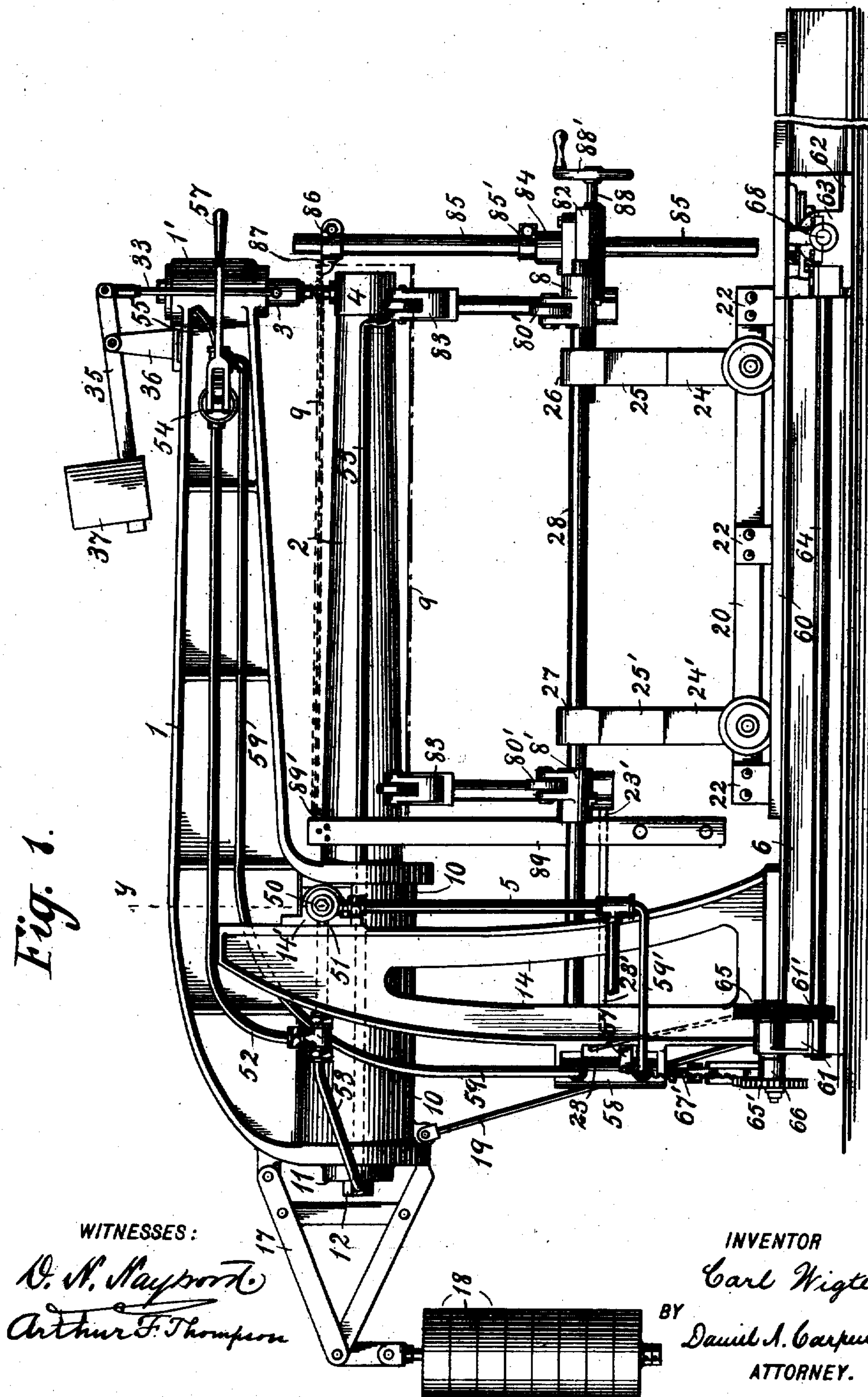


903,526.

C. WIGTEL.
HYDRAULIC PIPE RIVETING MACHINE.
APPLICATION FILED DEC. 13, 1900.

Patented Nov. 10, 1908.
4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

O. H. Maybrook
Arthur F. Thompson

INVENTOR

Carl Wigtel

BY

Daniel A. Carpenter
ATTORNEY.

903,526.

C. WIGTEL.
HYDRAULIC PIPE RIVETING MACHINE.
APPLICATION FILED DEC. 13, 1900.

Patented Nov. 10, 1908.
4 SHEETS—SHEET 2.

