No. 626,497.

Patented June 6, 1899.

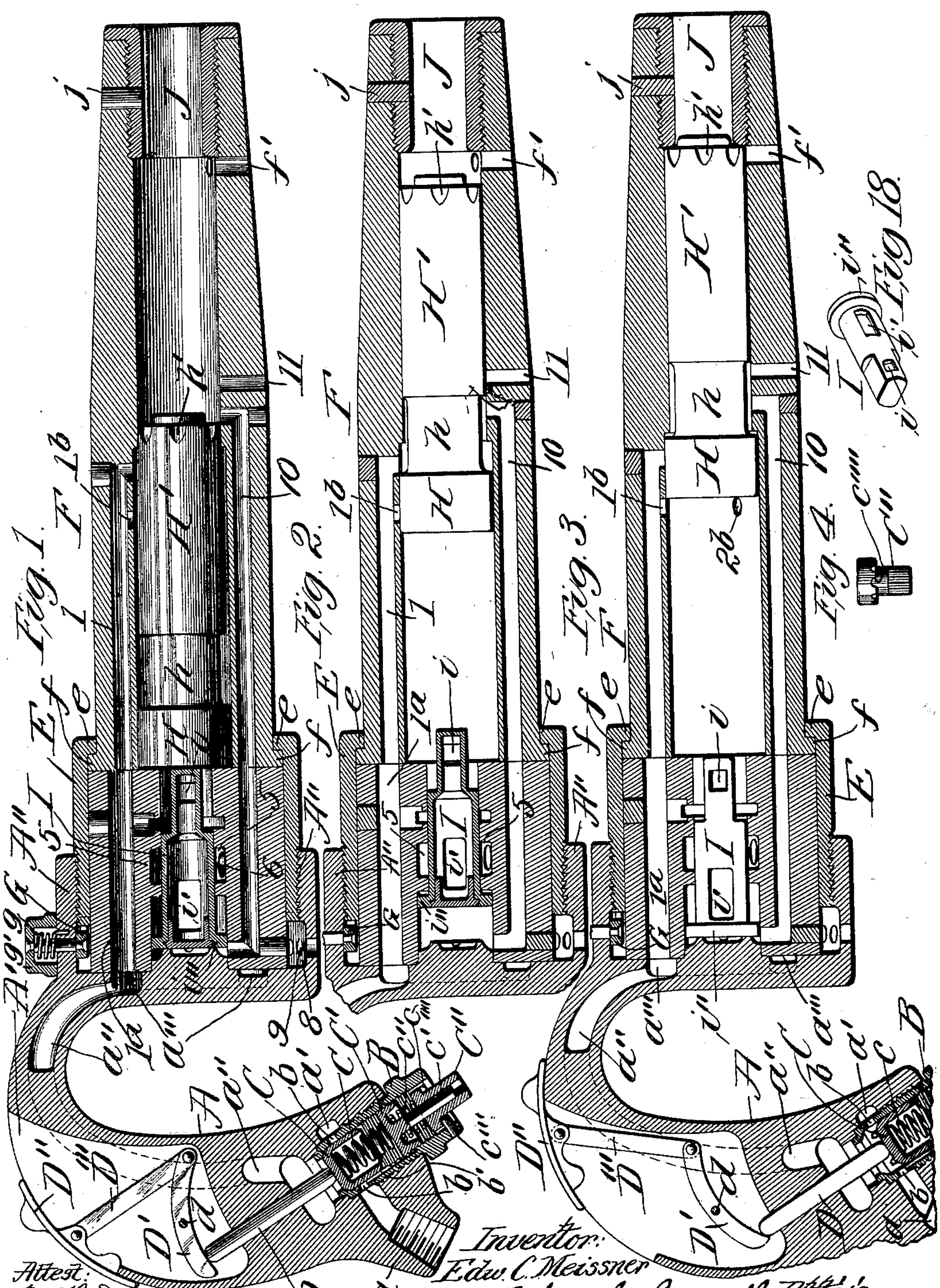
E. C. MEISSNER.

PNEUMATIC HAMMER.

