

No. 651,503.

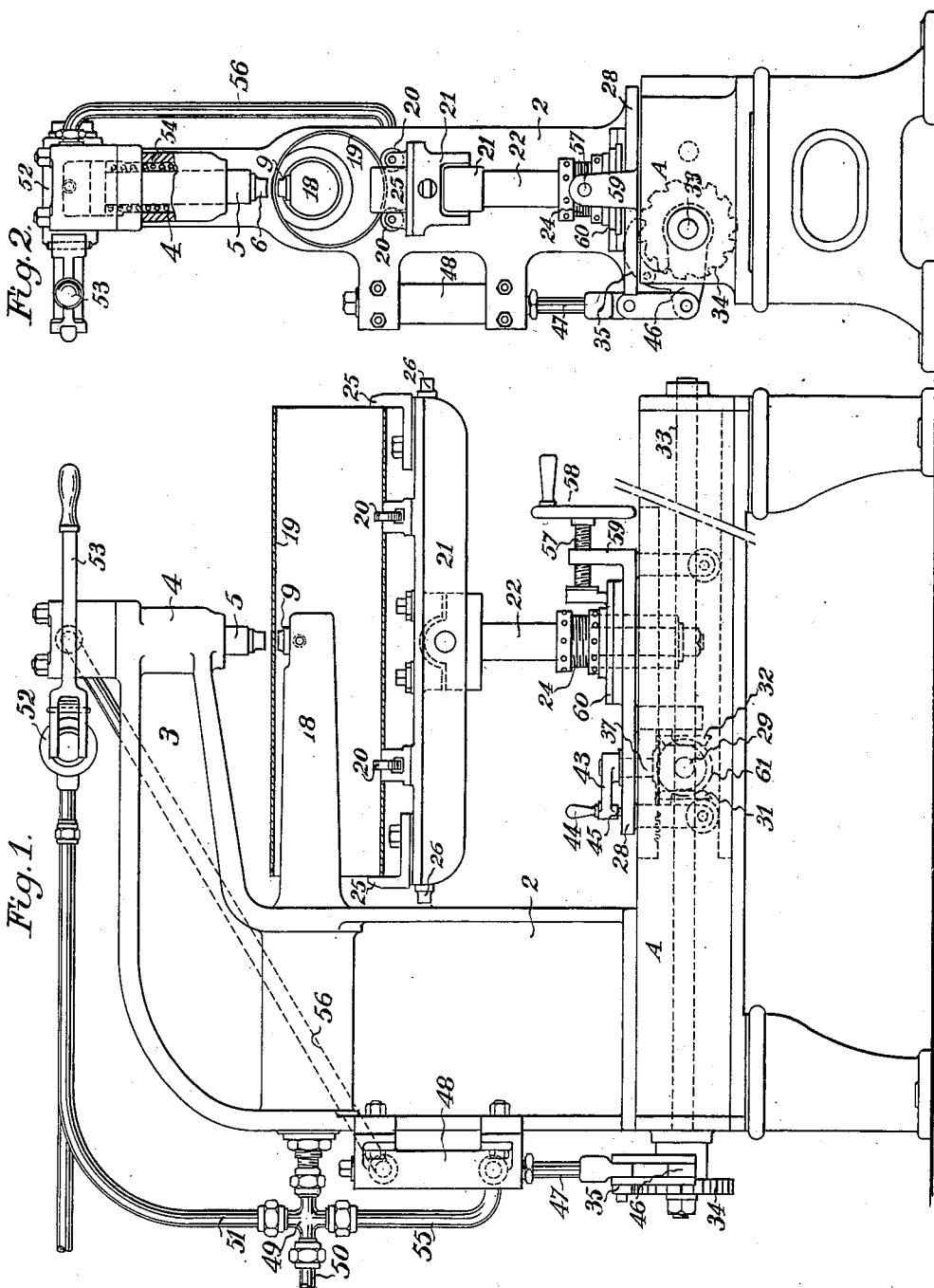
Patented June 12, 1900.

S. FOREMAN.
HYDRAULIC RIVETING MACHINE.

(No Model.)

(Application filed Feb. 16, 1900.)

