

(No Model.)

2 Sheets—Sheet 1.

W. M. WOOD.
PNEUMATIC TOOL.

No. 443,030.

Patented Dec. 16, 1890.

Fig. 1.

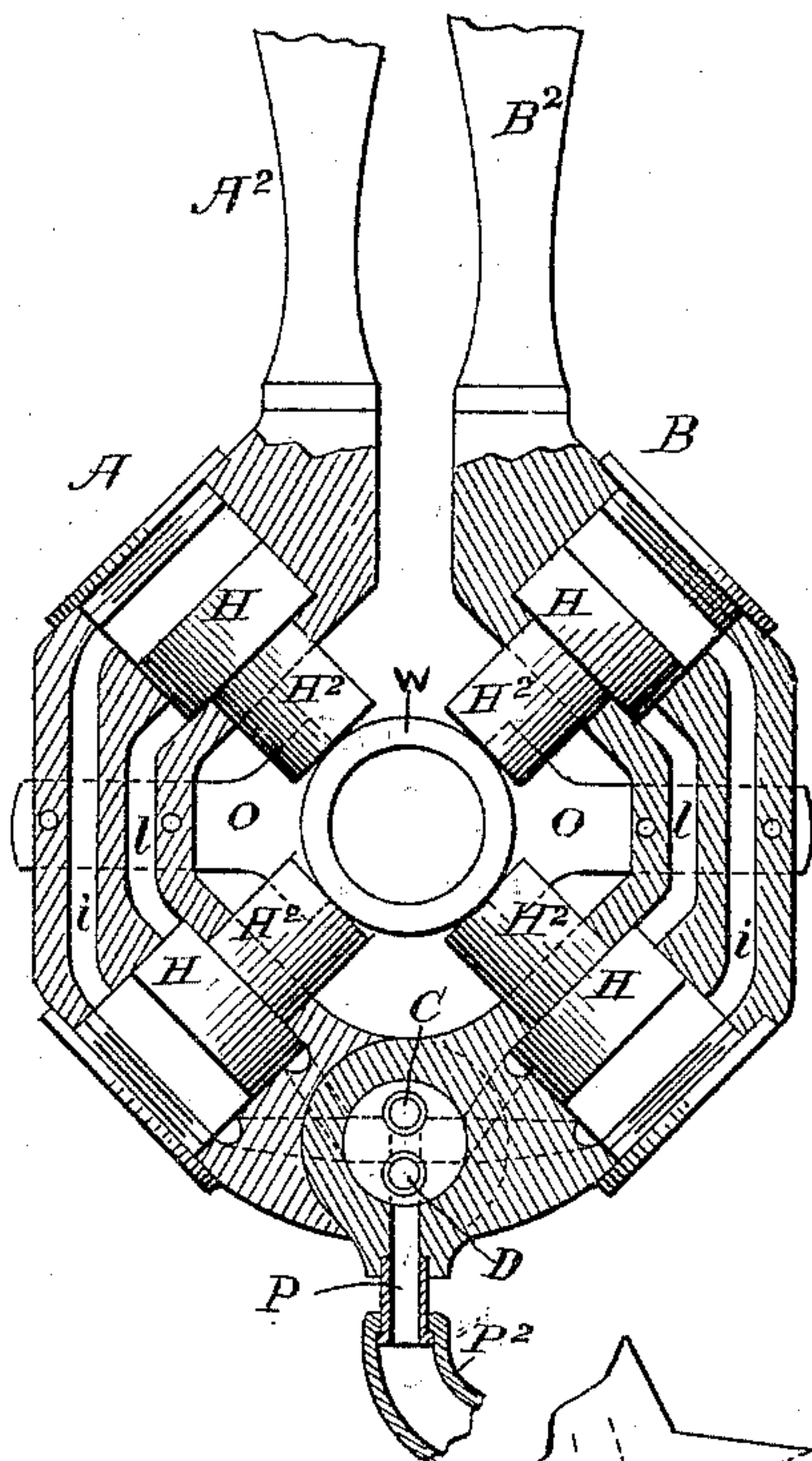


Fig. 2.

