(No Model.)

2 Sheets—Sheet 1.

V. SCHÖNBACH.

HYDRAULIC RIVETER.

No. 558,850.

Patented Apr. 21, 1896.

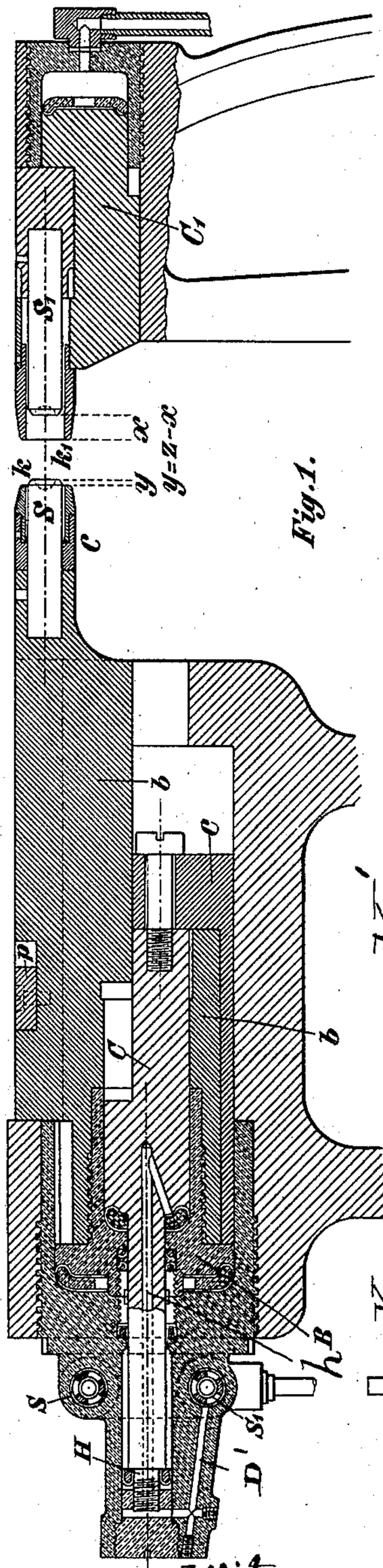


Fig. 1.

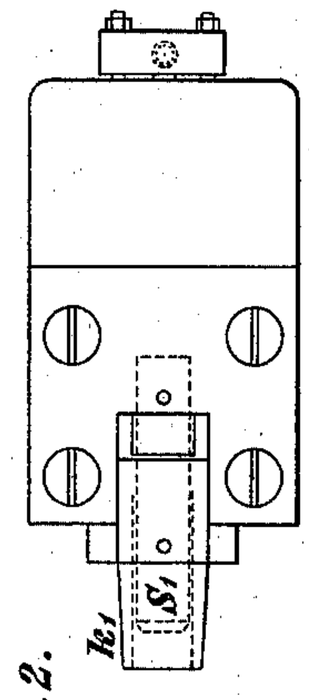


Fig. 2.

