No. 771,554. PATENTED OCT. 4, 1904.

W. L. KETCHEN & H. F. ADAMS.

PNEUMATIC HAMMER.

APPLICATION FILED OCT. 8, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

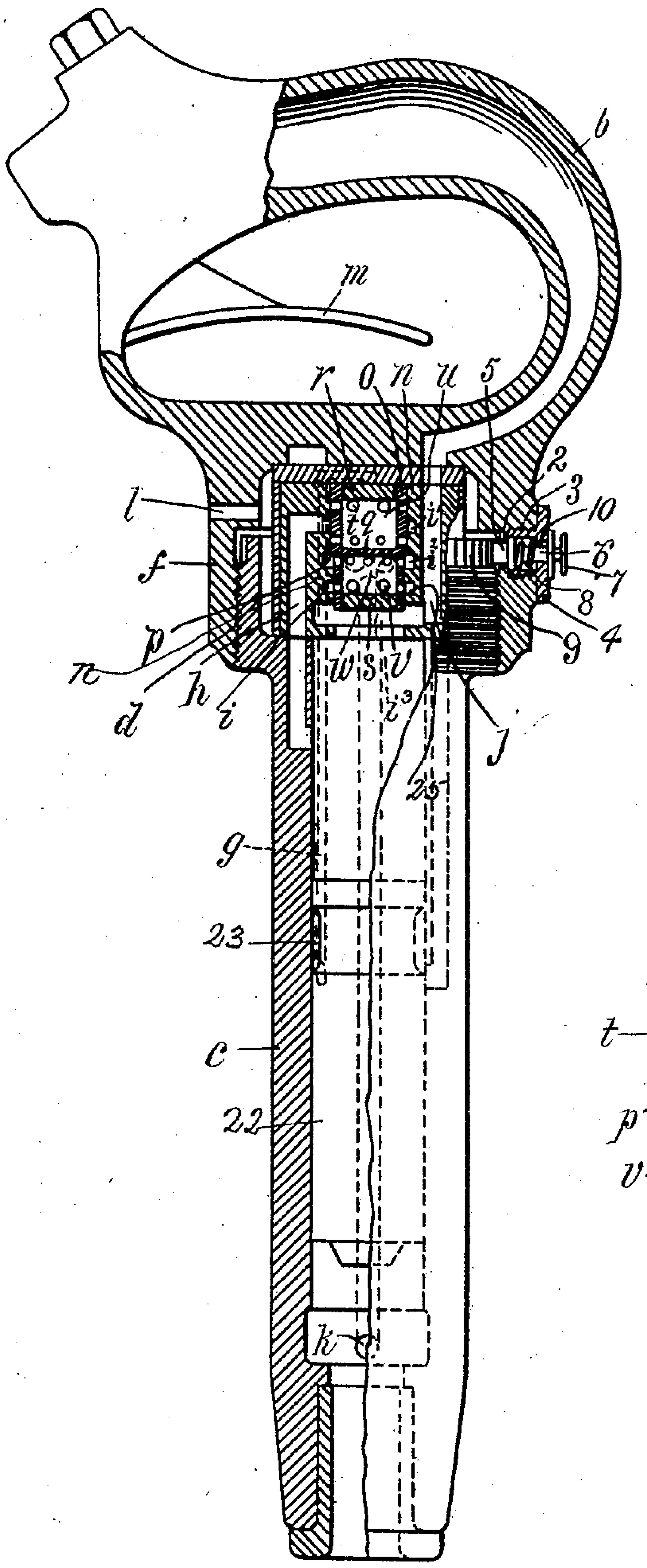


FIG. 2.