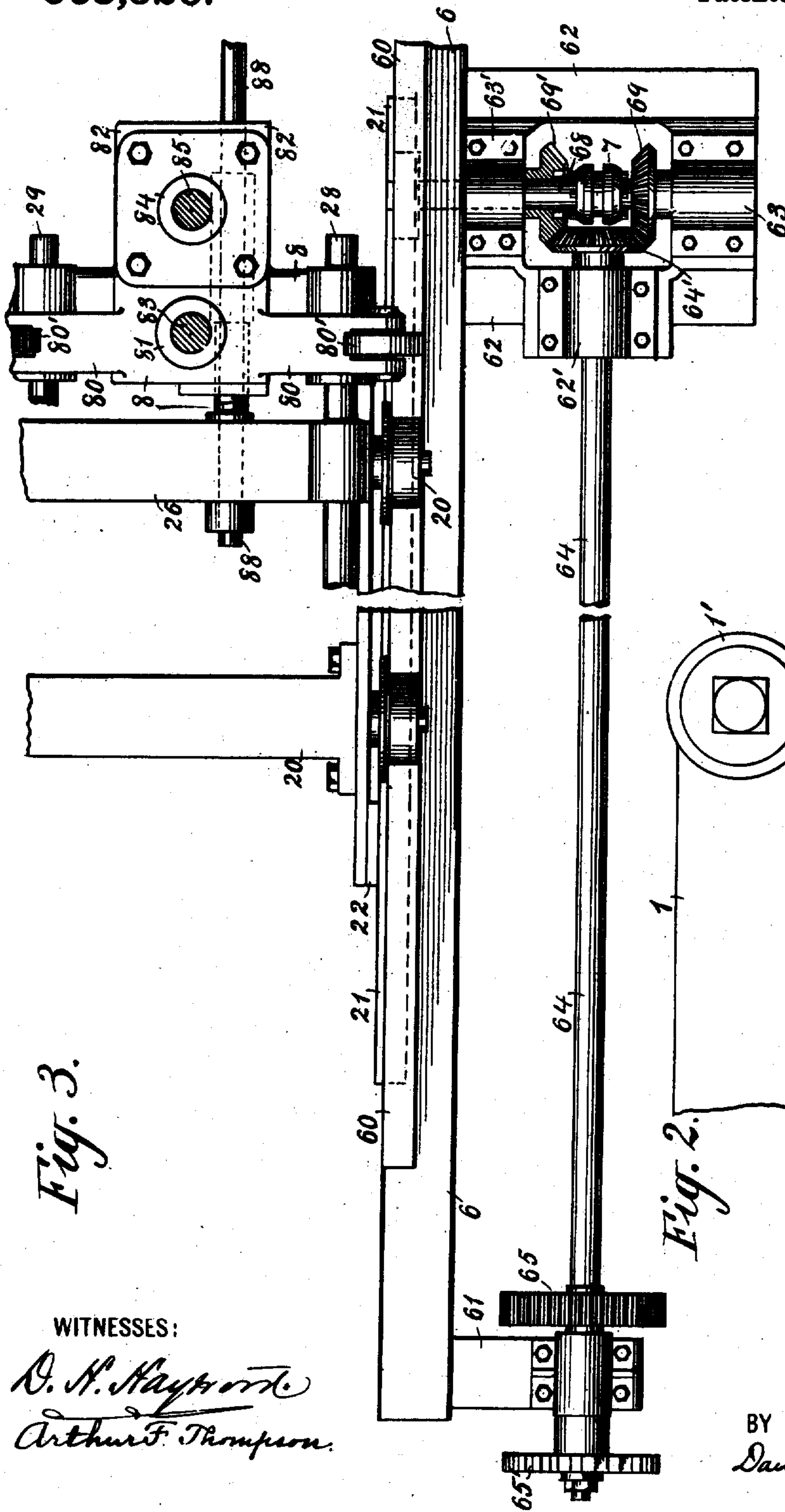


Fig. 3.

Fig. 2.

WITNESSES:

D. H. Haywood
Arthur F. Thompson

INVENTOR

Carl Wigtel

BY

Daniel A. Carpenter
ATTORNEY.

903,526.

C. WIGTEL.
HYDRAULIC PIPE RIVETING MACHINE.
APPLICATION FILED DEC. 13, 1900.

Patented Nov. 10, 1908.
4 SHEETS—SHEET 3.

Fig. 5.

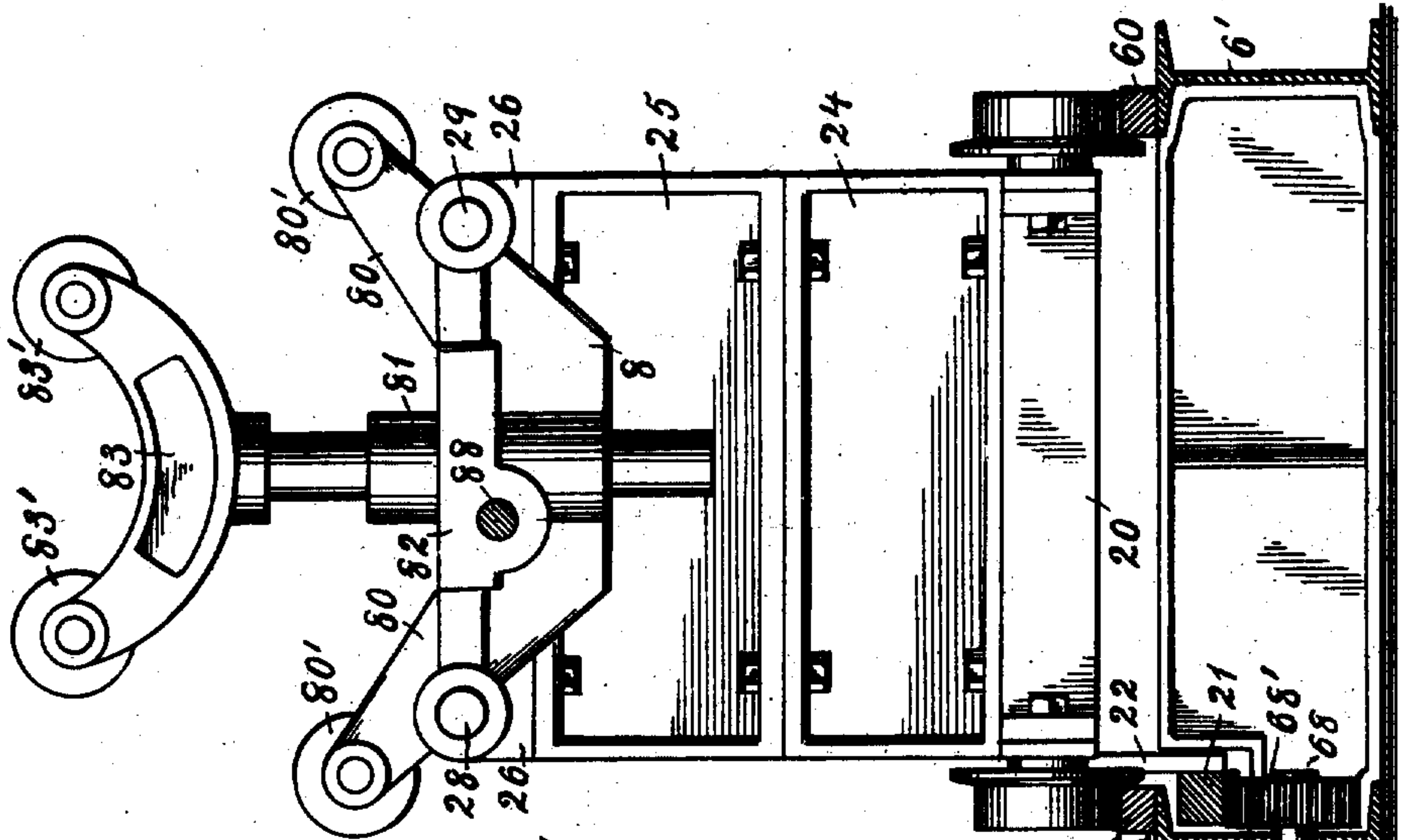


Fig. 6.

