(No Model.) 3 Sheets—Sheet 1.

H. SMITH.

HYDRAULIC MACHINE FOR RIVETING.

No. 401,975. Patented Apr. 23, 1889.

Fig. 1.

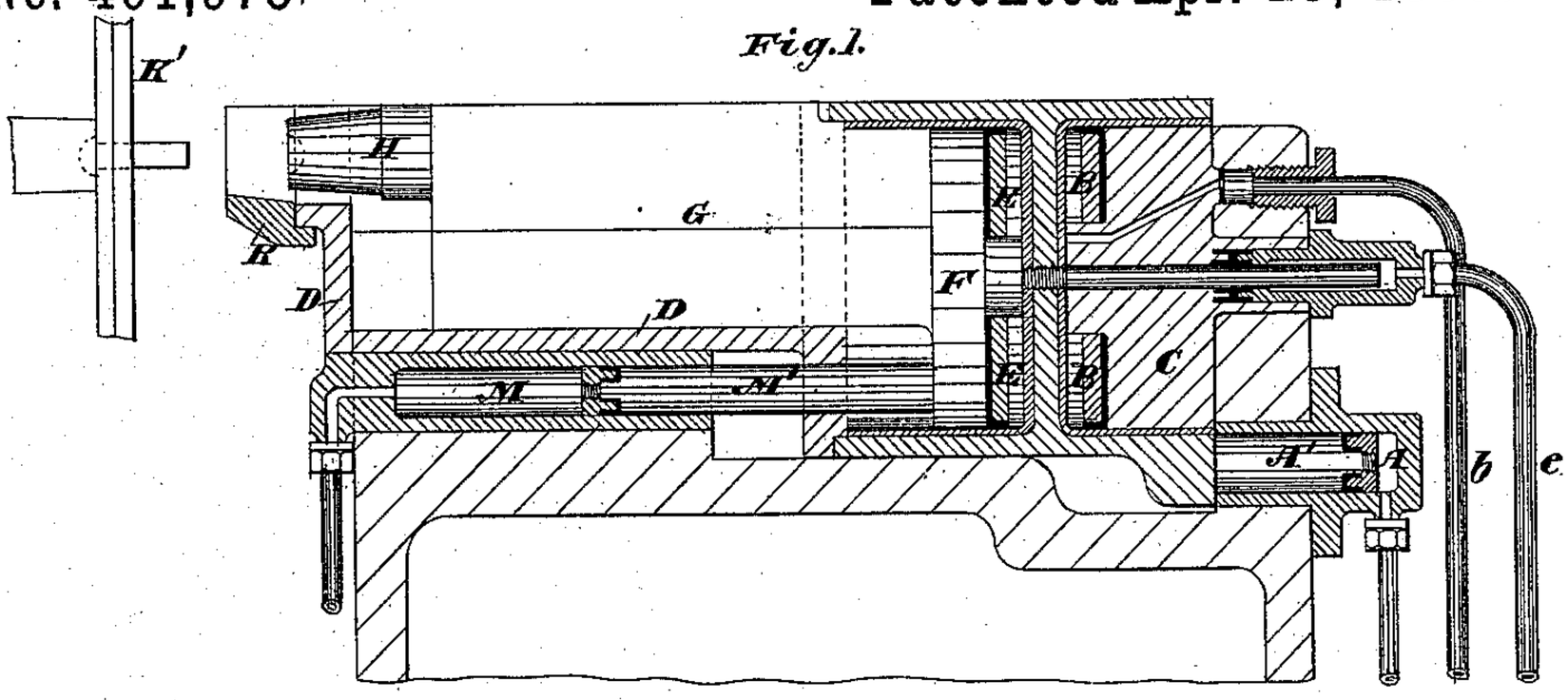


Fig. 2.