2 Sheets—Sheet 1.



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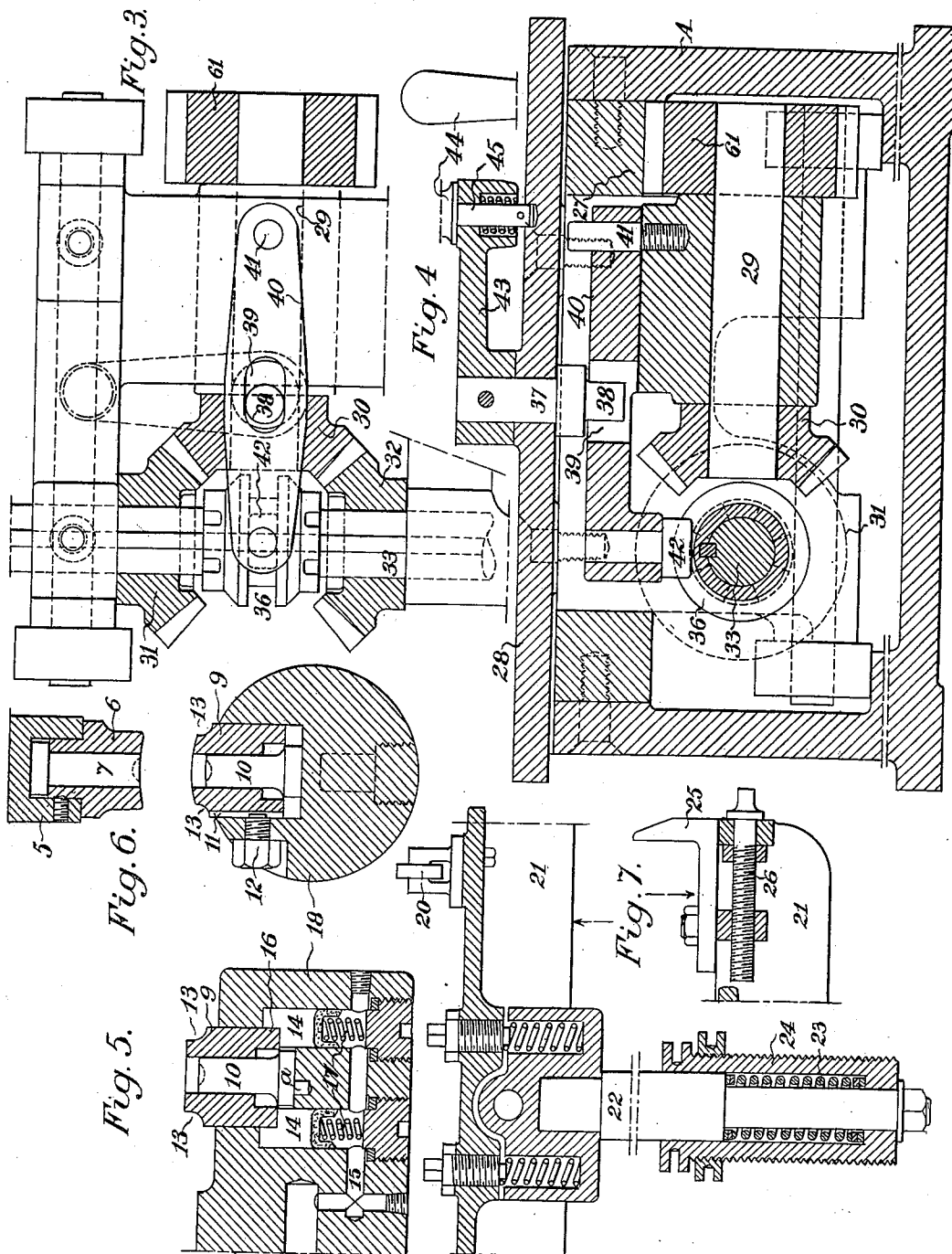
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UNITED STATES PATENT OFFICE.

STANTON FOREMAN, OF SACRAMENTO, CALIFORNIA, ASSIGNOR TO THE
SCHAW, INGRAM, BATCHER & COMPANY, OF SAME PLACE.

HYDRAULIC RIVETING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 651,503, dated June 12, 1900.

Application filed February 16, 1900. Serial No. 5,524. (No model.)

