T. C. PROUTY.

PNEUMATIC HAMMER.

APPLICATION FILED DEC. 21, 1905.

898,505.

Patented Sept. 15, 1908.

2 SHEETS—SHEET 1.

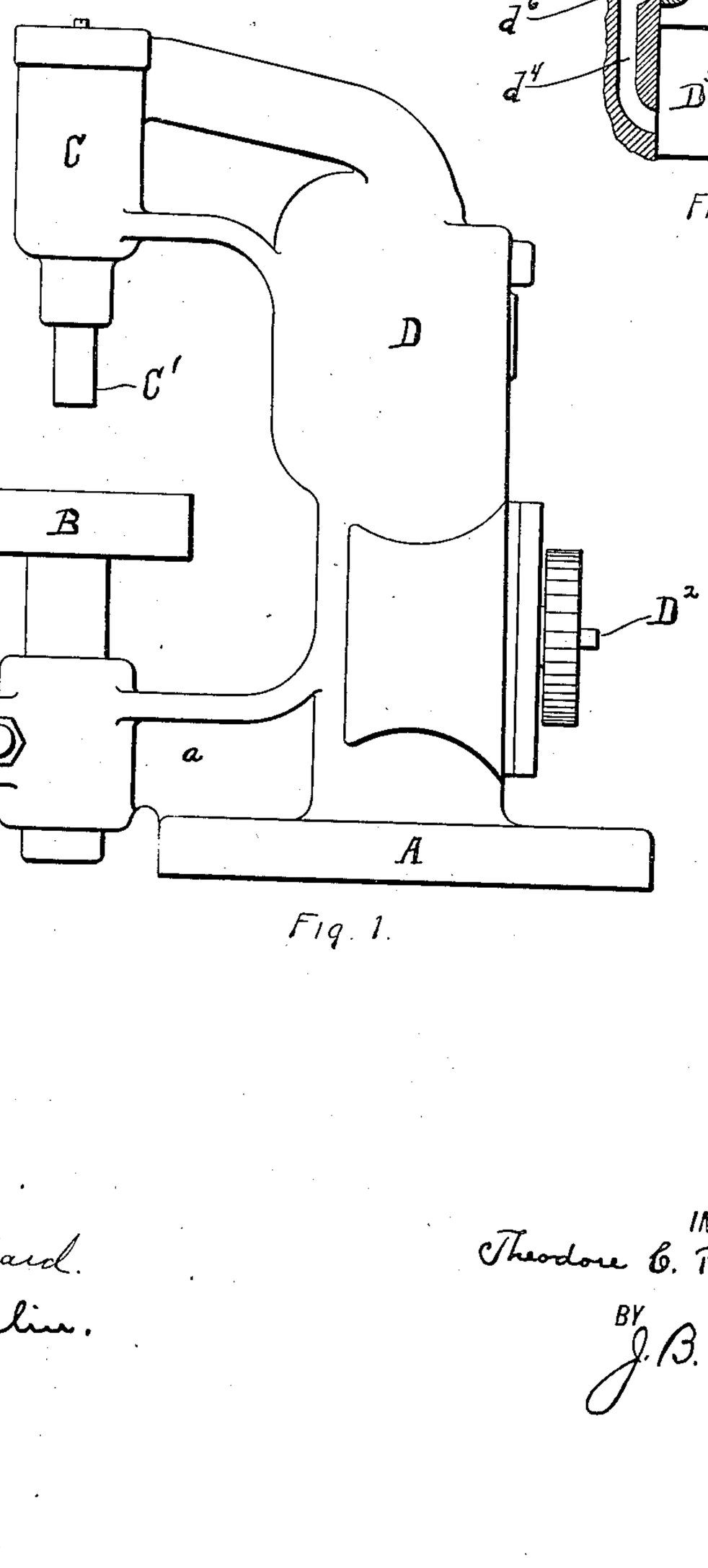

Fig. 1.