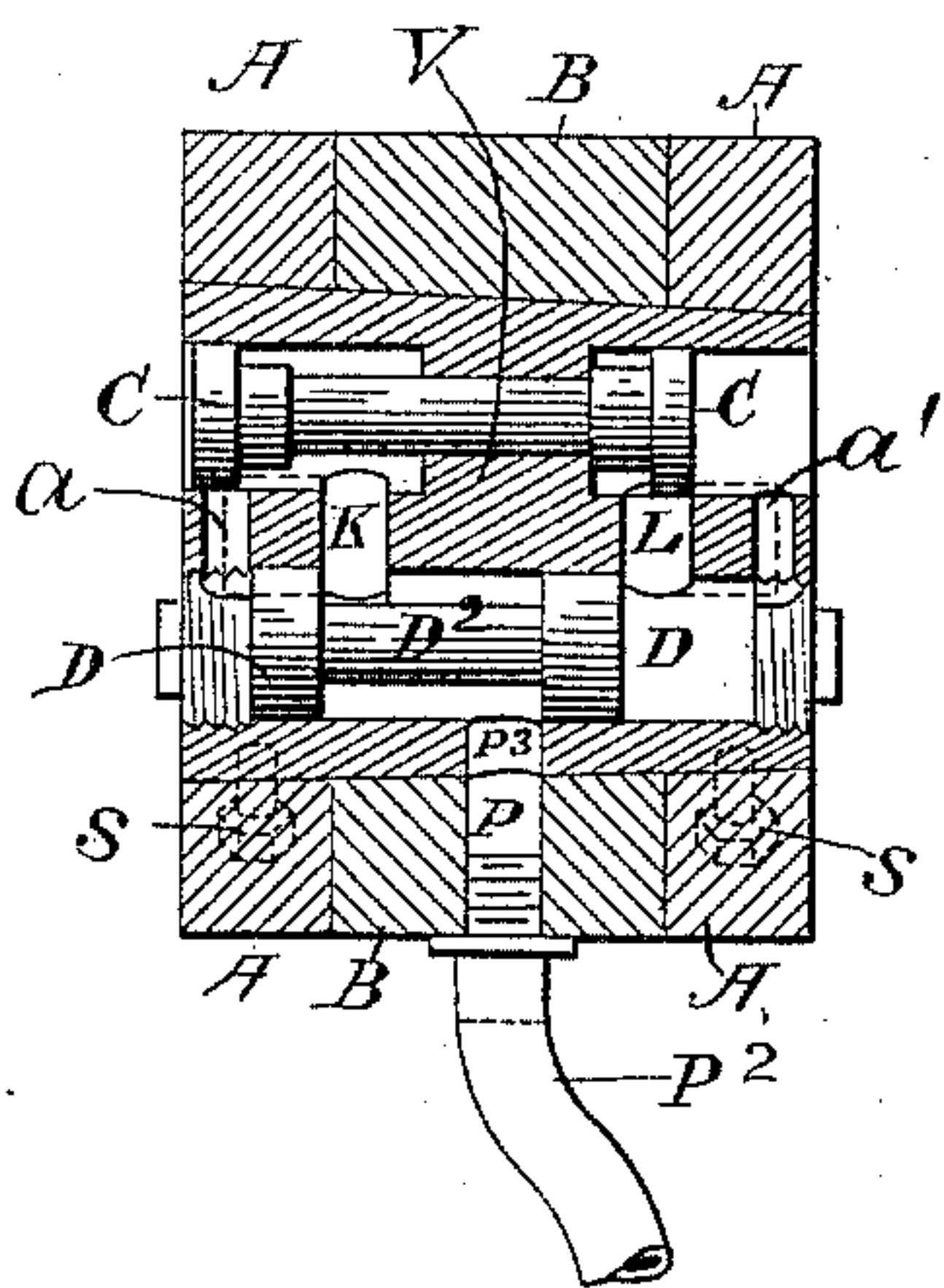
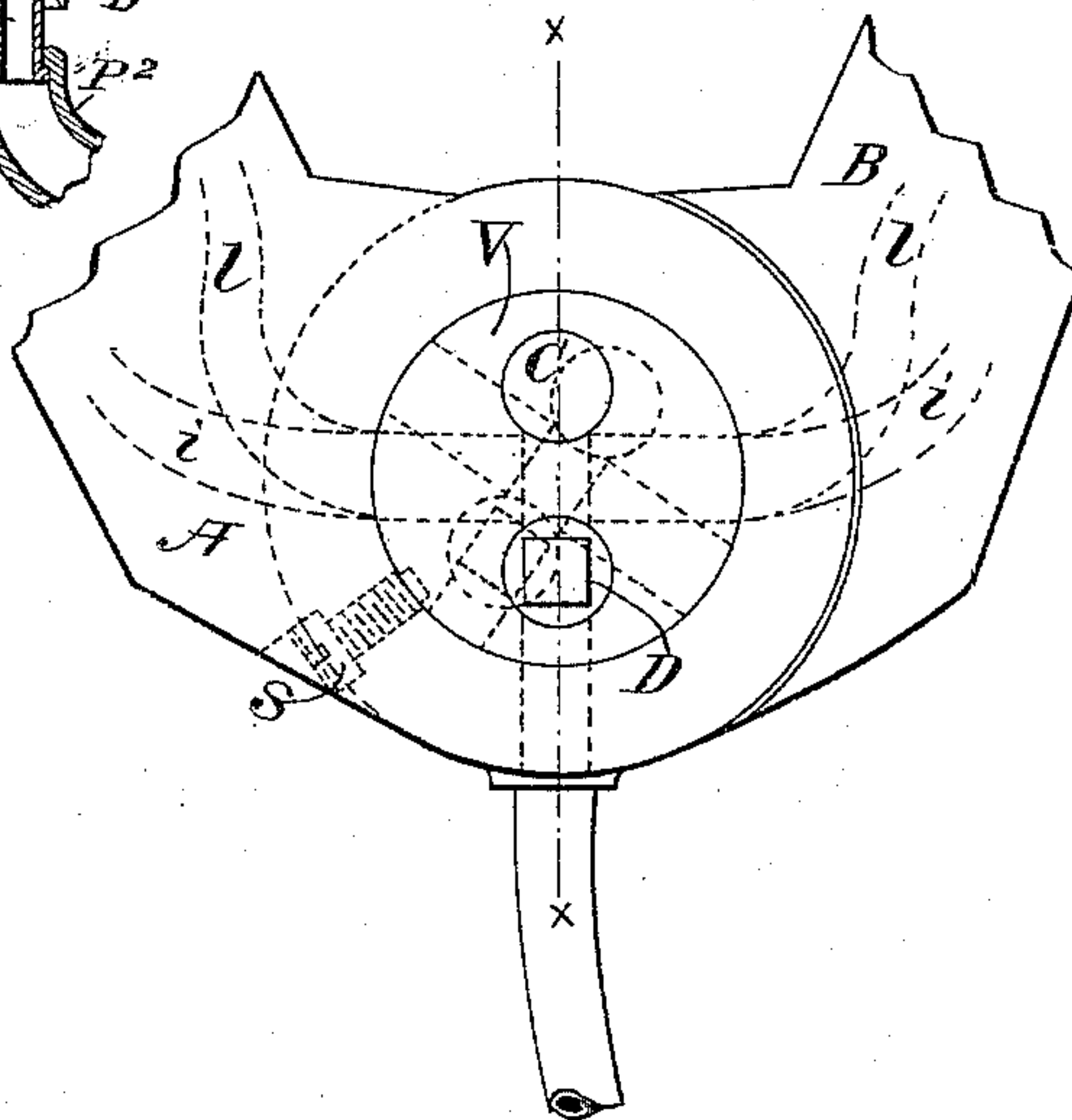