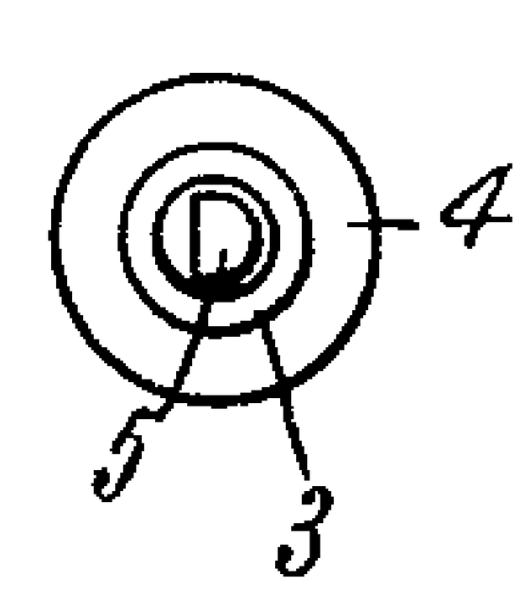
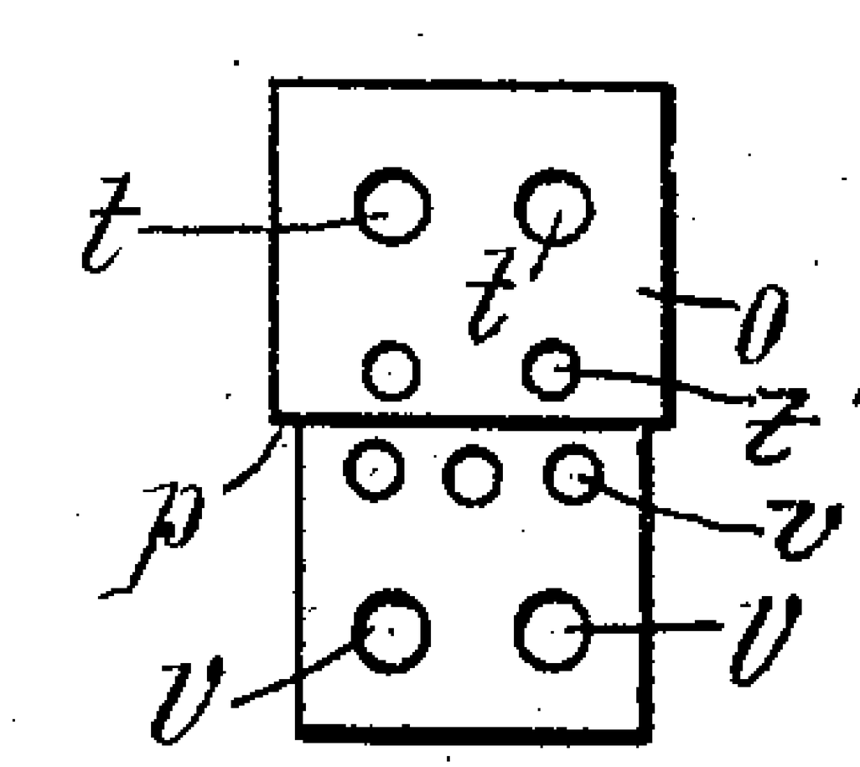


FIG. 3.



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NO MODEL. 2 SHEETS—SHEET 2.

FIG. 4.

