

No. 663,124.

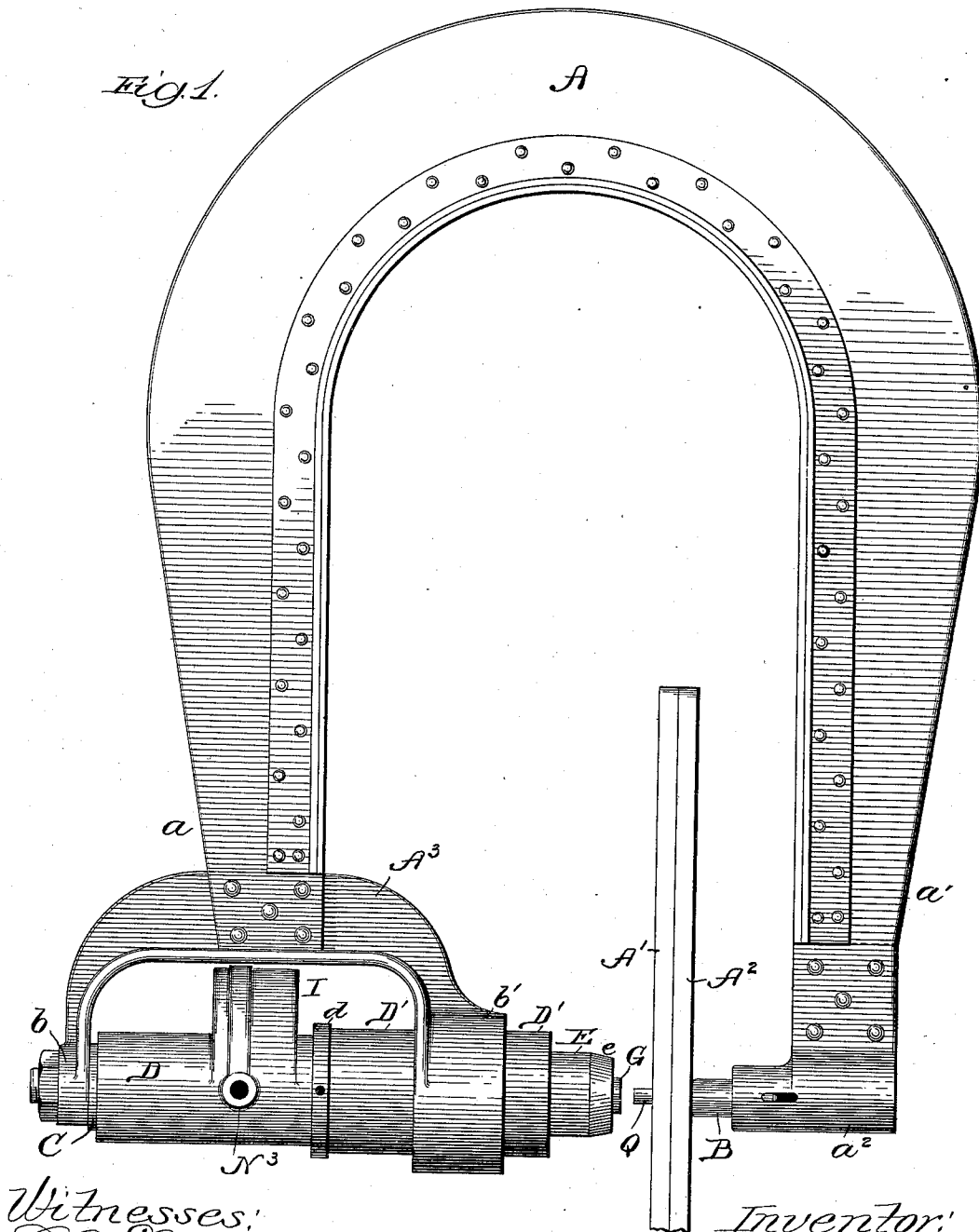
Patented Dec. 4, 1900.

H. J. KIMMAN.
PNEUMATIC RIVETER.

(Application filed Feb. 19, 1900.)

(No Model.)