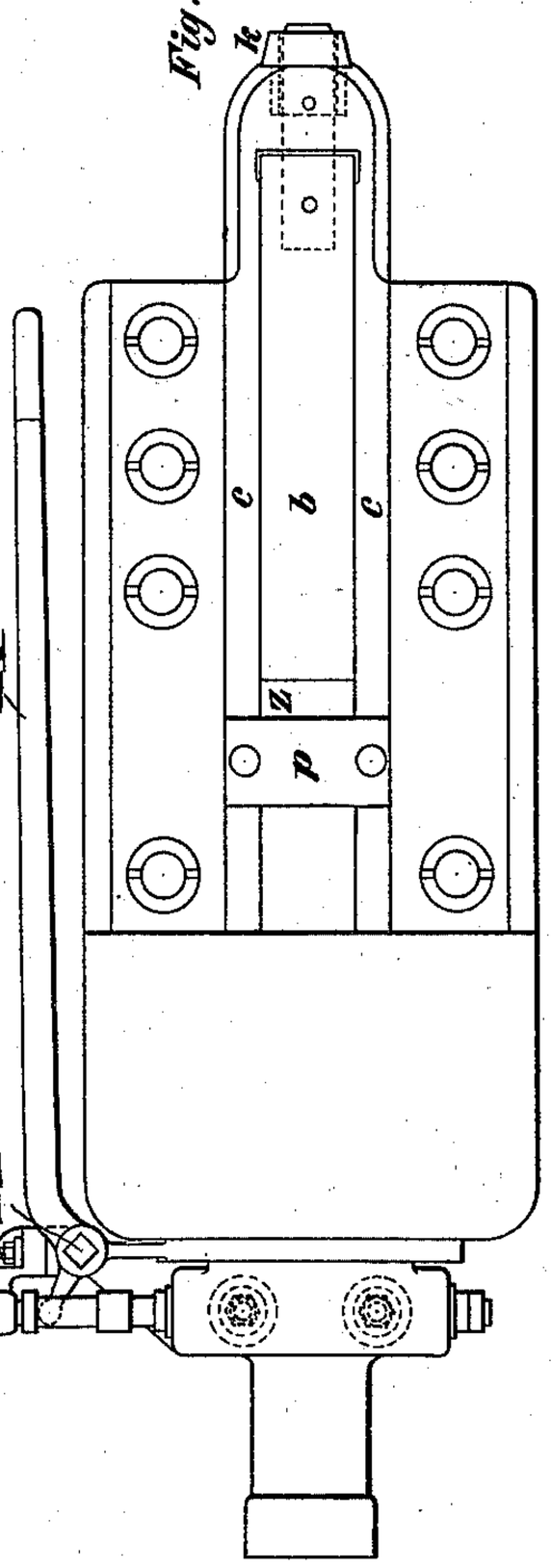


Fig. 5.

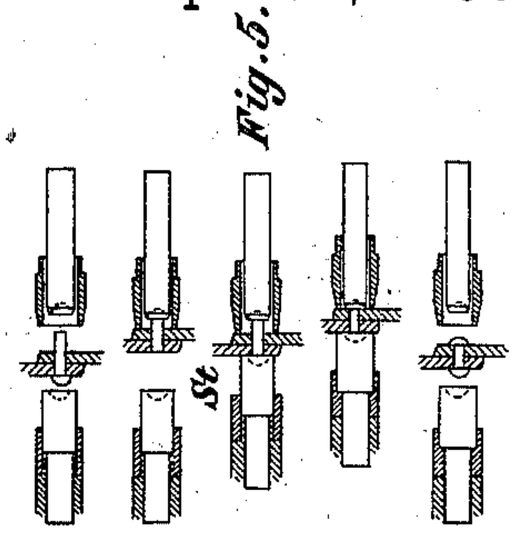


Fig. 4.

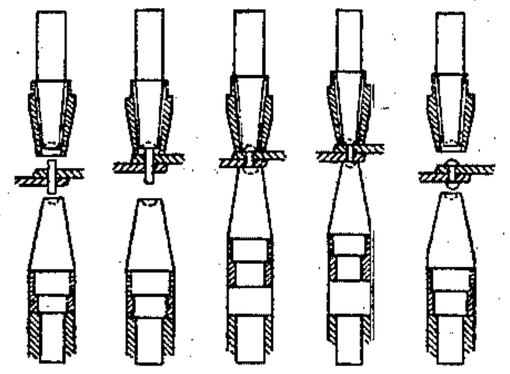
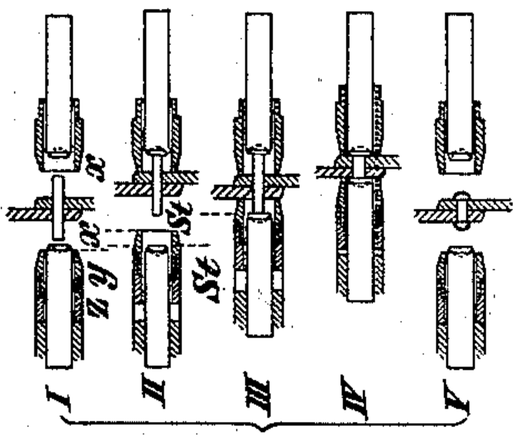


Fig. 3.



