No. 802,984. PATENTED OCT. 31, 1905.

M. H. GREEN.

PNEUMATIC HAMMER.

APPLICATION FILED JUNE 22, 1903.

2 SHEETS—SHEET 1.

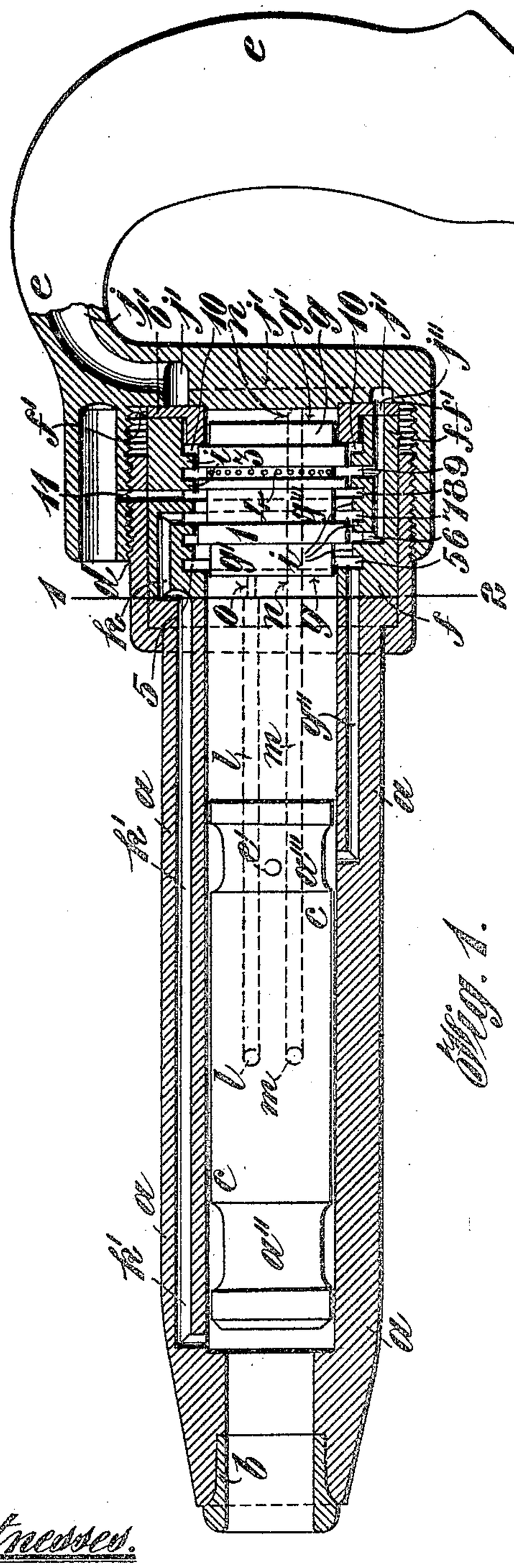

Fig. 1.

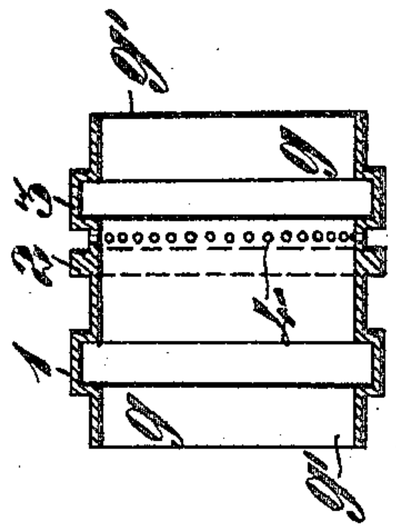

Fig. 4.

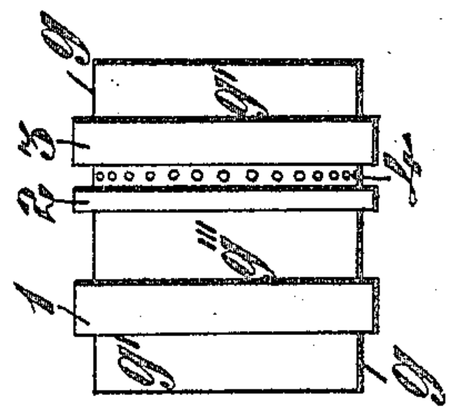

Fig. 6.