4 Sheets—Sheet 1.



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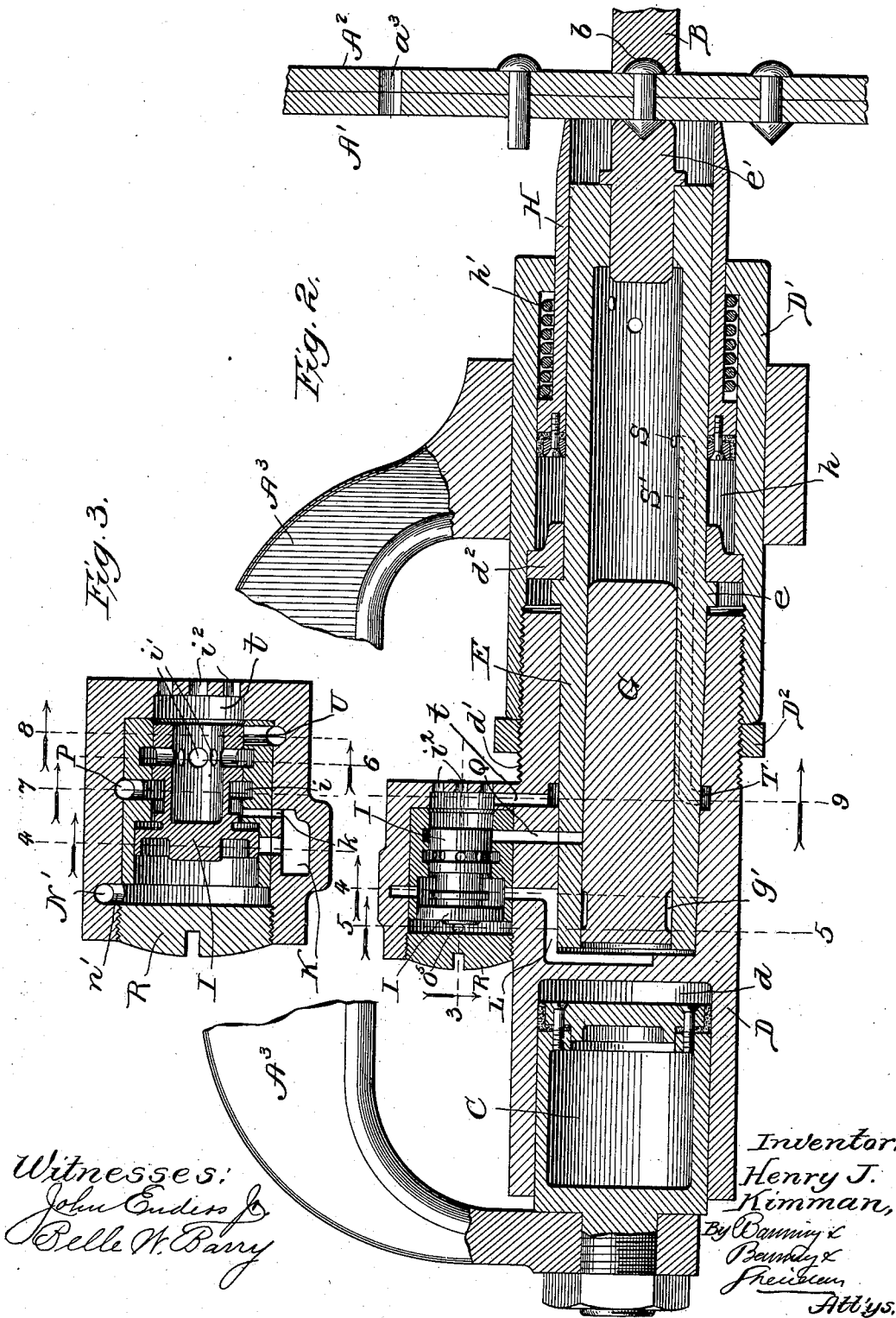
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4 Sheets—Sheet 2.



