April 12, 1932. S. E. MORTIMER 1,853,695

PNEUMATIC IMPROVEMENT FOR SOLENOID HAMMERS

Filed Feb. 25, 1930 2 Sheets-Sheet 1

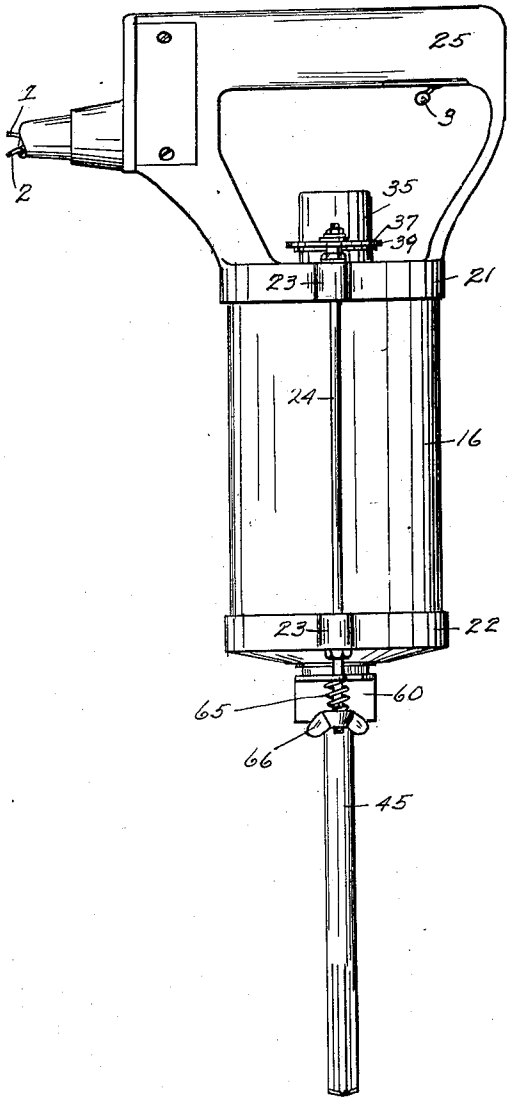

FIG. 1

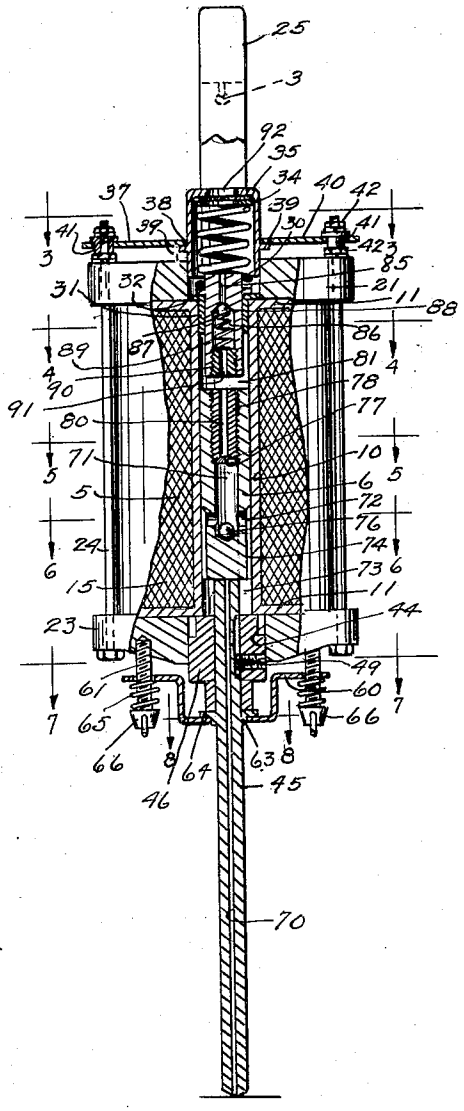

FIG. 2

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PNEUMATIC IMPROVEMENT FOR SOLENOID HAMMERS

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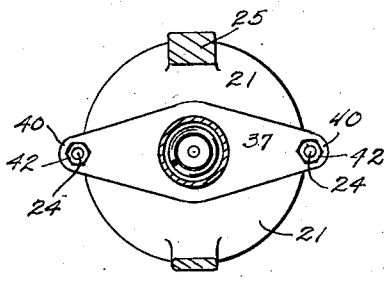