Fig. 3.

ATTEST:
J. H. Hurdle
W. H. Capel.

INVENTOR:
W. M. Wood

By H. L. Townsend
Attorney

(No Model.)

2 Sheets—Sheet 2.

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Fig. 4.

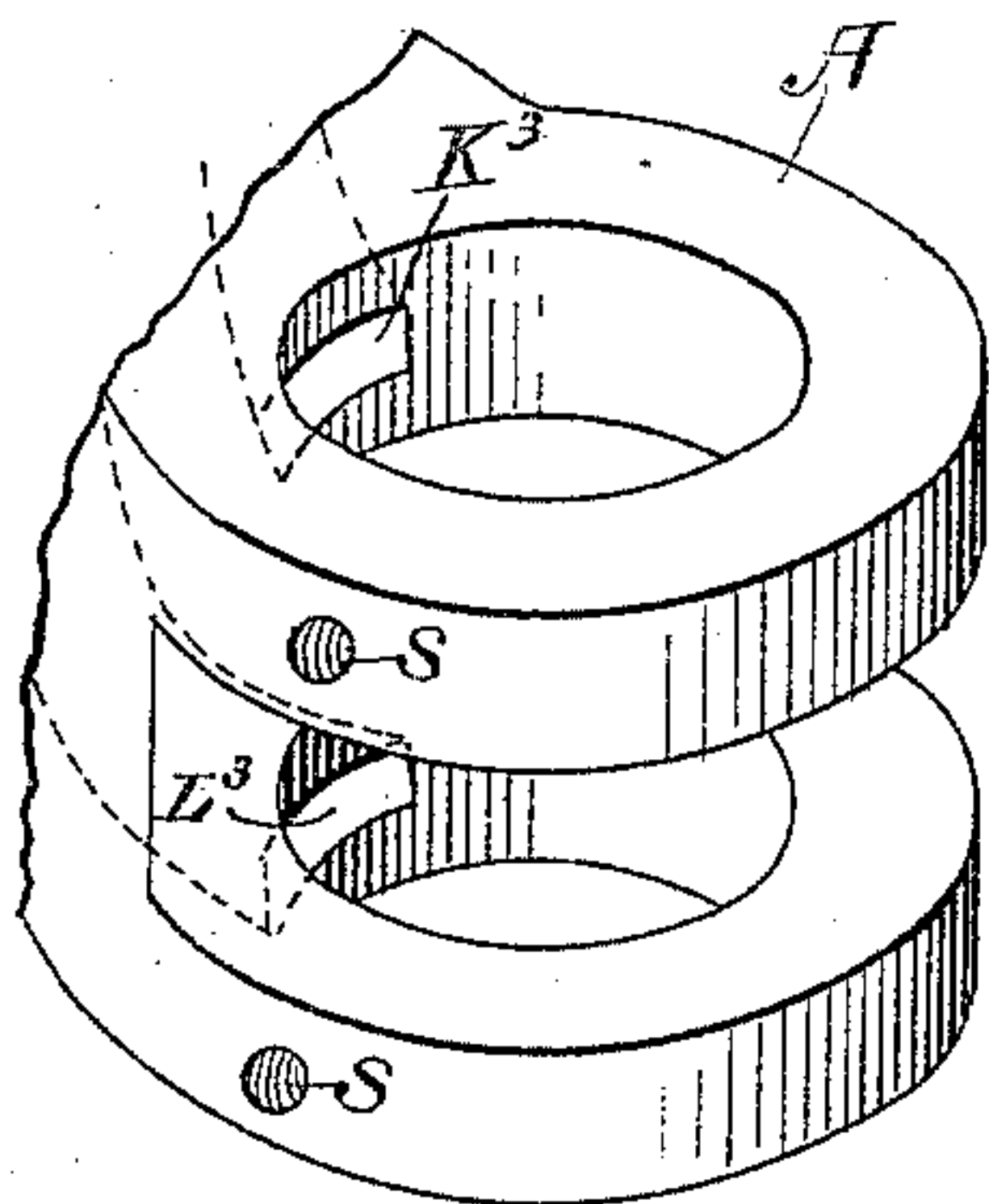


Fig. 5.