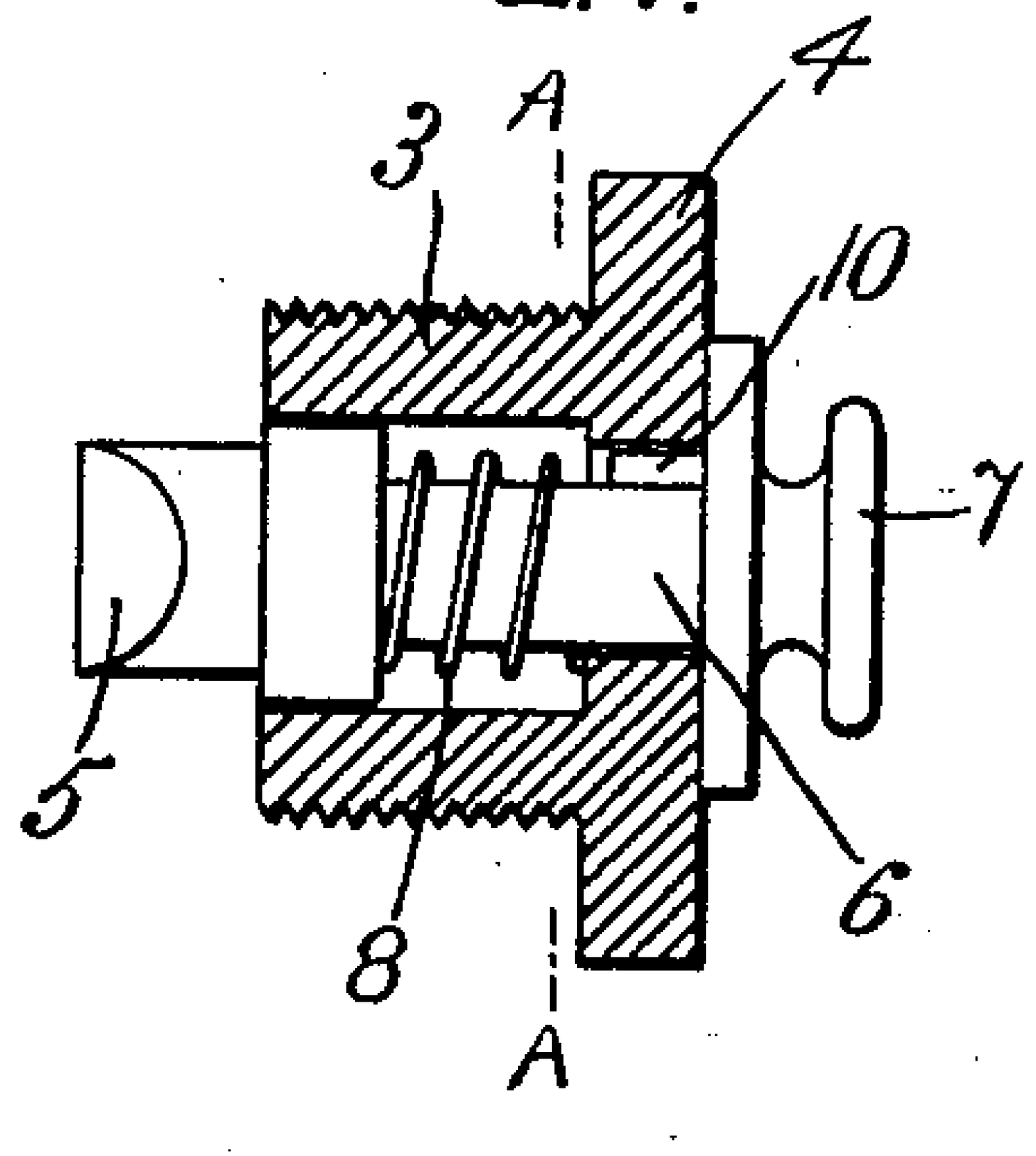


FIG. 5.