(Application filed Dec. 13, 1898.)

(No Model.)

2 Sheets—Sheet 1.



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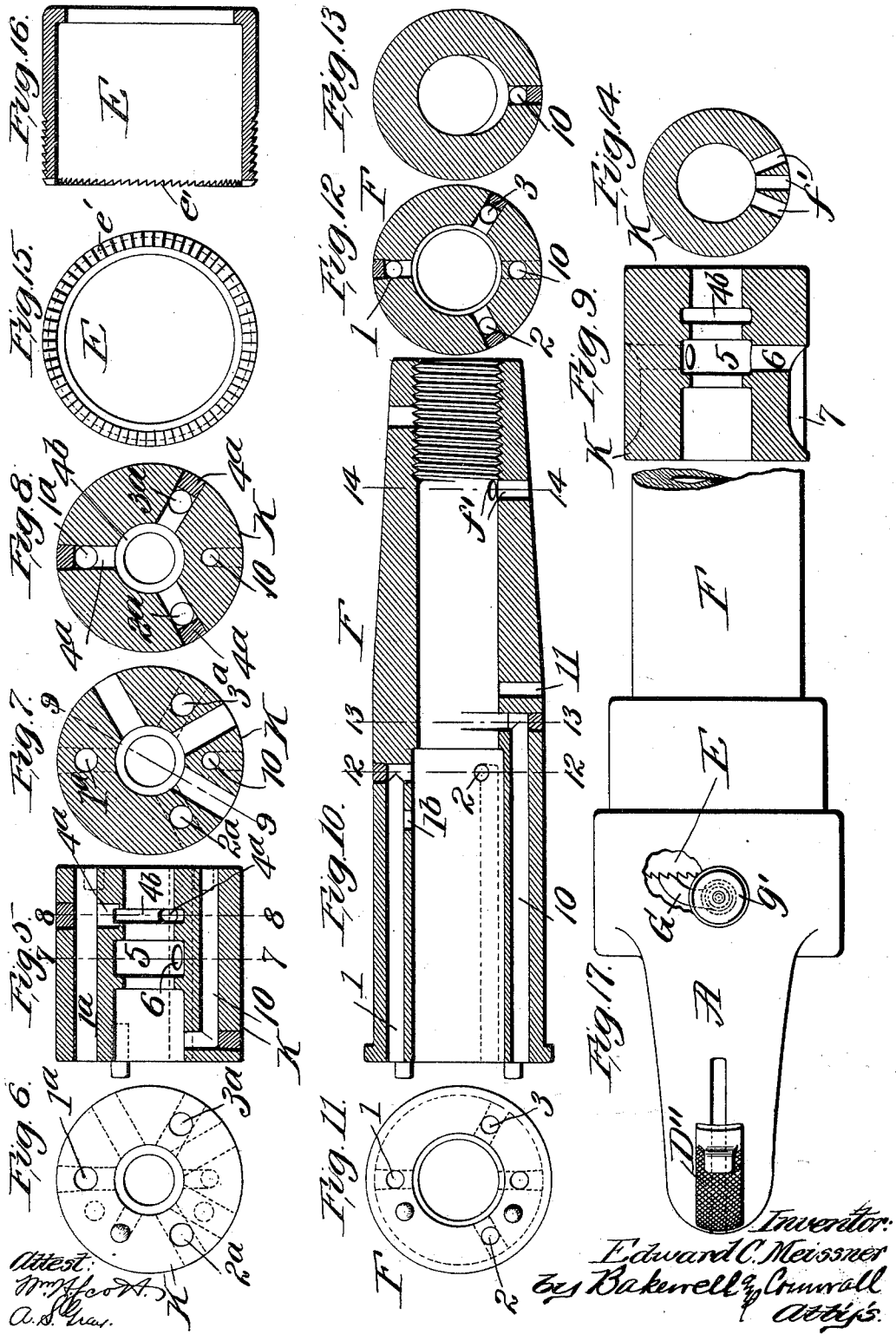
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(No Model.) 2 Sheets—Sheet 2.



THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWARD C. MEISSNER, OF ST. LOUIS, MISSOURI.

PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 626,497, dated June 6, 1899.

Application filed December 13, 1898. Serial No. 699,117. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. MEISSNER, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Pneumatic Hammers, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal sectional view through my improved pneumatic hammer, showing the piston in its rear position. Fig. 2 is a similar view, the handle being omitted, showing the piston in its forward position. Fig. 3 is a similar view showing the piston in its extreme forward position. Fig. 4 is a detail view of the adjusting-nut for placing a tension on the throttle-valve spring. Fig. 5 is a longitudinal sectional view of the valve-block. Fig. 6 is a rear end elevational view of the same. Fig. 7 is a cross-sectional view of the same on line 7 7 of Fig. 5. Fig. 8 is a cross-sectional view of said valve-block on line 8 8 of Fig. 5. Fig. 9 is a longitudinal sectional view on line 9 9 of Fig. 7. Fig. 10 is a longitudinal sectional view of the cylinder or barrel. Fig. 11 is an end elevational view of the same. Fig. 12 is a cross-sectional view of the cylinder on line 12 12 of Fig. 10. Fig. 13 is a cross-sectional view of the cylinder on line 13 13 of Fig. 10. Fig. 14 is a cross-sectional view of the cylinder on line 14 14 of Fig. 10. Fig. 15 is a rear end elevational view of the collar or coupling-sleeve for securing the handle to the cylinder and clamping the valve-block in position. Fig. 16 is a longitudinal sectional view through said sleeve. Fig. 17 is a view in side elevation of the handle and part of the cylinder, showing the manner of locking the coupling-sleeve in its home position; and Fig. 18 is a detail view of the piston-valve.

This invention relates to a new and useful improvement in pneumatic hammers, a term applied to direct-acting engines of a certain class, in which a chisel or like tool is loosely introduced into the nose of the cylinder for receiving impacting blows from the piston. The engine is designed to be held in the hand of an operator and guided in its work. Fluid-pressure, usually in the form of compressed air, is supplied to the engine through the medium of flexible hose or supply-pipe, which is connected to the outer end of the handle. A throttle-valve under control of the operator controls and regulates the admission of pressure fluid to the engine.

The object of this present invention is to construct an engine of the character described which is simple, cheap, and effective in operation and one which is free from vibrations usually present in engines of this class, which vibrations render the handling of the tool by the operator extremely tiresome and difficult.

With this object in view the invention consists in the novel construction of the throttle-valve, the means for adjusting the tension of its spring, and the means for regulating or controlling said valve.

Another feature resides in the construction of the cylinder, valve-block, and handle-base, whereby said parts are coupled by the sleeve or collar, and in the provision of means for locking said sleeve or collar in its home or adjusted position.

Another feature resides in the novel construction and method of operation of the piston-controlling valve.

Another feature resides in the construction of the piston and the port arrangements for admitting pressure to actuate the same, whereby in the absence of a tool-shank upon which the piston is to deliver a blow said piston will be moved forwardly to an abnormal position and cease reciprocating, the pressure being delivered only at one point—to wit, at the rear of the piston—and said port arrangements being such that upon the introduction of the tool the piston will be moved rearwardly into an operating position and immediately commence reciprocating.

Other features reside in the construction, arrangement, and combination of the several parts, all as will hereinafter be described, and afterward pointed out in the claims.

In the drawings, A indicates a handle provided with a suitable inlet duct or port through which the pressure is supplied to the engine. This port terminates at the outer end of the cylinder, and a threaded opening

a is provided for the attachment of the hose or suitable nipple.

B indicates a thimble threaded into the base of the handle and across a live-pressure chamber a', said thimble receiving a sliding throttle-valve C, which is held in a closed position by a spring c. A rod D, slidingly mounted in the handle, bears against the valve C at one end and a lever D', pivoted at d, bears against the other end of rod D. A sliding thumb-plate D'', preferably provided with a lug or projection at its upper end, is mounted upon a track on the handle by bridging a slot A' in said handle, into which slot the end of rod D projects and the lever D' is mounted. A link D''' connects the inner end of lever D' with the thumb-plate D'', so that when said thumb-plate is slid forward, as shown in Fig. 3, rod D will force the throttle-valve downwardly and open a series of openings b in the thimble B and admit fluid-pressure into the supply-duct a''. The face of the thumb-plate D'' is preferably knurled, so that it can be moved in both directions with ease by the thumb of the operator.