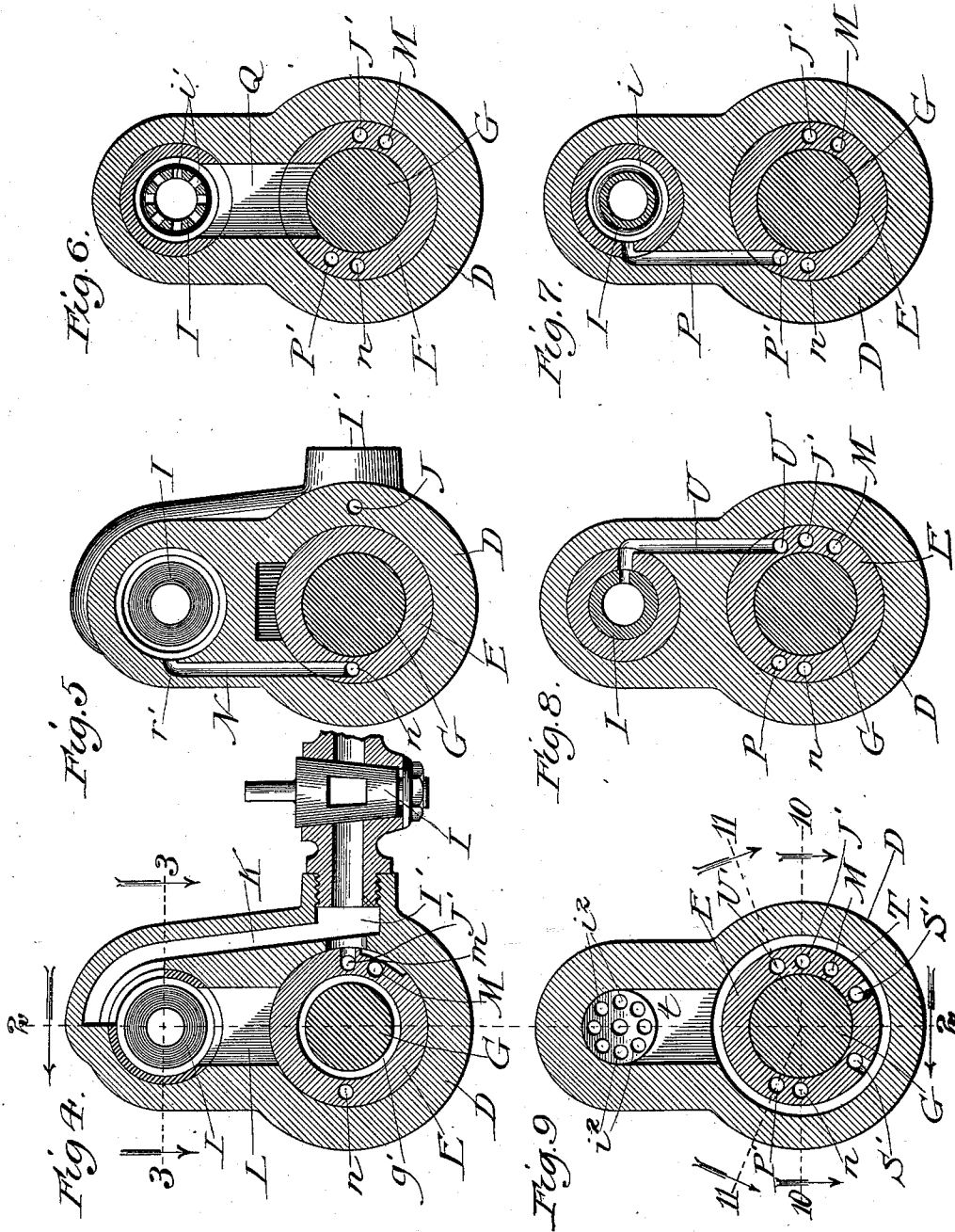
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4 Sheets—Sheet 3.



