W. H. WOOD.

HYDRAULIC RIVETING MACHINE.

APPLICATION FILED MAR. 17, 1908.

956,253. **Patented Apr. 26, 1910.**

3 SHEETS—SHEET 1.

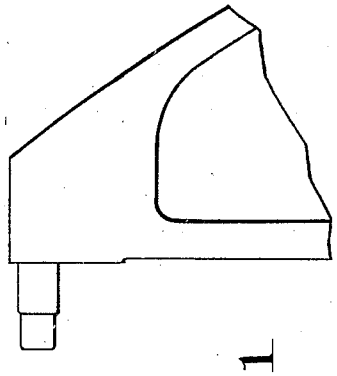


Fig. 1

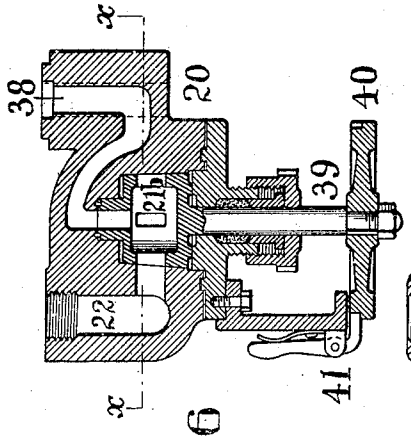


Fig. 6

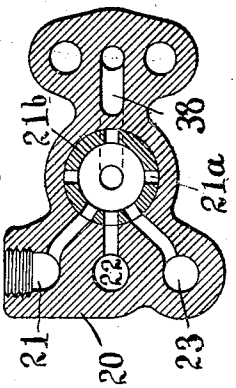
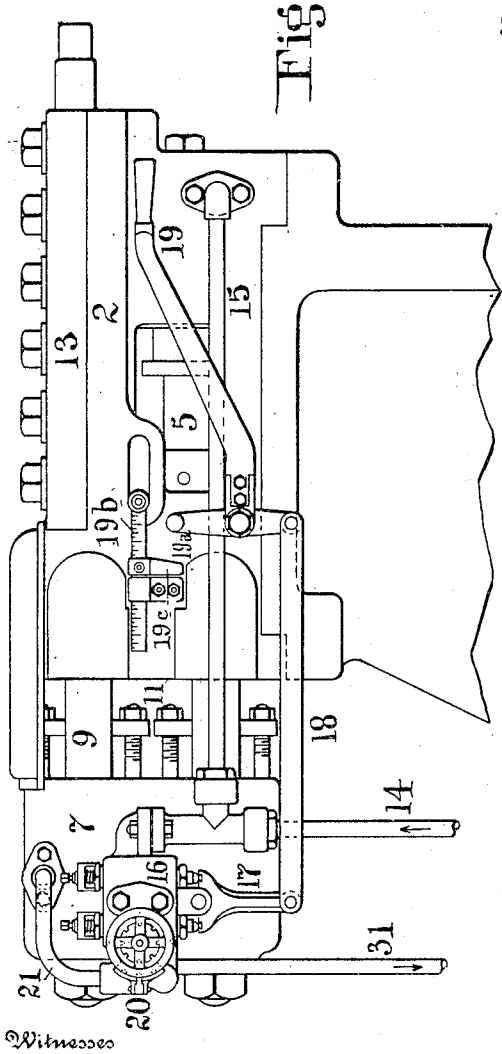