The spring C, which tends to hold the throttle-valve home, bears at its other end against a block C', which is interiorly threaded in the thimble B. Block C' is provided with an outwardly-extending stem c', angular in cross-section, which is received in a correspondingly-shaped opening in a cap-piece C'', which is held in its outer position by a spring c'', interposed therebetween and the block C'.

A pin c''', introduced into the outer end of thimble B after the parts are assembled, bears against the outer face of the flange on the inner end of the cap-piece and fits in suitable notches c'''', provided in the outer face of said flange, whereby when said cap-piece is pressed inwardly it slides on stem c' and being disengaged from the pin c''' is capable of being turned to adjust the block C' inwardly or outwardly, which adjustment regulates the amount of travel, and consequently the amount of port openings, of the throttle-valve. When pressure is released from the cap-piece, the spring c'' forces the same outwardly and causes an engagement between one of the notches thereof and the pin c''', which prevents accidental rotation of the parts.

A by-pass b' is provided within the thimble B to conduct pressure behind the throttle-valve for the purpose of balancing said valve when in an open position, so that the same may be easily operated by its spring, and also for assisting in holding said valve in a closed position.

The supply-duct a' is located to one side of the slot A' and opens into a concentric groove a''' in the handle-base. The handle-base is provided with interiorly-threaded flanges A'', which engage a collar or coupling-sleeve E, whose forward end is provided with an inturned flange e, fitting under a ring or flange f, formed at the rear end of the cylinder. The valve-block or that part of the engine which receives the piston-controlling valve is clamped between the handle-base and the end of the cylinder by means of this coupling-sleeve, and in order to lock the coupling-sleeve in its home position and prevent accidental unscrewing thereof, which would seriously affect the operation of the engine, I notch or form a series of serrations e' on the rear edge of this coupling-sleeve, as shown more clearly in Figs. 15 and 16, and mount in the flange A'' of the handle a spring-pressed pawl or dog G, which is permitted to ride over said serrations when the collar is being screwed home and which prevents the accidental unscrewing of said collar. This dog G is mounted on a stem, around which is wound a torsional spring g, one end of said torsional spring entering the flange and the other end the stem or a cap-piece g', arranged on the outer end of the stem and by which the same can be turned to raise the dog out of engagement with the serrations on the end of the coupling-sleeve whenever it it is desired to unscrew the said sleeve. The operation of this dog is shown more clearly in Figs. 1 and 17.

I will now describe the port arrangements and the manner in which pressure is admitted to the piston and its controlling-valve.

The cylinder or barrel, which I have marked F, as an entirety is bored to two different diameters, the larger of which receives the head H of the piston and the smaller the body portion H' of said piston, said head being connected to said body portion by a reduced neck or shank h. When the chisel-shank is in position, the piston moves forward and delivers an impacting blow, being arrested at such forward movement at practically the point indicated in Fig. 2. Ports 1, 2, and 3 open into the forward end of the larger bore of the cylinder near the shoulder or the beginning of the smaller bore, these ports registering with corresponding ports 1^a, 2^a, and 3^a, formed in the valve-block and which open at their rear ends into the live-pressure chamber or concentric groove a'''. Pressure is thus conducted under or in advance of the larger head of the piston and tends at all times to force said piston rearwardly. In other words, there is a constant pressure in advance of the piston and an intermittent pressure behind the larger head of the piston. This intermittent pressure is controlled by a valve I, preferably centrally arranged relative to the valve-block, said valve being of two different diameters—that is, being formed with a large head at its rear and being made hollow for purposes hereinafter described. Leading from the ports 1^a, 2^a, and 3^a in the valve-block are ports 4^a, which open into a concentric groove 4^b, controlled by the front end of the body portion of the valve I, these ports being closed when the valve is in its forward position and shutting off pressure from behind the piston, as shown in Fig. 2, said ports being open when the valve is moved rearwardly to admit pres-