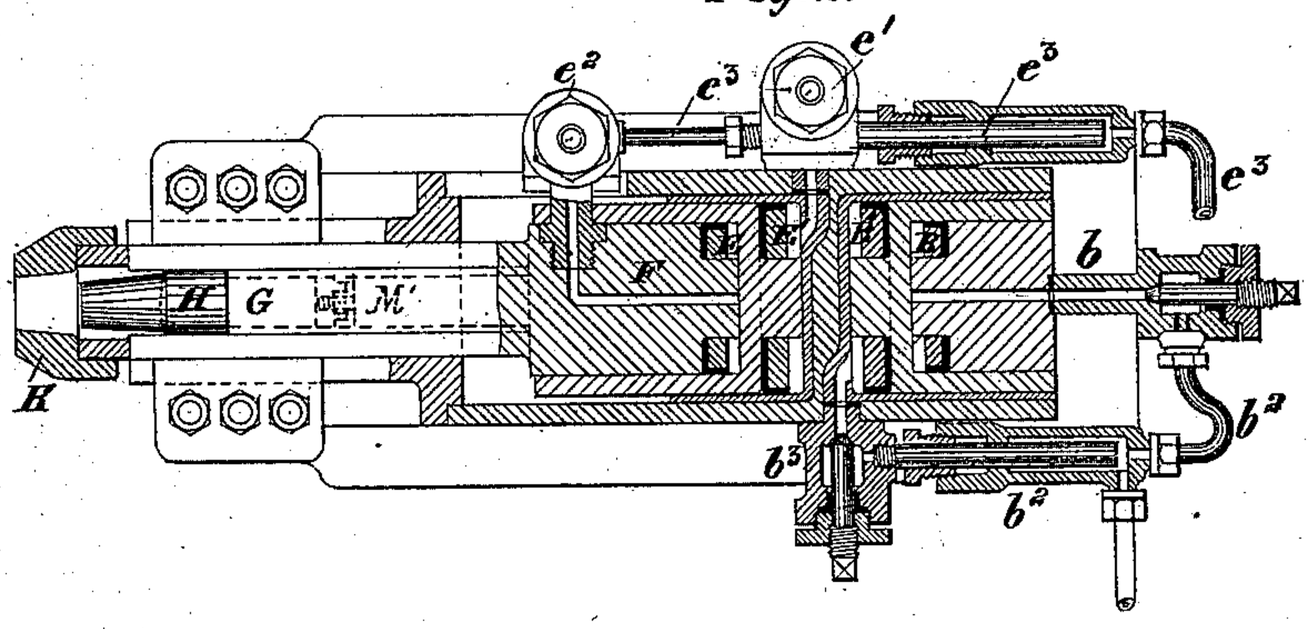
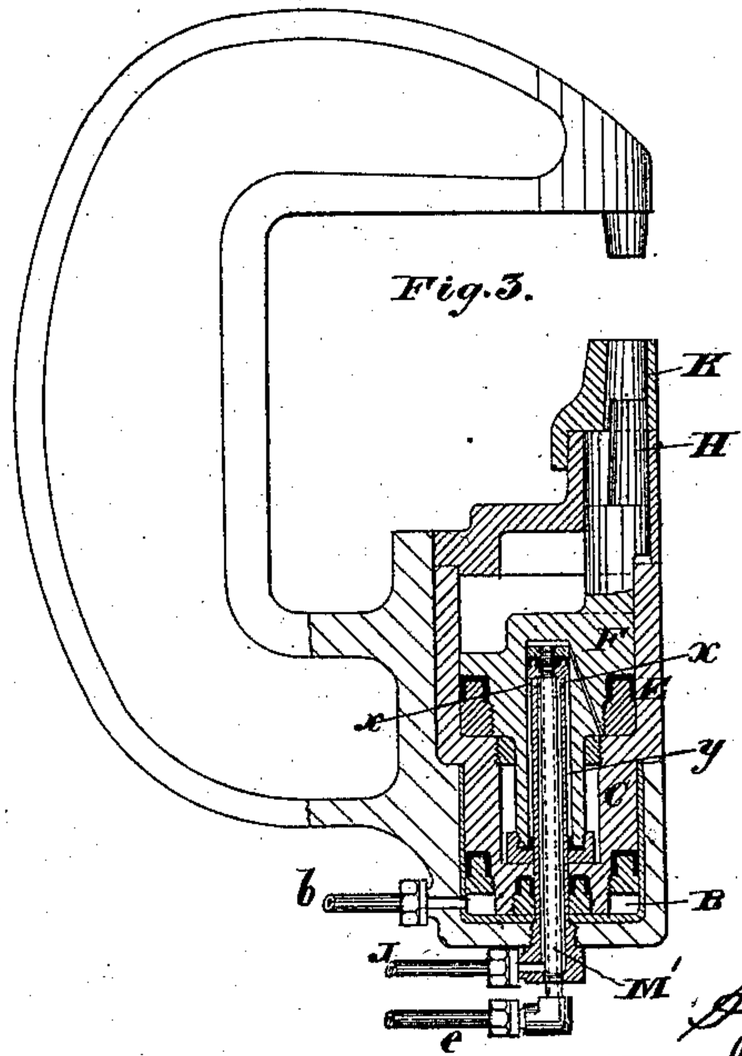