Fig. 7



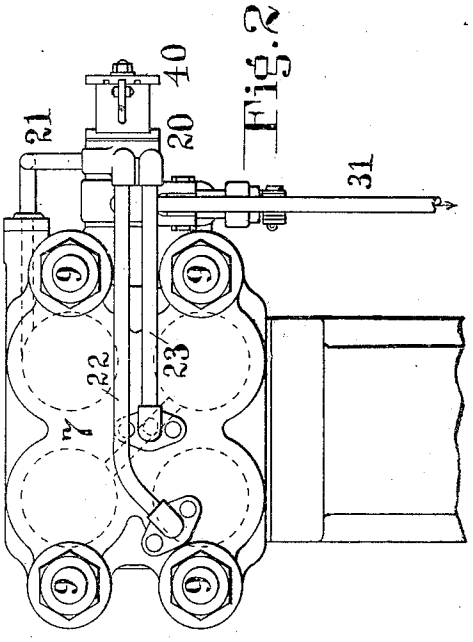


Fig. 2

Witnesses

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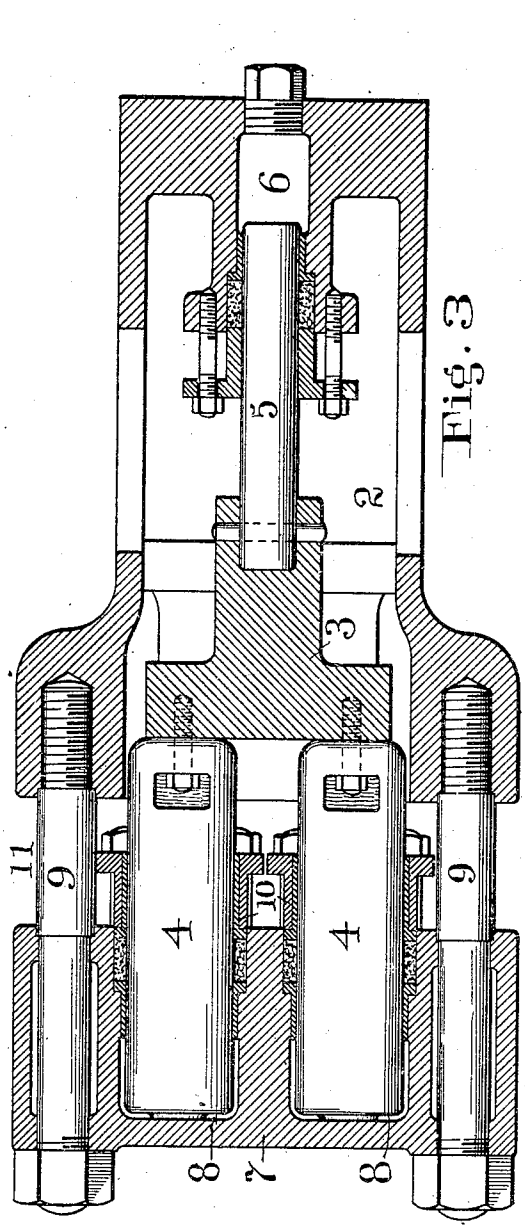

Fig. 3

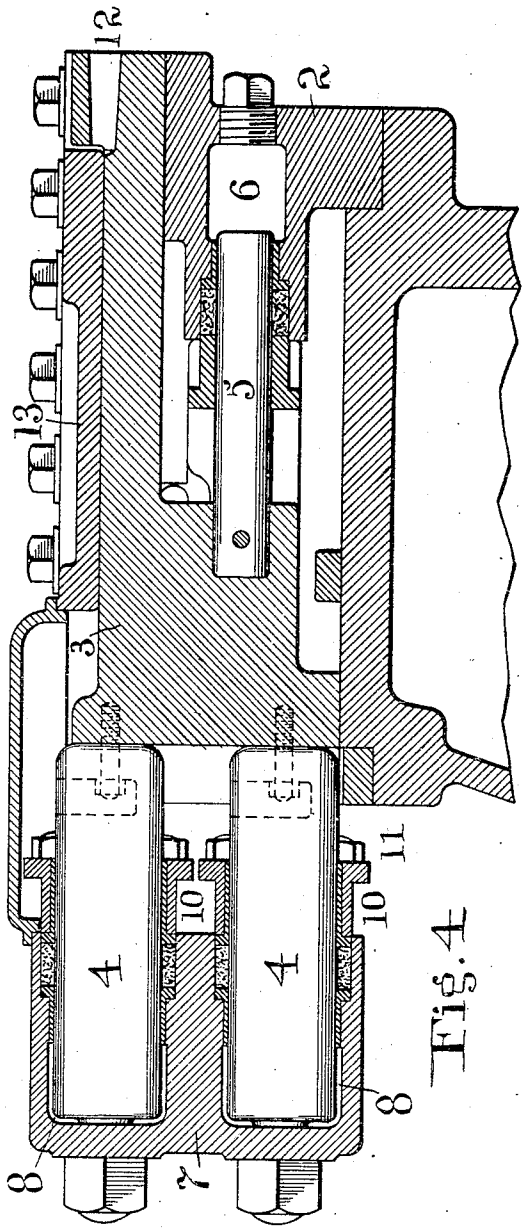

Fig. 4

Witnesses

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3 SHEETS—SHEET 3.