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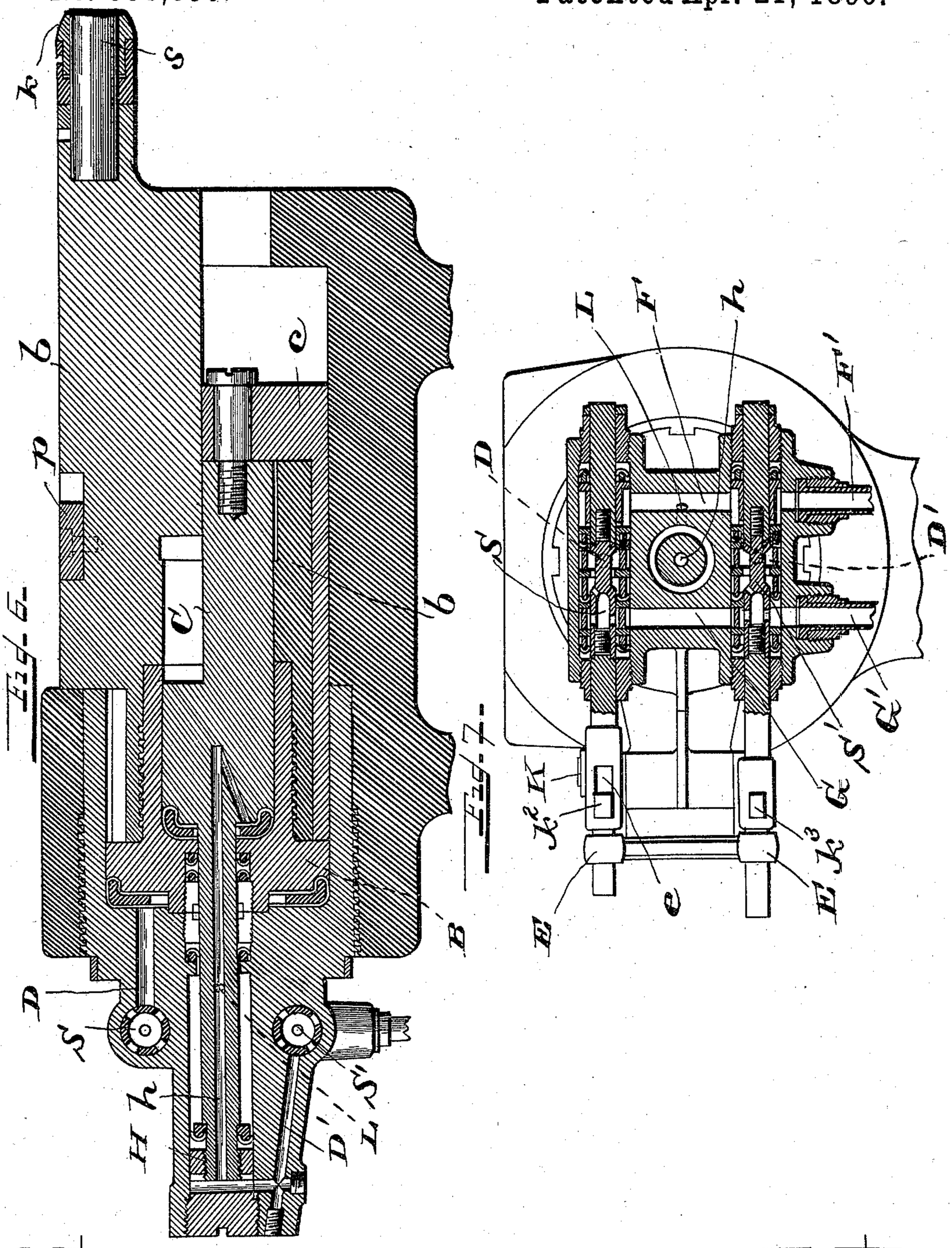
(No Model.) 2 Sheets—Sheet 2.