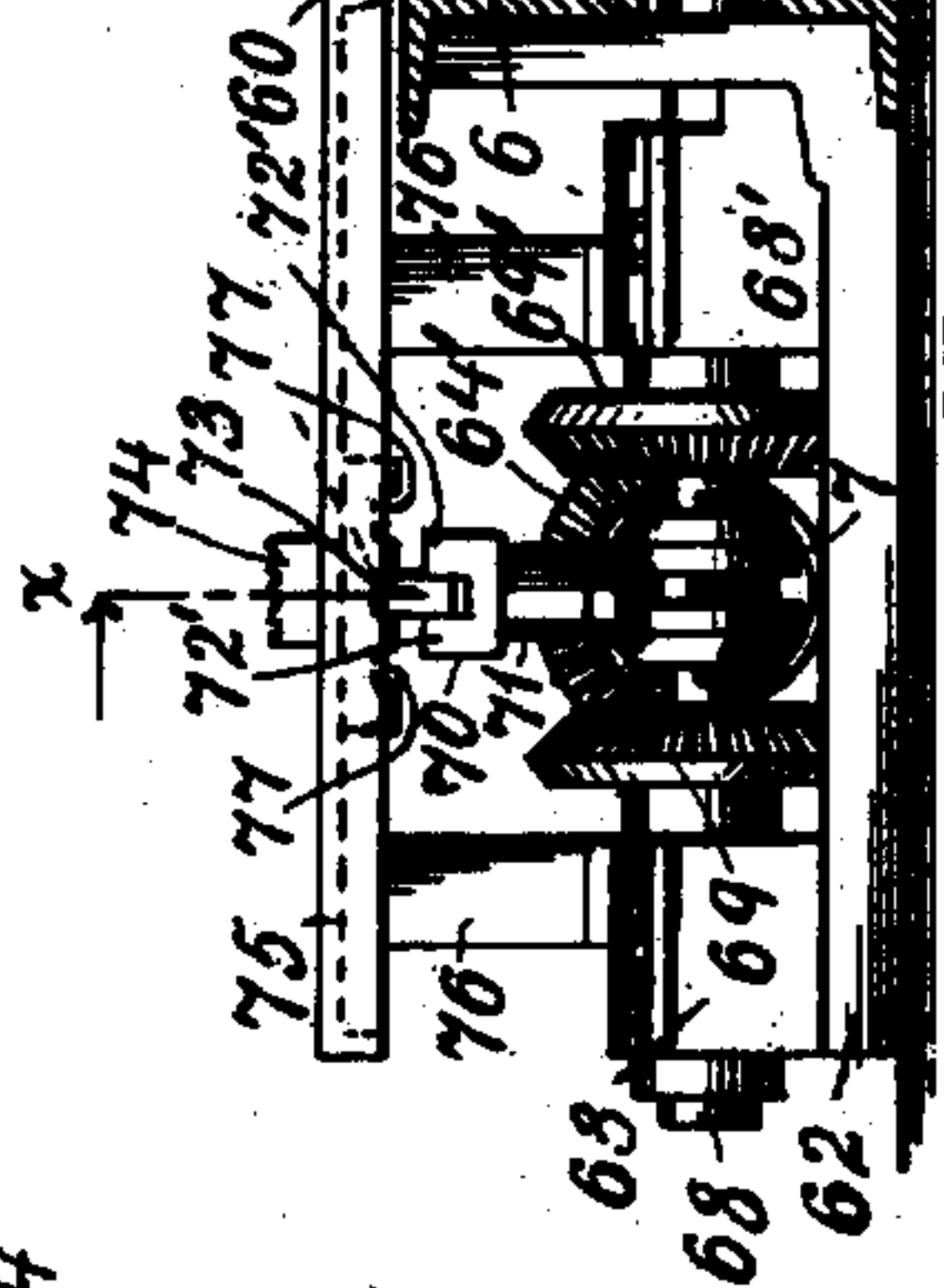
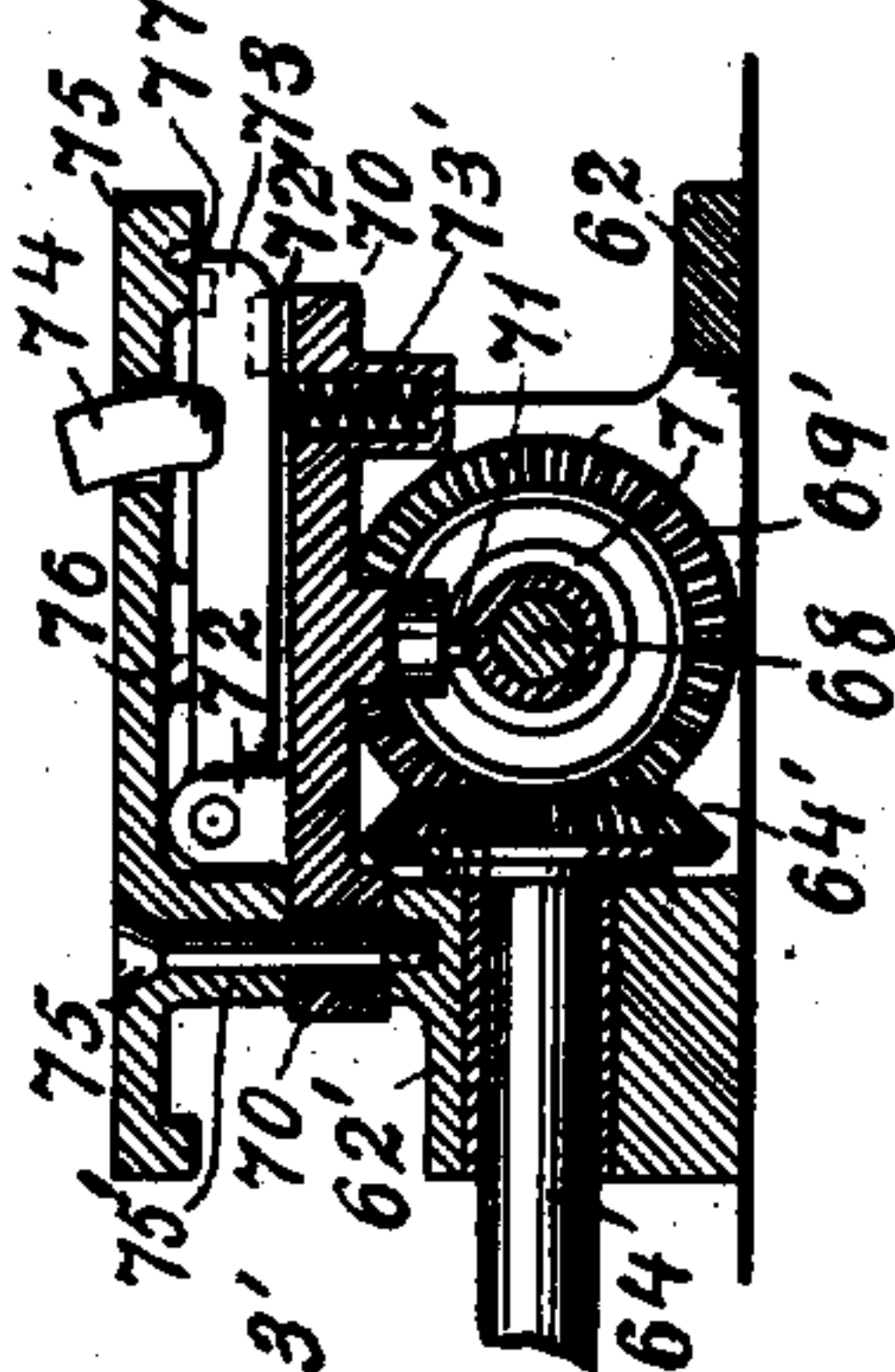