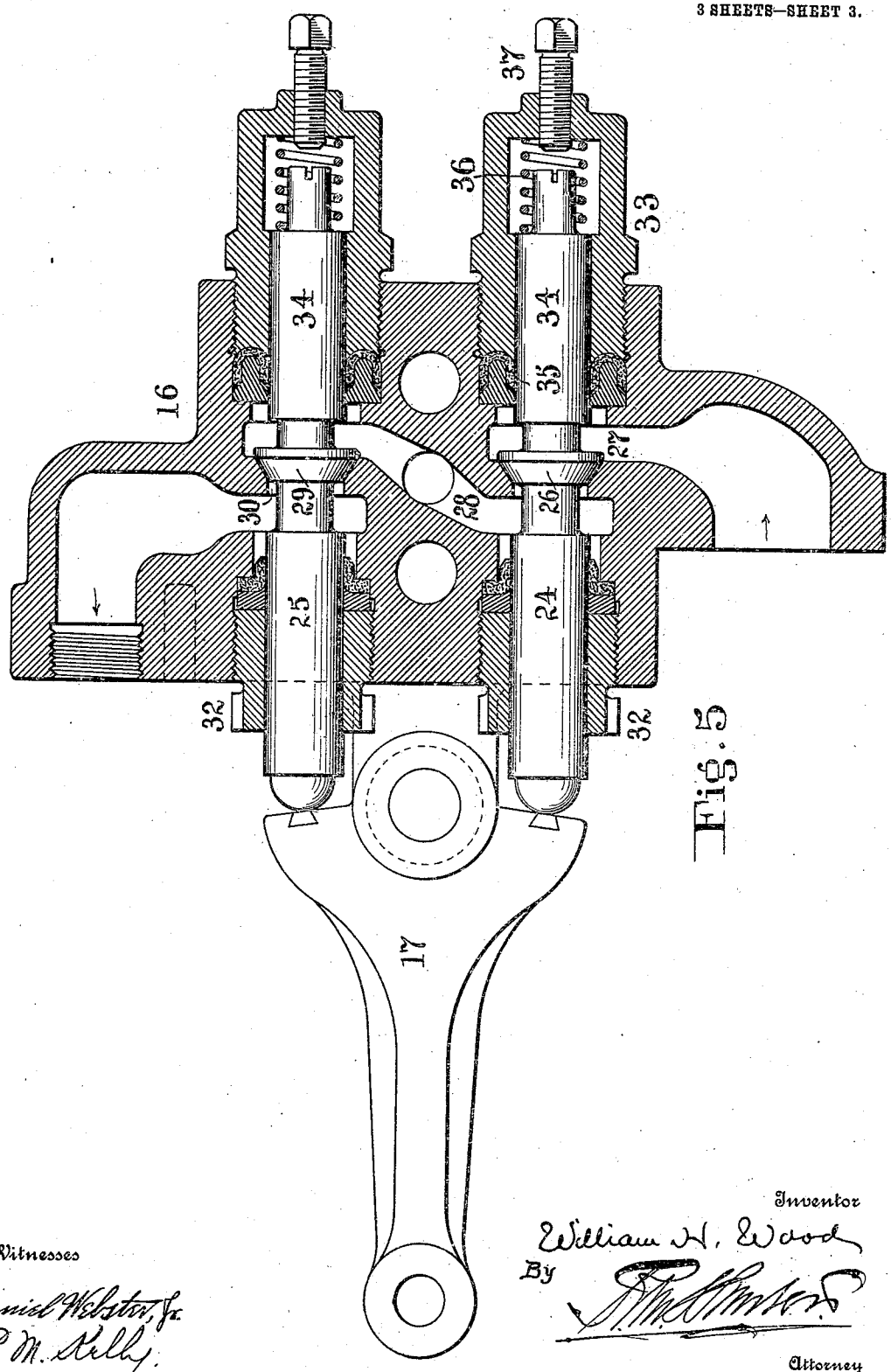

Fig. 5

Witnesses

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UNITED STATES PATENT OFFICE.