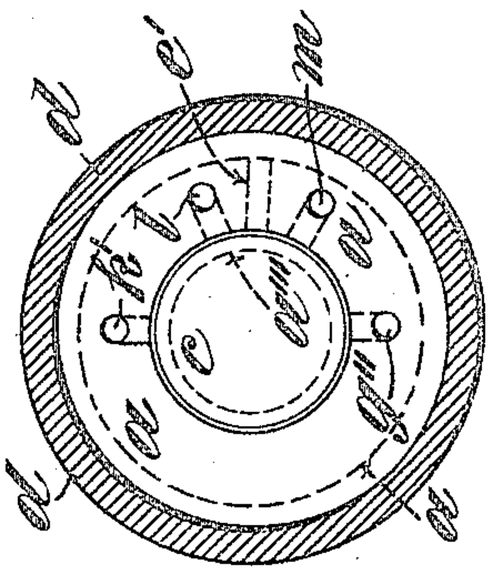

Fig. 5.

Witnesses.

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PNEUMATIC HAMMER.

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2 SHEETS—SHEET 2.

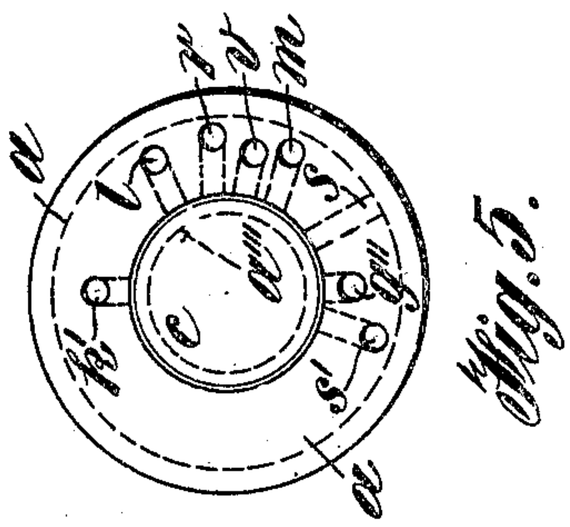

Fig. 5.

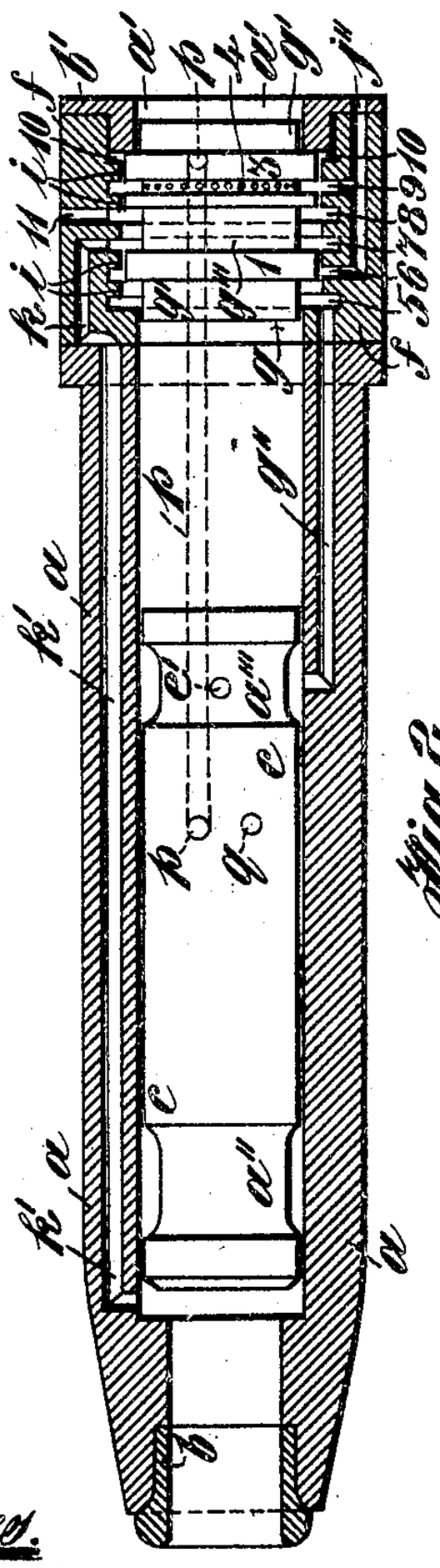

Fig. 2.