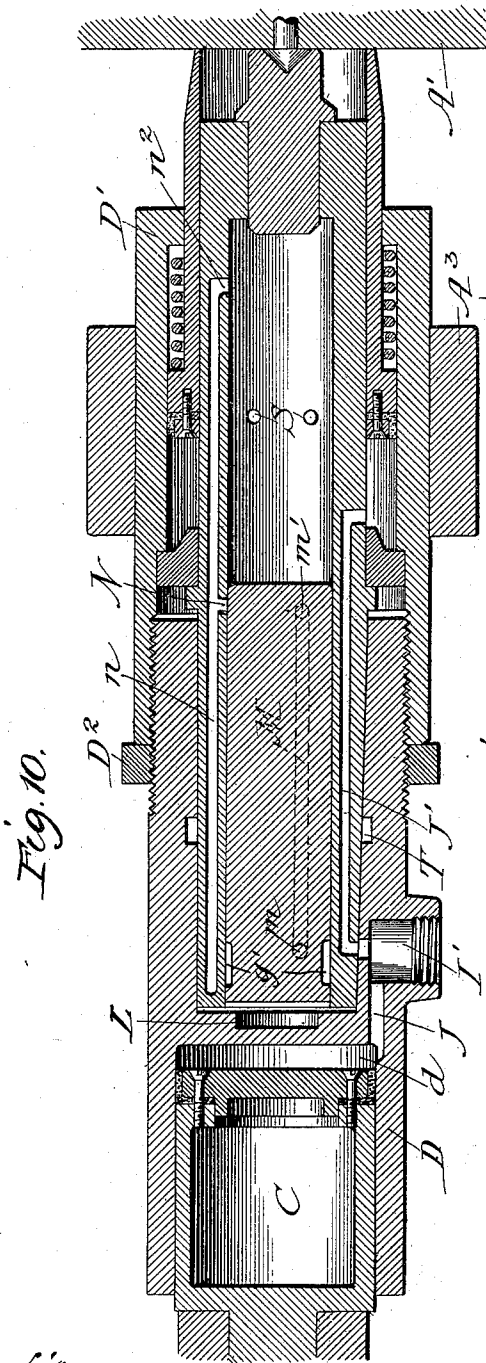
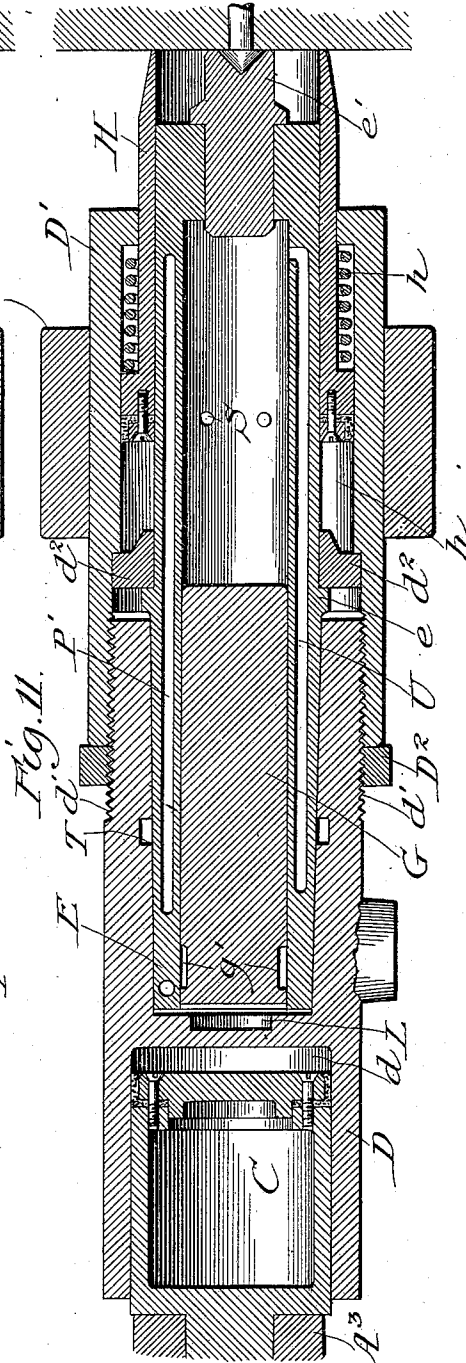
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4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

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PNEUMATIC RIVETER.

SPECIFICATION forming part of Letters Patent No. 663,124, dated December 4, 1900.

Application filed February 19, 1900. Serial No. 5,828. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. KIMMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pneumatic Riveters, of which the following is a specification.

My invention relates particularly to that class of pneumatic riveters which is provided with mechanism for feeding the operating-tool forward, and particularly to the means by which the material to be operated on is held in position, as will be more fully hereinafter described.

The principal object of the invention is to provide a simple, economical, and efficient pneumatic riveter.

A further object is to provide a simple, economical, and efficient portable riveter.

A further object is to provide a pneumatic riveter with mechanism for automatically clamping and holding the work in position.

Further objects of the invention will appear from an examination of the drawings and of the following description and claims.

The invention consists principally in the combination of a main cylinder, a hammer-cylinder secured therein, and means for moving such main and hammer cylinders forward.

The invention consists, further, in the combination of a main frame, a main piston attached to the main frame, and a main cylinder provided with a hammer-cylinder slidingly mounted on the main piston.

The invention consists, further, in the combination of a main frame, a main piston attached to the frame, a main cylinder slidingly mounted on the main piston, a hammer-cylinder secured in the main cylinder, and a cylindrical clamping-piston slidingly mounted in the main cylinder and adapted to clamp the work to be operated upon between it and the frame.

The invention consists, further and finally, in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation showing the improved riveter in position for use, with the plate-closer and hammer in open position. Fig. 2 is an enlarged longitudinal sectional detail of the con-

trolling-valve. Fig. 3 is a longitudinal sectional elevation of the controlling-valve and casing, taken on line 3 of Fig. 2, showing the valve in the opposite limit of motion from which it is shown in Fig. 2; Fig. 4, a transverse sectional view taken on line 4 of Fig. 3 looking in the direction of the arrows; Fig. 5, a transverse sectional view taken on line 5 of Fig. 2 looking in the direction of the arrows; Fig. 6, a transverse sectional view taken on line 6 of Fig. 3 looking in the direction of the arrows; Fig. 7, a transverse sectional view taken on line 7 of Fig. 3 looking in the direction of the arrow; Fig. 8, a transverse sectional view taken on line 8 of Fig. 3 looking in the direction of the arrow; Fig. 9, a transverse sectional view taken on line 9 of Fig. 2 looking in the direction of the arrow; Fig. 10 a longitudinal sectional view taken on line 10 of Fig. 9, and Fig. 11 a longitudinal sectional view taken on line 11 of Fig. 9.

