

H. E. LE GENDRE & G. LEICH.

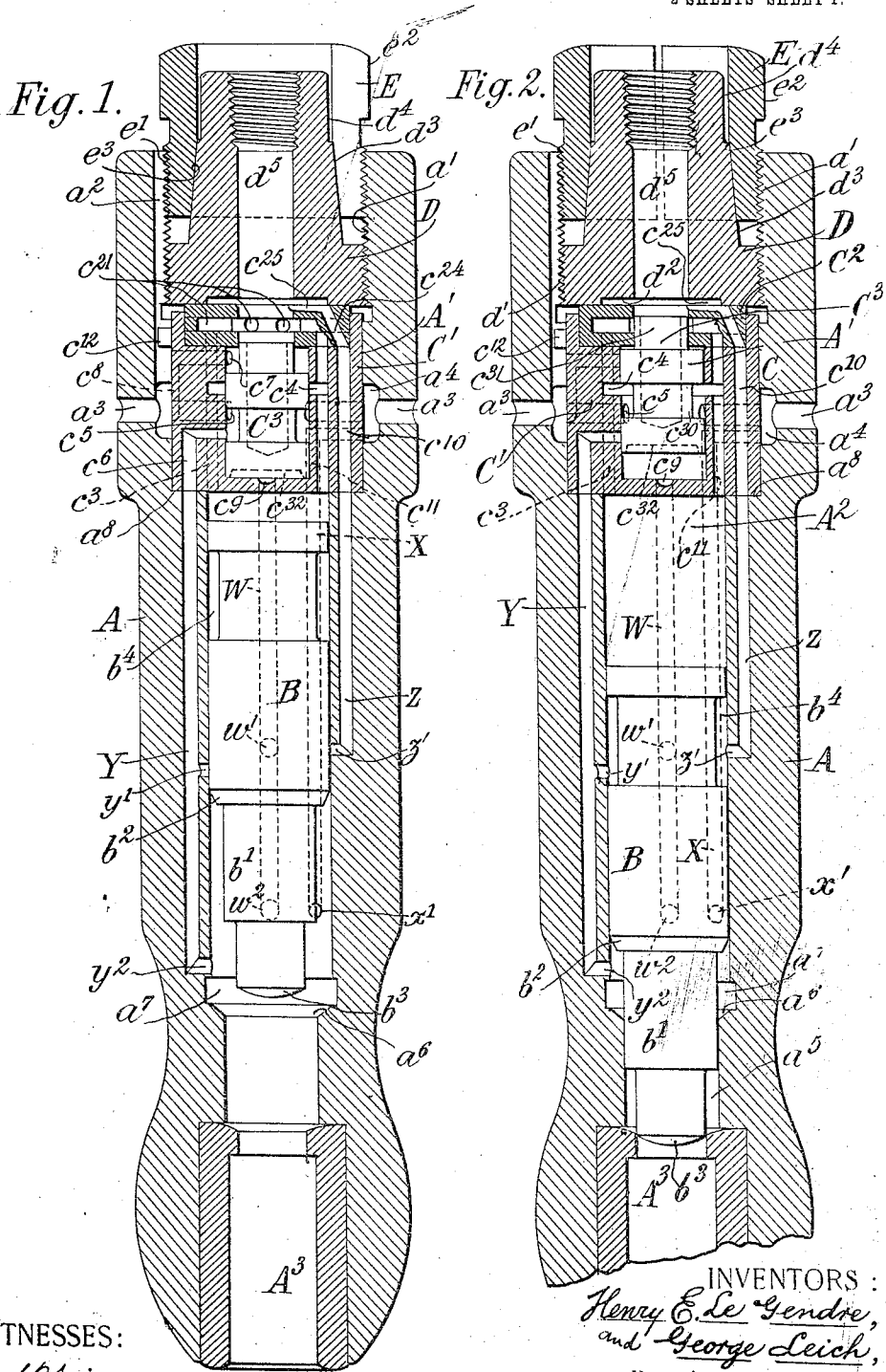
PNEUMATIC TOOL.