sure behind the piston, as shown in Figs. 1 and 3. As shown in Fig. 18, valve I consists of a cylindrical hollow body closed at its front and rear ends and is flattened on two sides at its forward end, which forward end projects through the valve-block to be struck by the piston in its rearward movement, said flattened forward end being provided with diametrically opposite openings *i*, which are open to the cylinder-chamber when the valve is in its forward position, but which are closed when the valve is forced rearwardly into the valve-block. Near the rear end of the valve are provided two or more openings *i'*, which are when the valve is in its rearward position idle in the same manner as are the openings *i*, but which when the valve is in its forward position open into a space 5 in the valve-block, which is the exhaust-chamber of the engine. This chamber 5 in the valve-block is located in advance of the larger bore of the valve-block in which the head *i''* of the valve operates, the material forming the rear wall of said chamber also acting as a stop to limit the forward movement of the valve. The rear edges of the openings *i'* when they pass this stop confine a small quantity of air at atmospheric pressure in front of the head *i''* for the purpose of cushioning the valve in its forward movement and preventing its head from hammering. Chamber 5 has leading from it a number of ports 6, which communicate with grooves 7 in the periphery of said valve-block, said grooves opening into an exhaust-chamber 8, formed in the handle-base behind the collar or coupling-sleeve E. 9 are openings from this exhaust-chamber to the exterior. Leading from behind the head of valve I is a port 10, whose forward end terminates in the smaller bore of the cylinder near the shoulder.

As shown in Fig. 1, assuming the throttle-valve to be open, pressure is being admitted through the ports 1^a, 2^a, and 3^a, and 1, 2, and 3 in front of the larger head of the piston. Likewise pressure is passing through ports 4^a and alongside the reduced or flattened parts of the valve to the chamber behind the larger head of the piston, where such last-named pressure preponderating by reason of the increased area of the piston exposed thereto will force the piston forwardly to deliver an impacting blow on the end of the tool-shank introduced through the nose of the cylinder. The position the piston occupies in delivering this impacting blow is illustrated in Fig. 2, where it will be seen that the space around shank *h* will connect the live pressure with the port 10, carrying said pressure behind the head of valve I for the purpose of forcing said valve forwardly, as shown in Fig. 2. This forward position of valve I protrudes its front end into the rear end of the larger cylinder-bore, opens its openings *i* to said chamber, and registers its openings *i'* with the exhaust-chamber 5. Such position of valve I relieves the pressure behind the piston, and the constant pressure in front of the piston forces the same rearwardly, confining for the time being the pressure behind the head of valve I. As the piston moves rearwardly the pressure therebehind passes into openings *i* through valve I, out through openings *i'*, and into chamber 5, whence it is led through ports 6 into grooves 7 and into the exhaust-chamber 8, whence it escapes into the atmosphere through openings 9. When the piston is near the rear limit of its stroke, it strikes the protruding end of valve I and forces the same rearwardly, so as to close its openings *i* and *i'*. This rearward position, as shown in Fig. 1, opens the front end of port 10 and permits the confined pressure behind the head of the valve to exhaust into the small bore of the piston and out through an opening 11 formed therein. When the valve is fully back, so as to prevent the escape of any pressure through the exhaust-passages, the front end of the cylindrical part of said valve opens ports 4^a and admits pressure behind the piston, as before.