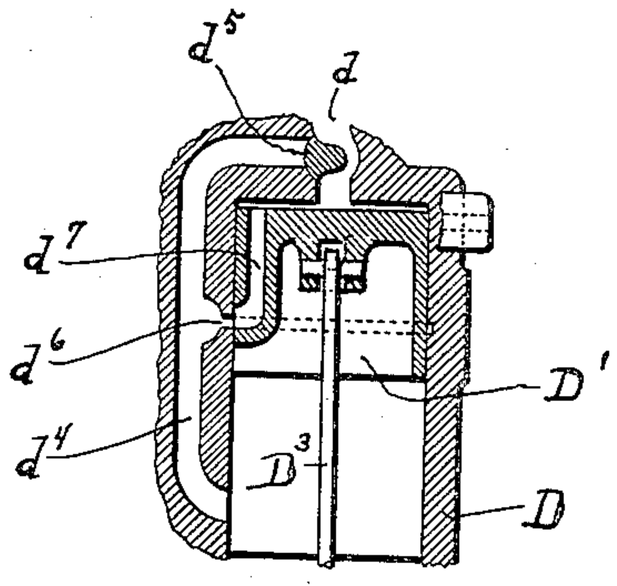

Fig. 4.

WITNESSES:

Robt. P. Millard.

Jno. T. Oberlin.

INVENTOR

Theodore C. Prouty,

BY

J. B. Fay

ATTORNEY

T. C. PROUTY.

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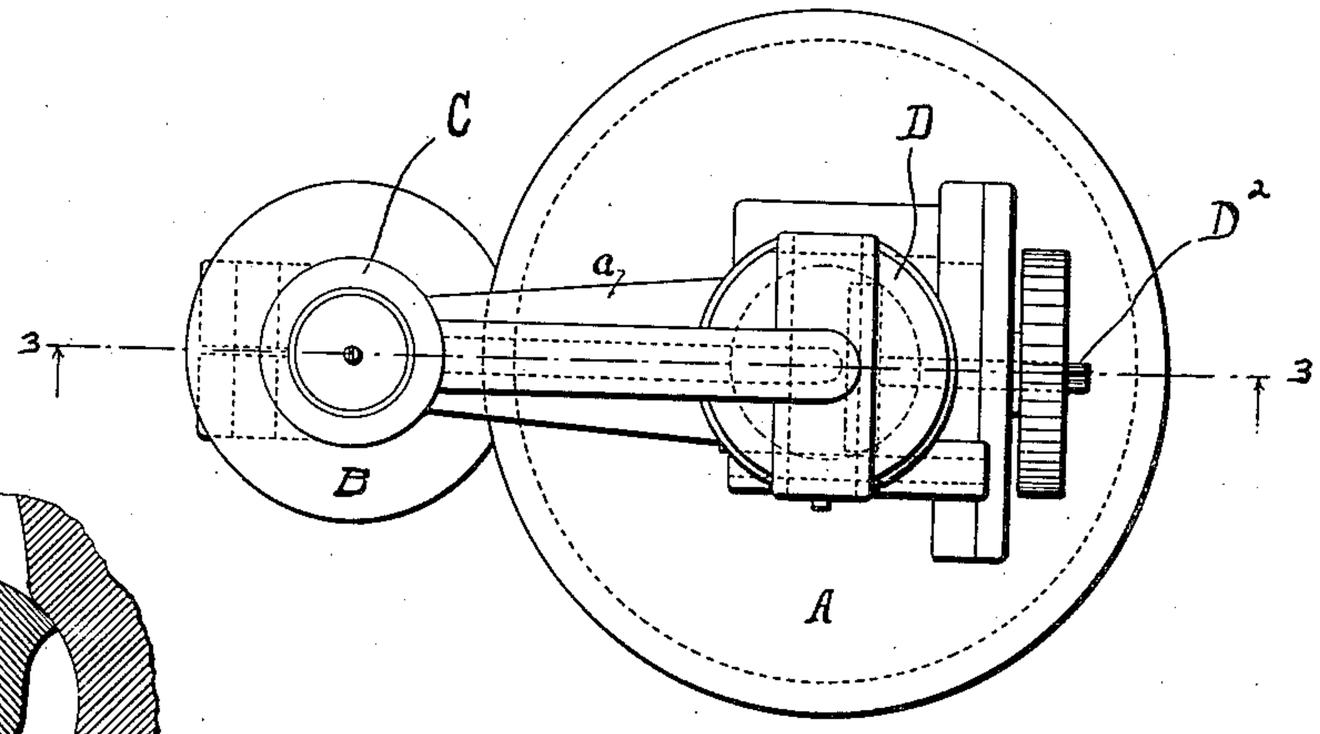

Fig. 2.

