase commutator type.) The armature shaft is journaled at its ends respectively in the removable end head or cap 1^a and the end head 1^b which is here shown as integral with the casing 1, the armature shaft at this end projecting through this latter end head. For the convenient handling of the tool, a handle 5 is provided in which a switch is mounted for the control of the current to actuate the motor. As shown a rod 6 with a thumb-piece 7 is mounted in the grasping portion of the handle with its outer end in convenient reach of the thumb or finger of the operator, with the result that the movement of the rod is communicated by means of a bell crank 8 to a switch contact 9. When the

thumb-piece 7 is pressed down, that is inwardly, the switch contact 9 is forced into contact with a carbon block 10 and the circuit to the motor is completed through suitable wiring. The movement of the switch is against the tension of a spring 11 which returns the thumb-piece 7 and consequently opens the circuit when the pressure on such thumb-piece is removed. The switch contacts are of course electrically insulated from the handle and the metallic structure of the tool.

Referring to the operating connections between the armature shaft and the hollow cylinder of the machine or tool hereinafter specifically described, a counterbalanced center crank 12 is arranged at one side of the motor casing and inclosed by a crank case 13 secured to the motor casing. One of the bearings 14 of the crank is mounted in the crank case 13 and the other in the end head or plate 1^b of the motor casing. In the present instance one of the crank disks 12^a is formed as a gear which meshes with a pinion 3^a secured to or formed on the outer or exposed end of the armature shaft. In the present instance this armature pinion is cut directly on the armature shaft itself.

The hammer barrel 16 which may be of suitable dimensions is adapted to be secured in the lower end of the crank case 13. In the present instance this barrel is screw-threaded at its upper end in order to screw into the crank case which is split at its end and provided with a clamping bolt 17 engaging two similar lugs 13^a (one of which is shown in Fig. 1) for the purpose of providing a clamp to prevent the barrel from unscrewing. The lower end of the barrel is provided with an opening in which by preference is arranged a bushing 18 to receive the shank of the chisel or drill 19.

The crank 12 is provided with a connecting rod or pitman 20 provided on one end with a suitable bearing to fit the crank pin of the crank and on the other end with a bearing to fit a pin 21 which passes through the parallel lugs 21^a on the upper end of a cylinder 22. This cylinder is hollow, being closed at its upper end preferably by an integral head and closed at its lower end preferably by a removable head 23 screw-threaded onto the lower end of the cylinder body. This cylinder taken as a whole is reduced in diameter as to its intermediate portion in order to form an annular space 24 between the inner walls of the barrel and the said intermediate portion of the hollow cylinder. In practice and as shown, the upper end of the cylinder is turned to form a sliding fit in the bore of the barrel. The cylinder head 23 is likewise turned to form a sliding fit in the bore of the barrel so that when it is incorporated with the cylinder body, the cylinder structure has a sliding fit within the

barrel by reason of the provision of end heads thereof as described. The cylinder is provided with two sets of holes 25 and 26 passing through its walls and communicating between the interior of the cylinder and the annular space 24. I prefer that each set shall consist of a series of holes although one hole if of proper area or carrying capacity would be sufficient. The two sets of holes are arranged in two parallel planes and at such distance from the ends of the cylinder that the piston 27 located therein shall be enabled to trap the air at the ends of the cylinder and be compressed thereby as required in the operation of the machine. The piston 27 is a hammering piston, the same being provided with a head which fits the bore of the cylinder 22 and with a stem or extension 27^a which fits a central bore in the cylinder head 23. It will be understood that both the head and the stem have sliding fits in the bores in which they travel.

Describing a cycle of operation and beginning with the parts in their relative positions shown in Fig. 1 at which time the cylinder 22 is slightly below the uppermost position and is on its downward stroke, the space 28 behind or above the piston 27 and the space 29 below or in front of such piston are in communication through the holes 25 and 26 and the annular air space 24 acting as a by-pass between said air spaces 28 and 29 so that the air pressure therein is the same. The cylinder 22 is now being forced downwardly, that is forwardly, by means of the electric motor and the crank and the piston 27 being free in the cylinder lags therebehind in its downward movement owing to its inertia, but when the cylinder is moved downwardly sufficiently far in relation to the piston 27 so that the holes 25 are cut off by the piston from further communication with the air space 28, the air in such space is compressed between the rearward end of the piston and the upper head of the cylinder. When this compression is sufficient to overcome the inertia of the piston, the latter then travels in unison with the cylinder, this condition being illustrated in Fig. 2. When the crank reaches its lowermost position, the movement of the cylinder momentarily stops and the compressed air in the space 28 drives the piston downwardly and causes its stem 27^a to deliver a sharp and snappy blow on the end of the shank of the chisel or drill, as shown in Fig. 3. It is to be noted that the holes 25 and 26 are now all in communication with the air spaces 24, 28 and 29 so that there is no back pressure below the piston head nor any reduction in pressure above it to retard the blow.

In Fig. 4 the cylinder is shown as starting upwardly with the piston slightly above

the drill shank due to the rebound after the blow and lagging behind the movement of the cylinder owing to inertia. The communication between the spaces 24, 28 and 29 has been cut off due to the closing of the holes 26 by the piston head and the air in the cavity 29 is now being compressed. When the upper end of the stroke of the cylinder is reached the piston is restored to the position shown in Fig. 1 by the expansion of the compressed air in the space 29. This completes a cycle of operation of the machine.

While in the foregoing description I have referred to the outer or forward end of the tool it will be understood that this is the proper description when the tool is held in this downward position as shown in the drawings. However, it is obvious that the tool is capable of working in any desired position, even in an inverted position, inasmuch as the action depends largely on the inertia of the piston.