In the art to which this invention relates it is well known that in order to head a rivet successfully it is desirable to use a "dolly-bar" or "counterbalance-weight" against the end of the rivet which is headed, so as to counteract the shock of the riveting operation on the unformed end and obtain the full benefit of the percussion blows. Further, when using these devices it is first necessary and usual to place the rivet to be headed through the material to be operated upon by hand, and such rivets oftentimes have to be driven through, which requires the use of hand labor and considerable loss of time.

The principal object of my invention, therefore, is to provide a simple, economical, and efficient riveting apparatus in one organized machine which can be taken advantage of to dispense with the usual dolly-bar or counterbalance-weight and which is provided with mechanism to automatically force the rivet into position and also hold the material to be operated upon in position for the riveting operation, all of which will more fully hereinafter appear.

In constructing a riveter in accordance with my improvements I make a main frame A of the desired size, shape, and strength to hold the operative and other parts in position. This frame, as shown in Fig. 1 of the drawings, is made, preferably, in the shape of

an inverted **U** having two depending arms *a* and *a'*, to which are secured the mechanisms hereinafter described. In the process of riveting two plates together—such, for instance, as are shown at **A'** and **A²** in the drawings—it is usual to have the rivets headed on one end before they are passed through the perforations in the plate. It is therefore essentially necessary to have means for holding the headed end of the rivet—such, for instance, as an anvil. In order to provide for such mechanism, one arm *a'* is provided with a boss or lug *a²*, having an opening therein in which is inserted an anvil portion **B**. It is desirable to make this anvil of hardened steel and provide it with a concaved recess *b* in the front end thereof, into which the headed end of the rivet, as shown in Fig. 2, may be inserted. The rivet is placed in position by inserting it through the perforations *a³* through the plates, so that the unformed end thereof projects through the plate a sufficient distance to provide an amount of metal for the other head of the rivet. The heading-tool therefore should contact this unformed end of the rivet, and as it is operated upon or being finished it should automatically follow it up until the operation is completed. To accomplish this result, I make a main piston **C** and secure or otherwise rigidly—that is, immovably—attach it to the yoke **A³**, which yoke is practically a continuation of the depending arm *a* of the main frame, though for economical reasons I prefer to make it separate and rivet it or otherwise secure it thereto. I provide a main cylinder **D** and slidingly mount it at one end of the main piston. This main cylinder is for economic and other reasons made in two parts, the main or rear portion **D** having the main pressure-chamber *d*, which is slidingly mounted upon the main piston and provided with an external screw-threaded portion *d'* at the other end, upon which is screw-threaded the second forward portion **D'** of the main cylinder, projecting outwardly therefrom and slidingly mounted in the other end of the yoke.

The rear portion of the main cylinder is provided with an axial-tapered bore, into which is snugly fitted the tapered end of a hammer-cylinder **E**, so that both cylinders in a measure form one rigid portion. The second or forward portion of this main cylinder is provided with an inwardly-projecting shoulder-ring *d²*, adapted to bear against an outwardly-projecting shoulder *e* on the hammer-cylinder, so that as it is screw-threaded to engage the rear portion the hammer-cylinder is pressed back into the tapered opening and held firmly in such position. A lock-nut **D³** serves to hold all of the parts in operative engagement.

From the foregoing description it will be seen that as the motive fluid is fed into the main pressure-chamber the main cylinder is moved forwardly, carrying therewith the

hammer-cylinder, with its heading-tool *e'*, into engagement with the unformed end of the rivet, while its reciprocating percussion-hammer **G** operates upon the heading-tool to form the end of the rivet. As the operation continues the end of the rivet contacted by the heading-tool is rapidly formed, and the motive fluid acts to automatically feed the hammer-cylinder, with its headed tool, forward as fast as the operation proceeds until the end of the rivet is completely formed.