Fig. 3.



Attest:
Emma Arthur.
Edmund Stein

Inventor:
Hugh Smith.
By Knight Bros
Attys

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H. SMITH.

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Fig. 6.

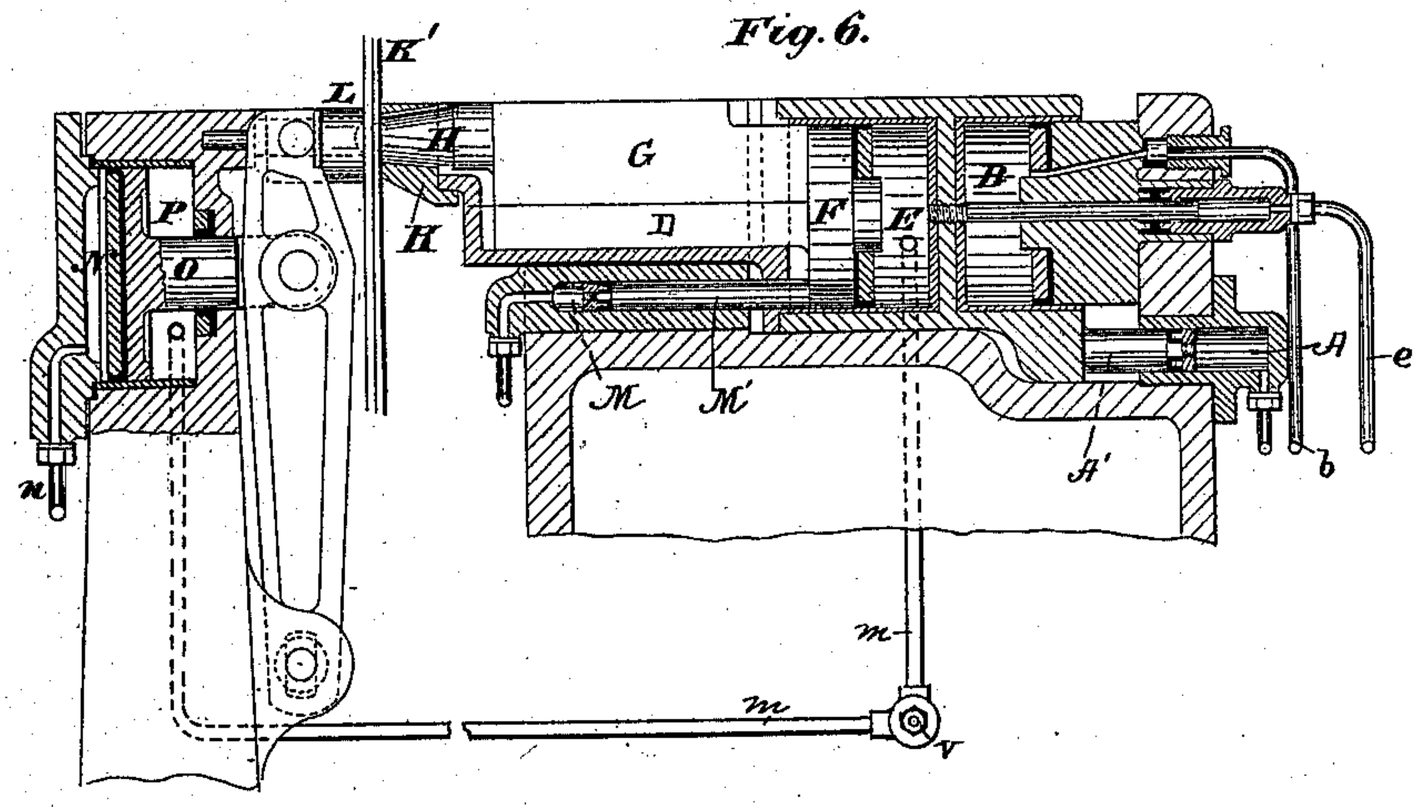


Fig. 5.

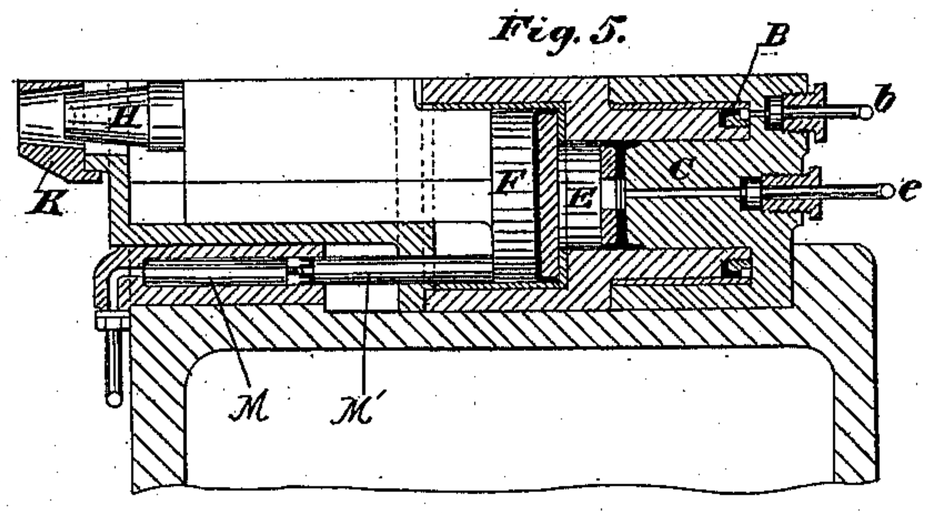
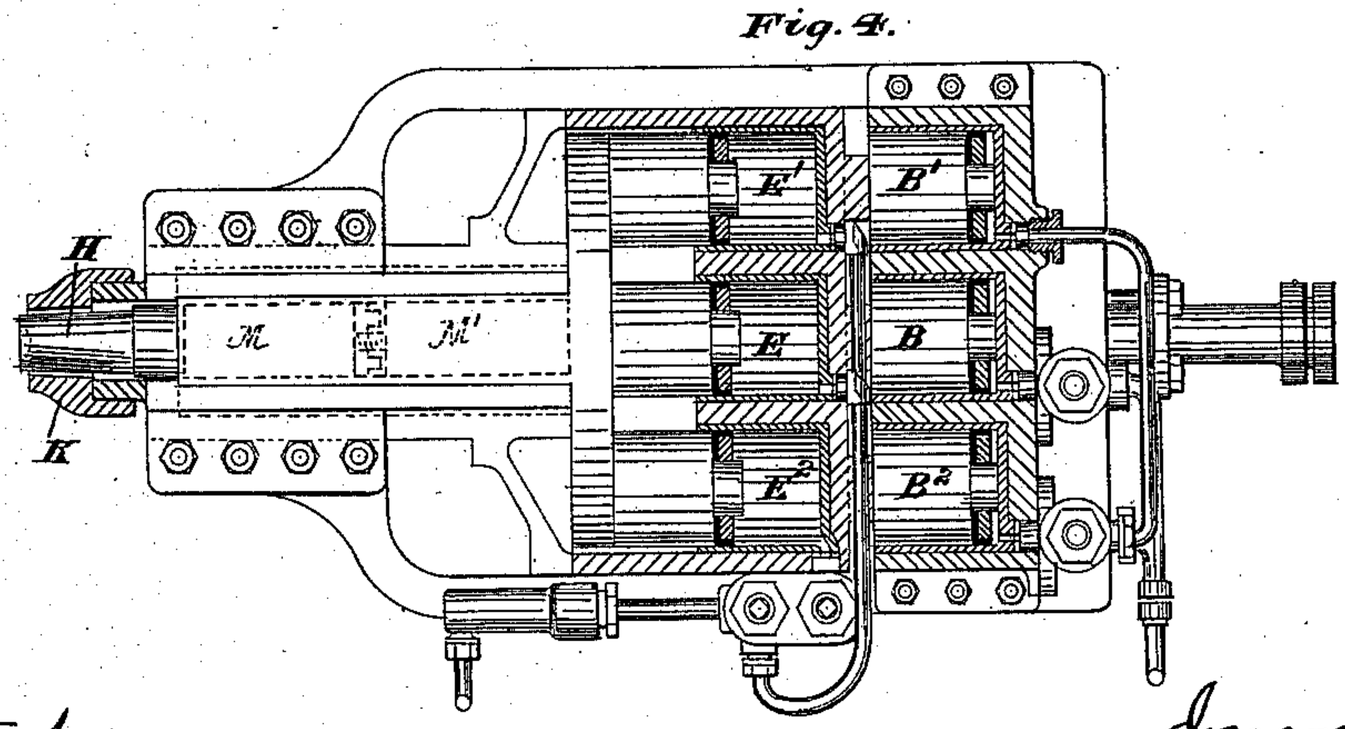