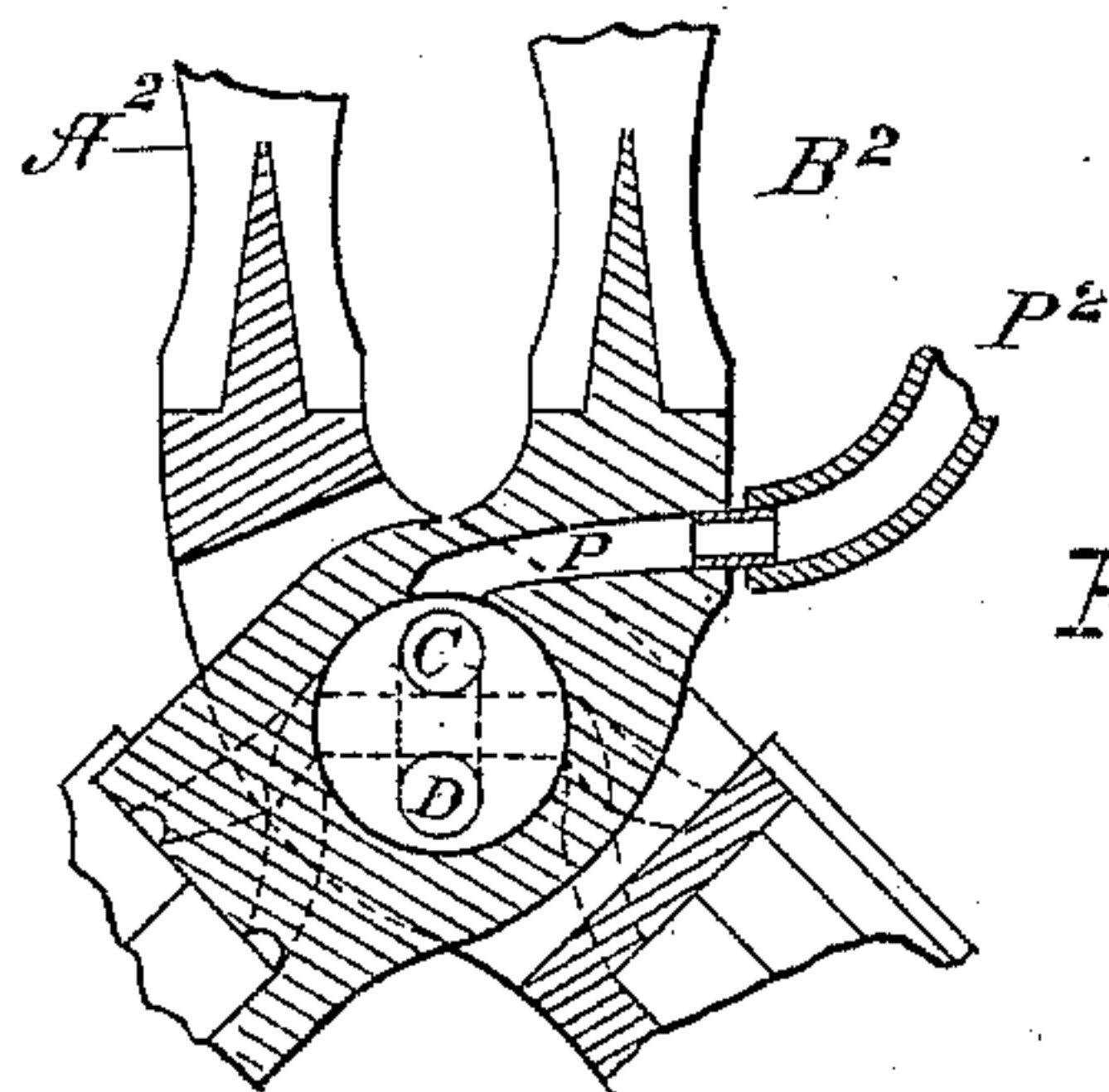
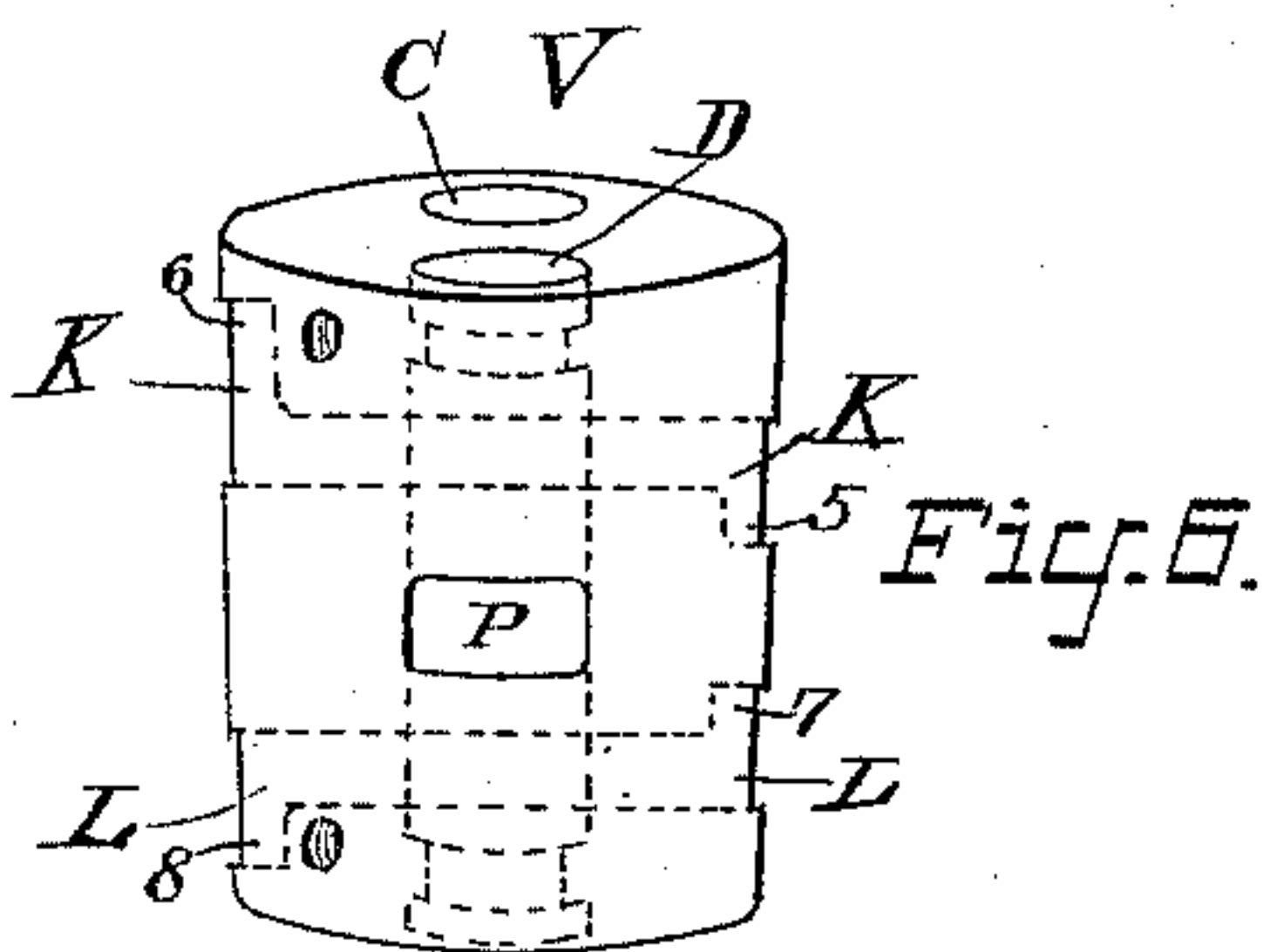