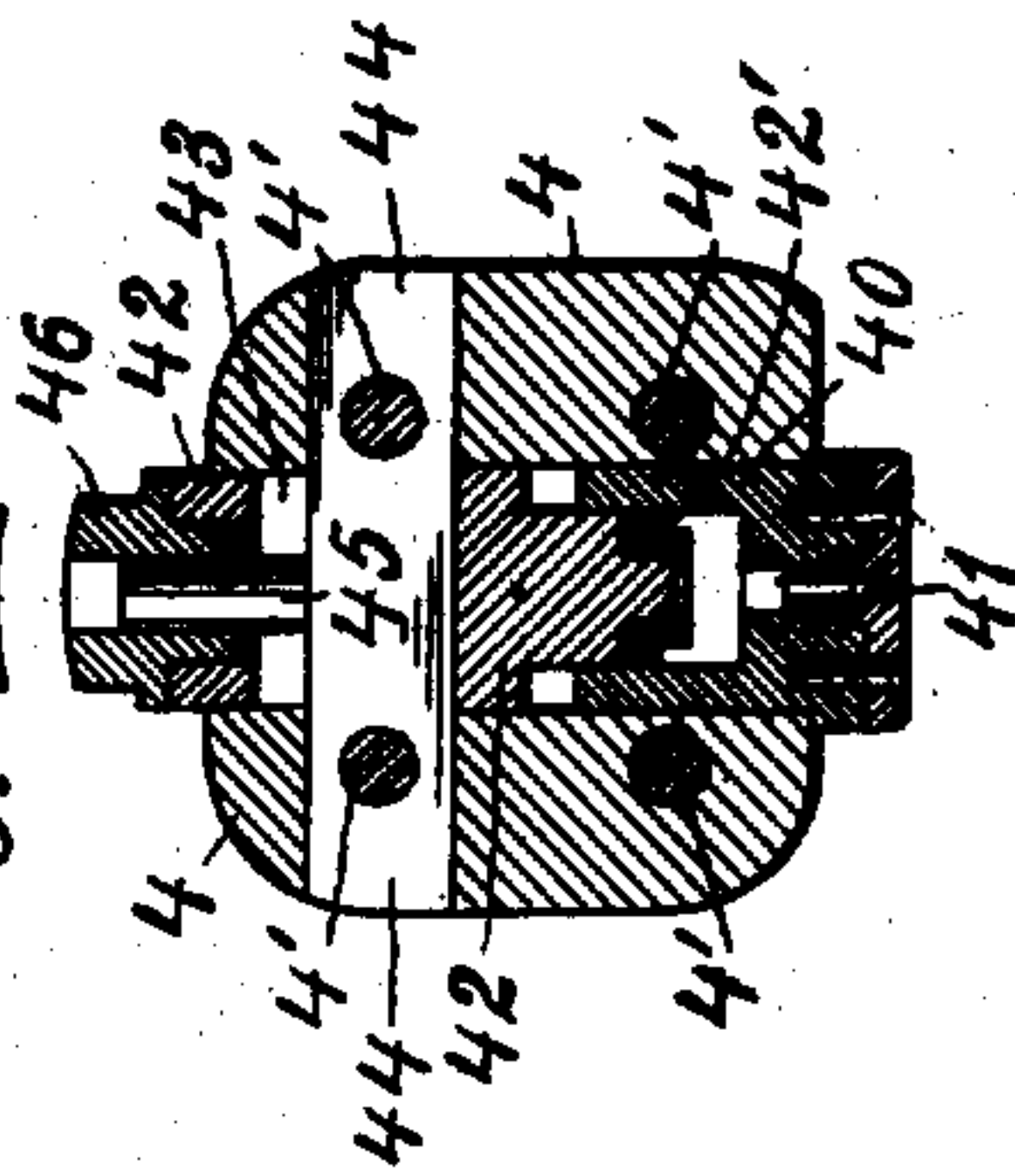
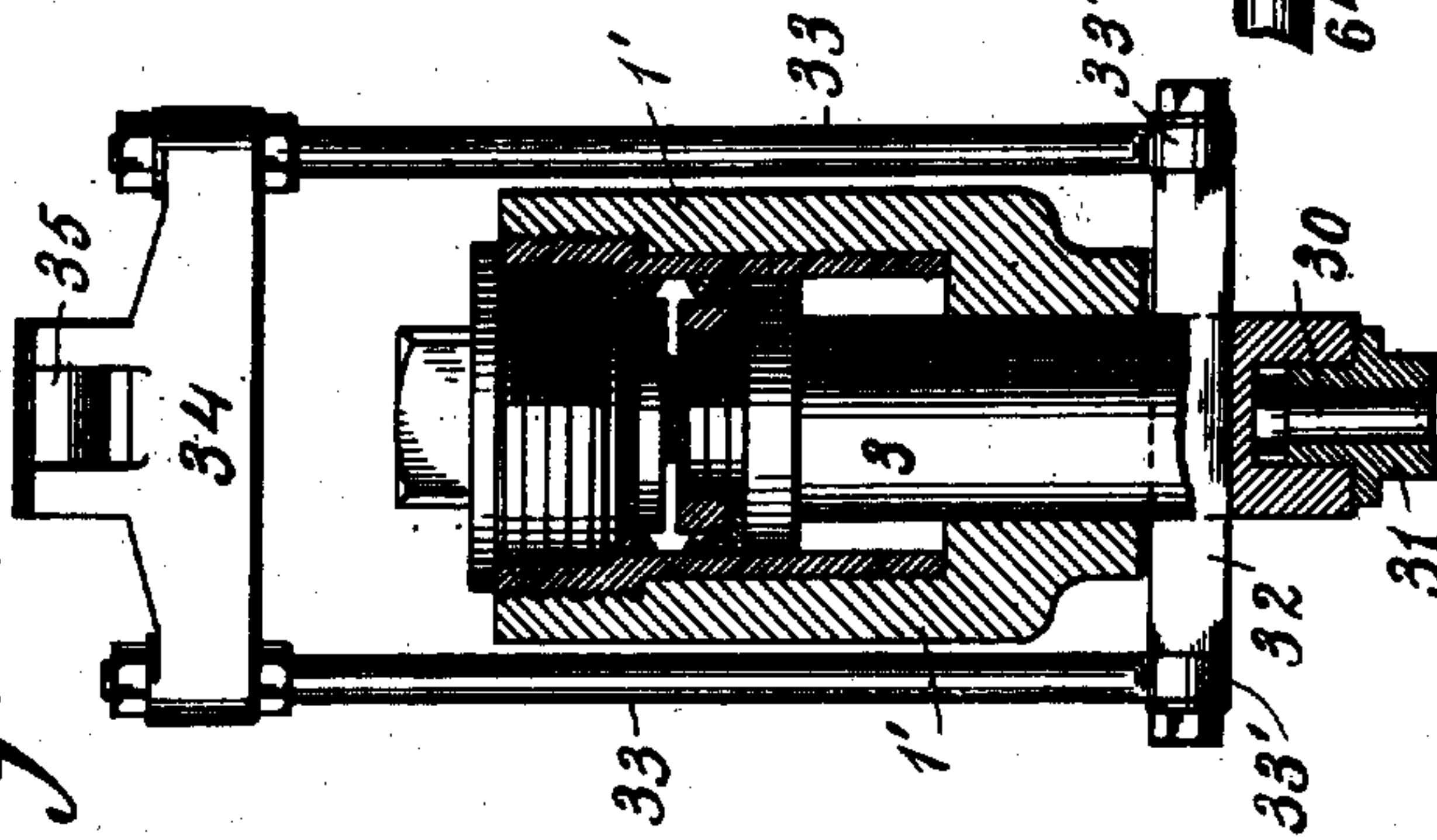