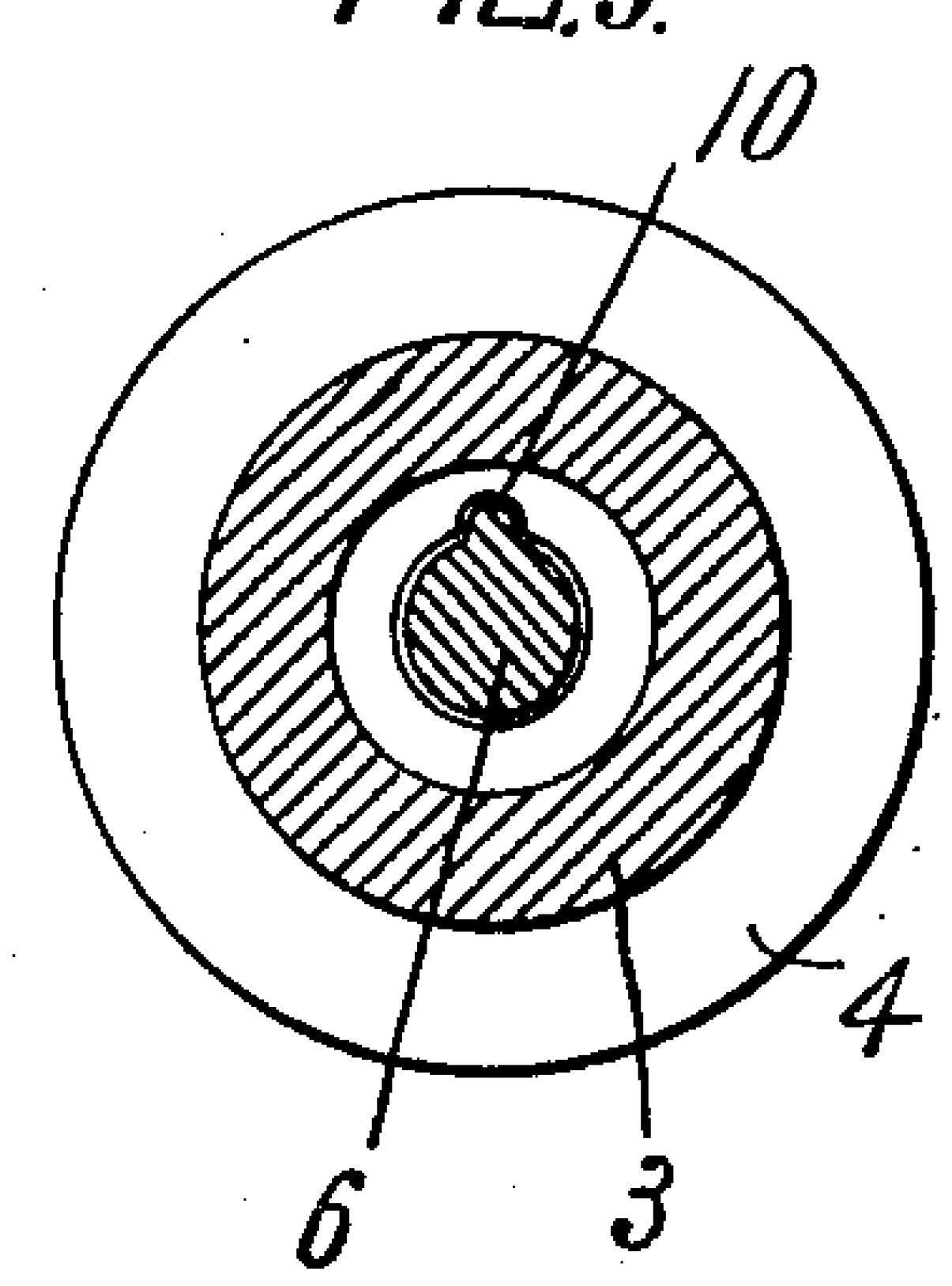