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HYDRAULIC RIVETING-MACHINE.

956,253. Specification of Letters Patent. **Patented Apr. 26, 1910.**

Application filed March 17, 1908. Serial No. 421,620.

To all whom it may concern:

Be it known that I, WILLIAM H. WOOD, a subject of the King of England, and a resident of Media, county of Delaware, State of Pennsylvania, have invented an Improvement in Hydraulic Riveting-Machines, of which the following is a specification.

My invention has reference to hydraulic riveting machines, and consists of certain improvements, which are fully set forth in the following specification, and shown in the accompanying drawings, which form a part thereof.

The object of my invention is to provide a construction of riveting machine in which various degrees of power may be secured from a single accumulator or source of initial energy; and more particularly to provide a construction in which the power may be increased in equal units whereby one, two, three or four units of power may be available at will and with the employment of a minimum number of pressure supply pipes. My object is also to so form the hydraulic elements that they are interchangeable to reduce cost and permit of easy repair and assemblage.

My invention consists of a driving head having four plungers of equal diameter secured thereto, combined with a cylinder-head having four cylinder chambers for the said plungers, and means for controlling the supply of water to two of said cylinders singly, and to the remaining two cylinders jointly, whereby with the employment of three admission pipes, control of the four cylinders may be had with the creation of the power of one unit or multiples thereof of 2, 3 or 4.

My invention also consists of a quadruple plunger driving head, combined with a quadruple cylinder-head therefor, a main pressure and exhaust valve, and a distributing valve between the main pressure and exhaust valve and the cylinders.

My invention also comprehends details of construction which, together with the features above specified, will be better understood by reference to the drawings, in which: Figure 1 is a side elevation of the upper part of the housing of a riveting machine embodying my improvements; Fig. 2 is an end view of the same; Fig. 3 is a sectional plan view of the riveter head; Fig. 4 is a sectional elevation of the same; Fig. 5 is a sectional elevation of the pressure and exhaust valve; Fig. 6 is a sectional plan view of the distributing valve; and Fig. 7 is a cross section of the same on line x—x of Fig. 6.

The general construction of the main housing, the leg and gap may be as heretofore employed. Secured upon the top of the main housing is the main head 2. Extending from the rear of this head are four bolts 9 upon which the cylinder-head 7 is supported and detachably clamped in position. The bolts 9 act as spacing devices for holding the cylinder-head at a definite distance away from the main head 2 so as to form a space 11 between them in which the packing glands 10 may be arranged and adjusted.

Arranged within and guided by the main head is the driving head 3 which is made with a large flat end adjacent to the cylinder-head and with a socket 12 at the other end for the riveting die. This driving head 3 has a long guiding contact within the main head 2 and is held in position by the cap plate 13 which is bolted down upon the top of the head 2. The forward part of the main head is provided with a cylinder 6, in which works a plunger 5 secured to the driving head. The object of this cylinder and plunger is to return the driving head to its normal position after completing each riveting operation. The pressure is supplied to this cylinder 6 continuously by the pipe 15 leading from the main pressure pipe 14.

4 are four plungers of equal diameter and length, and these are bolted to the flat end of the driving head, as shown in Figs. 3 and 4, and are so spaced that they fit into the cylinders 8 of the cylinder head 7 and are made liquid tight by the stuffing boxes and glands 10. While these plungers are not in direct line with the socket 12 for the riveting die, this is not material, because there is such large guiding surface for the driving head in the main head. It is evident that the cylinder-head 7 may be readily removed from the plunger by removing the nuts from the bolts 9 where for any cause either the cylinders or plungers are to be removed for repairs. The plungers 4 being all alike as to size and shape, are interchangeable, and this is a very important advantage both as to construction because of reduced cost and in use because of facility of repairs. By making these four plungers of the same size, the operation of the press

may be so controlled as to multiply the power in fixed units defined by one of the plungers, as one, two, three or four of these plungers may be put into operation under the pressure fluid, thereby giving to the machine capacity of 25, 50, 75 and 100 tons, or other corresponding powers according to the diameters of the plungers, or the pressure of the operating fluid, or both. In this way, the operator has at hand means for applying a multiplicity of pressures which may be readily brought into play, and yet under normal operations, the press would be set to operate repeatedly at one definite pressure predetermined upon.