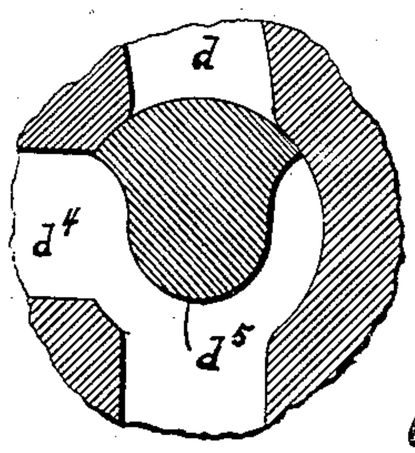

Fig. 5.

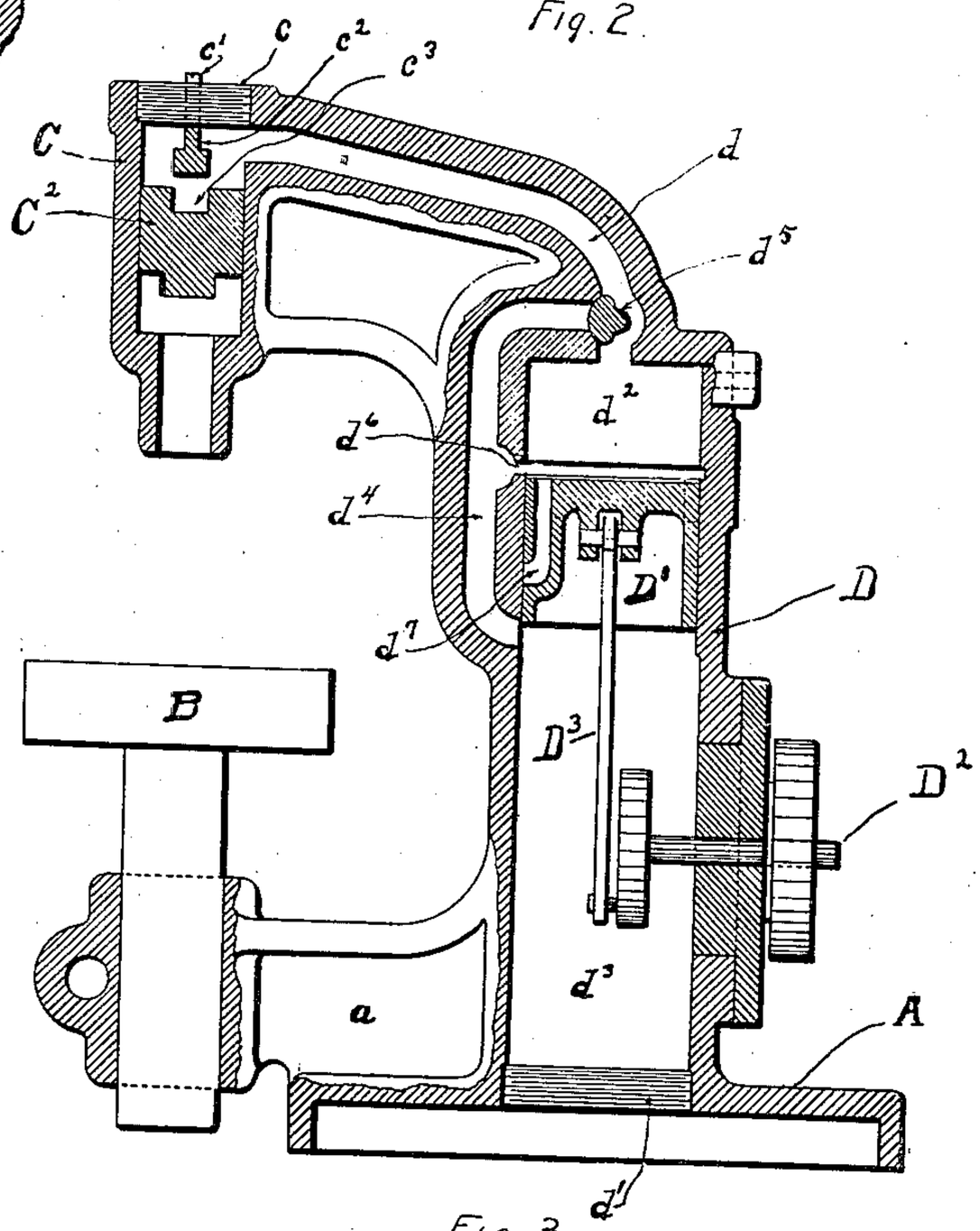

Fig. 3.