It is desirable that some means should be provided for clamping or holding the plates or material to be operated upon in position while the riveting operation is being performed. In order to accomplish this result, a cylindrical clamping-piston **H** is provided and slidingly mounted on the forward portion of the hammer-cylinder in an annular pressure-chamber *h*, formed by and between the hammer and forward extension of the main cylinders. A helical spring *h'* serves to move the clamping-piston to its retracted position and hold it in such position until motive fluid is introduced into the annular chamber. When the plate, with its unformed rivet, is brought into position with the headed end of the rivet against the anvil, as shown in Fig. 1, the introduction of fluid under pressure into the main cylinder forces such main cylinder, with its hammer-cylinder and operating-tool, instantaneously to contact the unformed end of the rivet. At the same time or simultaneously therewith fluid under pressure is admitted into the annular pressure-chamber, which acts to force the cylindrical clamping-piston forward to contact the plate, as shown in Fig. 2. The power exerted thereon acts to force the plate forwardly against the anvil, and consequently the rivet firmly through into a riveting position. The advantage of this is apparent to those skilled in the art, for the reason that the formed end of the rivet-head is often the point where leakage occurs and is due to the fact that the formed head of the rivet has not been firmly seated in position before the operation of riveting the unformed end has started.

To provide for the introduction and exhaust of fluid under pressure to the different chambers, a main throttle-valve **I** is provided and secured in desirable position opposite the main port **I'** on the main cylinder. The main cylinder is provided with a port or passage **J**, which leads from the throttle-valve to the pressure-chamber of the main cylinder. A second port or passage **J'** leads from the throttle-valve to the annular pressure-chamber in which the clamping-piston is mounted. A third passage **K** leads from the throttle-valve to the controlling-valve **I** of the hammer. This controlling-valve, as will be more fully hereinafter set forth, operates to admit and exhaust the motive fluid to and from each end of the hammer-cylinder, so as to reciprocate the piston-hammer therein. The throttle-valve is made in the form of a

three-way valve, such as is known in the plumbers' art as a "check-and-waste" valve, so that when turned in one direction motive fluid is admitted to the three cylinders and when turned in the other direction it permits the exhaust from any or all of such cylinders to take place. In this construction, however, and as clearly shown in Fig. 2, the exhaust from the hammer-cylinder occurs through the walls which form a casing for the controlling-valve, while the exhaust from the main and annular pressure-chambers occurs through the three-way valve.

In illustrating and describing the hammer-cylinder with its reciprocating hammer and controlling-valve, as shown clearly in the drawings, I prefer to use a hammer of the type illustrated therein and use a controlling-valve for such hammer-cylinder, which is known as a "piston-valve of the differential type." This differential piston-valve, however, does not form any part or portion of this invention, and I do not desire to claim its construction, arrangement, or combination with other parts in this application, for the reason that it is clearly shown, described, and claimed in a pending application, filed by me on the 16th day of October, 1899, Serial No. 733,750. Its construction and operation, however, will be briefly described herein. The motive fluid passes from the throttle-valve through the passage K (see Fig. 4) and thence through the opening k in the controlling-valve bushing and behind the head of the controlling-valve to force it into a position to the left of the casing and against the screw-plug, as shown in Fig. 3. The fluid under pressure is then permitted to pass through the passage L and between the rear head of the hammer-cylinder and the piston-hammer, which action forces such piston-hammer forward to contact the heading-tool. The piston-hammer for a short portion of its length, as clearly shown in the drawings, is reduced in diameter and, in connection with the cylinder, forms an annular chamber g' , so that as the piston-hammer nears its forward limit of motion fluid under pressure may pass from the throttle through the passage M, which connects with the supply-passage at m and the hammer-cylinder at m' , into the annular chamber, (see Figs. 4 and 10,) where it enters the by-pass N into the passage n leading through the hammer-cylinder to a passage N' in the valve-casing, which opens at n' between the controlling-valve and the screw-plug, thus forcing the controlling-valve back to its other limit of motion, as shown in Fig. 3. The moving of the valve into this position permits fluid under pressure to enter the chamber of the valve through the passage N around an annular passage i , formed by and in the valve and casing of the valve, from which it enters the passage P in the walls of the hammer-cylinder by means of the passage P' and passes to the front end of the pressure-chamber thereof, acting to drive the piston-ham-