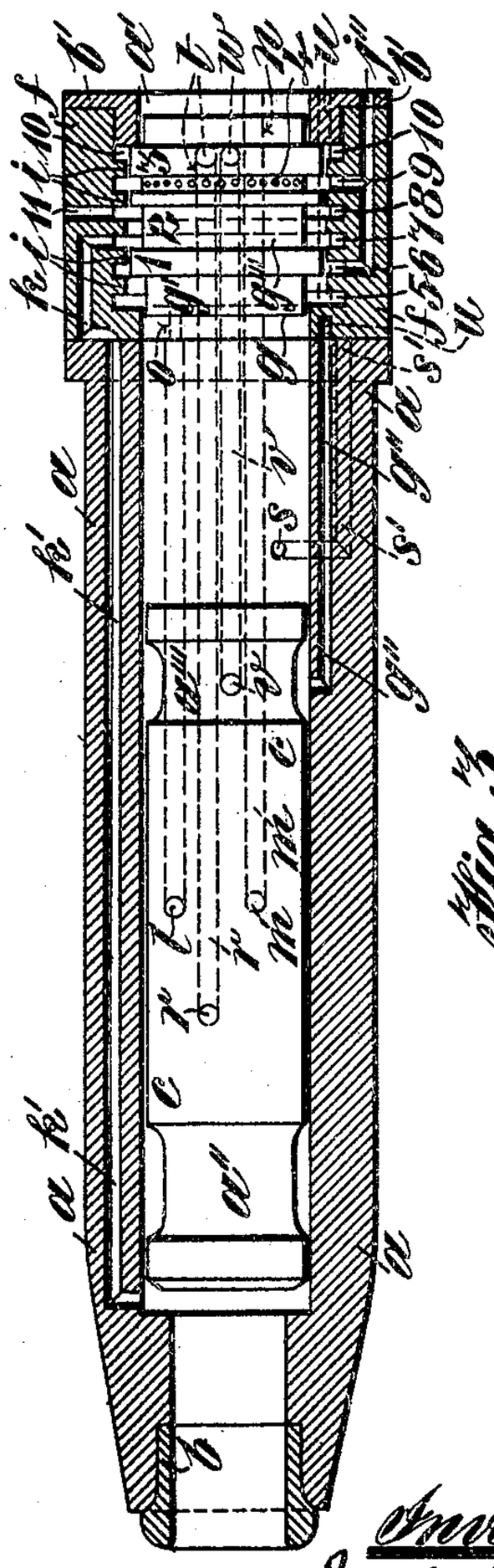

Fig. 3.

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UNITED STATES PATENT OFFICE.

MARK HENRY GREEN, OF MANCHESTER, ENGLAND.

PNEUMATIC HAMMER.

No. 802,984. Specification of Letters Patent. Patented Oct. 31, 1905.

Application filed June 22, 1903. Serial No. 162,602.

To all whom it may concern:

Be it known that I, MARK HENRY GREEN, engineer, a subject of the King of Great Britain and Ireland, residing at 45 Cheeryble street, Higher Openshaw, Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in or Relating to Pneumatic Hammers and Like Percussive Tools, of which the following is a specification.

This invention relates to improvements in percussive hammers and like tools operated by compressed air, the said improvements more particularly relating to means for controlling the operation of the valve and piston of the hammer, to an improved construction of valve, and to certain other details of construction having for their object the more efficient working of tools of this character and the prevention of the frequent breakages of the valves which occur in the class of tools to which my invention relates.

My invention will be fully described with reference to the accompanying drawings, in which—

Figure 1 indicates a longitudinal section of a pneumatic hammer constructed in accordance with my invention; Fig. 2, a modified form in which certain of the ports and passages shown in Fig. 1 are dispensed with; Fig. 3, a similar sectional elevation in which the constructive details of Figs. 1 and 2 are combined; Fig. 4, cross-section of the cylinder of the hammer on line 1 2 of Fig. 1; Fig. 5, end elevation of the cylinder shown in Fig. 3 from the valve-box end; Fig. 6, elevation of the valve, and Fig. 7 sectional elevation of the valve.