WITNESSES:

G. W. Saywell

Jno. F. Oberlin

INVENTOR

Theodore C. Prouty,

BY J. B. Fay

ATTORNEY

UNITED STATES PATENT OFFICE.

THEODORE C. PROUTY, OF AURORA, ILLINOIS, ASSIGNOR TO T. C. PROUTY COMPANY, LIMITED, OF ALBION, MICHIGAN, A CORPORATION OF MICHIGAN.

PNEUMATIC HAMMER.

No. 898,505. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed December 21, 1905. Serial No. 292,727.

To all whom it may concern:

Be it known that I, THEODORE C. PROUTY, a citizen of the United States, resident of Aurora, county of Kane, and State of Illinois, have invented a new and useful Improvement in Pneumatic Hammers, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to improvements in pneumatic hammers, riveting machines, and the like.

It relates particularly to that class of pneumatic hammers in which the actuating- or piston-cylinder is connected with the hammer-cylinder on one side of the hammer piston only, *i. e.* in which atmospheric pressure is utilized to raise the hammer prior to its working stroke.

The object of my invention is to provide means that, while utilizing fully this method of raising the hammer, are adapted to produce more quickly than has heretofore been realized, a high degree of compression to actuate the hammer on its down stroke.

Another object is to supply means, supplementary to the valve which controls the flow of air between the cylinders, whereby the length of the stroke of the hammer may be regulated, and work requiring either a very light blow or a very heavy blow thus handled on the same machine without changing hammers. Along with this last, a third object is sought to be achieved, namely the cushioning of the hammer, since otherwise it would tend to destroy the ends of the cylinder in which it operates.

To the accomplishment of the above objects my invention consists of means hereinafter fully described and particularly set forth in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—Figure 1 represents a side elevation of a pneumatic riveting machine involving my improvements; Fig. 2 is a plan view of the same; Fig. 3 is a vertical longitudinal cross-section of the same taken on the line 3—3, Fig. 2; Fig. 4 is a detail of the actuating cylinder showing the piston at the end of its up-stroke; and Fig. 5 is an enlarged detail view of the valve which controls communication between the two cylinders.

The particular type of pneumatic tool in connection with which I have chosen to describe my improved mechanism is that of a pneumatic riveting machine. This machine, as shown in Fig. 1, comprises a suitable base A, in a horizontal arm *a* of which is adjustably secured an anvil B.

Formed in a projecting portion of the body of the machine is a vertical hammer-cylinder C centrally positioned over anvil B; while formed in the body proper is another larger cylinder D in which the actuating-piston operates. Such cylinder D, along with the actuating piston and appurtenances, constitute the means whereby the air in the hammer-cylinder is alternately compressed and exhausted. The tup or hammer-head C′, which is designed to deliver the blows on anvil B, may be of any desired form, as it does not enter into my invention. Such tup C′ is operated by a hammer-piston C^2 in hammer-cylinder C, shown in Fig. 3, where, however, the tup itself is omitted. The upper end of the hammer-cylinder through which the hammer-piston is introduced in erecting the machine, is closed by a plug or cap *c* and centrally mounted on this cap from its under side is a screw *c′* having an enlarged cylindrical head c^2, the end of which projects through to the other side of the cap and is there provided with a slot or other means adapting it to be readily rotated. Hammer-piston C^2 has on its upper end a depression or cavity c^3 formed and disposed so as to register with the head of screw *c′* when the hammer is lifted. By making the head c^2 a fair working fit for the cavity c^3, it is readily seen that the air in such cavity will be confined and compressed when the hammer is lifted and the force of its blow cushioned as would not be the case were it to strike directly against the end of the cylinder. And further, since the adjusting screw can be made of any desired length and can be raised and lowered to occupy any desired position in the cylinder, it forms a simple and convenient means for regulating the length of the hammer's stroke. The downward stroke of the hammer is cushioned in the usual manner by the air confined between