Referring to Figs. 1 and 2, the water is supplied under pressure by pipe 14 and its admission to and exhaust from the cylinders is controlled by a pressure and exhaust valve 16. The water is distributed to and from the several cylinders by the distributing valve 20. By means of this distributing valve the water may be delivered by pipe 21 to one cylinder or by pipe 23 to two of the cylinders connected in diagonal, or to said three cylinders, and if desired, by pipe 22 to the remaining cylinder. It thus follows that if the available power per cylinder is 25 tons, then the distributing valves may supply water under pressure to one cylinder by pipe 21, to two cylinders by pipe 23, to three cylinders by pipes 21 and 23, or to four cylinders by pipes 21, 22 and 23. The more common pressure to be employed will be due to two cylinders, and hence in this case the plungers 4 will be arranged to apply the pressure both on the cylinder-head and the driving head in the most satisfactory way as to stress distribution.

The distributing valve is shown in Figs. 6 and 7 in detail. The water under pressure enters at port 38 and passes into the axis of the rotary hollow drum valve-piece 21^b, which is adapted to be rotated by a hand-wheel 40 on the valve stem 39. A latch 41 is employed to lock the hand-wheel and the valve piece in their various positions of adjustment. The valve-piece has a series of apertures 21^a through its walls which may be brought into operative connection with the ports of the pipes 21, 22 and 23. As the valve is set in Fig. 7, it is distributing to all four of the cylinders 8, but by adjusting it differently, the supply to pipes 21, 22 and 23 may be made as desired to secure the results hereinbefore pointed out. The water enters and exhausts from the cylinders through the distributing valve.

The pressure and exhaust valve 16 is more fully shown in Fig. 5. It comprises a body part 16 having a water inlet port 27 and an exhaust port 30 connecting in a chamber 28 which communicates with the port 38 of the distributing valve 20. The inlet port 27 is controlled by a pressure valve 26 and the exhaust port 30 is controlled by an exhaust valve 29. These valves 26 and 29 are respectively operated by plungers 24 and 25 of the same cross section as the ports and which extend through stuffing boxes 32 of any suitable construction and are operated by the rocking lever 17. When the lever 17 is thrown in one direction, it will move valve 26 to open the supply port 27, and when moved in the other direction it will move the valve 29 to open the exhaust port 30. This lever 17 is operated by a link 18 and hand lever 19 adjacent to the work end of the riveter-head. As it would be difficult to open these valves 26 and 29 against the high pressure of the water, I provide a counterbalance for said valves as follows. Each of the valves has a plunger 34 of the same area as the opening of the ports 27 and 30 controlled by the valves 26 and 29, said plungers working through stuffing boxes 35 of any suitable construction and extending to the outside. These plungers are guided in the body of the cages 33 which also act as packing glands and within the cages are coiled springs 36 to normally cause the valves to seat. Set-screws 37 are employed to limit the throw of the valves. It will now be seen that the pressure of the water acts equally upon the plungers 34 and valves 26 and 29 so that the latter are balanced and may be moved with very little exertion. The details of this valve may, of course, be varied so long as counterbalancing features are maintained. The exhaust pipe 31 connects with the exhaust port 30.

It will now be understood that in the operation of my improved riveter in commercial practice, I first determine the power required for any given work to be done and adjust the distributing valve 20 to select the particular cylinders to be supplied with fluid pressure. In the further operation of the apparatus, it is only necessary to operate the valve 16 as may be required to secure the proper reciprocation of the driving head. Should more power be required from any cause, it is only necessary to adjust the distributing valve to suit the requirements and the unit of power will be increased when the valve 16 is again operated.