Fig. 4.



Attest:
Emma Arthur.
Edward Steer.

Inventor,
Hugh Smith.
By Knight Bros.
Attys

(No Model.) 3 Sheets—Sheet 3.

H. SMITH.

HYDRAULIC MACHINE FOR RIVETING.

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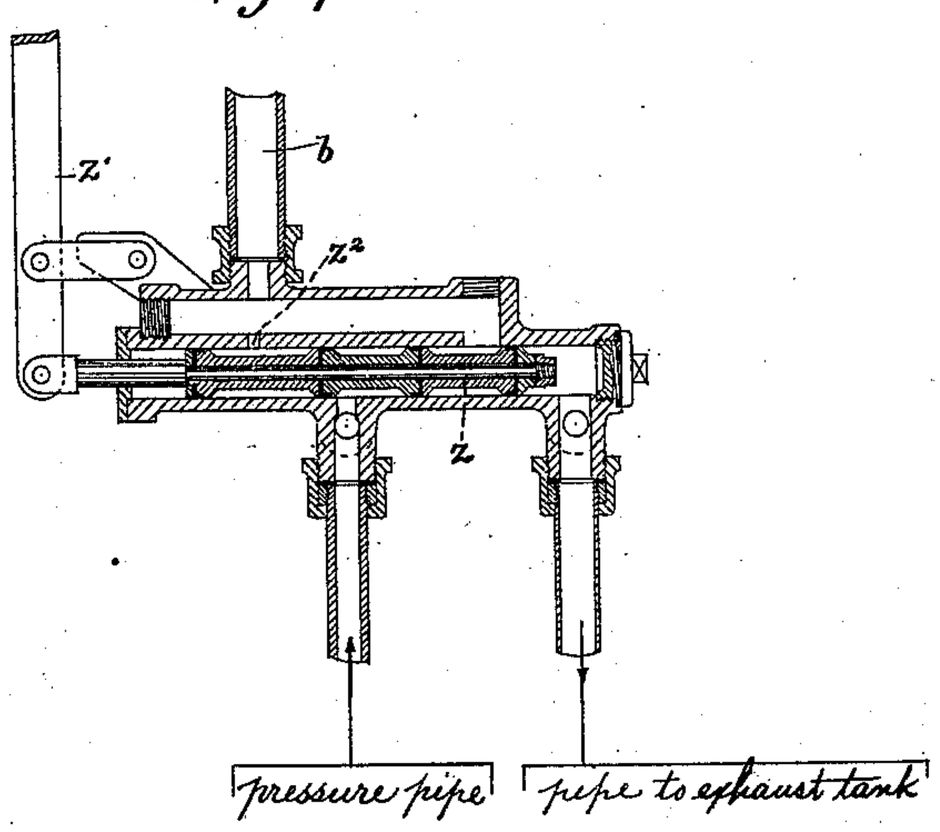
Fig. 7.