APPLICATION FILED NOV. 3, 1910.

1,065,375.

Patented June 24, 1913.

2 SHEETS—SHEET 1.



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2 SHEETS-SHEET 2.

Fig. 3.

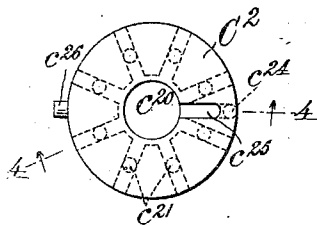


Fig. 7.

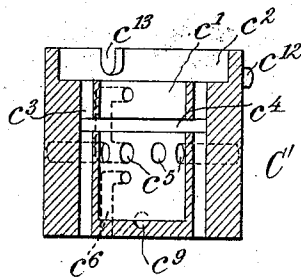


Fig. 4.

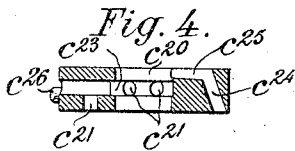


Fig. 8.

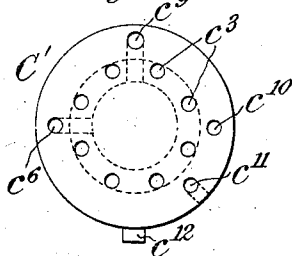


Fig. 5.

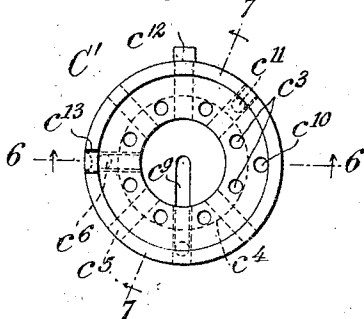


Fig. 9.

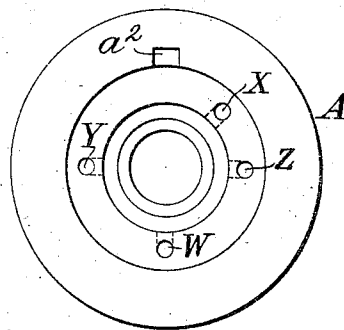


Fig. 6.

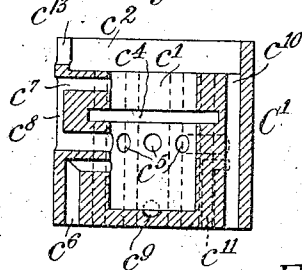
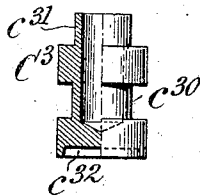


Fig. 10.



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UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL.

1,065,375.

Specification of Letters Patent.

Patented June 24, 1913.

Application filed November 3, 1910. Serial No. 590,498.

To all whom it may concern:

Be it known that we, HENRY E. LE GENDRE and GEORGE LEICH, citizens of the United States, residing, respectively, at Cresskill, in the county of Bergen and State of New Jersey, and in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Pneumatic Tools, of which the following is a specification.

This invention relates to pneumatic tools having a reciprocating plunger or hammer. Its objects are to so improve the construction of such instruments that interruption in the operation thereof, due to solid particles or obstructions lodging themselves in the fluid ducts or passages, may be minimized; that the instrument may be more durable, that a more reliable and efficient action of the valve controlling the motive fluid from the supply pipe may be secured, and also to improve the construction generally whereby the parts may be conveniently manufactured, conveniently and accurately assembled, securely held together, and a smooth, efficient and reliable working of the whole instrument attained.

The invention is embodied in a tool body or casing having suitable chambers therein for the reception of the parts, ports and passages to and from parts thereof and to the exterior of the instrument, a reciprocating plunger or hammer, which has an additional function of participating in the control of the motive fluid within the instrument, and valve mechanism, also having suitable ports and passages therein controlling the admission of motive fluid to the rear of the plunger and certain exhaust operations.