It is desirable in this class of engines to provide means whereby the piston will cease operating in the absence of the tool-shank without necessitating the operator closing the throttle-valve every time he changes the position of the tool with respect to the work being done, and to accomplish this I permit the piston to move forwardly to an abnormal position in the absence of the tool-shank, so as to close the ports 1, 2, and 3 in front of the larger head thereof and open ports 1^b, 2^b, and 3^b, leading from ports 1, 2, and 3, respectively, near their forward ends. No pressure being in front of the piston under these conditions the pressure behind the piston will hold it in such forward position until the tool-shank is again inserted to move the piston rearwardly to the position shown in Fig. 2 or to such position that the ports 1, 2, and 3 will be opened in front of the larger head of the piston. It is obvious that when the piston is in its forward position, as shown in Fig. 3, being its abnormal forward position, the valve I is in its rearward position and is admitting pressure behind the larger head, which pressure can be in some instances relied upon to hold the piston forwardly and prevent its operation without resort being had to the openings 1^b, 2^b, and 3^b; but by reason of the possibility of accidental displacement of valve I from such rearward position, which might result in shutting off this pressure behind the piston and opening the exhaust of such pressure, I prefer to make the cessation of movement of the piston positive by providing the ports 1^b, 2^b, and 3^b. It will be seen that the exhaust behind the head of the valve is open to the exterior through the ports 10 and 11, and, further, that accidental displacement of the valve in the presence of the ports 1^b, 2^b, and 3^b is prevented by reason of the constant pressure against the forward end of the valve. In the front end of the cylinder I prefer to

thread in a hard metal bushing or sleeve J to receive the tool-shank, which bushing is pinned in place by a pin *j*. The inner end of this bushing receives the front end of the piston when the same is in an abnormal position, and thereby prevents the larger head of the piston from coming in contact with the shoulder in the cylinder and prevents the battering of one or both of said parts. The forward end of the piston is also, preferably, provided with notches *h'* for the purpose of giving a lead to the valve-exhaust in advance of the rearmost position of the piston. Openings *f'* are provided in the forward end of the cylinder immediately back of the bushing J to admit the intake and outward passage of the air drawn in and forced out by the cylinder in its reciprocations.

It will be noticed that I have referred to several of the ports as being in triplicate for the purpose of admitting and exhausting a large volume of pressure fluids; but it is obvious that but one or more of such ports can be used, if desired.

I am aware that many minor changes in the construction, arrangement, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a handle formed with a track, of a thumb-piece slidingly mounted on said track, and a throttle-valve mounted in said handle, which valve is operated by said thumb-piece; substantially as described.

2. The combination with a slotted handle provided with a track, of a thumb-piece, slidingly mounted on said track, a spring-pressed throttle-valve mounted in said handle, and a series of connected levers actuated by said thumb-piece for operating said valve; substantially as described.

3. The combination with a handle, a throttle-valve mounted therein, said valve comprising a thimble or sleeve, a throttle-valve for controlling openings through said sleeve, an adjustable plug behind said valve, a spring interposed between said valve and plug, and a sliding cap-piece for adjusting said plug; substantially as described.

4. The combination with a handle of a throttle-valve mounted therein, said valve comprising a thimble fixed in said handle, a sliding throttle-valve arranged in said thimble for closing ports therein, an adjustable plug behind said valve, a spring interposed between said plug and valve, a sliding cap-piece arranged on said plug for adjusting the same, and means for locking said cap-piece against rotary movement; substantially as described.

5. The combination with a handle, of a sliding thumb-piece arranged thereon, a link connected to said thumb-piece, a lever to which said link is connected, a push-rod against which the other end of said lever bears, and a spring-pressed throttle-valve whose position is controlled by said push-rod; substantially as described.

6. The combination with the handle-base formed with a threaded flange, a valve-block against which said base abuts, a cylinder having an outwardly-extending flange on its rear end which abuts against the other end of said valve-block, a collar or coupling-sleeve having an inturned flange engaging the cylinder-flange, said sleeve being also threaded and engaging the handle-base flange, the rear end of the coupling-sleeve being formed with radial ratchet-teeth, and a spring-pressed dog G, mounted in the flange of the handle-base for engaging the ratchet on the coupling-sleeve, and locking the parts together; substantially as described.

7. The combination with a handle-base formed with flanges A'', of a valve-block abutting against said handle-base, a cylinder F, provided with a flange *f*, at its rear end and abutting against said valve-block, a collar or coupling-sleeve E, formed with an inturned flange *e*, at its front end, which coöperates with the cylinder-flange *f*, said coupling-sleeve having a threaded connection with the flange A'', and a dog G, engaging notches or serrations at the rear of said coupling-sleeve, said dog being mounted in the flange of the handle-base, and being provided with a spring for causing its engagement with the collar or coupling-sleeve; substantially as described.