Fig. 4.



WITNESSES:

D. H. Mayhew
Arthur F. Thompson

INVENTOR

Carl Wigtel

BY

Daniel A. Carpenter
ATTORNEY

C. WIGTEL.
HYDRAULIC PIPE RIVETING MACHINE.
APPLICATION FILED DEC. 13, 1900.

903,526.

Patented Nov. 10, 1908.

4 SHEETS—SHEET 4.

Fig. 8.

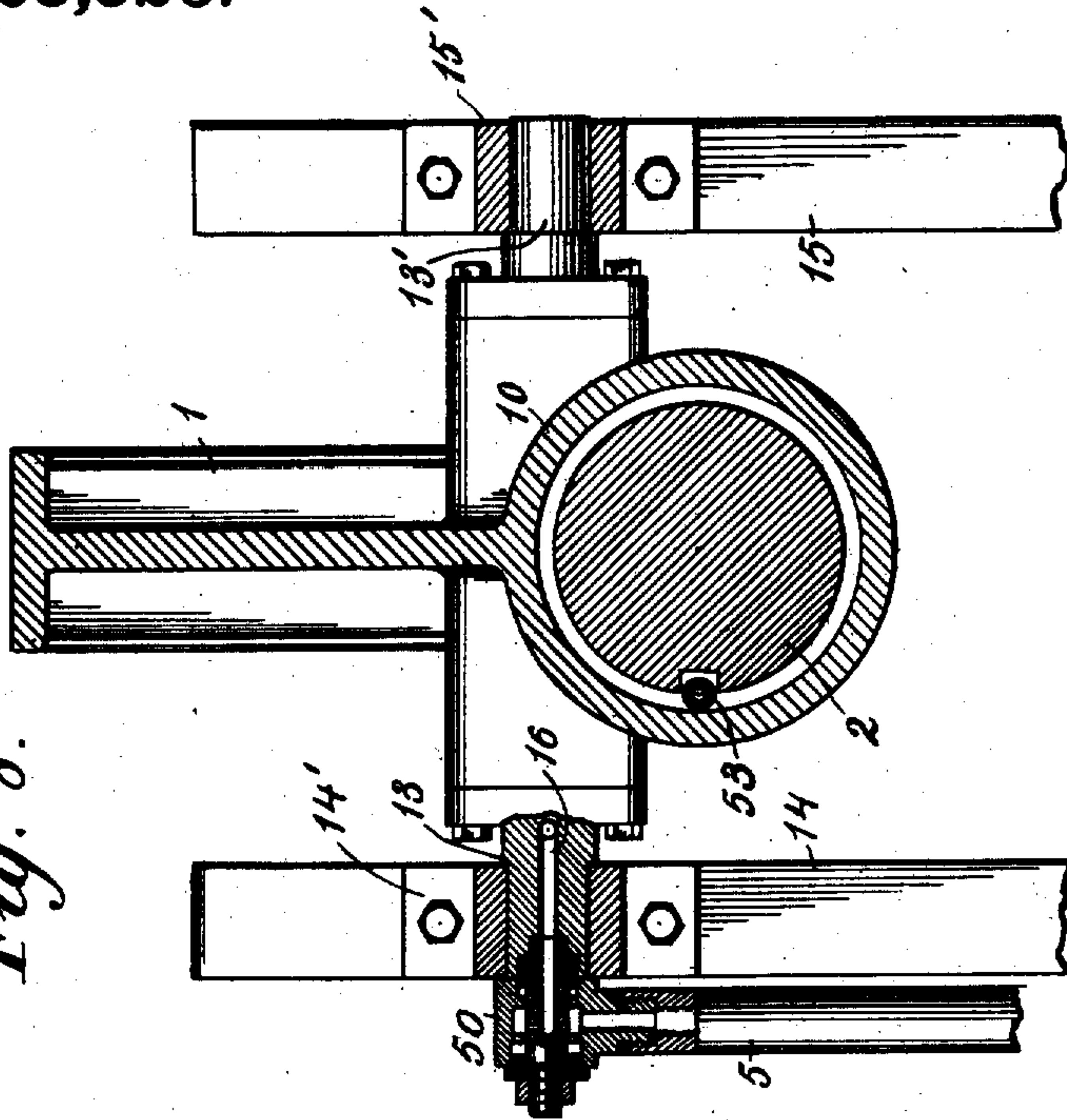
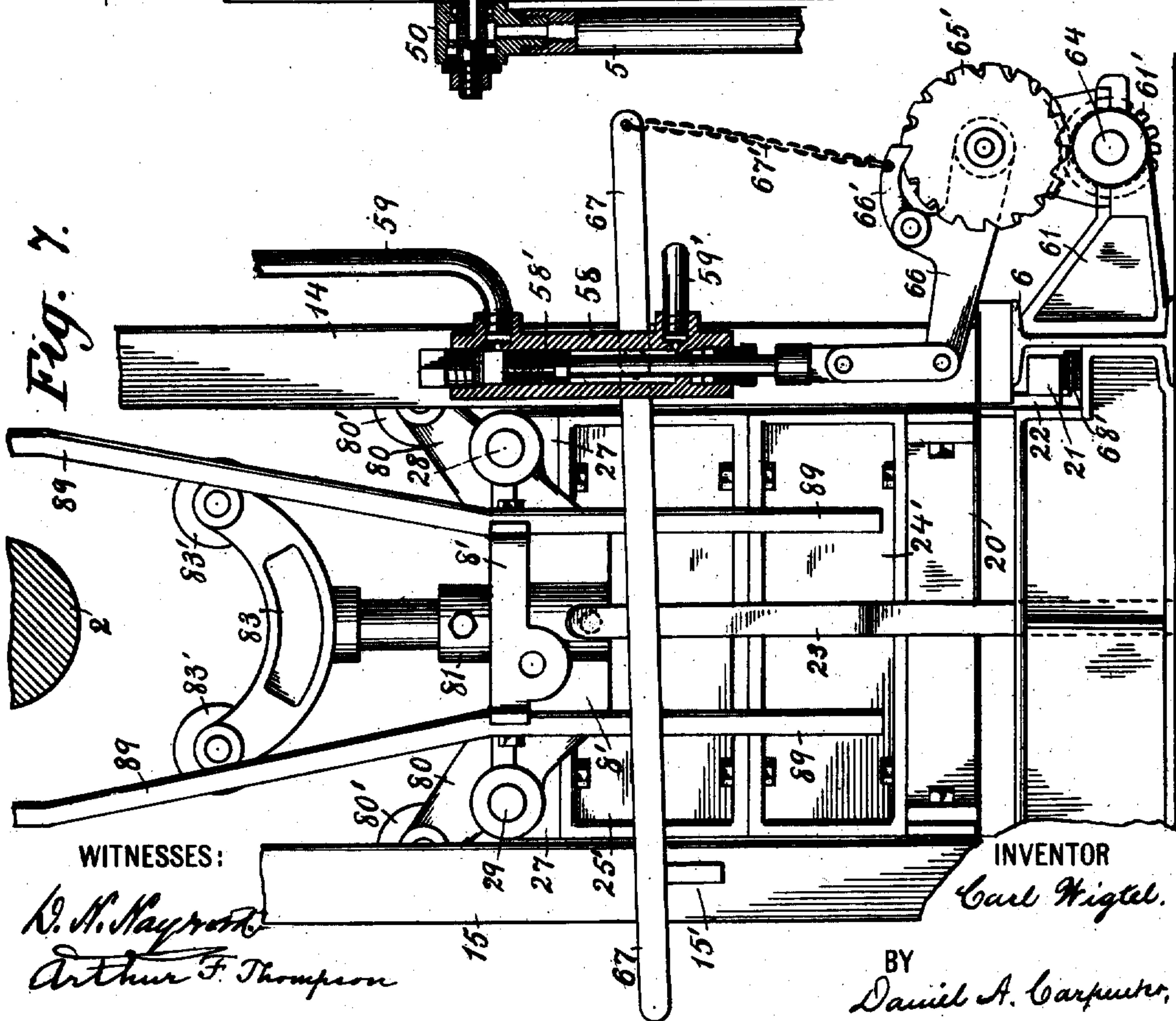


Fig. 7.



WITNESSES:

R. H. Mayroth
Arthur F. Thompson

INVENTOR

Carl Wigtel.

BY

Daniel A. Carpenter,

ATTORNEY

UNITED STATES PATENT OFFICE.

CARL WIGTEL, OF NEW YORK, N. Y., ASSIGNOR TO FRANCIS H. STILLMAN, OF BROOKLYN, NEW YORK.

HYDRAULIC PIPE-RIVETING MACHINE.

No. 903,526.

Specification of Letters Patent.

Patented Nov. 10, 1908.

Application filed December 13, 1900. Serial No. 39,668.

To all whom it may concern:

Be it known that I, CARL WIGTEL, a citizen of the United States, and resident of Brooklyn, county of Kings, city and State of New York, have invented a certain new and useful Improvement in Hydraulic Pipe-Riveting Machines, of which the following is full, clear, and exact description, reference being made to the accompanying drawings, forming part of this specification.

This invention relates to improvements in the construction of hydraulic riveting-machines with which tubular skelps are riveted longitudinally to form sections of riveted pipe, and the object of the invention is to provide for the construction of a machine capable of properly upsetting the rivets within the skelps, and comprising, besides a riveting-machine proper, supplemental work-carrying mechanism for supporting the skelps, and facilitating their adjustment, and feeding them forward and backward between the riveting-tools, as will be hereinafter fully explained.