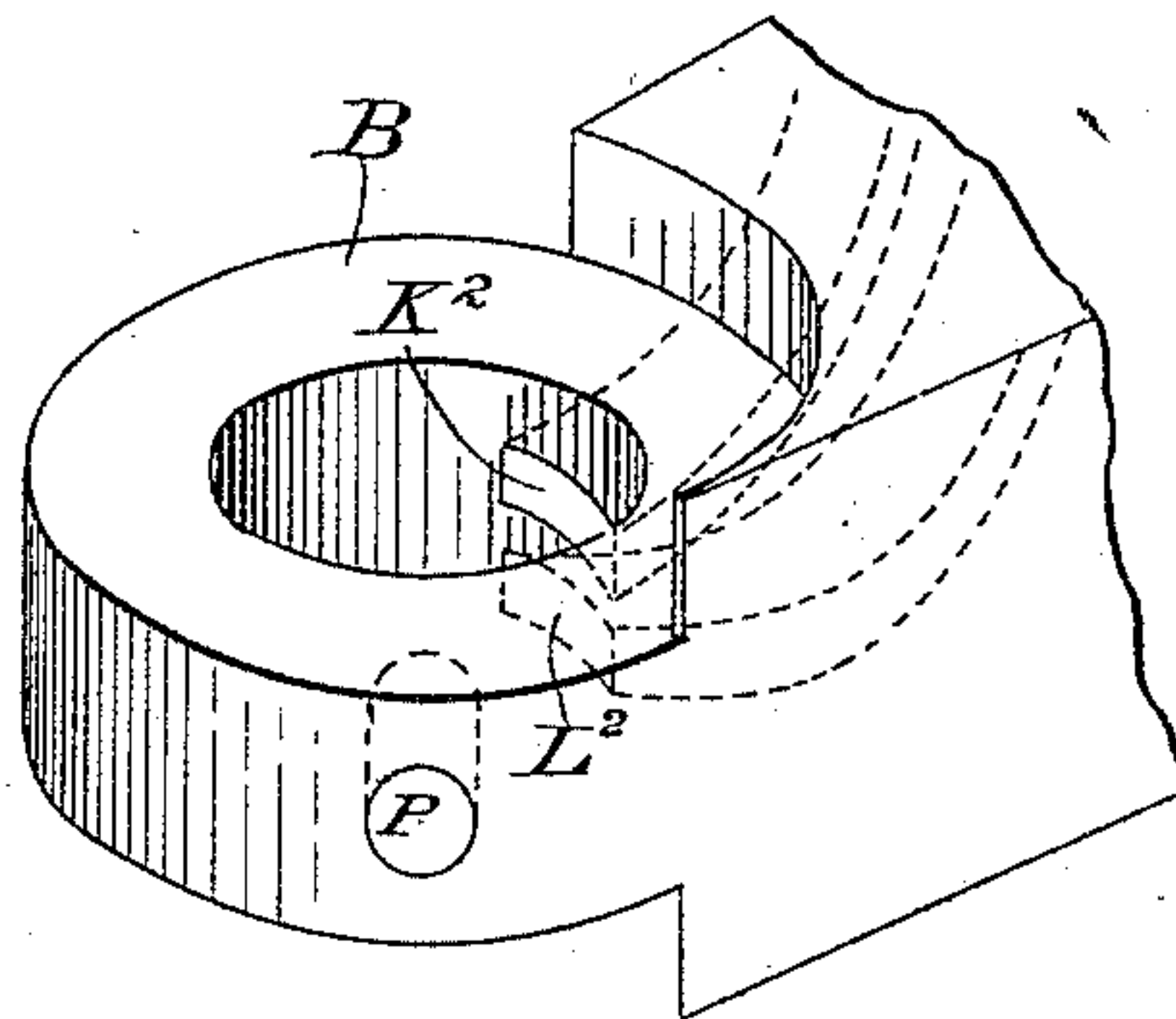