FIG. 3

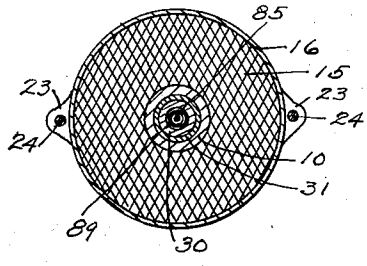

FIG. 4

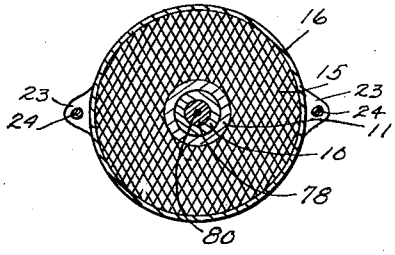

FIG. 5

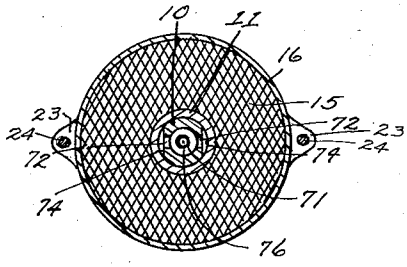

FIG. 6

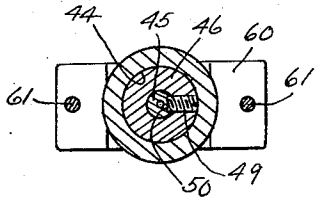

FIG. 7

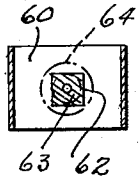

FIG. 8

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UNITED STATES PATENT OFFICE

SAMUEL E. MORTIMER, OF LORAIN, OHIO, ASSIGNOR OF TWENTY-FIVE ONE-HUNDREDTHS TO CLARENCE M. GRIGGS, OF LORAIN, OHIO

PNEUMATIC IMPROVEMENT FOR SOLENOID HAMMERS

Application filed February 25, 1930. Serial No. 431,084.

My invention relates to a pneumatic improvement for solenoid hammers, and is especially adapted for a solenoid hammer, which is to be used for drilling rock, concrete, and other mineral or hard substances. This invention has for its general object, the provision of a solenoid actuated hammer for drilling rock or other hard substances, wherein the dust, caused by the cutting or drilling operation, is automatically removed from the cavity.

Another object of this invention is the provision of a device which is capable of being contained within a solenoid hammer or drill, and which will pneumatically remove the dust and small particles of material from beneath a drill. A further object is the provision of an improvement in a solenoid actuated hammer wherein the solenoid plunger may be used as an actuator to force the dust, caused by the drilling operation, away from the drill. Another object is the provision of an improved solenoid hammer wherein a pneumatic pressure means is located within the hammer, in axial alignment with the tool.

Another object is the provision of a pneumatic solenoid hammer, for drilling purposes, wherein the drill stem has a longitudinal, axial opening throughout its entire length, and wherein the reciprocation of the solenoid plunger forces air through the opening in the drill, but in which construction no valve is required in the drill and wherein the base, or blow delivering portion, of the plunger may be substantially solid.

A further advantage is the novel arrangement of attaching a drill to a solenoid hammer, whereby the drill is retained against excessive longitudinal displacement and wherein novel means is used to prevent relative rotation between the drill and the hammer.

Other advantages and objects of this invention will become apparent from the following description relating to a preferred embodiment illustrated in the drawings, and the essential and novel features will be summarized in the claims.

Referring to the drawings: Fig. 1 is a side elevation of a solenoid hammer embodying my invention; Fig. 2 is a front elevation of the hammer partially broken away to reveal the internal construction, and the angle of vision being at right angles to that shown in Fig. 1; Fig. 3 is a horizontal section in a plane indicated by the lines 3—3 in Fig. 2; Fig. 4 is a horizontal section in a plane indicated by the lines 4—4 in Fig. 2; Fig. 5 is a horizontal section in a plane indicated by the lines 5—5 in Fig. 2; Fig. 6 is a horizontal section in a plane indicated by the lines 6—6 in Fig. 2; Fig. 7 is a horizontal section in a plane indicated by the lines 7—7 in Fig. 2; Fig. 8 is a horizontal section in a plane indicated by the lines 8—8 in Fig. 2.