mer rearwardly to the other limit of its motion. (See Fig. 11.) During the backward movement of the piston-hammer the fluid at the rear part of the hammer-cylinder is forced out through the exhaust-passage Q, perforations i' in the controlling-valve to the interior axial opening thereof, and through the openings i'' in the valve-casing into the outer air. During this backward movement of the piston-hammer the motive fluid which is between the head of the controlling-valve and the plug R is permitted to pass through the passage N' in the valve-casing, passage n in the hammer-cylinder, and pass n'' into the pressure-chamber of the hammer-cylinder, from which it passes, with the exhaust, through the openings S into the passage S', through which it is conveyed or forced into the annular chamber T, thence through the passage t into the valve-casing, and out into the atmosphere through the perforation i'' . As the superior pressure has thus been exhausted from the front end of the controlling-valve, the high pressure on the rear end of the controlling-valve returns it to the position shown in Fig. 2. This action brings the openings or perforations i' of the controlling-valve into alinement with the annular passage i of the valve formed between the controlling-valve and its bushing and permits air to pass from passage P through such openings into the interior of the valve and out through the perforations i'' of the casing thereof. At the same time the controlling-valve uncovers the opening U and permits the air to exhaust from the front of the cylinder through passage U' in the cylinder and U in the valve-casing. The passage S', hereinbefore described, is always open to the air and permits some of the air to exhaust therethrough; but the passage U' is only opened during the time the piston-hammer is traveling forward, and it prevents a compression of air in front of the hammer. As the piston-hammer continues its backward motion it will be seen that it passes the opening in the exhaust-passage Q and confines the air in the rear part thereof, so as to permit it to act as a cushion and at the same time save a quantity of air, which acts to accelerate the air in its forward movement.

While I have given a detailed description of the construction and operation of this hammer and its controlling-valve, it will be understood that I do not claim it as a portion of this invention, for the reason that any of the well-known types of pneumatic hammers with the different kinds of controlling-valve may be used in lieu thereof, the description herein being merely given for the purpose of enabling those skilled in the art to practice the invention.

I claim—

1. In a machine of the class described, the combination of a main cylinder, a hammer-cylinder secured therein, and means for moving the main cylinder forwardly, substantially as described.

2. In a machine of the class described, the combination of a supporting portion, a main piston attached to the supporting portion, a main cylinder slidably mounted on the main piston, and a hammer-cylinder mounted in the main cylinder, substantially as described.
3. In a machine of the class described, the combination of a supporting portion, a pneumatic hammer, means for moving the pneumatic hammer with its operating-tool forward to contact the work, an anvil, and clamping mechanism for grasping the work to be operated upon between it and the anvil, substantially as described.
4. In a machine of the class described, the combination of a main supporting-frame, a main piston secured to the supporting-frame, a main cylinder slidably mounted on the main piston, a hammer-cylinder provided with an operating-tool and a piston-hammer secured in the main sliding cylinder and adapted to be fed to the work by the movements thereof, an anvil adapted to receive one end of the rivet, and clamping mechanism for clamping the two between it and the anvil, substantially as described.
5. In a machine of the class described, the combination of a main supporting-frame provided with a main cylinder, an anvil adapted to receive one end of a rivet, a hammer-cylinder movably mounted in the main cylinder and provided with an operating-tool adapted to contact the other end of the rivet and finish the same, a piston-hammer within the hammer-cylinder to contact with the operating-tool, means for moving the hammer-cylinder forward to its work, and a cylindrical clamping-piston arranged to be operated by fluid-pressure to clamp the work between it and the anvil, substantially as described.
6. In a machine of the class described, the combination of a main frame, a main piston secured to the main frame, a main cylinder slidably mounted on the piston and in the main frame, and a hammer-cylinder secured to the main cylinder, substantially as described.
7. In a machine of the class described, the combination of a supporting-frame, an anvil secured to the supporting-frame to receive one head of a rivet, a main piston secured to the supporting-frame, a main cylinder slidably mounted on the main piston, a hammer-cylinder secured in the main cylinder and provided with an operating-tool arranged to contact the rivet and a reciprocating hammer, and a cylindrical clamping-piston movably mounted in an annular pressure-chamber in the main cylinder for clamping the work to be operated upon between it and the anvil, substantially as described.
8. In a machine of the class described, a main supporting-frame, an anvil in the supporting-frame adapted to receive one end of a rivet, a piston for the main cylinder secured to the main supporting-frame, a main cylinder slidably mounted on the main piston, a hammer-cylinder secured in the main cylinder and provided with an operating-tool and reciprocating hammer, and a clamping-piston slidably mounted in an annular pressure-chamber between the main cylinder and the reciprocating hammer to clamp work between it and the anvil, substantially as described.
9. In a machine of the class described, a main supporting-frame provided with an anvil portion adapted to receive a rivet, a main piston for the main cylinder secured to the main supporting-frame, a main cylinder slidably mounted on the main piston, a hammer-cylinder secured in the main cylinder and provided with a heading-tool and reciprocating hammer, and a cylindrical clamping-piston slidably mounted on the hammer-cylinder, substantially as described.
10. In a machine of the class described, a main supporting-frame provided with an anvil portion adapted to receive a rivet, a main piston for the main cylinder secured to the main supporting-frame, a main cylinder slidably mounted on the main piston, a hammer-cylinder secured in the main cylinder and provided with a heading-tool and reciprocating hammer, a cylindrical clamping-piston slidably mounted on the hammer-cylinder, and valve mechanism for simultaneously admitting motive fluid into the pressure-chambers of the main, hammer, and clamping cylinders, substantially as described.
11. In a machine of the class described, a main supporting-frame provided with an anvil portion adapted to receive a rivet, a main piston for the main cylinder secured to the main supporting-frame, a main cylinder slidably mounted on the main piston, a hammer-cylinder secured in the main cylinder and provided with a heading-tool and reciprocating hammer, a cylindrical clamping-piston arranged in an annular pressure-chamber between the main and hammer cylinders, valve mechanism for simultaneously admitting motive fluid into the pressure-chambers of the main, hammer, and clamping cylinders, and spring mechanism for retracting the cylindrical clamping-piston, substantially as described.
12. In a machine of the class described, the combination of a main supporting-frame, an anvil secured thereto and adapted to receive one end of a rivet to be operated upon, a main piston secured to the supporting-frame, a main cylinder slidably mounted on the main piston and in the supporting-frame, a hammer-cylinder secured in the main cylinder and provided with a heading-tool and reciprocating hammer, a cylindrical clamping-piston slidably mounted in an annular space between the hammer and main cylinders, a controlling-valve for governing the inlet and exhaust of fluid-pressure to the hammer-cylinder, and a throttle-valve for opening and closing communication with the supply of motive fluid and the controlling-valve of the hammer-cylinder and the pressure-chambers