If desired the tool or machine may be provided with a blowing arrangement for blowing out the dust and cuttings from the hole, the necessary compressed air for this purpose being produced by the machine in its operation. In Fig. 1 I have shown one form of such blowing arrangement and another form is shown in Figs. 6 to 12.

Referring to the form illustrated in Fig. 1, the lower end of the barrel is provided with an inlet port 30 communicating directly with the atmosphere and governed by a check valve 31. This end of the barrel is also provided with an outlet port 32 which is governed by an outlet or discharge valve 33. The discharge port communicates by means of a suitable flexible pipe or hose with the drill steel 19 which in this particular instance has a central bore or passage 19^a which extends from the cutting end of the tool toward the inner or shank end thereof as illustrated in Fig. 5 but not entirely through the tool. The upper end of this passage has a lateral passage or port 19^b which is adapted to communicate with the hose 34. In the present instance I attach the delivery end of the hose to the drill steel in a removable manner and by the means illustrated in Fig. 5, although other means might be adopted for the purpose. As shown a yielding bushing or collar 35 preferably made of rubber, fits over the drill steel at a point adjacent the port 19^b and a bushing or nipple 36 is passed through an opening in one side of such rubber collar, to which nipple the hose is attached. The rubber collar is held in place by means of a split ring or strap 37 surrounding the same which is clamped onto the collar by means of the clamping bolt 38 passing through the lugs 39.

In Figs. 6 to 12 I have shown a modified

form of construction as respects the blowing arrangement, the construction and mode of operation of the hammering elements of the machine being the same as in the form above described. In this modified form the front end of the barrel is provided on its interior with an annular screw-threaded flange 40 into which the intermediate portion of a bushing 41 screws. The upper end of this bushing is provided with a marginal flange 41^a provided with a series of ports 41^b. This flange tightly fits the inner walls of the barrel and forms an annular space or chamber 42 between such marginal flange 41^a and the annular flange 40. This chamber is provided with a series of inlet ports 43 and the series of ports 41^b is governed by a suitable check valve such as the flat ring 44 which is adapted to rise to open the ports 41^b on the suction stroke of the cylinder 22 and to close on the other or forward stroke thereof. The bushing 41 has a central restricted bore 45 which is of the same diameter as the stem of the piston so that the latter has a sliding fit therein for a purpose hereinafter explained. In this instance the working tool 46 has a central bore or passage 46^a which extends the entire length so that the space within the bushing 41 communicates with such passage and is adapted to convey any compressed air therein to the end of the tool.

Referring to the operation of the blowing arrangement, and starting with the position of the parts as shown in Fig. 6, the cylinder 22 is now on its downward or forward movement, with the result that the air in front is forced from the barrel and through the working tool to the hole being drilled or the work being done. The maximum of the compressing movement of the cylinder 22 is substantially shown in Fig. 7 and although the cylinder 22 moves forwardly slightly more than therein shown the stem of the piston moves rapidly forwardly to deliver its blow and in doing so passes through the port or passage 45 in the bushing 41, thereby closing the space in front of the piston from the space in the forward end of the bushing. On the return or upward movement of the cylinder 22 the piston and its stem lags behind as hereinbefore explained and thereby keeps the port 45 closed during substantially the entire period of the upward movement of the cylinder so that at this time the fresh air from the atmosphere is drawn inwardly through the ports 43 and 41^b and into the forward end of the barrel in advance of the cylinder 22 and in rear of the bushing 41. Not until this supply or charge of fresh air is sucked into the barrel does the stem of the piston clear the port 45. The object and purpose of this construction is to assure the pumping of fresh air and the preventing of any suck-

ing of air mingled with dust upwardly through the working tool with the obvious disadvantages.

I claim:

- 5 1. In a power hammer, the combination of a barrel, a power operated hollow cylinder slidably fitting therein and having complete circumferential contact with the interior walls of the barrel, said cylinder
10 having ports in two different points intermediate its length and communicating with the interior of the cylinder, means affording communication between the two ports, said barrel walls being imperforate with respect
15 to the external atmosphere where traversed by the cylinder; and a piston movable in the cylinder and having a stem projecting through one end of the cylinder and adapted to deliver its blow upon a working tool.
- 20 2. In a power hammer, the combination of a barrel, a power operated hollow cylinder slidably fitting therein and having complete circumferential contact with the interior
25 walls of the barrel, said cylinder having ports in two different points intermediate its length and communicating with the interior of the cylinder; one of said parts having means of communication between the two ports, and
30 a piston movable in the cylinder and having a stem projecting through one end of the cylinder and adapted to deliver its blow upon a working tool.
3. In a power hammer, the combination of
35 a barrel, a power operated hollow cylinder reciprocable therein and having its intermediate portion reduced in diameter to form

an annular air space between it and the inner walls of the barrel, said barrel walls being imperforate where traversed by the cylinder, and the cylinder having ports in
40 two different points intermediate its length communicating between its interior and said annular space, and a piston movable in the cylinder and having a stem projecting
45 through one end of the cylinder and adapted to deliver its blow upon a working tool.

4. In a power hammer, the combination of a barrel, a power operated hollow cylinder reciprocable therein and having its intermediate portion reduced in diameter to form
50 an annular air space between it and the inner walls of the barrel, said barrel walls being imperforate where traversed by the cylinder, and the cylinder having ports in two different points intermediate its length
55 communicating between its interior and said annular space, and a piston movable in the cylinder and having a stem projecting through one end of the cylinder and adapted to deliver its blow upon a working tool,
60 said ports being arranged at a distance from the ends of the cylinder to provide air compression spaces for the piston after closing the ports and such ports together with the
65 annular space forming a by-pass for the air on opposite sides of the piston when the latter is in a position between the two ports.

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