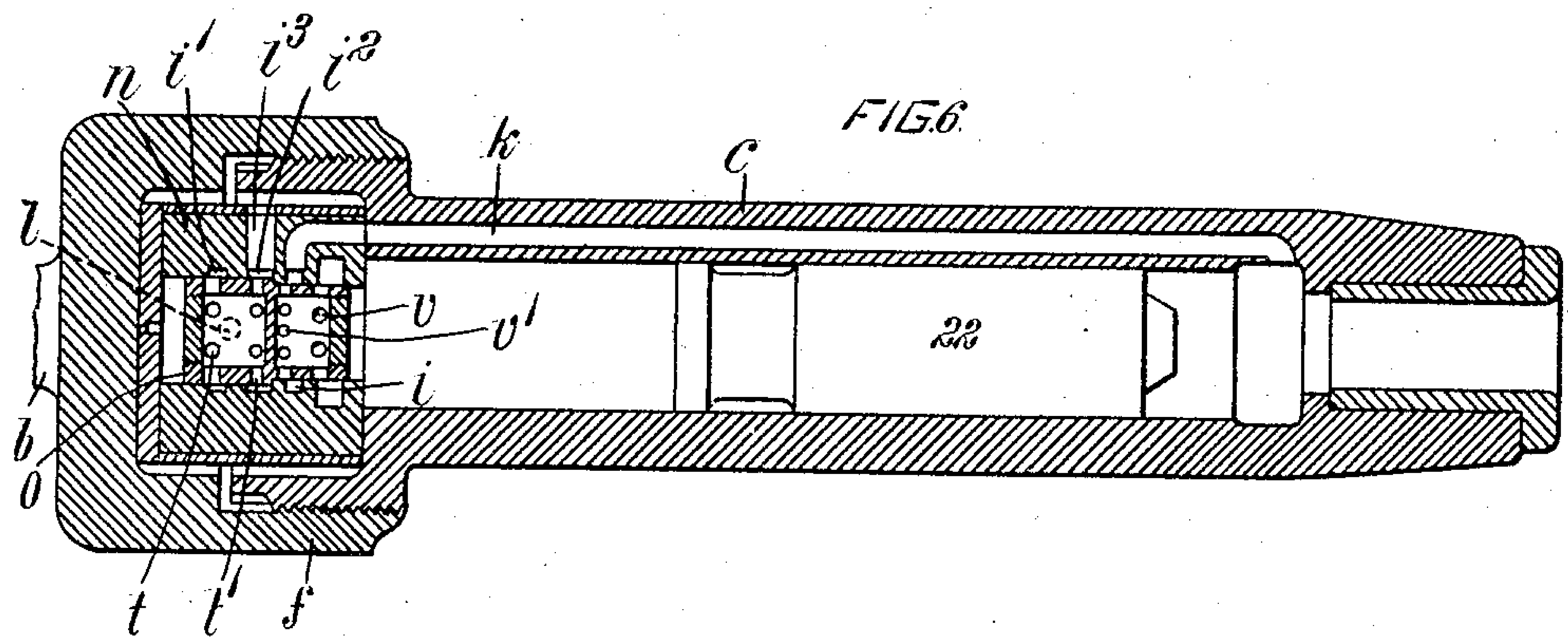