As a convenient means for automatically stopping the advance of the driving head and rivet die should the operator fail to arrest the advance by closing the pressure valve, I show an adjustable stop 19^c which is secured to a scale bar 19^b connected to the driving head, said stop being caused to strike the arm 19^a of the lever 19 and force it into position to close the pressure valve 16. The stroke is thereby positively limited and carelessness or bad judgment on the part of the operator will not permit the driving head to be forced abnormally forward. While this automatic device stops the

action of the press, the return movement does not take place until the lever 19 is thrown by hand to open the exhaust valve. The scale permits the stop 19e to be adjusted to determine the extent of possible travel of the driving head before the pressure valve is automatically shut off.

I have shown my invention in the form I have found it most suitable for commercial use, and while I prefer the constructions shown, I do not confine myself to the details as these may be modified without departing from the spirit of the invention.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. In a hydraulic press adapted for riveting, the combination of a main head having a plurality of spacing and retaining bolts at one end and a guideway through it, a die carrying head guided in the main head, four plungers secured to the end of the die carrying head, a removable cylinder-head having four cylinders in alinement with the four plungers and secured in position by the spacing and retaining bolts so as to leave a clearance space between the main head and cylinder-head, stuffing boxes for the cylinder-head surrounding the plungers and arranged in the space between the cylinder-head and main head, means for supplying fluid under pressure to one of said cylinders or to combinations of them consisting of pipes separately connecting with two of said cylinders, a third pipe connecting with the two remaining cylinders, and controlling means for directing the fluid through one, two, or all three of the pipes at one time.

2. In a hydraulic press adapted for riveting, the combination of a main head having a guideway through it and a return cylinder at one end, a removable cylinder-head having four cylinders detachably secured to the other end of the main head, a die operating head guided in the main head and having a return plunger at one end working in the return cylinder of the main head and also having four detachable plungers at the other end working in the cylinders of the cylinder-head, means to supply fluid pressure to the return cylinder, and means for supplying fluid pressure to the four cylinders to cause the plungers to operate as one, two, three or four units consisting of three pipes communicating with the four cylinders and hand controlled means for distributing the fluid pressure to one or more of said pipes.

3. In a hydraulic press adapted for riveting, the combination of a main head having a cylinder-head provided with four cylinders of equal area formed therein, a die carrying head guided in the main head and having four seats for plungers at one end, four detachable plungers of equal cross section respectively arranged in the four cylinders and connected to the seats of the die carrying head, and means for supplying fluid pressure simultaneously to two of the cylinders diagonally arranged and also supplying fluid pressure successively to the remaining two diagonally arranged cylinders.

4. In a hydraulic press adapted for riveting, the combination of a main head having a cylinder-head provided with four cylinders of equal area formed therein, a die carrying head guided in the main head and having four seats for plungers at one end, four detachable plungers of equal cross section respectively arranged in the four cylinders and connected to the seats of the die carrying head, pressure and exhaust valves for controlling the supply and discharge of pressure fluid to the press, and means for supplying fluid pressure simultaneously to two of the cylinders diagonally arranged and also supplying fluid pressure successively to the remaining two diagonally arranged cylinders whereby the plungers may be operated as one, two, three or four units.

5. In a hydraulic press adapted for riveting, the combination of a main head having a cylinder-head provided with four cylinders formed therein, a die carrying head guided in the main head and having four seats for plungers at one end, four detachable plungers respectively arranged in the four cylinders and connected to the seats of the die carrying head, and means for supplying fluid pressure simultaneously to two of the cylinders diagonally arranged and also supplying fluid pressure successively to the remaining two diagonally arranged cylinders.

6. In a hydraulic press adapted for riveting, the combination of a main head having a cylinder-head provided with four cylinders formed therein, a die carrying head guided in the main head and having four seats for plungers at one end, four detachable plungers respectively arranged in the four cylinders and connected to the seats of the die carrying head, pressure and exhaust valves for controlling the supply and discharge of pressure fluid simultaneously to two of the cylinders diagonally arranged and also supplying fluid pressure successively to the remaining two diagonally arranged cylinders whereby the plungers may be operated as one, two, three or four units.

In testimony of which invention, I have hereunto set my hand.

WILLIAM H. WOOD.

Witnesses:
R. M. HUNTER,
R. M. KELLY.