The control of the motive fluid admitted to the instrument is divided between the valve and the plunger, no air being passed through the valve, which is imperforate. The valve being thus without passages, reduces the liability of stoppage of the tool by clogging. It also enables the valve to be constructed with larger bearing surfaces whereby wear is reduced.

The invention further includes a particular form of closing and locking means for the end of the casing. This part of the invention is, however, claimed in a divisional application, Serial No. 665,164, filed Dec. 11, 1911.

For a detailed description of the invention reference will be had to the accompanying drawings, wherein—

Figure 1 is a vertical section of a tool constructed according to my invention, showing the plunger in its upper position. Fig. 2 is a similar view showing the plunger in a lower position, near the end of its working stroke. Fig. 3 is a plan view of the valve-box cap. Fig. 4 is a sectional view thereof on the line 4—4 of Fig. 3; and Fig. 5 is a plan view of the top of the valve boxing. Fig. 6 is a sectional view of the boxing on the line 6—6 of Fig. 5. Fig. 7 is a sectional view of the boxing on the line 7—7 of Fig. 5; Fig. 8 is an underside view of the bottom of the boxing; Fig. 9 is a plan view of the top of the casing; and Fig. 10 is a view of the valve proper.

In the drawings A represents the casing of the tool, B the plunger or hammer within said casing and adapted to be reciprocated therein, C the valve mechanism as a whole, also contained within the casing, and D a cap or plug for closing the upper end of the casing.

The casing A has a bore longitudinally therethrough of different diameters at different points of its length.

The upper part A' of the bore A is of relatively large diameter and is adapted to contain the valve mechanism. It is also adapted to receive the cap D, and for this purpose it is provided with screw-threads a' at its outer end. There is also preferably provided a longitudinal slot a'' in the casing at this part of the bore which is adapted to act as a guide for a centering pin c^{12} on the valve-box, as hereinafter described. Extending into the part A' of the bore from the exterior of the casing are a plurality of port-holes a^3 , through which spent motive fluid is exhausted from various parts of the

tool. Instead of running directly into part A' of the bore, the port-holes a^3 preferably communicate with an annular groove or recess a^4 formed in the casing in line with said port-holes.

The intermediate portion A² of the bore is of less diameter than that of the portion A', and contains the plunger or hammer B. The lower end a^5 is of still less diameter than the portion A² of the bore and there is thereby formed a shoulder a^6 between the two parts, a corresponding shoulder b^2 being formed on the plunger or hammer B whereby to limit the downward movement of the plunger. Adjacent to the shoulder a^6 , and at or near the lower part of the portion A² of the bore, is preferably formed an annular recess or groove a^7 , in which a quantity of air is adapted to be trapped upon the downward stroke of the plunger to cushion the same, and relieve the instrument of shock when not operating against an object or when the impact of the plunger upon an object is not wholly absorbed. As this portion A² of the bore is of less diameter than the portion A' there is formed between these two portions a shoulder a^8 . This shoulder a^8 provides a seat against which the valve-boxing C' may be secured and also presents a surface from which ducts or passages W—X—Y and Z leading to different portions of the portion A² of the bore may be drilled. Passage W has two ports w^1 and w^2 communicating with the portions A² of the bore at different longitudinal points. Passage X has but one port x^1 which communicates with said portion A² of the bore at a point approximately in line with and to one side of port w^2 of passage W. Passage Y also has two ports y^1 and y^2 , the latter communicating with A² of the bore in proximity to shoulder a^8 therein. Passage Z has but one port z^1 which communicates with the bore at a point approximately in line with and to one side of port w^1 of passage W, and preferably slightly above port y^1 of passage Y.

In the lower end of casing A there may be formed a recess or socket A³ within which may be inserted the shank or butt of a tool or other device to be hammered upon. This recess may, however, be dispensed with, and the end of the casing suitably shortened.