FIG. 6.



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No. 771,554. Patented October 4, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM LAIRD KETCHEN AND HARRY FRANKLIN ADAMS, OF MONTREAL, CANADA.

PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 771,554, dated October 4, 1904.

Application filed October 8, 1903. Serial No. 176,250. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM LAIRD KETCHEN and HARRY FRANKLIN ADAMS, both of the city of Montreal, in the district of Montreal and Province of Quebec, Canada, have invented certain new and useful Improvements in Pneumatic Hammers; and we do hereby declare that the following is a full, clear, and exact description of the same.

This invention relates particularly to pneumatic hammers wherein a valve is located centrally and longitudinally thereof; and the object thereof is to render the action of the hammer more sensitive and increase the speed thereof.

The invention may be said, briefly, to consist of a tubular valve of uniform interior diameter and with the exterior diameter of one-half greater than that of the other in order to provide a shoulder which constitutes a seat. A pair of plugs close the opposite ends of the tubular valve. A partition separates the interior thereof into two independent valvular chambers, and the perimeter of each chamber is perforated.

A further feature of the invention is a removable nut carried by the handle and adapted to in turn carry a latch to engage the inner end of the barrel of the hammer and prevent it becoming unscrewed after it has been screwed in place.

For full comprehension, however, of our invention, reference must be had to the accompanying drawings, forming a part of this specification, in which similar reference characters indicate the same parts, and wherein—

Figure 1 is a longitudinal sectional view of a pneumatic hammer provided with a valve and lock constructed according to our invention. Fig. 2 is an end elevation of our improved lock removed, and Fig. 3 is a side elevation of our improved valve removed. Fig. 4 is a longitudinal sectional view of the plug which carries the pawl whereby the parts of the hammer are locked together and illustrating particularly the key for preventing the rotation of this pawl. Fig. 5 is a transverse vertical section thereof, taken on line A A, Fig. 4. Fig. 6 is a longitudinal sectional view of the hammer provided with our improved valve.

The handle *b*, barrel *c*, having one end screw-threaded, as at *d*, and the interiorly-screw-threaded short sleeve *f*, formed integrally with the handle and adapted to receive the screw-threaded end of the barrel, together with the piston 22, with its groove 23, valve-cage *n*, having interior shoulder 25, ports *g*, *h*, *i*, *i'*, and *i*^{2}, *j*, *k*, and *l*, and the supply-controlling lever *m* are of well-known construction and will not be described in detail.

Our improved valve is located slidably in the valve-cage *n*, and consists of a short length of metallic tubing *o*, having one-half of increased diameter to provide a circumferential shoulder *p*, constituting a valve-seat. The perimeter thereof is smooth otherwise, and its interior is divided midway of its length by a partition or diaphragm *q*, and a pair of plugs *r s* close the ends, while a series of perforations *t* and *t'* lead into the space *u*, inclosed by the diaphragm, plug *r*, and the portion of the valve between them, and a second series of perforations *v* and *v'* lead into the space *w*, inclosed by diaphragm *q*, plug *s*, and the portion of the valve between them. The space *u* constitutes at times an exhaust-chamber, and the space *w* constitutes alternately a supply and an exhaust chamber, the chamber *u* serving as the exhaust-chamber only when the chamber *w* acts as a supply-chamber during the other intervals—that is to say, when chamber *w* acts as an exhaust the chamber *u* performs no function. A valve of this construction presents a more extensive bearing-surface, and owing to its even perimeter the life of the hammer is extended, because the bearing-surfaces slide one over the other without any chance of edges catching. The valve is also of minimum weight, and consequently is more sensitive and will act more quickly than the valves heretofore known. The shoulder upon our valve cannot catch upon the edges of the ports *i*, because the valve's movement is not sufficient, said shoulder, as before pointed out, acting only as a seat. The plug *r* beside serving as one of the walls of the chamber *u* also serves as a piston-face, which offers a maxi-

mum resistance to the motive fluid (generally compressed air) and causes said fluid to move the valve immediately the fluid enters the valve-chamber, thus causing the valve to respond more quickly than heretofore. The plug *s* presents a piston-surface whereby the valve is lifted.

The operation of a hammer provided with our improved valve is as follows: The live air enters through the handle into port *j*, wherein a constant pressure is maintained. In Fig. 1 the valve is illustrated in its position to admit air to move the piston 22 toward the tool, and simultaneously with this movement of the piston the air in the space in advance of the piston is exhausted through ports *k* and *i*, valvular ports *v*, chamber *w*, valvular ports *v'*, and ports i^2 and i^3 to the atmosphere. When the piston reaches a point in its travel with its groove 23 registering with the end of port *j*, the live air passes through groove 23 to port *g* and flows therethrough to the inner end of the valve-cage *n*, thus exerting a greater pressure upon that end of the valve (owing to its greater diameter) than is exerted upon the other end, which has the effect of instantaneously moving the valve to its seat with the shoulder *p* upon the valve resting upon the interior shoulder 25 of the cage. The valve in this position shuts off the live air from the rear end of the piston and causes it to flow from port *j* through valvular ports *v*, chamber *w*, valvular ports *v'*, port *k* to the portion of the interior of the barrel between the inner end of the tool (not shown) and the striking end of the piston, thereby returning the piston. During this return movement the air is exhausted from the space between the inner end of the piston and the valve through ports *h* and *i'*, valvular ports *t*, chamber *u*, valvular ports *t'*, and ports i^2 and i^3 to the atmosphere. When the piston in its return travel covers port *h*, the exhaust is of course shut off and the body of air between the piston and the valve is compressed, (under the force of the momentum of the piston,) and whatever pressure may be in port *g* and the inner end of the valve-cage is overcome, and the valve again assumes the position in which it is illustrated and the operation is repeated. It is obvious that valvular ports *t*, chamber *u*, and valvular ports *t'* are to all intents and purposes a port effecting at times a communication between the ports *i'* and i^2.