On the accompanying sheets of drawings: Figure 1 is a side elevation of the machine; Fig. 2, a plan of a fragment thereof including the head, and a portion of the main stake next to the head; Fig. 3, a broken plan of parts of the supplemental mechanism; Fig. 4, a front sectional elevation of the front part of the riveting-machine proper, the section being on the axes of the riveting-tools; Fig. 5, a front elevation of certain parts of the supplemental mechanism; Fig. 6, a section on the line x of Fig. 5, viewed in the direction indicated by the arrow; Fig. 7, a fragment of a rear elevation of the machine, and a vertical section of a cylinder containing a piston that forms part of the supplemental mechanism; and Fig. 8, a front elevation, and vertical section on the line y , Fig. 1, of a fragment illustrating the interior of a coupling through which fluid passes to a system of pipes attached to the frame.

Similar reference-numerals designate like parts in different views.

The main characteristics of the riveting-machine proper are essentially those of the machine described and claimed in my application for a patent, filed October 5th, 1900, and bearing the Serial Number 32,066, and several claims of that application are in-

tended to cover mechanism that is also shown and described, but not claimed in this.

The machine illustrated is a six-ton riveter, having a gap of fifty-six inches, the stroke of the ram being an inch and a half. It works under a pressure of fifteen hundred pounds per square inch, and is used for riveting skelps of from eight to forty-two inches in diameter, with one-quarter inch cold rivets.

The stakes 1 and 2 of this machine are secured together by means of a socket formed on the base of the main stake 1, the anvil-stake 2 extending through this socket and having on it a plate 11 which extends behind the main stake and is fastened by a tap-bolt 12, passing through it into the stake 2. The ram 3 is confined in and projects from the head 1' formed on the main stake, and in a recess in the face of the ram are fixed the riveting-tool 30, and a hollow post 31 through which the riveting-tool extends as appears by Fig. 4. The riveting-tool contains at its lower end a cavity conforming to the heads of the rivets, and the faces of the tool and post are curved as shown, their curvature being that of the exterior surface of the tubular skelps which are to be riveted. A bar 32 extends through the lower part of the ram, and with this bar rods 33 are connected by eyes 33', the rods being attached at their upper ends to a cross-beam 34. A lever 35, pivoted to a standard 36 on the stake 1, is pivoted at its front end to the beam 34, and on the rear arm of this lever is a weight 37, which overbalances the weight on the front arm. Not only then is the ram held in, or raised to, its highest position, unless the fluid-pressure on the ram is great enough to overcome the action of the weight 37, but it is kept from turning on its axis, so that the curved faces of the riveting-tool and post 31 are maintained in a proper relation to the curved surface of the work.

At the front end of the anvil-stake 2 is a block 4 which fits on and against the end of the stake, and is bolted to it by tap-bolts 4'. A round hole extends through this block from top to bottom, and is closed at its lower end by a hollow plug 40, in whose head is a fluid-passageway 41 that communicates with the main part of the interior of the plug. In the hole in the block and in the hollow plug is a piston 42, the head of the piston being in

the plug and having on it a ring of packing 42'. The piston contains a slot 43, and in the block is a bar 44 which extends transversely through the block and the slot in the piston, and is fastened in the block by two of the tap-bolts. A riveting-post 45 is mounted on this bar, its axis coinciding with that of the piston, and on the piston is a compressor-sleeve 46, which surrounds the riveting-post, and extends above it when the piston is in its highest position in the block. The face of the sleeve is curved convexly, its curvature corresponding to that of the interior of the skelps, and it is kept in a proper relation to the work since the piston is prevented from turning by the bar 44.

Trunnions 13 and 13' are affixed to the main stake near the front end of the socket 10, and the united stakes are mounted on the trunnions between standards 14 and 15, to which are attached boxes 14' and 15' that receive the trunnions. The trunnion 13 contains a fluid-passage 16, with which a pipe 5 is connected by a swivel-coupling 50, and which communicates at the rear of the trunnion with a pipe 51 which is fastened to the main stake, and from which branches 52 and 53 extend to the valve-casing 54 and the rear end of the anvil-stake respectively. The branch 53 passes through the socket 10, fitting in a groove in the anvil-stake, and extends along this stake to the block 4, it being connected at its front end with the fluid-passage 41 in the head of the hollow plug 40. From the valve-casing 54 a pipe 55 extends to the head 1', above the ram, and to the valve-casing is attached a release-pipe 56, as appears by Fig. 2. The valve-casing contains the valves by which the actuating fluid is admitted to the head from the pipe 52, and allowed to pass from the head into the release-pipe. They are actuated by the hand-lever 57. The fluid passes into the pipe 5 at its lower end, through a pipe which is connected with an accumulator, or other apparatus, by which the fluid is subjected to pressure, and after it is admitted to the pipe 5 it remains therein and in the pipes 51, 52 and 53, with the pressure upon it, and acts upward constantly on the piston 42 in the block 4, while the use of the machine continues.

There being considerably more weight on the trunnions in front of their axis, than there is behind it in front of the rear ends of the stakes, a counter-weight is hung from a bracket 17 attached to the stake 1, the counterweight comprising a suitable number of blocks 18 to nearly but not quite compensate for the excess of weight in front of the axis. The front ends of the stakes are prevented from descending too far by a tie-rod 19, pivoted to a lug on the socket 10 and connected at its lower end with a fixed beam, the connection of the rod with the beam being such that the rod is movable downward

but not upward from the position in which it is shown in Fig. 1.

The standards 14 and 15 are affixed to a frame, which is supported on a foundation below the floor, and which is composed of side-beams 6 and 6' connected together by cross-beams, the standards resting on the side-beams at the rear end of the frame. On the beams 6 and 6', in front of the standards, are parallel rails 60 whose tops are flush with the surface of the floor, and on these rails is a carriage 20. A rack-bar 21 is attached to the carriage by hangers 22, fastened to one side of the carriage-frame and extending downward therefrom below the floor, the rack-bar being under the flange of the beam 6. On the outer side of this beam are a bracket 61 and a frame 62, which are bolted to the beam, the frame resting on the foundation and having on it bearing-blocks 62', 63 and 63'. A shaft 64 has bearings in the bracket 61 and block 62', and on this shaft are a pinion 61' near the bracket 61, and a bevel-gear 64' at the front end of the shaft. A gear 65, which engages with the pinion 61', and a ratchet-wheel 65' are mounted on a short shaft which has a bearing in the bracket 61 over that of the shaft 64, and on which is a bar 66 carrying a pawl 66', which engages with the ratchet-wheel as appears by Fig. 7, except when it is held out of engagement therewith. The pawl is connected with a bar 67 by a chain 67', the bar being loosely pivoted on the standard 14, and when the pawl engages with the ratchet-wheel the bar rests on the top of a projection 15' on the standard 15. Another bar 23, attached to the framework, extends upward therefrom in front of and close to the bar 67. To the back of the standard 14 is attached a cylinder 58, which contains a piston 58', whose piston-rod extends below the cylinder and is connected with the bar 66. A pipe 59 extends from the pipe 55 to an orifice near the top of the cylinder, and a pipe 59' connects the pipe 5 with an orifice near the bottom of the cylinder. A shaft 68, having bearings in the blocks 63 and 63' and extending through the web of the beam 6, carries next to its inner end a pinion 68' which engages with the rack-bar 21. Bevel-gears 69 and 69', that engage with the bevel-gear 64', are loosely mounted on this shaft between the bearing-blocks 63 and 63', and on the shaft between the gears is a block 7 which is movable along the shaft but is prevented from turning on it by a feather, and by which the gears may be alternately locked to the shaft, but which may be held disengaged from both gears. A lever 70, that is pivoted at its rear end on a vertical axis on the bearing-block 62' and projects over the block 7, has on its under side a projection 71 that extends into a groove in the block, and on this lever, between a lug 72