Referring principally to Figs. 1, 4, 6, and 7 for the time being, *a* is the cylinder of the hammer; *b*, the nipple located therein for receiving the chipping, calking, or other tool; *c*, the piston, which is of ordinary construction; *d*, the clamping-collar for supporting the valve-box, and *e* the handle, which is constructed in the usual form and is provided with the ordinary valve or valves for controlling the admission of compressed air to the valve-box of the hammer and with a screw-chased chamber to engage with the clamping-collar just referred to. *f* is the valve-box, faced at one end to come in contact with the rear end of the cylinder *a* and at the other end with a face to come in contact with a fixed collar or cap *b'*, which in turn bears against the internal face *f''* of the handle. The collar *b'* is provided with an internal annular flange which extends within the valve-box. The flange, by engaging a ring 3 on the valve *g*, limits the inward movement of said valve, and thereby provides a space or chamber *a'*, the use of which will be later described. *g* is the valve, which is of improved construction—that is to say, it consists of a tube, as more clearly indicated in Figs. 6 and 7, provided at its ends with portions *g'* and between these portions with raised collars or projecting rings, all of which are of the same diameter, in contradistinction to some valves which have hitherto been used and provided with collars or rings of varying diameters. 1, 2, and 3 are the raised collars, and 4 indicates a series of holes between collars 2 and 3 and communicating with the interior of the valve. The valve-box *f* is provided internally with a series of rings *i*, whose internal diameter corresponds with the external diameter of the rings 1, 2, and 3 on the valve. The collars on the valve and the rings within the box, although closely approaching each other, do not contact. This allows of a certain amount of leakage, the benefit of which will be hereinafter explained. The rings *i* form between them a series of spaces 5, 6, 7, 8, 9, and 10, which are in communication with certain ports or passages in the valve-box, which in turn communicate with certain ports or passages in the cylinder *a* of the hammer. The piston *c*, provided with annular grooves *a''* and *a'''*, and valve *g* are indicated in the positions they occupy prior to starting the hammer in action.

The construction of the hammer, apart from what has already been said, will be understood much better by a description of the action of the hammer as indicated in Figs. 1, 4, 6, and 7. The live air after passing through the controlling-valve in the handle of the hammer proceeds by way of passage *j* to the annular groove *j''* in the handle and thence through passage *j'''* in the valve-box to recesses 6 and 9 in the valve-box, whence it can pass through holes 4 into the rearward end of the cylinder momentarily. Meanwhile by means of port *e'*, which is open to the atmosphere through the wall of the cylinder *a*, recess 5 in the valve-box is by means of passage *j''* and annular groove *a'''* in piston open to the atmosphere, and consequently there is no pressure of air in recess 5. Instantaneously the live air in moving through passage *j'''* leaks past ring 3 and into the chamber *a'* or recess at the rear end of the valve *g*, the amount so leaking being sufficient to overcome any slight

pressure of air there may be in cylinder *a* and drive the valve *g* forward toward the left by acting on the ring 3, thereby causing ring 1 to close up recess 5, ring 2 to come opposite the third ring of the valve-box from the left and bring holes 4 opposite the exhaust-passage 11 from the valve-chamber to the atmosphere. This action also brings space *g'''* of the valve opposite passage *k* in the valve-box, which is in communication with passage *k'*, communicating with the forward end of the cylinder *a*. The air at the rear end of the cylinder is now free to exhaust through holes 4 and passage 11, while live air passing through port 6 and passages *k k'* at the same time drives the piston *c* toward the rear end of the cylinder. On ring 1 closing up recess 5 communication by means of passage *g''* and port *e'* with the atmosphere is cut off, at the same time preventing live air getting to the rear end of the cylinder. When the piston *c* has traveled about three parts of its stroke rearward, the annular groove *a''* puts passages *l* and *m* in the cylinder *a* and *n* and *o* in the valve-box in communication, thus allowing live air from groove *j'* to pass via *n* and *m* and likewise *l* and *o* to space 5 in the valve-box, thus forcing the valve *g* into its rearward position. (Shown in Fig. 1.) It will be understood that when the valve is in this position the ring 3 uncovers recess 9 and simultaneously passage *j'''* admits live air through the ring of holes 4 in the valve to the rear end of the cylinder. At the same moment ring 1 on the valve covers up space 6 in the valve-box and ring 2 uncovers space 8, thus allowing the front end of cylinder to exhaust via passages *k'* and *k* through recess *g'''* and exhaust-passage 11 to the atmosphere.

From the foregoing it will be seen that the passages 5 and 7 8 in the valve-box are alternately put in communication with the exhaust-passage 11 to the atmosphere, and consequently the valve moves very readily to the left through the agency of live air escaping beyond ring 3 into the chamber *a'*, while it as readily moves in the opposite direction by live air coming through the passages *l* and *o* into recess or chamber 5, in each case the live air acting on the outer faces of the rings 1 and 3. Very little air-pressure is required, and as the area of the rings against which it impinges is very small the valve is moved gently and liability to breakage is avoided.