According to our invention an improved lock is provided to prevent displacement of the barrel relatively to the handle of the hammer, and the sleeve *f* of the handle has an opening 2 therethrough, the outer end whereof is enlarged and tapped, a nut 3, of tubular form, being threaded into the enlarged portion of this opening and having a circumferential flange 4 at its outer end to limit the extent to which it may be screwed into the sleeve. A pawl or latch 5 is carried in this nut and has a stem 6 with a knob 7 at its outer end, said stem projecting through said nut, while an expansile spring 8 normally causes said pawl to project inwardly through the opening in the sleeve. The inner end of the barrel is provided with a series of ratchet-teeth 9, with which the pawl engages and prevents the barrel being unscrewed until the knob 7 is pulled upon, which frees the pawl from the ratchet-teeth. The main advantageous feature of this lock is that the barrel is effectively prevented from being displaced after it has been tightly screwed into contact with the handle, thus obviating any chance of leakage from the valve-chamber and enabling the highest efficiency to be secured from our improved valve. The spring-pawl has a key 10 upon one side of its stem and adapted to engage and slide in a groove in the nut when the pawl is in engagement with the ratchet-teeth and to rest upon the center face of the nut when the pawl is drawn out and turned, thus serving to retain the pawl out of engagement with the ratchet-teeth when the barrel is to be disconnected.

What we claim is as follows:

1. A tubular valve for the purpose set forth, having both ends closed and presenting flat surfaces at right angles to the axis of the valve, a shoulder upon the perimeter of said valve between its ends, the portion of such valve between the shoulder and one end being perforated and the portion thereof between the shoulder and the opposite end having a port therein, and means preventing the passage of a motive fluid from the first-mentioned perforations to the last-mentioned port.

2. In a pneumatic hammer having motive-fluid supply-ports and exhaust-ports, a tubular valve having an annular shoulder encircling the perimeter thereof between its ends and constituting a seat, the portion of the perimeter from said shoulder to one end of the valve being plane and of uniform diameter throughout and the portions of the perimeter from the shoulder to the opposite end of the valve being of uniform diameter throughout and of greater diameter than the first-mentioned portion and valvular means whereby the motive fluid from said supply-ports will reciprocate said valve and actuate the hammer.

3. A tubular valve having an annular shoulder encircling the perimeter thereof and constituting a seat, portions of the perimeter from said shoulder to each end of the valve being plane, said tubular valve having both ends closed, a transverse diaphragm dividing the interior of said valve midway of its length, and the perimeter of said valve having a series of perforations, substantially as described and for the purpose set forth.

4. In a pneumatic hammer the combination with the barrel thereof having a series of ports therein, of a tubular valve having an

annular shoulder encircling the perimeter thereof and constituting a seat, said perimeter being perforated, a pair of plugs closing the opposite ends of said tubular valve, and a transverse diaphragm dividing the interior of said valve midway of its length into two independent chambers in said valve one of which acts alternately as a supply and an exhaust chamber while the other chamber acts as an exhaust-chamber during the intervals that the first-mentioned chamber acts as a supply-chamber, substantially as described and for the purpose set forth.