of the main and clamping cylinders, substantially as described.

13. In a machine of the class described, the combination of a main supporting-frame, an anvil secured thereto and adapted to receive one end of a rivet to be operated upon, a main piston secured to the supporting-frame, a main cylinder slidingly mounted on such piston and in the supporting-frame, a hammer-cylinder secured in the main cylinder and provided with a heading-tool and reciprocating hammer, a cylindrical clamping-piston slidingly mounted on the hammer-cylinder and in an annular space between the hammer and main cylinders, a controlling-valve for governing the inlet and exhaust of fluid-pressure to and from the hammer-cylinder, a throttle-valve for opening and closing communication with the supply of motive fluid and the controlling-valve of the hammer-cylinder and the pressure-chambers of the main and clamping cylinders, and a helical spring surrounding the cylindrical clamping-piston for retracting such piston, substantially as described.

14. In a machine of the class described, a supporting-frame, a main piston secured to the supporting-frame, a main cylinder slidingly mounted thereon and made in two parts, a hammer-cylinder secured in one of such parts and extending through the other part so as to form an annular pressure-chamber, a heading-tool and reciprocating hammer in such hammer-cylinder, and a cylindrical clamping-piston mounted in the annular pressure-chamber between the hammer-cylinder and the main cylinder, substantially as described.

15. In a machine of the class described, the combination of a supporting-frame, a main piston secured to the supporting-frame, a main cylinder made in two parts slidingly mounted on the main piston one part of which

is provided with a tapered inner bore, a hammer-cylinder provided with a tapered end fitting the tapered bore of one portion of the main cylinder and extending through the other portion of the main cylinder so as to provide an annular pressure-chamber, a heading-tool and reciprocating hammer in such hammer-cylinder, and a cylindrical clamping-piston slidingly mounted in the annular pressure-chamber between the hammer and main cylinder, substantially as described.

16. In a machine of the class described, the combination of a main supporting-frame, an anvil secured thereto to receive one end of a rivet, a main piston secured to the supporting-frame, a main cylinder made in two portions, one—a rear portion—slidingly mounted on the main piston and the other—the forward portion—having screw-threaded engagement with such rear portion, a hammer-cylinder secured in the rear portion of the main cylinder provided with a heading-tool and reciprocating piston and providing an annular pressure-chamber between it and the forward portion of the main cylinder, and a cylindrical clamping-piston slidingly mounted on the hammer-cylinder in the annular pressure-chamber between the hammer and the forward extension of the main cylinder, substantially as described.

17. In a machine of the class described, a reciprocating frame portion provided with an anvil adapted to receive one end of a rivet, a main piston rigidly secured to the main supporting-frame, a main cylinder, a hammer-cylinder, a heading-tool and a reciprocating piston in such hammer-cylinder, and a cylindrical clamping-piston in the annular pressure-chamber, substantially as described.

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