V. SCHÖNBACH.

HYDRAULIC RIVETER.

No. 558,850. Patented Apr. 21, 1896.



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UNITED STATES PATENT OFFICE.

VICTOR SCHÖNBACH, OF CAROLINENTHAL, AUSTRIA-HUNGARY.

HYDRAULIC RIVETER.

SPECIFICATION forming part of Letters Patent No. 558,850, dated April 21, 1896.

Application filed October 28, 1893. Serial No. 489,415. (No model.)

To all whom it may concern:

Be it known that I, VICTOR SCHÖNBACH, a subject of the Emperor of Austria-Hungary, residing at Carolinenthal, in the Kingdom of Bohemia and Austrian Empire, have invented certain new and useful Improvements in Hydraulic Riveters; and I do hereby declare that the following is a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the said invention.

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings, which illustrate one form in which I have contemplated embodying my invention, and said invention is fully disclosed in the following description and claim.

Referring to the said drawings, Figure 1 is a vertical longitudinal sectional view of my improved riveting-machine. Fig. 2 is a top plan view of the same. Figs. 3, 4, and 5 are diagrammatic views illustrating the manner of using my improved machine. Fig. 6 is an enlarged longitudinal sectional view of the main portion of the machine, showing more clearly the valves and fluid-passages. Fig. 7 is a similar transverse sectional view through the valve-casings and valves.

The object of my invention is to provide a hydraulic riveting-machine having outer and inner plate-closing devices and a construction by means of which a considerable saving of pressure-water is effected, said machine being also adapted to the formation of heads upon pins or studs unprovided with heads.

Referring to the drawings, B represents the riveting-ram working in a cylinder formed in the machine-frame and connected by means of the guide-piece *b* with the cupping-tool *s*. Within the riveting-ram is arranged the plate-closing ram C, which, by means of the guide-piece *c*, moves the outer plate-closing tool or crown *k*, although it may be also used as a riveting-piston, if desired, by substituting a cupping-tool for the crown *k*. The ram C has a central extension running back toward the rear end of the machine, where it is provided with a piston H, which I term the "auxiliary" piston, working in a cylinder formed at the rear of the machine, there being a space for pressure-water both at the rear and in front of the piston H, so that said auxiliary piston can be used as a return-piston. A fluid-passage *h* extends longitudinally to the piston H, the extension of ram C, and has a delivery-aperture in rear of the ram C, so as to supply pressure-water thereto.

Adjacent to the rear end of the machine are a pair of horizontal transversely-disposed valve-casings located one above and one below the axis of the ram. (See Figs. 6 and 7.) The upper valve-casing is connected by a passage D with the cylinder of the ram B, and said casing is provided with a transversely-sliding valve S, the stem of which is mounted in suitable guides E. The lower valve-casing is provided with a similar valve S′, mounted also in the guides E, and said casing is connected by a passage D′ with the cylinder in which the piston H moves, and by means of the longitudinal passage *h* with the cylinder in the ram B in which the ram C moves. In the rear end of the machine (see Fig. 7) are formed a vertical passage F, which I term the "pressure-water-supply" passage, and a similar passage G, which I term the "exhaust-water" passage. These passages are connected, respectively, with the pressure-water inlet-pipe F′ and the exhaust-water pipe G′, the valves S and S′ serving to connect the passages D and D′ alternately with the pressure-water-supply or exhaust-water passages.

In order to secure the proper movement of the valves, I conveniently employ the construction best illustrated in Figs. 2 and 7.