5. In a pneumatic hammer the combination with the barrel thereof having a series of ports therein, of a tubular valve having an annular shoulder encircling the perimeter thereof and constituting a seat, said perimeter being perforated, a pair of plugs closing the opposite ends of said tubular valve, and means providing two independent chambers in said valve one of which acts alternately as a supply and an exhaust chamber while the other chamber acts as an exhaust-chamber during the intervals that the first-mentioned chamber acts as a supply-chamber.

6. In a pneumatic hammer comprising a barrel, and a handle portion, said handle portion having a part overlapping said barrel, and means for connecting said barrel to said overlapping portion, the combination with said barrel and handle, of a nut of tubular form carried in an opening in said overlapping part, said opening extending completely through said overlapping part, an annular series of ratchet-teeth formed upon the inner end of said barrel, a spring-pawl carried within said tubular nut and adapted to engage said ratchet-teeth, means for disengaging said pawl from said ratchet-teeth, and means for locking said pawl in its disengaged position.

7. In a pneumatic hammer the combination with a barrel, and a handle portion, of a device for locking same together, means for disengaging said locking device thereby allowing one of said parts (the barrel or the handle) to move relatively to the other, and means for locking said locking device in its disengaged position.

8. In a pneumatic hammer comprising a barrel, and a handle portion one of such parts having a portion overlapping the other part, the combination with said overlapping part, of a nut of tubular form and threaded into an opening in said sleeve in line with the inner end of the barrel, and having a circumferential flange upon its outer end, and means carried by said nut and adapted to lock the overlapping part to the part overlapped thereby.

9. In a pneumatic hammer comprising a barrel, and a handle portion, said handle portion having a part overlapping said barrel, and means for connecting said barrel to said overlapping portion, the combination with said barrel and handle, of a nut of tubular form carried in an opening in said overlapping part, and having a circumferential flange upon its outer end adapted to be jammed upon the edge of the opening, said opening extending completely through said overlapping part, an annular series of ratchet-teeth formed upon the inner end of said barrel, a spring-pawl carried within said tubular nut and adapted to engage said ratchet-teeth, means for disengaging said pawl from said ratchet-teeth.

10. In a pneumatic hammer comprising a barrel, and a handle portion, the handle portion being formed with an interiorly-screw-threaded sleeve, and the barrel being formed at one end with an exteriorly-screw-threaded annular flange adapted to be threaded into said interiorly-screw-threaded sleeve, the combination with said sleeve and barrel, of a nut of tubular form and threaded into an opening in said sleeve in line with the inner end of the barrel, said opening extending completely through said sleeve, an annular series of ratchet-teeth formed upon the exterior of the extremity of said screw-threaded flange of the barrel, a spring-pawl carried within said tubular nut and adapted to engage said ratchet-teeth, means for disengaging said pawl from said ratchet-teeth, and means for locking said pawl in its disengaged position.

11. In a pneumatic hammer comprising a barrel, and a handle portion, the handle portion being formed with an interiorly-screw-threaded sleeve, and the barrel being formed at one end with an exteriorly-screw-threaded annular flange adapted to be threaded into said interiorly-screw-threaded sleeve, the combination with said sleeve and barrel, of a nut of tubular form and threaded into an opening in said sleeve in line with the inner end of the barrel, and having a circumferential flange upon its outer end adapted to be jammed upon the edge of the opening, said opening extending completely through said sleeve, an annular series of ratchet-teeth formed upon the exterior of the extremity of said screw-threaded flange of the barrel, a spring-pawl carried within said tubular nut and adapted to engage said ratchet-teeth, means for disengaging said pawl from said ratchet-teeth.

In testimony whereof we have affixed our signatures in presence of two witnesses.

WILLIAM LAIRD KETCHEN.
HARRY FRANKLIN ADAMS.

Witnesses:
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