Referring again to the drawings and especially to Fig. 1, electric current supply lines, 1 and 2 lead to a suitable control switch 3 which communicates with coil windings 5 of a solenoid arranged in the usual manner to cause a core member or plunger 6 to reciprocate.

In the embodiment illustrated I prefer to employ a non-magnetic cylinder or barrel 10 having at the opposite ends thereof outwardly extending flanges 11. Surrounding the barrel are suitable electromagnets, diagrammatically illustrated at 15. A cylindrical shell or housing 16, preferably of non-magnetic material, surrounds the electromagnets. The shell, barrel and electromagnets are clamped together by upper and lower clamping blocks or plates 21 and 22 respectively. The plates 21 and 22 have outwardly extending ears 23 through which suitable bolts 24 pass which bolts serve to retain the plates in a clamped position. Integral with the upper plate 21 is a hand grip or handle 25, which in the embodiment shown houses the switch 3, and through which the electric conductors 1 and 2 enter the hammer.

The plunger 6 reciprocates within the barrel 10 and is restrained from excessive upward movement by a plug 30, slidingly mounted in a sleeve 31 mounted in the barrel 10. The sleeve has an outwardly extending flange 32, adjacent its uppermost portion, which bears against the outer face of the upper flange 11 of the barrel, thereby preventing downward movement of the sleeve.

The plug 30 has a shoulder 33, intermediate its ends, which is held against the flange 32 by an upwardly extending compression spring 34 extending above and surrounding the plug. The spring is retained in position by a cap 35 which permits a comparatively small reciprocatory movement of the plug 30.

The cap 35 is restrained against excessive upward movement by a plate 37 having an opening 38 through which the cap passes, the plate bearing against a shoulder 39 of the cap. Mounted in ears 40 of the retaining plate 37 are flanged sleeves 41 which are secured in position on the bolts 24 by suitable locking nuts 42. It will be noted that the sleeves 41 permit a restricted downward movement of the plate 37 and the cap 35. I find that this type of mounting serves to lessen to a great extent the vibrations caused by the rebound of the plunger 6.

The drill, or cutting tool is mounted in a centrally located circular opening 44 in the lower clamping plate 22. In the embodiment shown, the drill stem 45 is mounted for reciprocation in a cylindrical sleeve or mounting 46 which in turn is slidably mounted in the opening 44. It will be noted that relative rotation between the sleeve 46 and the drill stem, is prevented by a set screw 49, threaded into the sleeve and coacting with an external vertical slot 50, in the drill stem.

A retaining plate 60 mounted on studs 61, secured to the lower clamping plate 22, serves to retain the drill 45 in position relative to the hammer. In the embodiment illustrated in Figs. 1, 2 and 8, the plate 60 has a square opening 62 adapted to receive a squared portion 63 of the drill shank, thereby preventing relative rotation between the drill 45 and the hammer. The plate 60 is retained in position against a shoulder 64 of the drill by suitable compression springs 65 held in position on the studs 61 by wing nuts 66. The shoulder 64 of the drill shank bears against the lower surface of the sleeve 46 thereby resiliently retaining the sleeve in position against the flange 11 of the barrel 10. It will be noted that the drill shank 45 extends some distance above the sleeve 46, and normally receives the blow from the plunger 6, but if the drill is idle, (not in contact with the work), the blow will also be applied to the sleeve 46 and by reason of the resilient mounting the drill will be retained in position without damage to the parts.

My invention contemplates the use of the plunger 6 for a piston or actuator to force a blast of air downward through an axial opening 70 extending the entire length of the drill 45. Extending partially through the plunger 6 is a longitudinal opening 71 which, at its lower portion, communicates with transverse openings 72 in the wall of said plunger. The lower portion of the plunger 6 has flattened sides 74 which form passageways between the openings 72 and the chamber 73 of the barrel 10. Within the axial opening 71 of the plunger 6 is a ball 76 which, on the downward movement of the plunger, is forced upwardly against a seat 77 formed in a plug 78 threaded into the plunger 6. This is partially due to the fact that the plunger acts faster than gravity and therefore leaves the ball suspended, and partially because of the air pressure set up in the chamber 73 and passageways 72. The plug 78 has an opening 80 which communicates with a chamber 81 above the plunger 6, hence on the upward movement of the plunger air is drawn into the lower chamber 73 between the stem 45 and the barrel 10.