the other side of the piston and the lower end of the cylinder. As has been indicated, the actuating-cylinder is formed in the body proper of the machine, Fig. 2. One end of this cylinder, the upper as illustrated, is connected with the closed end of hammer-cylinder C by means of a duct *d;* the other end of such actuating-cylinder is closed by a plug or cap *d'* in the same fashion as cylinder C is closed. Fitted in cylinder D is a reciprocating piston D', that is moved upward and downward by a drive shaft D^2 and connecting rod D^3 in the well-known manner. Since in using machines of the kind in hand it is required that the operating parts, including the piston D', should run at a comparatively high rate of speed, it is desirable that all such parts, particularly in cylinder D, should run in oil. Accordingly the structure shown, wherein the sides of the actuating-cylinder are constructed to form a base inclosing the driving mechanism for the piston, is well adapted to facilitate such lubrication, the oil being contained in such base, the lower end of which, as has been stated, is closed. The bearing in which the drive-shaft is mounted should also be air-tight, so as to effectually close the actuating cylinder to the atmosphere. The purpose of such closure will appear later.

The piston obviously divides the cylinder, thus closed, into two chambers d^2 and d^3, which, however, are adapted to be continuously or uninterruptedly connected by means of a duct or passage d^4. This passage leads from a point in cylinder D below the lower limit of movement of piston D' to a point in the duct *d* which connects the cylinder, or more specifically chamber d^2 thereof, with hammer-cylinder D. A valve d^5 located at the junction of d^4 with duct *d*, serves to simultaneously control connection between the two chambers of the actuating-cylinder through such duct d^4, and connection between the actuating-cylinder and the hammer-cylinder through such duct *d*. The position of valve d^5 to permit continuous communication between the two chambers of cylinder D is shown in Fig. 5, while in Fig. 3 the valve is shown positioned to cut off such communication and to open communication between chamber d^2 and the hammer-cylinder. In addition to such optional continuous communication between the chambers d^2 d^3 of the actuating-cylinder, periodic communication therebetween is automatically effected at approximately the end of each stroke of the piston. For this purpose I provide a duct d^6 that opens from duct d^4 into the cylinder just above the upper face of the piston when in its lower position, and a duct d^7 in the piston itself that extends from its upper face to a point near its base and is adapted to register with duct d^6 when the piston occupies its upper position.

Having thus described the several parts entering into my improved pneumatic riveting machine, I shall now proceed to describe its mode of operation. It will be readily perceived from the foregoing description that when valve d^5 is turned to connect duct d^4 with chamber d^2 of the actuating-cylinder, as shown in Fig. 5, neither a compression nor a vacuum will be produced upon piston D' being reciprocated, the air being simply caused to circulate back and forth between the two chambers. When, however, such valve d^5 is turned as shown in Fig. 3, duct *d* being thus opened and the direct connection of duct d^4 therewith entirely closed, the upward stroke of the piston compresses the air in upper chamber d^2 and the connected hammer-cylinder C and thereby drives hammer-piston C^2 with attached tup downwardly; at the same time it produces a rarefaction of the air in lower chamber d^3 which it will be remembered is closed to the atmosphere. But just as the piston reaches the limit of such upward compression stroke, the two chambers are connected in the manner described by the registry of duct d^7 of the piston with duct d^6 in the cylinder wall, and the pressure in the upper cylinder is thereby instantly relieved. The following downward stroke of the piston is accordingly at once effective in producing a vacuum in the upper chamber and connected hammer-cylinder, and the hammer-piston in the latter is raised by the pressure of the atmosphere without. Upon the conclusion of the downward stroke of the piston the two chambers are again connected long enough to permit an equalization of pressures therein so that the piston starts on its upward movement without losing any of its travel in an effort to compress against a vacuum, which would be the case except for my construction. It is thus seen that the compression stroke of the piston, instead of being made at the start against a partial vacuum, is made against a partial compression or at least full atmospheric pressure; and that similarly, before the beginning of the piston's down, or vacuum stroke, the compression existing in the chamber is first relieved. It will be also noted that by the construction of valve d^5, the duct *d* leading to the hammer-cylinder may be gradually opened and the force of the hammer's blows thus regulated, the excess of air being diverted through the gradually closing duct d^4; and further, that, independently of such regulation, the length of the stroke of the hammer is adjustable by means of set-screw *c'* which also serves by its construction to cushion the hammer's upward stroke.