8. The combination with a threaded flange A'', of a coupling-sleeve E, engaging therewith, said coupling-sleeve being provided with notches or serrations on its engaging end, a dog G, pivotally mounted in the flange, a torsional spring for holding said dog in engagement with the coupling-sleeve, and a cap-piece fixed on the dog's spindle, by which the dog may be disengaged from the coupling-sleeve; substantially as described.

9. The combination with a cylinder bored to two different diameters, of a piston of corresponding diameters arranged therein, said cylinder being provided with ports for admitting constant pressure in front of the larger head of said piston, and a valve of two different diameters, which projects into the said larger bore of the cylinder for intermittently admitting pressure behind the larger head of said piston, and a port which is controlled by said piston, for intermittently admitting and exhausting pressure behind the head of said valve; substantially as described.

10. The combination with a cylinder formed with two different diameters, of a piston arranged in said cylinder, the body portion of said piston operating in the smaller diameter, and the larger head of said piston in the larger diameter, said head being connected to said body portion by a reduced shank, of

a valve-block arranged at the rear end of said cylinder, said valve-block containing a valve of two diameters, which operates in a correspondingly-bored opening, a pressure-supply passage having a port which constantly opens in advance of the larger head of the piston, and having a port which is controlled by said valve, which port intermittently admits pressure behind the larger head of the piston, and a port opening behind the head of the valve, which port is controlled by the piston; substantially as described.

11. The combination with a valve-block formed with an inlet-passage 1^a, port 4^a, exhaust-space 5, and port 10, of a hollow valve I, provided with a head at its rear end, and with openings i and i' in its side wall, which coöperate with the exhaust-passage when the valve is in a forward position, and a piston for positively moving said valve to the rear for closing said exhaust-passages and opening the inlet-port 4^a; substantially as described.

12. The herein-described valve, which is adapted to be moved positively in one direction by contact of its controlled piston, said valve being moved in the opposite direction by pressure, the same consisting of a hollow body portion having an enlarged head at its rear end, openings i and i' in its side walls, and flattened sides at its front end; substantially as described.

13. The combination with a cylinder formed with a bore of two diameters, of a piston of corresponding diameters arranged in said bore, a valve-block abutting against the rear end of the cylinder, a hollow valve I, slidingly mounted in said valve-block, the forward end of which valve is reduced and projects into the cylinder-bore, a head on the rear end of said valve, the side walls of said valve being provided with openings i and i', and suitable port arrangements whereby pressure is constantly admitted to force the piston to the rear, the pressure behind said piston being exhausted through the exposed opening i, the piston near the rear extremity of its stroke contacting with the valve to move the same rearwardly and open a live-pressure port, around the flattened sides of the valve to admit a preponderance of pressure behind the piston; substantially as described.

14. In a pneumatic hammer, the combination with a cylinder bored to two different diameters, with a shoulder between, a pressure-supply duct opening into the larger chamber near its forward end, a piston having an enlarged head fitting in the larger bore, and a small body portion fitting in the small bore, said head being connected to said body portion by a reduced shank, a valve which projects into the cylinder, and which is struck by the piston to be moved in one direction, and a port for intermittently admitting pressure behind the other end of said valve for throwing the same; substantially as described.

15. The combination with the cylinder formed with bores of two different diameters, of a piston arranged therein, a valve for controlling the admission of pressure to, and its exhaust from, the chamber behind the piston, said valve projecting into said chamber in one of its positions, where it is struck by the piston and moved in one direction, a passage leading from behind the valve and opening into the piston-chamber by a port located in advance of the shoulder between the bores of the cylinder, which port is adapted to be opened and closed by the piston, an exhaust-port 11, in the cylinder, in advance of said last-named passage, said cylinder being likewise provided with a port-opening 1^b, for admitting pressure behind the piston when said piston has moved forward beyond its normal operating position; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 7th day of December, 1898.

EDWARD C. MEISSNER.

Witnesses:
WM. H. SCOTT,
A. S. GRAY.