In Fig. 2 the construction of valve and valve-box is somewhat similar to that shown in Fig. 1, the valve especially being exactly the same. All other parts similar to those in Fig. 1 bear the same reference characters. In this construction I have dispensed with passages *l*, *m*, *n*, and *o* and added passages *p* and *q*, the former communicating from the interior of the cylinder *a* with the chamber *a'* at the rear of the valve-box by means of recess 10, while *q* is a transverse exhaust-passage through the walls of the cylinder *a* to the atmosphere. In this case the valve is driven backward and forward alternately by means of the air which escapes beyond the rings 1 and 3 into the recess 5 and recess 10 and chamber *a'*. In other words, live air passes through the passage *j'''* to the rear of the valve just as port *e'* and passage *g''* are open to exhaust. The valve *g* is thereby moved to the left, placing the holes 4 and the rear end of the cylinder *a* in communication with the exhaust-passage 11 and the recess *g'''* in the valve in communication with passages *k* and *k'*, leading to the forward end of the cylinder, thus allowing live air to get in front of the piston *c* and move it rearward. Immediately the annular groove *a''* in the piston comes opposite passages *p* and *q* the recess 10 and space *a'* in the valve-box are brought into communication by *p* and *q* with the atmosphere, thus relieving the pressure at the rear end of the valve and allowing the live air escaping beyond the ring 1 into recess 5 to drive the valve to the right, when the action described in connection with Fig. 1 continues.

In Fig. 3 I have practically combined the two examples shown in Figs. 1 and 2. In other words, by adding passages *r*, *s*, and *v* in the cylinder *a*, dispensing with exhaust-port *e'* in the cylinder, and by adding passages *t*, *u*, and *w* in the valve-box the valve can be driven by live air in both directions. By this means the valve *g* is moved positively in either direction. The reference characters in Figs. 3 and 5 apply to similar parts shown in Figs. 1 and 2. The valve and piston are in a similar position, and the action of the hammer is as follows: Live air passes through passage *j'''* and into the rear end of the cylinder *a* through the holes 4 in the valve *g*, and at this time port *s*, which opens transversely through walls of cylinder to atmosphere, is, as shown, uncovered by the rear end of the piston *c* and is therefore open to atmosphere. Passage *s'* communicates with *s* and also with space 5 in the valve-chamber, so that pressure is relieved therein. Simultaneously passage *u* in valve-box connecting with passage *g'* in cylinder allows live air to pass through said passages round annular groove *a'''* in piston to passage *v* in cylinder and thence by passage *w* and recess 10 in valve-box to chamber *a'*, thereby driving the valve forward positively. When the valve has completed its movement, the rear end of the cylinder is by means of holes 4 and exhaust-passage 11 put in communication with the atmosphere for exhaust. Simultaneously live air passes from passage *j'''* round recess *g'''* through passages *k* and *k'* to the forward end of the cylinder, thereby driving the piston to the rear. Immediately annular groove *a''* in piston *c* comes opposite passages *l* and *m* live air from annular groove *j''* in the handle passes down passage *n* and *m*, round groove *a''* into passage *l*, and thence by way of pas-

sage *o* in the valve-box to the valve, thus putting pressure into annular space 5 for driving the valve back to the rearward position indicated in the drawings. Almost simultaneously the forward end of the piston *c* uncovers the passage *r*, which thereby puts chamber *a'*, through passage *t* and recess 10, in communication with the exhaust, relieving the pressure in the said chamber and allowing the valve to maintain the position given it by means of the live air, as just described. The movement of the valve to the rearward position places the forward end of the cylinder in communication with the exhaust to atmosphere, as in the case of Figs. 1 and 2.

Pneumatic hammers constructed as described are very effective in operation and less liable to derangement than in some hammers previously in use.

What I claim as my invention, and desire to protect by Letters Patent, is—

A pneumatic hammer and like tool comprising a valve, provided with rings on its exterior surface of equal diameter, a series of grooves alternating therewith each of equal diameter but of less diameter than the rings and a series of holes communicating with one of said grooves and with the interior of the valve, of a valve-box provided on its interior surface with a series of rings, corresponding in diameter with the rings on the valve, a series of annular spaces alternating with said valve-box rings, live-air-supply passages in the valve-box communicating with the annular spaces of the valve-box, a series of passages in the valve-box communicating respectively with passages in the cylinder of the hammer and with the atmosphere, a cylinder provided with a slidable piston having annular grooves near each end, a series of passages in said cylinder communicating with the passages and grooves in the valve-box and with the annular grooves in the piston, as and for the purpose set forth.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

MARK HENRY GREEN.

Witnesses:

WILLIAM M. TAYLOR,

WILLIAM A. COLEBOURN.