To all whom it may concern:

Be it known that I, STANTON FOREMAN, a citizen of the United States, residing at Sacramento, county of Sacramento, State of California, have invented an Improvement in Hydraulic Riveting-Machines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an apparatus for riveting the longitudinal overlapping seams for the formation of pipe sections or joints, and it is especially adapted for the manufacture of small-sized pipe, such as that of less than eight inches in diameter, and which necessitates some changes in the apparatus from that which is used for larger-sized pipe, this being especially necessary for the reason that the reduced size of the mandrel necessary for these smaller pipes makes it difficult to obtain sufficient strength and rigidity of the unsupported end of the mandrel to allow it to project far enough to rivet the full length of the pipe-sections.

My invention comprises mechanism for supporting and holding a pipe in position, mechanism for advancing it along the mandrel from one end to the center to double-rivet one half of the length and withdrawing and reversing it upon the mandrel to rivet the other half, mechanism for allowing the pipe to automatically adjust itself to the line of the riveting-heads, and a yielding support for the pipe, allowing it to rise after each rivet is set in readiness to be advanced for the next-following rivet.

It also comprises details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal elevation of my machine. Fig. 2 is a front elevation. Fig. 3 is a plan in detail of the reversing mechanism. Fig. 4 is a transverse section of the same. Fig. 5 is a detail longitudinal section of the forward end of the mandrel. Fig. 6 is a transverse section of the mandrel and the riveting end of the cylinder. Fig. 7 is a detail section of the pipe-carrier.

For the riveting of the longitudinal seams of pipe a mandrel and a corresponding yoke are employed, one carrying a fluid-pressure

ram, by which the rivets are forced into place and upset, and the other carrying an opposing rivet-header against which the rivet is forced to form the head on the inner or unheaded end. For a large pipe, such as from eight inches in diameter upward, the arm and mandrel are united at the rear ends and project far enough to the front to receive the full length of the pipe sections or joints as they are ordinarily constructed, and the apparatus is suspended or otherwise allowed to move, so that when the ram-piston is elevated and the pipe is in readiness to be moved the mandrel will drop within the pipe, so as to be clear of contact, and thus allow it to be freely advanced. The mandrels in these larger sizes of pipe are also sufficiently large to give the necessary resisting strength to enable the riveting mechanism to properly do its work; but with the reduced sizes of pipes it is not possible to make a mandrel sufficiently strong to allow of its being made the full length of the pipe, and there is not enough room within the pipe and around the mandrel to allow it to tilt as much as would be necessary to free the pipe between the setting of the rivets. In the present case, therefore, I have shown a bed or frame A, of any suitable description, mounted upon legs or other foundation firmly fixed to the floor or foundation beneath. A standard 2 extends upwardly from one end of the bed and has an arm 3 extending to one side from the top, forming a support for the fluid-pressure cylinder 4, which is carried upon the outer end of this arm or support. The piston or plunger movable in this cylinder has a downwardly-projecting stem or rod 5, upon the lower end of which is carried a socket-piece 6, through which the upper riveting-tool 7 passes. The riveting-tool 7 has the lower end properly curved to fit the head of the rivet. The "socket-piece" (as I have termed it) is secured in the lower end of the plunger-stem by a set-screw or equivalent fastening, and its lower face is made concave, having a curvature corresponding with that of the exterior of the pipe to be riveted, so that when pressed down upon the pipe it will coincide with its curvature, and if the plates of the pipe are in any way out of shape it will tend