Fig. 7.

ATTEST:

J. A. Hurdle
Wm. H. Capel.

INVENTOR:
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UNITED STATES PATENT OFFICE.

WILLIAM M. WOOD, OF BOSTON, MASSACHUSETTS.

PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 443,030, dated December 16, 1890.

Application filed August 1, 1890. Serial No. 360,657. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. WOOD, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a certain new and useful Pneumatic Tool, of which the following is a specification.

My invention relates to tools in which hammers, dies, swages, cutters, or other instruments are kept in rapid operation by the rapidly-repeated movement of mechanism which is operated by the power of air, gas, steam, or other fluid or agent conveyed to the apparatus from some exterior source, and is especially designed for application to instruments employed for reducing by a hammering or swaging process the burr or expansion at the weld formed between two pieces of metal by the process of electric welding.

I have hereinafter described my invention as carried out in connection with a tool wherein the agent which is employed for reciprocating or operating the parts is air, gas, steam, or other fluid, though in some particulars my invention is applicable to tools wherein the tool may be reciprocated or kept in rapid operation by means of some other agent supplied by suitable conductors to the parts of the tool. In those cases where a number of tools are employed, all operating in lines converging upon the work or mounted so as to surround the same, provision must be made for the ready application of the instrument to the work and for removing the same. Before my invention it was the practice to employ an instrument having but three tools or hammers working on radial lines toward the work, the space between them being sufficient to permit the instrument to be slipped over the work.

My present invention consists, essentially, in mounting the reciprocating plungers that operate or carry the hammers, dies, or similar devices converging upon the work upon two arms or supports adapted to be swung or moved apart, so that the instrument may be placed over the work and then closed down upon it in position to permit all the tools to act on the same together.

My invention consists, further, in the manner of controlling the agent which supplies the power for actuating the tool; and it con-

sists, essentially, in the combination, with the apparatus, of a cut-off so arranged with relation to the two arms or other supports carrying the two parts of the tool that when the instrument is opened to detach it from the work the cut-off will be closed; but when the instrument is applied to the work and the two arms or parts of the support are moved together, so as to bring the tools into position to operate upon the work, the cut-off will be opened, and the air, gas, steam, or other fluid or agent may flow to the apparatus for the purpose of actuating the hammers, dies, or other instruments.

My invention consists, further, in making the cut-off a part of the hinge or joint by which the two portions of the instruments are hinged together, as will be hereinafter more particularly described.

My invention consists, also, in the combination, with the plungers which actuate the several tools, of a valve movement controlling the operation thereof and mounted in a pin or plug which connects the two parts of the joint or hinge.

My invention consists, further, in the details of construction and combinations of devices, hereinafter described, and more particularly specified in the claims.

In the accompanying drawings, Figure 1 shows in vertical section and partial side elevation an apparatus embodying my invention, wherein the pressure of air, gas, steam, or other fluid is employed to operate the plungers which actuate the tool. Fig. 2 is an end view of the parts at the joint enlarged. Fig. 3 is a horizontal section on the line X X, Fig. 2, through the joint and the valve movement contained therein. Figs. 4 and 5 illustrate the two sides of the joint respectively detached from one another. Fig. 6 is a side elevation of the plug or pin which connects the two sides or arms of the apparatus. Fig. 7 illustrates a modification in the construction of the apparatus at the joint and handle portion of the same.

Referring to Fig. 1, A B indicate, respectively, the two sides or arms which form the support for the several hammers, dies, or other tools employed and the parts actuating the same. The two arms A B are hinged together or otherwise movable with relation to

one another so that they may be swung apart so as to permit the instrument to be applied over the work, here illustrated at W as a round bar or rod. The two arms or supports A B may be hinged or jointed in any suitable manner, but preferably by means of an ordinary knuckle-joint, parts of which are indicated in Figs. 4, 5, and 6, Fig. 6 showing the plug or pin for the joint.

A² B² are handles by which the two arms A B may be opened and closed. The two arms or supports A B carry the four tool-operating plungers H H H H, here shown as pistons working in cylinders in the arms A B and adapted to be reciprocated by fluid-pressure applied alternately at opposite sides of the pistons through chambers or passages *i l*. The plungers H are arranged, as shown, to operate on converging lines, so that they may act all together upon the work W. The tools operated by said plungers are here shown as hammers H². The passages *i i* all connect with a port, to be presently described, through which the air, gas, steam, or other fluid under pressure is delivered through the passages and to the cylinders at one side of the pistons, while the passages *l* connect with a similar port for delivering air or other gas or fluid under pressure to the opposite side of the piston. The pressure at ports connecting with *i l* is controlled by a valve-movement, as will be presently described. Instead of a valve controlling the admission of air, gas, steam, or other fluid under pressure, any other means might be used for producing pressure at opposite sides of the pistons H alternately. The ports referred to serve also as exhaust-ports in the preferable construction of the apparatus. The plungers may be cushioned on their back-stroke by means of projections on a cylinder-head adapted to fit into air cups or cavities in the piston-heads or plungers. The fluid employed for operating the plungers being supplied through a flexible conduit, the instrument may be held in the hand and turned around the work, so as to bring the tools to bear on all parts of it.