K represents a vertical rock-shaft mounted in suitable bearings at the rear of the machine and provided at its upper end with an arm k^2, engaging an elongated slot *e* in the stem of valve S. At its lower end said rock-shaft is provided with an arm k^3, engaging closely a recess in the stem of valve S′. Said rock-shaft is operated by means of a suitable handle or lever K′. By employing the elongated slot *e* it will be seen that when the rock-shaft K is operated by the hand-lever K′ the lower valve S′ will be moved a distance before the arm k^2 reaches the end of slot *e*, when upon a further movement of the hand-lever and rock-shaft the two valves S and S′ will move together.

L, Fig. 7, represents a passage connecting the pressure-water passage F with the cylinder in which the piston H moves, but forward of said piston. Hence it will be seen that there is a constant supply of pressure-water transmitted through the passage L to the front side of piston H independent of the valve and exerting a constant pressure on the front side of said piston.

When the machine is in its normal or inactive condition, the valves are in the position shown in Fig. 7, in which the passage D communicates with exhaust-passage G through the valve S, and the passage D′ likewise communicates with the exhaust-passage through the valve S′, the pressure-water being admitted only in front of the piston H through the passage L. When the handle K′ is moved so as to throw the arm k^2 from one end of the slot *e* to the other, the valve S will not be moved at all, but the valve S′ will be moved so as to admit pressure-water through the passage D′ in rear of the piston H and through the passage *h* to the rear of the ram C. As the area of the ram C is greater than that of the front side of piston H, the pressure of the water upon the ram C will overcome the resistance offered on the front side of piston H, and the ram C, with the crown *k*, will move forward. During this forward movement only the small piston H and ram C are using pressure-water. This operation follows when the ram C is free to move with respect to ram B, and the ram C may thus be used alone as a riveting device by substituting a cupping-tool for the crown *k*. The movement of ram C with respect to ram B is, however, preferably limited by means of a movable plate *p*, connected with the slide *c* and engaging a recess in the slide *b*. When this plate is in position, as in Figs. 1, 2, and 6, the ram C moves forward alone until the plate *p* strikes the forward end of its recess, after which the rams C and B move forward together under the influence of the piston H, the rear face of which has a larger area than its front face, and consequently overcomes the back pressure. During this movement of the ram B, the passage D being in free communication through the valve S with the exhaust-water passage G, the exhaust-water follows the ram B and fills the cylinder in which it moves, thus saving a waste of pressure-water.

When the lever K′ is moved to its next position, the valve S will be forced over so as to close the communication between passage D and the exhaust-water passage and open communication between the passage D and the pressure-water passage F, thereby supplying pressure-water directly to the ram B to complete the riveting operation. When the lever K′ is thrown back to its original position, the valves S and S′ will be moved into the position illustrated in Fig. 7 and will establish a communication between both passages D and D′ and the exhaust-passage G, the only piston then receiving pressure-water being the piston H, which receives pressure on its front side through the passage L, thereby returning the rams B and C to their original position. It should be stated that the exhaust-water pipe G′ is connected with a reservoir (not shown) on a higher level than the machine, so that the exhaust-water will readily follow the ram B, as above described. There is also on the side of the stationary cupping-tool *s′* a piston or a ram C′, which is submitted to a constant pressure, and therefore retains the inner closing-tool *k′* in the position indicated in the drawings. The piston-C′ does not move until the tool *k′* is submitted to a more powerful pressure than that to which the ram is subjected. I prefer to connect the ram C′ with a separate small accumulator (not shown) having the pressure variable according to requirements.