The valve mechanism C comprises a plurality of parts C', C² and C³ (illustrated in detail in Figs. 3-9 inclusive.) C' is a boxing or housing for the slide or valve proper C³, which is preferably formed as a piston, and is provided with a longitudinal bore c^1 therein. It is also provided with a number of passages and ports, the free passageway through the majority of which is controlled by said valve C³. In the upper end of this

boxing C' there is preferably formed a cavity or recess c^2 for the reception of the cap C². Drilled longitudinally through this boxing C' is a series of longitudinal passages c^3 communicating with the part A² of the bore in the casing. These passages c^3 are also in communication with the bore c^1 of the boxing C' through an annular slot or groove c^4 which extends into the same. A series of radial passages c^5 is also drilled through this boxing to the bore c^1 in the interior thereof, which passages register with ports c^6 in casing A, or with grooves or recess c^7 therein. These passages c^5 are preferably located in proximity to groove c^4 referred to above. Extending from the bottom of said boxing C' to the lower part of the bore c^1 is a passage c^8 , registering, when the boxing is in place in the casing, with passage Y in the latter. Extending from the upper part of the bore c^1 to the outer side of the boxing is a passage c^9 which is in communication with one of the passages c^3 through a groove c^9 on the outer side of the boxing. Communicating with the bottom of the bore c^1 is a passage c^{10} which registers with the passage W in the casing. There is also a passage c^{11} extending longitudinally through the boxing and registering with the passage Z in the casing A when the boxing is in place, and a passage c^{12} extending from the bottom of the boxing C' to a point in the side thereof—(see Figs. 5 6 and 8)—registering with one of the port holes a^1 in the casing A (or with the groove or recess a^4 therein), and with the passage K.

On one side of the boxing C' may be placed a pin or stud c^{13} adapted to enter the groove a^2 in the casing A, and thereby insure that the parts will register properly when assembled. There is also provided a notch or slot c^{14} in the upper end of the boxing C' into which a similar pin or part c^{15} of the valve box cap may enter.

C² is a cap which fits over the top of the boxing C', and in the recess c^2 preferably formed therein. This cap has a bore c^{20} therethrough, this bore being of smaller diameter than the bore c^1 in boxing C'. There is also a series of passages c^{21} leading from the bottom of said cap to the bore c^{20} therein, which series of passages c^{21} register with the series c^3 in the boxing C' (which last-named passages are in direct communication with the bore in casing A in rear of the plunger B when the boxing is in place). These passages c^{21} preferably communicate with the bore c^{20} in the cap through a groove or recess c^{23} formed in the wall of the bore, which insures the instantaneous admission of a copious supply of motive-fluid upon uncovering of the groove by an extension on valve C³ hereafter to be

described. This cap C^2 also has a passage c^{24} therethrough registering at its bottom end with the passage c^{10} in the boxing C' (which last-named passage registers with passage Z in the casing A). The upper end of this passage c^{24} is in constant communication with the source of air-supply and there is preferably a groove c^{25} in the top face of cap C^2 leading from the main air-supply passage to this passage c^{24} to facilitate passage of motive-fluid thereto. To insure that the passages in cap C^2 shall properly register with those in boxing C' , a pin or stud c^{26} may be formed thereon which will engage with the slot or notch c in boxing C' . These various passages and bores of the valve mechanism may be formed by very convenient manufacturing operations by making the parts separately as they are shown. Those passages running longitudinally through the parts may be easily drilled from one or the other ends of the parts, and those running transversely may likewise be easily drilled from the sides of the parts. The transverse parts of these passages which are angular may be conveniently formed by drilling from the outer sides into or through the longitudinal parts of the passages, and, if desired, filling the outer portions of these drill holes. The outer portions of such drill holes may, however, be left open, so as to facilitate cleaning of the passages, and access may be very readily had to them by removing the parts from the casing. In practice passages c^{21} in cap C^2 are more liable to become stopped or clogged by particles of solid matter (such as particles of dirt, particles of rubber from the fluid supply-hose usually employed, etc.) than the others, and it is therefore especially desirable to leave open the outer portions of the drill holes by which the transverse portions of these passages are formed. It is also desirable to provide a considerable number of these passages c^{21} and of the passages c^3 in boxing C' with which passages c^{21} register. The groove c^8 on the exterior of the boxing C' may be conveniently formed by a burring tool.