brought upon the next rivet, it will force the pipe and its support downward, the spring 23 yielding until the overlapping plates of the pipe are seated upon the socket-piece, and it continues to yield as the pipe is forced down until the rivet has been set. The pipe 19 is held in place upon the carrier 21 by stops 25, projecting upwardly from the carrier beyond each end of the pipe-section, and either one or both these stops or holders is movable by means of a screw or like device, as shown at 26. The pipe is thus held in place on the carrier and prevented from shifting longitudinally, but is easily released after one line of rivets has been set and turned to bring the other line of rivet-holes in position, after which it is again clamped until this line of rivets has been set, when it can be released to allow the section to be entirely removed. The advance of the pipe after the setting of each rivet is produced by means of a rack 27, fixed upon the carriage 28, this carriage being mounted upon wheels and easily movable or slidable longitudinally and parallel to the axis of the mandrel, so that by moving this carriage the standard 22, which is mounted upon it, and the carrier 21 and the pipe will all be moved in unison. The rack 27 is engaged by a pinion upon a shaft 29, this shaft having a beveled pinion 30 fixed to it. This pinion 30 is turnable in either direction, so as to advance the carriage first in one direction until one line of rivets is set and then in the opposite direction to set the other line. This advance and reverse movement is effected by means of pinions 31 and 32, loosely mounted upon the horizontal shaft 33. This shaft is rotated by a ratchet-wheel 34, fixed to it and intermittently turned by a pawl 35, which is movable, as will be hereinafter described. The ratchet-wheel and the shaft 33 always turning in one direction, the movement of the rack and the carriage which it drives in either direction is effected by reversing mechanism, as follows: The clutch 36 is movable upon a feather on the shaft 33 and lies between the pinions 31 and 32. The outer ends of this clutch are adapted to engage with either of the pinions 31 or 32 when it is moved toward them. This clutch mechanism may be a cup-shaped or tapering friction-clutch or it may consist of spurs or irregularities upon the end engaging corresponding ones upon the inner faces of the pinions. Any well-known form of clutch or coupling for this purpose may be employed. When the clutch stands intermediate between the pinions 31 and 32, no action will take place; but the pinion 30, its shaft, and the spur-gear carried by it are free to revolve, and the carriage and its rack-bar can therefore be moved by hand or otherwise when it is desired to rapidly move the pipe off or onto the mandrel. The varying positions of the clutch are effected by means of a journal-shaft 37, having an eccentric-pin 38 projecting from the inner end and into a slot 39,

made in a pivoted swinging arm 40. The pivot of this arm is at the upper end, as shown at 41, and the lower end has spurs or lugs 42, which engage with the groove or channel in the clutch-ring 36, so that by turning the eccentric-pin 38 to one side or the other the arm 40 will be correspondingly moved, carrying with it the clutch, so as to engage either of the pinions or be disengaged from both.

43 is a crank or rocker arm having a handle 44 and a spring-pressed locking-pin 45, which holds it at any point of adjustment. By pulling the handle 44 out and disengaging the pin 45 the handle may be turned so as to lie horizontally upon one side or upon the other side, thus turning the eccentric-pin and engaging the clutch with either of the pinions 31 or 32 to move the carriage in either direction. When the rocker-arm or crank 43 is set vertically, the clutch will be intermediate, and the carriage can be moved by hand.

The means for operating the pawl 35, which turns the ratchet, are as follows: The pawl is loosely pivoted upon a lever-arm 46, which is pivoted and turnable about the shaft 33, which carries the ratchet-wheel. This arm projects horizontally outward from the ratchet, and its end is connected with the rod 47. This rod connects with the plunger movable in the cylinder 48, and pressure to move this plunger is derived from the accumulator or other source of hydraulic pressure, as follows: 49 is a cross-coupling, to one arm of which is connected the pipe 50 to bring fluid from the accumulator or other source of pressure. The opposite arm connects with a pipe extending into the mandrel and furnishing pressure to operate the plate-closing device. A pipe 51, extending upwardly, follows the curvature of the yoke or arm 3 and leads into the upper part of the ram-cylinder 4. A valve movable in a chamber 52, intermediate between the pipe 51 and the ram-cylinder, serves to admit the pressure to force the ram-plunger down and to exhaust the pressure by opening communication with an exhaust-pipe. This valve is actuated by a lever 53, conveniently arranged for the operator. When the plunger is released from the pressure above, it is raised by the action of a coiled spring 54, situated in the lower part of the plunger chamber or cylinder 4 and sufficiently stiff for the purpose designed. The last pipe 55 from the cross-coupling 49 opens into the lower part of the pawl-actuating plunger-chamber 48, and pressure through this pipe acts continuously upon the lower part of the plunger and would tend to raise the plunger if it was not resisted by a superior pressure upon the upper part of the plunger, conducted thereto by a pipe 56, connecting with the upper part of the pressure of the ram-cylinder, as shown. If an equal amount of pressure be conducted through each of these pipes, the difference in area between the upper and lower part of the piston within the cylinder 48, caused by the