O O are sliding gages fixed to the arms carrying the tools and adapted to engage with the work, as indicated, so as to adjust the hammers for different sizes of work and cause them to be normally equidistant from the center.

The valve-movement which controls the passage of the fluid to the plungers is mounted in the pin or plug V, connecting the two parts of the hinge. I prefer to employ for this valve-movement a combination of valves invented by me and arranged as follows:

D D is a double-acting piston working in a suitable chamber, as shown, and kept in operation by air or fluid pressure admitted alternately at opposite ends of the cylinder through the ports *a a'*. The piston-heads D are connected by a rod D², thus leaving a pressure-space, which is put in communication by the reciprocation of the piston

alternately with the ports, which form openings between the pressure-space and the pressure-spaces of another double-acting piston C C. Passages K L extend transversely through the plug V, carrying the plungers and in line, as shown, so as to make ports or passages indicated at K L, Fig. 3, connecting the spaces in which the pistons D C work. These passages K extend completely through the plug, as shown, and at the surface thereof are enlarged, as indicated by the dotted lines in Fig. 6, for the purpose to be presently described. Air, gas, or other fluid under pressure is delivered to the space between the piston-heads D through the port or opening P³, as will be presently described. Suitable stops are provided for the double piston D at the end of the cylinder in which it works, and by suitable construction the piston may be cushioned at the end of a stroke by confining the air or gas under pressure in cavities or cups upon the piston-heads, which slip over projections on the cylinder-heads at the end of a stroke.

C C is a second double-acting piston, which is kept in operation by air or gas pressure admitted alternately through ports K L, Fig. 3, to spaces at the inside of the piston-heads. The piston-heads are connected by a rod, as shown, working through a diaphragm, and the connecting-rod may have a packing at the point where it passes through the diaphragm, if desired, although this is not absolutely necessary, since a slight amount of leakage from one side to the other will not prevent the operation of the apparatus. Piston-heads C C alternately cover and uncover the ports *a a'* for admission of the air or gas under pressure to the cylinder in which the piston D works. This air or gas pressure is conveniently and preferably taken from the part of the cylinder for piston C C wherein the pressure exists for operating the latter. Piston C C may be cushioned at the end of each stroke by allowing the piston-heads to confine a small volume of air between the head and the diaphragm in obvious manner, and the cushioning action may be assisted by means of springs, should it be deemed desirable. These springs may also aid in reversing the movement of the piston. The outer ends of the cylinders for the double piston C are left open to the outer air or to an exhaust-chamber, so that ports *a a'*, when uncovered by a movement of their piston C toward the central diaphragm, may form exhaust-ports for the cylinder in which the piston D works.

To make the operation of the two pistons D D C C, in the manner to be presently described, control the action of the plungers H H, it is simply necessary to put the passages *i l* in permanent connection with the spaces at the inner sides of the heads C C. This connection is made by means of the passages K L, merging in the ports located in the walls between the two pistons, as shown in Fig. 3, and

the ports K^2 K^3 L^2 L^3 , Figs. 4 and 5, in the two parts of the hinge. Port K^3 communicates with the passage l in one arm or part of the apparatus, and port K^2 in the other part of the hinge communicates with the passage l in the other side or arm. The transverse passage K in the plug is enlarged at 6 toward the end of the plug, so as to be brought into registry with port K^3 , and is at the other side of the plug enlarged in the opposite direction, as indicated at 5, so as to register with the port K^2 . The transverse passage l is enlarged longitudinally of the plug, as indicated at 8, so as to form communication with the port L^3 , leading to the passages l in one side or arm, as A, and is enlarged, as indicated at 7, toward the middle of the plug, so as to register with the port L^2 in part B, connecting with passages i in such part or arm B.

The operation of the automatic valve movement described in connection with the several plungers is as follows: In the position of the pistons shown the air passes by port K and port a to one side of piston D, the space at the opposite side of piston D being open through the port a' to the exhaust. The piston D is thereupon moved, with the effect of shutting off the air pressure at port K from piston C and opening the port L for communication with the source of air-pressure. At the same time the movement of the piston D is sufficient to open communication by port K with the space at the left-hand end of the cylinder for D, so that the air or gas may exhaust from the pressure-space at the left end of the double piston C as soon as the said piston C moves slightly to the right and opens the port a at the rear side of the piston-head C. Piston C now moves to the right, until finally it opens communication by way of the port a' between the space at the inside of the right-hand piston C and the right-hand end of piston D to produce reverse movement, the exhaust at the opposite end of piston D taking place now through port a . The piston D by its reverse movement opens the port K for admission of air or gas under pressure to cause movement of piston C to the left, the exhaust for such piston C now taking place through port L , which has been uncovered by the movement of D, to the left, so that the exhaust may pass through the cylinder of D and out by port a' . The reversal of movement of the large piston C at each stroke may be assisted by a spring, as well as by the fact that the piston D, after covering port K or L and so as to shut off the air-pressure from C and open the port K or L as an exhaust, will on continuation of its movement produce rarefaction of the air or gas which may be confined in the position of the piston C shown, thereby causing an inequality of the pressures, tending to move the piston C after communication is established by way of port L to the space at the inside of the right-hand piston-head C. It will be obvious that as the ports K L communicate with the spaces be-