Valve C^3 is preferably of cylindrical form and preferably made hollow to lighten the same. An annular groove c^{20} is formed therein, through which passages c^3 and passage c^6 , in boxing C' , may alternately be placed in communication with passages c^5 , which in turn communicate with port-openings a^3 leading to the exterior of the tool. It is of approximately the same diameter as the bore c' of the boxing C' , in which bore it is adapted to fit and have a limited sliding or reciprocating movement. The bottom c^{32} of this valve C^3 is also preferably slightly concaved, in order that motive-fluid

may get under it at proper times, as will hereinafter more fully appear.

The plunger B is preferably of cylindrical form and of approximately the same diameter as the portion A^2 of the bore in casing A , within which it fits and is adapted to reciprocate. The plunger has a reduced end b' of approximately the same diameter as the reduced portion a^5 of the bore A^2 , and a shoulder b^2 which is adapted to abut against the shoulder a^6 on the interior of the casing. It also has a nose or projection b^3 , which is adapted to come in contact with the object to be operated upon. There is also provided on the plunger an annular groove b^4 , through which communication may be established between certain of the passages leading into the bore A^2 , as will be hereinafter fully described.

D and E indicate, respectively, a plug or cap for closing the end of the casing A , and a nut for locking said plug in place. This plug or cap D has a cylindrical portion, preferably having screw-threads d' thereon, and is adapted to fit within the upper part A' of the bore and press upon or be pressed upon, the cap C^2 so as to hold the parts of the valve mechanism together and to press the whole upon shoulder a^8 in the interior of the casing. The lower end of this plug is preferably recessed, as indicated at d^2 , and trued so that it may fit tightly against the valve box cap C^2 , and prevent escape of motive-fluid between these parts. This plug also has a conical or tapering projection or extension d^3 thereon, and a squared end d^4 which may be engaged by a wrench. This plug also has a comparatively large passage d^5 longitudinally therethrough, through which air or other fluid under pressure may be admitted to the tool, and is formed with interior screw threads by which the end of a supply-pipe is connected. Lock nut E is of cylindrical form having screw-threads e' thereon. This nut is of approximately the same diameter as the upper part A' of the bore in casing A , and the threads e' thereon are adapted to engage with the threads d' in the casing. It also has squared faces e^2 which may be engaged by a wrench, and a conical or tapering bore e^3 of approximately the same size as the tapered extension d^3 of plug D , which extension is adapted to project into said bore. The nut is preferably split, whereby it may be spread when the nut and plug are pressed into engagement.

Operation: The parts being assembled, as illustrated in Figs. 1 and 2, fluid under pressure is admitted through passage d^5 in plug or cap D . The parts being in the position illustrated in Fig. 1, motive-fluid in considerable volume will be admitted to the bore in rear of plunger B , through passages c^{21}

in cap C² and passages c³ in the boxing C'. This will drive the plunger B forward with relatively great force, whereby its nose b³ may be caused to deliver a blow upon the end or butt of a tool inserted in socket A³ in the lower end of the casing. Fluid in front of the plunger will be expelled or exhausted through port y² and passage Y, passages c⁴, annular groove c⁵⁰ in valve C³, passages c⁵, groove a⁴ and port-openings a⁵. As the plunger B moves forward, and preferably near the limit of its forward movement, it will uncover port z' of passage Z and a moment later, preferably, port y' of passage Y. It will also preferably simultaneously close port x' of passage X and incidentally port w² of passage W. Passage Z being in constant communication with the motive-fluid supply through passage c¹⁰, passage c²¹ and groove c²³, fluid under pressure will be admitted to the annular groove b⁴ in plunger B and thence through port y', passage Y and port y² to the bore in front of the plunger D, there to be entrapped between and impressed by the shoulder b² on the front part of the plunger and the shoulder a⁶ on the casing. This compression of motive-fluid cushions the plunger on its forward stroke and provides the motive force for the reverse or rearward movement of the plunger. As the plunger B is approaching the limit of its forward movement (and preferably simultaneously with the uncovering of port z' of passage Z), it uncovers port w' of passage W. Passage Z being in constant communication with the motive-fluid supply, as previously described, fluid under pressure will be admitted to the annular groove b⁴ in plunger B and thence through port w' of passage W, passage W, and passage c⁶ through the bottom of valve-boxing C' behind valve C³. The area of the bottom of valve C³ exposed to fluid pressure being greater than that of its extension c²¹ exposed to the fluid pressure in passage d², valve C³ will be forced upward, motive-fluid in front thereof being expelled or exhausted through passage c⁷, groove c⁸ and groove a⁴ and port-holes a⁵. The ports will now be in the position illustrated in Fig. 2 and the reverse or rearward movement of plunger B is now ready to begin. Rearward movement of plunger B is given to it by the quantity of motive-fluid which has been entrapped and compressed in the lower end of part A² of the bore (as hereinbefore described.) Fluid in the rear of the plunger B is expelled or exhausted to the exterior of casing A through passages c⁹, groove c⁴, annular recess c⁵⁰, in valve C³, passage c⁵, groove a⁴ and port-holes a⁵. As plunger B moves rearward it will uncover, preferably simultaneously, ports w² of pas-