To permit air to enter the chamber 81 on the downward movement of the plunger, and prevent its escape on the upward movement of the plunger, I provide the plug 30 with a suitable passageway and check valve 88.

As illustrated, the plug 30 has an axial opening 85 extending its entire length. The lower portion is enlarged as at 86 and forms a seat 87 against which a ball 88 is forced by a suitable spring 89, retained in position within the plug by a threaded member 90 having an axial opening 91. When the plunger acts downwardly the ball 88 is withdrawn from the seat by a partial vacuum in the chamber 81 and air enters the chamber through an opening 92 in the cap 35 but when the plunger 6 acts upwardly, the ball 88 is urged against its seat 87, and the air, not able to escape upwardly, is forced downwardly into the chamber 73.

To prevent dirt and dust from entering the various passageways I prefer to mount a fine wire mesh screen between the spring 34 and the end of cap 35, which screen effectively covers the opening 92 for the purpose described.

Having set forth the principles of my invention and described and illustrated a preferred embodiment thereof for practical use, what I claim and desire to secure by Letters Patent, is,—

1. In a solenoid actuated hammer, a housing, solenoid coil windings within the housing, a plunger adapted to be reciprocated by the flux produced by the windings, a guideway in which the plunger reciprocates and which is divided into two chambers by the plunger, a drill having an axial opening therethrough, a valve associated with the plunger and communicating with both chambers, a second valve member associated with one of said chambers, wherein the plunger on its stroke toward the other of said chambers imparts a sharp blow directly to the drill and forces air through the said axial opening in the drill.

2. A combined hole drilling and cleaning device, comprising an openended non-mag-

netic cylinder, solenoid coil windings associated with the cylinder, a plunger within the cylinder adapted to be reciprocated by the magnetic flux produced by the windings, a drill mounted in the lower opening of the cylinder having an axial opening therethrough, a valve in said plunger, a second valve mounted in the upper opening of the cylinder, one of said valves being normally seated and the other normally open, wherein the plunger on its down stroke directly contacts the drill and forces air out through the axial opening in the drill.

3. A combined hole drilling device and compressor comprising an open ended non-magnetic cylinder, solenoid coil windings associated with the cylinder, a plunger within the cylinder adapted to be reciprocated by the magnetic flux produced by the windings, a drill resiliently mounted in the lower opening of the cylinder having an axial opening therethrough, a valve in said plunger and normally open, a second valve mounted in the upper opening of the cylinder, means to normally prevent movement of the last named valve in a downward direction and means to permit said valve to move upwardly.

4. A combined cutting and cleaning device comprising a solenoid actuated plunger, a cylindrical guideway for the plunger, a tool resiliently mounted for reciprocation in one end of the guideway, the tool having an axial opening therethrough, the plunger dividing the guideway into two chambers and mounted for delivering strokes directly upon the said tool, a valve mounted in the plunger and communicating with both chambers, the axial opening in the tool communicating with one of the chambers, a check valve mounted in the upper end of the guideway and communicating with the other chamber and means to prevent relative rotation between the tool and the guideway.

5. A combined hole drilling and cleaning device, comprising an open-ended non-magnetic cylinder, solenoid coil windings associated with the cylinder, a plunger within the cylinder adapted to be reciprocated by the magnetic flux produced by the windings and comprising an axial opening through its upper portion and a solid lower portion having flattened faces to provide lateral side passageways between the axial opening and the lower chamber of the cylinder, said plunger having radial openings connecting the passageways with said axial opening, a drill mounted in the lower opening of the cylinder having an axial opening therethrough, a valve in said axially open portion of the plunger, normally open, and a second valve mounted in the upper opening of the cylinder and normally seated.

6. A combined cutting and cleaning device comprising a solenoid actuated plunger, a guideway for the plunger, a tool in one end of the guideway and having an axial opening therethrough, the plunger also having an axial opening through one end portion thereof and a valve in said portion, the other end portion of said plunger being solid but provided with flattened surface portions forming passageways leading from the lower chamber of the cylinder to the level of the axial opening of said plunger and with radial openings communicating between the said passageways and the axial opening in the plunger, the plunger valve being normally open, and said solid portion of the plunger reciprocating in alinement with the tool to strike directly upon the latter.

In witness whereof, I have hereunto set my hand this eighteenth day of February, 1930.

SAMUEL E. MORTIMER.