The relative motion of *b* and *c* may be so limited that when the dead or idle movement *s t* has been completed the cupping-iron may directly strike the rivet and the crown *k* also come into immediate contact with the plate, so that *k* will be in advance of *s* a distance of *x*, and there will be room between the said crown and the cupping-tool for the formation of the head of the rivet. If the relative displacement of the two rams equals *z*, the cupping-iron should in its initial position stand in front of the crown a distance of $y = z - x$. Owing to this adjustment of parts where pins or bolts are employed, the material of which the same are made is properly distributed. This result is besides insured by the fact that exactly the same relative position which exists between the crown and the cupping-tool is also provided for on the side of the fixed cupping-tool *s′*—*i. e.*, that *k′* is also in advance of *s′* a distance of *x*, which is just sufficient to allow the head of the rivet to be formed between the two. From this it will be seen that the distribution of the material of which the rivet is made is controlled to a nicety. The inner plate-closing device, however, in addition to the distribution of material, has this main object, that the moment when the dead motion of the piston or driver B and C is completed the blank between the pieces *k* and *k′* is under the action of the auxiliary piston retained in a stationary position, so as to be incapable of lateral displacement even before the riveting-pin is flattened down. When after this the formation of the rivet-heads is proceeded with, the pressure of the blank firmly gripped in the machine increases to correspond to the maximum pressure of C or C′, as the case may be, so that during the formation of the rivet-heads a lateral displacement of the blanks becomes an utter impossibility. By this means, too, the formation of the heads otherwise than straight is avoided, and all heads are exactly of the same size and properly centered. The inner plate-closing device, moreover, offers the advantage that even when ready-made rivets are employed these may be inserted into the ma-

chine from outside, so that it is never necessary for a man to stand inside the article to be riveted—say a boiler.

The operation of the machine will be readily apparent from the positions illustrated by Figs. 3, 4, and 5. Fig. 3 shows the operation under normal conditions where the riveting is performed by means of bolts or pins without heads. Both the inner and outer closing tools or crowns are set in position, whereby provision is made for the proper distribution of the material. The blank is placed against the inner crown. When the dead movement *s t* is completed, as indicated in position III, the blank is securely gripped or compressed between the two crowns or closing devices and the material of the pin on either side evenly distributed. When the pressure-lever is pulled behind B, C′ recedes while C will be shifted in B, so that both rivet-heads form at the same time. (Position IV.) This, however, will only happen when the pressure of C and that of C′ are equal; but when the pressure of C′ is less than that of C the head at *s′* will form first, and C will not recede within B until after the resistance of C′ and of the bolt provided with a head at *s′* has become more powerful than the pressure of C. Conversely, when the pressure of C is less than that of C′, a rivet-head will first form at *s*. For the purpose of the general operation of the machine it is immaterial whether C and C′ exercise equal or different pressures. From the foregoing it will be understood that riveting by means of headless bolts or pins is possible even when C and C′ are not under pressure. Fig. 4 illustrates a case in which C is not under pressure—*i. e.*, where the crown *k* is placed at a distance. In this case a head will form at *s* first, while the distribution of the material will be effected by the inner crown. This arrangement may be applied in practice when C is employed as a riveting piston or driver, while the pressure of C′ is made less than that of C. Where the plate-closing is effected by means of a single instead of a double device, it will be understood that the guiding and adjustment of the blank require a great deal more attention and care.

Fig. 5 illustrates the operation of the machine where ordinary rivets are used. In this case the outer closing piece or crown *k* is somewhat removed. The riveting-bolt is inserted from outside and the plate-closing is performed by the piece *k′*.

From the operation as applied to the various cases herein mentioned it will be readily seen that the machine is capable of a great variety of combinations and special provisions as regards the plate-closing operation and the pressure.

What I claim, and desire to secure by Letters Patent of the United States, is—

In a hydraulic riveting-machine the combination with the plate-closing tool and cupping-tool, of a stationary cylinder and a riveting-piston for actuating the cupping-tool, a piston moving within said riveting-piston for actuating the plate-closing tool, an auxiliary cylinder and piston of smaller diameter for moving said actuating-piston, a communicating passage between the said auxiliary cylinder and the piston for actuating the plate-closing tool, means for supplying water under pressure to said auxiliary cylinder and piston and through said passage to the piston for said plate-closing tool, and means for supplying pressure-water to the riveting-piston for the cupping-tool and for continuing the supply to said auxiliary piston during the operation of riveting, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

VICTOR SCHÖNBACH.

Witnesses:
TH. WALDAPFEL,
ADOLPH FISCHER.