diameter of the piston or plunger rod 47, which connects with the lower part of the piston, would cause the piston to remain at the bottom of its stroke; but when the exhaust is opened to allow the fluid to discharge from the upper part of the ram-cylinder 4 and while the piston of said cylinder is rising the pressure upon the upper part of the piston 48 through the pipe 56 is temporarily relieved, and this allows the pressure through the pipe 55 to raise the piston in the cylinder 48 and through its rod 47 to act upon the pawl, thus advancing the ratchet-wheel a single tooth. These teeth are so spaced that a single advance of the ratchet-wheel moves the pipe-carriage, and with it the pipe, a distance equal to that between the rivet-holes. The distance thus advanced will vary with the size and thickness of pipe and the proximity of the rivet-holes, and for this reason the ratchet-wheel 34 may be removed and others substituted, being changed in diameter or number of teeth to correspond with the distance between the rivet-holes and the consequent advance which it is desired to give the pipe-section after each rivet has been set.

It will be manifest that some slight variation in the movement of the pipe-carriage and pipe will take place, depending on the position and intermission of the gears 30, 31, or 32 by which the movement takes place, and the section may be moved a trifle too little or too far. A supplemental adjustment to compensate for this is produced by means of a screw 57 and a hand-wheel 58, by which it is turnable. This screw 57 turns through a suitable standard or nut 59 on the carriage 28 and acts to advance an independent block or carriage 60, which is slidable longitudinally upon guides on the main carriage 28. This movable carriage supports the socket of the standard 22, and by this screw adjustment these parts are movable independently of the main adjustment and are thus brought to the exact position required to bring the rivet-holes in proper alinement with the line of movement of the rivets.

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

1. A hydraulic riveting-machine consisting of a stationary frame having an arm or support and a mandrel, said arm or support and mandrel united at the rear and separated at the front, a fluid-pressure ram upon the arm or support, and a heading-tool carried thereby, a yielding plate-closing device and an internal heading-tool carried by the mandrel, said tools operating at right angles to the arm or support and mandrel, connections with a source of pressure-supply whereby the upper heading-tool is depressed, and connections located within the mandrel by which pressure is supplied simultaneously to act upon the plate-closer whereby the plates are clamped between it and the upper heading-tool, said plate-closer being moved by superior pres-

sure from above to allow the rivet to contact with the inner head-forming tool.

2. In a hydraulic riveting apparatus, a fixed mandrel and arm or support, a yielding plate-closer and heading-tool carried by the mandrel, a fluid-pressure-actuated ram and a heading-tool carried thereby in opposition to the plate-closer and tool carried by the mandrel, a carriage and mechanism by which it is advanced after the setting of each rivet to bring the next rivet-hole in line, and a tilting carrier or frame mounted upon the carriage and forming a pipe-support whereby the pipe is allowed to automatically adjust itself to the positions of the riveting-tool.

3. In a hydraulic riveting apparatus, a mandrel and arm or support, an internal yielding plate-closer and riveting-tool concentric therewith, an exterior fluid-pressure ram and heading-tool carried thereby, a carriage and mechanism by which it is advanced a distance equal to that between the rivet-holes after the setting of each rivet, a tilting carrier supported thereon, supports fixed in pairs upon said carrier upon which the pipe rests and upon which it is turnable to bring either series of rivet-holes into the line of the riveting-tools, and an end clamping mechanism by which the pipe-section is held in position after adjustment.

4. A hydraulic riveting-machine, exterior and interior heading-tools, a fluid-pressure ram and yielding plate-closer, a tilting carrier and clamps by which the pipe is secured thereto, a carriage upon which the carrier is supported, mechanism by which the carriage is advanced a distance equal to that between the rivet-holes after the setting of each rivet, and a supplemental slide movable upon the carriage whereby the carrier and pipe may be exactly adjusted to the riveting-tools.

5. In a hydraulic riveting-machine, the exterior and interior rivet-heading tools, a fluid-pressure ram and yielding plate-closing device, a carrier and means for supporting and securing the pipe thereon, a carriage movable to bring the rivet-holes successively in line with the riveting-tools, a standard supporting the carrier from the carriage, and a guide or socket within which it is vertically slidable, and a yielding support to said standard whereby the pipe is raised from the mandrel after a rivet is set, and is allowed to be depressed with relation thereto while the riveting is being effected.