sage W and x' of passages X; and cover, preferably simultaneously, the ports w' of passage W and z' of passage Z. Port w² is in communication with the lower part of the bore in boxing C', through passage W and passage c⁶. The upper end of valve C³ being constantly subject to the pressure of the fluid in passage d², and the supply of fluid to the lower part of the bore in boxing C' being (through passages Z and W, etc.) now cut off the valve will be forced downward, fluid in the rear thereof being expelled or exhausted through passage c⁹, passage W, port w² into the part A² of the bore in the casing, and out through port x' of passage X, passage X, groove a⁴ and port-holes a⁵. Downward movement of valve C³ will restore the parts to the position of Fig. 1 and the cycle of operation will be repeated.

While we have illustrated and described one form of the invention it is obvious that many modifications and changes may be made therein without departing from the spirit thereof.

What we claim is:—

1. In a pneumatic tool, a valve mechanism comprising a boxing, a valve-proper and a cap, said boxing having a series of longitudinal passages therein communicating with the interior of the casing, and said cap having radial ports and passages therein communicating with said longitudinal passages, controlled by said valve-proper.
2. In a pneumatic tool, a valve mechanism comprising a boxing, a valve-proper, and a cap, said boxing having longitudinal passages therein, said cap having a longitudinal bore, radial passages passing from said bore to its exterior, and communicating with said longitudinal passages in said boxing, and said boxing having a recess in which said cap fits.
3. In a pneumatic tool, a valve mechanism comprising a boxing, a valve-proper, and a cap, said boxing having longitudinal passages therein, said cap having a longitudinal bore, radial passages passing from said bore to its exterior, and communicating with said longitudinal passages in said boxing, said boxing having a flange adapted to cover the exterior ends of said radial passages of said cap.
4. In a pneumatic tool, a valve mechanism comprising a boxing, a valve-proper, and a cap, said valve proper having a body portion and an extension of less diameter than said body portion, said boxing having passages therein and a bore in which the body portion of said valve proper is adapted to fit, and said cap having a bore in which the extension on said valve is adapted to fit and radial passages extending from said

bore to the exterior of said cap, said radial passages communicating with said passages in said boxing.

5 In a pneumatic tool, a valve mechanism comprising a boxing, a valve-proper, and a cap, said valve-proper having a body portion and an extension of less diameter than said body portion, said boxing having passages therein and a bore in which the
10 body portion of said valve-proper is adapted to fit, and said cap having a bore in which the extension on said valve is adapted to fit and radial passages extending from

said bore to the exterior of said cap, said radial passages communicating with said 15 passages in said boxing, and said boxing having a flange thereon covering the exterior ends of said radial passages in said cap.

In witness whereof, we have hereunto signed our names in the presence of two 20 subscribing witnesses.

HENRY E. LE GENDRE.
GEORGE LEICH.

Witnesses:

EDW. REIDHEAD,
A. B. GLOVER.