It is of course understood that not only is my improvement capable of modification to suit other kinds of pneumatic hammers than the riveting machine in which it has been

shown as being embodied, but that it is also capable of ready adaptation to almost any type of device actuated by fluid pressure. For example, instead of having the actuating- and hammer-cylinders involved in the same integral structure, the hammer, it can readily be seen, might be of the portable type and duct *d* replaced with a flexible connection.

Having thus described my invention in detail, that which I particularly point out and distinctly claim is:—

1. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, a piston reciprocable in said cylinder, and means operating in unison with said piston for periodically effecting an equalization of pressure in said cylinder on the two sides of said piston.

2. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, a piston reciprocable in said cylinder, and ducts in said cylinder and piston, respectively, arranged and constructed to periodically connect the parts of said cylinder on the respective sides of said piston and thereby equalize the pressures in such cylinder parts.

3. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, a piston reciprocable in said cylinder, and ducts in said cylinder and piston, respectively, arranged and constructed to connect the parts of said cylinder on the respective sides of said piston at approximately the end of each stroke of the latter and thereby equalize the pressures in such cylinder parts.

4. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, and a piston reciprocable in said cylinder, said cylinder being further provided with a duct adapted to connect the two ends thereof at approximately the end of one stroke of said piston, and said piston being provided with a duct adapted to register with said cylinder-duct to connect the two ends of said cylinder at approximately the end of the other stroke of said piston.

5. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, and a piston reciprocable in said cylinder, said cylinder being further provided with a duct leading from a point on one side of said piston when at approximately the end of one stroke to a point on the other side thereof, and said piston being provided with a duct leading from one face thereof to a point on its side disposed to register with one of the openings of said cylinder-duct in the course of said piston's other stroke.

6. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, and a piston reciprocable in said cylinder, said cylinder being further provided with a duct leading from a point above, to a point below, said piston when the latter is in its position farthest removed from the end of the cylinder having the externally connected duct, and said piston being provided with a duct leading from the upper face thereof to a point on its side disposed to register with the upper opening of said cylinder-duct when said piston is in its upper position.

7. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, a piston reciprocable in said cylinder and forming two chambers therein, a duct for uninterruptedly connecting such chambers, means controlling said duct, and means operating in unison with said piston for periodically effecting an equalization of pressure in such chambers.

8. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, a piston reciprocable in said cylinder and forming two chambers therein, a duct for uninterruptedly connecting such chambers, means controlling said duct, and ducts in said cylinder and piston, respectively, arranged and constructed to periodically connect such chambers and thereby equalize the pressures therein.

9. In mechanism of the class described, fluid compressing and exhausting means comprising a closed cylinder provided with a duct for external connection, a piston reciprocable in said cylinder and forming two chambers therein, a duct for uninterruptedly connecting such chambers, means controlling said duct, another duct in said cylinder disposed to connect such chambers at approximately the end of the exhaust stroke of said piston, and a passage in said piston disposed to communicate with said last-named cylinder-passage at approximately the end of the compression stroke of said piston, whereby such chambers are again connected.

10. In mechanism of the class described, fluid compressing and exhausting means comprising a cylinder closed to the atmosphere, a piston reciprocable in said cylinder, whereby two chambers are formed therein, a duct leading from one of said chambers and affording means for external communication therewith, a duct connecting the other of such chambers with said first duct, means adapted to simultaneously control said two ducts, and other ducts disposed so as to connect such two chambers at each stroke of the

piston, said piston serving to close said last named ducts at other times.

11. In mechanism of the class described, fluid compressing and exhausting means comprising a cylinder closed to the atmosphere, a piston reciprocable in said cylinder, whereby two chambers are formed therein, a passage leading from one of said chambers and affording means for external communication therewith, a passage in said cylinder connecting the other of such chambers with said first passage, a valve at the junction of said two passages adapted to simultaneously control the same, a second passage in said cylinder disposed to connect such chambers at approximately the end of the exhaust stroke of said piston, and a passage in said piston disposed to communicate with said last named cylinder-passage at approximately the end of the compression stroke of said piston, whereby such chambers are again connected.

Signed by me, this 6 day of December 1905.

THEODORE C. PROUTY

Attested by—

A. M. SCOTT,

M. L. PADDOCK.