tween the piston-heads C and the diaphragm between them, where pressure and exhaust take place alternately, there will be in the passages i l and in the spaces at the opposite sides of the plungers H H H H a condition of alternate pressure and exhaust or lowering of pressure which will cause said plungers to reciprocate with the piston C. Thus when there is pressure in the space between one of the piston-heads C and the intermediate diaphragm, tending to move said piston in one direction—as, for instance, in the space communicating by port K with the passages l —there will be at the same time exhaust-passages opened for the escape of the steam or other fluid under pressure from the space between the inner side of the other piston-head C and the intermediate diaphragm, so that the pressure in the passages i , communicating with port Z , may be relieved. Under this condition the pistons, H will move back away from the work through the pressure communicated through K and passages l , the exhaust taking place through i and L a' . When, however, the valve mechanism moves in the opposite direction through the pressure communicated to the space between the head C and the intermediate diaphragm, with which space port L communicates, there will be, as before described, an exhaust for the air, gas, steam, or other fluid under pressure in the space with which the port K communicates, so that under this condition of affairs pressure will now be communicated through K and passages i to the rear of the plungers H, while an exhaust will exist through the passages l , the port L , and the port a . It will be observed that the ports K L are pressure and exhaust ports for the double-acting piston C, and are controlled by the action of the double-acting piston D D, so as to produce reciprocation of the piston C, while in the same manner the ports a a' are alternately inlet and exhaust ports for piston D, and are controlled by the movements of C. Each piston operates, therefore, as a valve for controlling the inlet and exhaust of the other by means of two sets of ports a a' K L , and each piston moves in its own cylinder, and is not, as in some previous constructions, carried by the other. The air or gas under pressure is supplied to port B^3 through passage P in one part or side B of the hinge or joint. The plug V is fastened by means of screws S in the other side A, so that the two ports or openings P P^3 will move with relation to one another when the arms A B are swung apart. In the position shown, where the tool is closed down upon the work, the ports P P^3 move with relation to one another into position indicated by the dotted lines, Fig. 2, and the air or other fluid is cut off. The air, gas, steam, or other fluid under pressure is supplied to the passage P through a flexible tube P^2 or by other means.

In Fig. 7 I have illustrated a modification in the arrangement of the handles with relation to the apparatus. Here the handles con-

nect with the device at the joint, and pressure moving the handles together operates after the manner of a pair of shears to bring the two parts at the opposite end of the instrument toward one another. The passage P is carried through one side of the instrument, as before, to register with the passage or port carried by the pin or plug V.

What I claim as my invention is—

10 1. The combination, substantially as described, of a plurality of hammers, dies, or similar devices working on converging lines and mounted upon two arms or supports adapted to be swung or moved apart, so that
15 the instrument may be applied to or removed from the work, as and for the purpose described.

2. In a pneumatic tool, the combination, substantially as described, of two arms or sup-
20 ports A B, jointed or hinged together and each carrying one or more tool-operating plungers, as and for the purpose described.

3. The combination, substantially as described, of the two hinged arms A B, each carrying two or more tool-operating plungers
25 working in lines converging toward a common center.

4. In a pneumatic tool, the combination, substantially as described, of tool-operating
30 plungers mounted on hinged supports jointed or hinged to one another and having a cut-off located in the hinge, as described, so as to be opened and closed as the arms are moved for the purpose of applying or removing the tool.
35

5. The combination, substantially as described, of the two arms or supports A B, each carrying one or more plungers, a source of fluid under pressure for operating said
40 plungers, and a cut-off connected with the two arms A B, so as to be shut when the arms are separated.

6. The combination, substantially as described, of tool arms or supports hinged together and each carrying one or more tool-operating plungers, and a valve-movement mounted in the plug or pin which connects
45 the two parts of the hinge.

7. The combination, substantially as described, of the arms hinged together and carrying the tool operating plungers, passages

connected with the cylinders for said plungers and leading to ports in the hinge, a plug or pin V, connecting the two parts of the hinge and carrying a controlling-valve mechanism, and passages in the plug leading from such valve mechanism to the ports in the two sides of the hinge. 55

8. In a pneumatic tool, the combination, with the tool-operating plungers carried on two arms or supports, of a hinge or joint connecting the arms, and an automatic valve for the plungers mounted in the connecting-pin for the hinge. 60

9. The combination, substantially as described, with the automatic valve-movement having two pistons and connecting-ports, of the passages K L, extending through the plug and connecting with ports in the two sides of the hinge. 65

10. In a pneumatic tool, the combination, with the arms hinged together and carrying the tool-operating plungers, of a valve-movement mounted in the pin for the hinge, and passages K L, extending through the pin to ports connecting with passages in the arms, the passages in the pin including ports or passages for the valve mechanism, wherein pressure and exhaust alternately occur. 70

11. The combination, substantially as described, of the two arms A B, each carrying one or more tool-operating plungers, a joint or hinge connecting the same, and a cut-off one member of which is carried by the joint-pin moving with one arm, while the other is carried by the other arm of the instrument. 75

12. The combination, substantially as described, of the arms A B, having ports or passages *l i*, a pin or plug V, by which the two arms are hinged together, pistons D C, working in said plug or pin, and passages K L, extending transversely through the pin between the two pistons, said passages at their ends connecting, respectively, with ports or passages in the two arms. 80

Signed at Boston, in the county of Suffolk and State of Massachusetts, this 31st day of July, A. D. 1890. 85

WILLIAM M. WOOD.

Witnesses:

H. D. SEARS,

W. H. HODGES. 95