6. In a hydraulic riveting-machine, a standard or support and mandrel, an interior yielding plate-closing device and riveting-tool operating in unison with the exterior fluid-pressure ram and heading-tool carried thereby, a longitudinally-movable carriage and support for the pipe, mechanism comprising an intermittently-movable ratchet-wheel mounted upon a shaft, a second shaft with pinion engaging a rack upon the carriage, a reversible gear mechanism consisting of intermeshing beveled pinions, a clutch adapted

to engage one or the other of the driving-pinions, a fulcrumed lever having its free end connected with the clutch, an eccentric-pin turnable in a slot in said lever and a crank-arm by which said eccentric is turned to move the lever to one side or the other.

7. In a hydraulic riveting apparatus, a fixed hollow mandrel and a standard or support from which it is supported, a fluid-pressure ram carried by the standard and a riveting-tool actuated thereby, a second riveting-tool supported upon the end of the mandrel and an annular plate-closing socket-piece movable with relation to said interior tool, plungers movable in cylinders and acting to press the plate-closer upwardly, pipe connections with the source of pressure-supply extending through the hollow mandrel and connecting with the cylinders.

8. In a hydraulic riveting-machine, a fixed mandrel and a standard from which it projects and is supported, a fluid-pressure ram mounted upon the standard and a riveting-tool carried thereby, a second riveting-heading-tool mounted upon the end of the mandrel in opposition to that carried by the ram a sleeve or socket concentric and movable with relation to the interior tool, vertically-moving plungers fitting in cylinders upon each side of the heading-tool having their upper ends adapted to support opposite sides of the socket-piece or sleeve, a pipe or passage opening into the cylinders and connecting with a source of fluid-pressure supply whereby the plungers are simultaneously raised and the sleeve forced above the level of the riveting-tool so that plates to be riveted are first compressed together between the exterior riveting-head and the interior yielding sleeve and the latter is afterward forced down by superior pressure of the ram to allow the rivet to be headed between the two tools.

9. In a hydraulic riveting-machine, a fixed mandrel, a standard to which it is connected, a fluid-pressure ram, a riveting-tool carried by the ram, an interior riveting-tool arranged in opposition to the tool carried by the ram and supported upon the outer end of the mandrel, a yielding socket-piece or sleeve vertically movable with relation to the riveting-tool of the mandrel having a convex surface coincident with the curvature of the pipe and

a corresponding socket-piece through which the riveting-tool of the ram passes, said socket-piece having a concaved lower face coincident with the exterior curvature of the pipe whereby the latter is first compressed between said socket-piece before the riveting-tools have acted to head the rivet.

10. In a hydraulic riveting-machine, a fixed mandrel and supporting-standard having an arm or support, a fluid-pressure ram mounted upon the arm or support, the riveting-tool carried thereby, an internal riveting-tool supported upon the outer end of the mandrel, said tools operating substantially at right angles to the projection of the arm or support and mandrel, socket-pieces or sleeves through which the riveting-tools pass, the interior socket-piece being yieldingly supported and slidable with relation to the tool which it incloses having a convex surface corresponding with the curvature of the pipe and the concavity of the exterior socket-piece, and a guide whereby it is maintained in position and prevented from turning during its reciprocations.

11. In a hydraulic riveting-machine, a fixed mandrel with riveting-tool and yielding plate-closer arranged substantially at right angles thereto, an exterior fluid-pressure ram and a riveting-tool carried thereby, socket-pieces through which the exterior and interior riveting-tools pass, said socket-pieces having their faces respectively made concave and convex to fit the shape of the pipe and guides by which they are prevented from turning.

12. In a hydraulic riveting apparatus, a fixed mandrel a riveting-tool carried thereby and surrounding yielding socket-piece, a fluid-pressure ram and exterior riveting-tool carried thereby with corresponding socket-piece through which it passes, said tools operating substantially at right angles to the mandrel and said socket-pieces having the angles cut away to allow them to extend between the adjacent lines of rivets without contact therewith.

In witness whereof I have hereunto set my hand.

STANTON FOREMAN.

Witnesses:

F. H. KIEFER,
S. E. POPE.