Attest.
Emma Arthur,
Edward Steer.

Inventor.
Hugh Smith.
By Knight Bros.
attys.

UNITED STATES PATENT OFFICE.

HUGH SMITH, OF GLASGOW, COUNTY OF LANARK, SCOTLAND.

HYDRAULIC MACHINE FOR RIVETING.

SPECIFICATION forming part of Letters Patent No. 401,975, dated April 23, 1889.

Application filed August 22, 1887. Serial No. 247,587. (No model.) Patented in England May 26, 1887, No. 7,651.

To all whom it may concern:

Be it known that I, HUGH SMITH, a citizen of the United Kingdom of Great Britain and Ireland, residing at Glasgow, in the county of Lanark, Scotland, have invented new and useful Improvements in Hydraulic Machines for Riveting, (which have been patented in Great Britain May 26, 1887, No. 7,651;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the manufacture or art to which it relates to make and use the same.

My invention relates to improvements in fluid-pressure machines for riveting and closing plates and to means for varying the power both for plate-closing and for riveting. With this object I arrange the cylinder or cylinders of the machine in such a manner that the fluid-pressure is first admitted by suitable valves to the plate-closing cylinder or cylinders, and when the plates are closed I admit the fluid-pressure to the rivet-closing cylinder or cylinders. The back-pressure of the rivet-closing cylinder or cylinders, acting against the plate-closing cylinder or cylinders, relieves the pressure on the ram or rams of the latter in proportion as the resistance of the rivet to staving causes the fluid-pressure in the rivet-closing cylinder or cylinders to rise. The power of the plate-closing cylinder or cylinders may be equal to or greater or less than that of the rivet-closing cylinder or cylinders.

Figure 1 of the accompanying drawings is a vertical section through a riveting-machine head, showing one mode of applying the principle of this invention thereto, the position of the traveling parts of the machine being full back. Fig. 2 of the accompanying drawings represents in section a double or two-power combined plate-closing and riveting machine constructed on the same principle as the form shown by Fig. 1. Fig. 3 represents the adaptation of the principle of this invention to a portable riveting-machine. Fig. 4 represents a three-power combined riveting and plate-closing machine constructed on the principle of my invention. Fig. 5 represents a method of plate-closing with a less pressure than that used for riveting. Fig. 6 represents a vertical section through the head of the riveting-machine having a plate-closing arrangement, as shown in Fig. 1, but with an additional plate-closing arrangement on the hob or bolster of the machine; and Fig. 7 is an enlarged detail view of the mechanism for controlling the admission of pressure and the exit of the exhaust from the cylinders.

In working with the machine shown by Fig. 1, I first admit the fluid-pressure into a small cylinder, A, the ram A′ of which forces forward the large cylinders B E and slides D G till the plate-closing snap K strikes the plate K′. While this is being done the cylinder B, which is the plate-closing cylinder, is, by the valves applied to its pipe *b*, kept open to the water in the exhaust-tank, and as the cylinders are carried forward by the action of the ram A′ the water from the tank runs in and fills up the space left between plunger C and the front end of the cylinder B, thereby effecting considerable economy in the fluid under pressure to be subsequently used. When the snap K strikes the plate K′, the pipe *b* of the cylinder B is shut off from communication with the exhaust-tank by means of a double valve, *z*, and its operating-lever *z′*, and by the same operation and means it is opened to the fluid-pressure through the small port z^2. The plunger C being fast to the machine-casting, the fluid-pressure forces the cylinder B forward and communicates forward pressure to the plate-closing snap K through the medium of the outside slide, D, the snap being thereby caused to close the plates. The rivet-closing cylinder E, which is or may be made in the same casting with the plate-closing cylinder B, moves forward in unison with that cylinder; but the plunger F of the cylinder E is during the said movement held back by fluid-pressure admitted in the cylinder M, the plunger M′ of which presses on the plunger F, so as to prevent it from acting on the rivet until the plate-closing pressure is fully on the plates. The cylinder M is in constant communication with the accumulator. When the forward motion of the cylinders B E is completed, the rivet-closing cylinder E is opened to fluid-pressure through the pipe *e*, and the plunger F then moving forward communicates pressure to the riveting-snap H through

the slide G. As the resistance of the rivet to staving causes the pressure to rise in the cylinder E, the back-pressure gradually withdraws or relieves an equal amount of pressure from the plate-closer K—that is to say, every ton of pressure exerted to stave the rivet causes the same amount to come off the plate-closing snap K, and there is thereby got a gradual transference of the pressure from the plate-closing to the rivet-closing snap. When the staving of the rivet is completed, the snaps K H, slides D G, plunger F, and combined cylinders B E are returned to their full back position by fluid-pressure exerted on the ram M′, the pressure in the cylinders A, B, and E being first released or opened to the exhaust.

With the arrangement shown in Fig. 2, which is also shown in its full back position, the fluid-pressure for the lesser plate-closing power is admitted through the valve and pipe *b* into the plate-closing cylinder B, which has the effect of moving the cylinders B, B′, E′, and E forward and of exerting pressure on the plate-closing snap K. If it is desired to stave the rivet with the lesser riveting power, fluid-pressure is admitted through the valve e^2 and telescopic pipe e^3 to the cylinder E, causing its plunger F to move forward and exert pressure on the snap H. When it is desired to exert greater power in closing the plates, the fluid-pressure is shut off from the cylinder B and admitted through the telescopic pipe b^2 and valve b^3 into the cylinder B′, which is of greater area than the cylinder B, and similarly, when it is desired to exert a greater power on the rivet-closing snap H, the fluid-pressure is shut off from cylinder E and opened through the valves *e′* to the cylinder E′. The cylinders E and B are of equal area, as are also the cylinders E′ and B′, and these, when operated as described, exert equal pressure—that is to say, the pressure exerted by E is equal to that exerted in B, and the pressure in E′ to that in B′. If a different pressure is desired for the plate-closing snap from that exerted on the rivet-closing snap, the rivet-closing cylinder E may be used in conjunction with the plate-closing cylinder B′, or the rivet-closing cylinder E′ may be used with the plate-closing cylinder B. The resistance of the rivet to staving causes the pressure to rise in the cylinder E′ or E and releases the pressure on the plate-closer K, as with the preceding arrangement. After each rivet has been closed, the traveling parts of the apparatus are or may be returned to their full back position by the operation of a ram, M′, (shown in dotted lines,) similar to that employed in the form shown by Fig. 1.

In the form shown in Fig. 3, which represents an adaptation of the principle to a portable riveting-machine, the rivet-closing cylinder E is cast in one piece with the plunger C of the plate-closing cylinder B. F is the rivet-closing plunger within which the draw-back arrangement works. The fluid-pressure to act on the plunger F is admitted by a pipe, *e*, which passes through the center of draw-back ram M′, and the fluid-pressure to operate the draw-back is admitted through the pipe J and passes through the holes *x* into the annular space or trunk *y* in the plunger F, the said pressure being in constant communication with the accumulator. As the resistance of the rivet to staving causes the pressure to rise in the cylinder E, the back-pressure on the cylinder B relieves an equal pressure on the plate-closer K, as before set forth.

With the arrangement shown by Fig. 4 I admit fluid-pressure to the center cylinder B for plate-closing and to the center cylinder E for rivet-closing with the first or lowest power. For the second power the water is shut off from the cylinders and admitted to the two side cylinders, B′ and B^2, for plate-closing and E′ and E^2 for rivet-closing, and for the third or greatest power I admit water to all three of the plate-closing cylinders B, B′, and B^2, and then to the three rivet-closing cylinders E, E′, and E^2. A small auxiliary ram, as at A′, Fig. 1, to save pressure fluid or power may be used with this or other adaptation of this machine, and the rams or plungers are or may be returned to their normal position by the operation of a rim, *m′*, in a cylinder, M. (Shown in dotted lines.)

In the arrangement shown by Fig. 5 the area represented by the difference of areas of the plunger C and cylinder B is such as to give the desired pressure on the plate-closing snap K, and to this area the fluid-pressure is first admitted through the pipe *b* to close the plates. I then admit fluid under pressure through the pipe *e* to the space E, so as to force forward the rivet-closing plunger F with a pressure due to the full area of the said plunger, and when the fluid-pressure gradually rises to its maximum the plate-closer K is forced back with a pressure due to the difference of area between the plungers F and C, their back-pressure being balanced by the plate-closing pressure at B. I thus get the gradual transference of pressure from the plate-closer K to the rivet-closer H when using a lighter pressure for plate-closing than for rivet-closing.

Referring to the form shown by Fig. 6, the rivets are required to be put in from the outside of the shell—that is, at the opposite side from the hob. I remove the plate-closing snap K and work with the plate-closing snap L, which is actuated by the plunger O in the following manner: Fluid-pressure is admitted constantly to the cylinder N through the pipe *n*, which causes the plunger O to remain full forward. I then admit fluid-pressure to cylinder E, which closes the plates between snaps H and L. Communication is now opened between cylinder E and the part P of the cylinder N through the pipe *m*, having a valve, *v*, for regulating the area of opening, and when the pressure in P begins to rise it causes the plunger O to move back, the press-

ure at N being already balanced by the forward pressure from the cylinder E. On account of the area of inlet to the cylinder E being much larger than the area of communication between E and P, the result is that the pressure at E will only rise in proportion as a rivet resists staving, and I will thus get a gradual transference of the pressure from the plate-closing to the rivet-closing snap. Instead of between E and P, I may apply the above-described communication after the plates have been closed between B and P, the cylinder B under this mode of working being filled with water and then cut off from the source of supply.

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

1. In a hydraulic riveting-machine, the combination, with the plate-closing snap and the rivet-closing snap, of the traveling plate-closing and rivet-closing cylinders opening in opposite directions and having their heads abutting, and stationary and traveling plungers in said cylinders, respectively, the traveling plunger being adapted to impart pressure to the one and the cylinders to the other of said snaps, substantially as set forth.

2. In a hydraulic riveting-machine, the combination, with the plate-closing snap and the rivet-closing snap, of the traveling plate-closing and rivet-closing cylinders, of equal diameters, and the said cylinders having their heads abutting, stationary and traveling plungers in said cylinders, respectively, the said cylinders and traveling plunger being adapted to impart pressure to the plate-closing snap and the rivet-closing snap, respectively, and an auxiliary ram for forcing said cylinders forward, substantially as set forth.

3. The combination, with the plate-closing and rivet-closing snaps adapted to close toward each other and the cylinders and plungers for operating them, of a duct leading from the back of the one plunger to the front of the other plunger, whereby the back-pressure in one cylinder will decrease the forward pressure of the other plunger, as set forth.

4. The combination, with the plate-closing snap and the rivet-closing snap, of traveling cylinders, stationary and traveling plungers in said cylinders for causing pressure upon said snaps, the stationary cylinder N, snap L, and plunger O, for imparting pressure to said snap L, as set forth.

In witness whereof I have hereunto set my hand and seal this 4th day of August, 1887.

HUGH SMITH. [L. S.]

Witnesses:

GEO. M. CRUIKSHANK,

WALLACE FAIRWEATHER,

Fel. Inst. Patent Agents, both of 62 *St. Vincent Street, Glasgow.*