and another similar lug fixed on the top of the lever, a bar 73 is pivoted on a horizontal axis. This bar passes between projections 72' on the lever, and rests near its front end on a coil-spring 73', which is secured in a hole in the lever and exerts an upward pressure on the bar, and on the top of the bar is a block 74 whose upper face is grooved or rough. Above the bar is a plate 75, on the under side of which are posts 75' and 76, by which it is supported on the lever 70 and the bearing-blocks 63 and 63', the pivot of the lever extending through the post 75' and the posts 76 being fastened to the bearing-blocks. The top of this plate is flush with the floor, and the block 74 projects above it through a slot in which the block is movable transversely in opposite directions from the position in which it is shown in Fig. 5. On the under side of the plate is a rib containing three notches 77 in which the upper edge of the bar 73 fits.

In Fig. 5 the block 7 is shown disengaged from both the gears 69 and 69', the bar 73 being in the middle notch 77, in which it is held by the upward pressure of the spring 73'. Then the carriage 20 may be pushed along its track in either direction, the shaft 64 not hindering its movement. Motion is imparted to this shaft by the action on it of the piston 58', through the connecting mechanism, the motion being intermittent and in one direction only, and if the block 7 is engaged with one of the bevel-gears on the shaft 68 the shaft 64 imparts an intermittent motion to the carriage 20, the carriage being moved towards the front end of the track if the block is engaged with the gear 69, or towards the rear end of the track if the block is engaged with the gear 69'. The operator of the machine engages the block with or disengages it from either gear by depressing the block 74 with his foot and forcing it towards the outer or inner edge of the plate 75, thereby releasing the bar 73 from the notch in which it was retained, and turning the lever 70 on its axis, and moving the block 7 with the lever. The block 7 is held in its proper position on the shaft, after the foot is removed from the block 74, by the bar 73 engaging with the notch 77 into which it is forced by the spring 73'.

The skelps are supported by apparatus fixed on the carriage 20. In riveting skelps whose diameter is eight inches or upwards but not over eighteen inches, all the apparatus shown is used, but in riveting larger skelps only parts of it are used. This apparatus consists of a pair of lower packing-plates 24 and 24' bolted on the carriage-frame, a pair of upper packing-plates 25 and 25' bolted on the lower plates, a pair of blocks 26 and 27 bolted on the upper packing-plates, a pair of parallel bars 28 and 29 extending through the blocks 26 and

27 and being movable lengthwise therein, and other devices mounted on the bars in front of the block 26 and behind the block 27. In front of the block 26 is a cross-piece 8, and behind the block 27 is a cross-piece 8', through which the parallel bars extend and which are fastened to the bars. Each cross-piece comprises arms 80 with rollers 80' mounted thereon, and a stock 81, and on the cross-piece 8 is an extension 82 whose top is flat. The cross-pieces support attachments 83, whose legs fit in the stocks 81 and which are adjustable vertically, they being held at the proper elevation by set-screws. The rollers 83' of each attachment 83 are nearer to each other than are the rollers of each cross-piece. A stock 84 is mounted on and bolted to the extension 82 of the cross-piece 8. Through this stock and a slot in the extension passes a post 85, which is secured at the proper elevation by a collar 85' in which the post is adjustable, and on the post is an adjustable collar 86 having on it a projection 87. A screw 88, to which is affixed a hand-wheel 88', passes through the cross-piece 8 and its extension and through the block 26, engaging with a female screw in the cross-piece but being in a smooth hole in the block, to which it is attached by collars fixed on it close to the faces of the block as appears by Fig. 3.

At the back of the cross-piece 8' are bars 89 which are bolted to the cross-piece and extend upward therefrom on both sides of the anvil-stake, and to which is attached a cross-beam which passes over the anvil-stake, and to this beam is affixed a projection 89'. The bars 89 have holes in them through which they may be bolted to the cross-piece when it is in a position below that in which it is shown. On the cross-piece 8' is also fastened a rod 23', which extends backward therefrom and whose rear end is directly in front of the bar 23.

Each skelp is commonly riveted with two rows of rivets, it being first fed inward over the anvil-stake and riveted with one row, and then fed outward and riveted with the second row. The machine is shown in Fig. 1 at work on an eight-inch skelp near the outer end of the first row or beginning of the second row of rivets. The skelp 9 rests on the rollers 83', and on the projections 87 and 89' which extend into it and are in contact with the top of its inner surface, it being so held that when the front ends of the stakes are in their lowest positions, as they are in the intervals between the operations, then the compressor-sleeve is out of contact with the interior of the skelp. At the beginning of each operation the ram descends until the riveting-tool 30 and post 31 meet the head of the rivet and top of the skelp, and then the stakes are turned on the trunnions by the reaction of the fluid on the

top of the interior of the head or ram-cylinder, the ram being supported by the skelps and the front ends of the stakes being raised. The compressor-sleeve is thus brought into
 5 contact with and pressed firmly against the inner surface of the skelp around the protruding stem of the rivet, so that the parts of the skelp are pressed tightly together between the sleeve and the riveting-tool and post 30
 10 and 31. There the sleeve is held while the riveting-post 45 is driven upward within it, the force tending to raise the front end of the anvil-stake being greater than that acting upward on the sleeve-supporting piston 42
 15 and reacting on the anvil-stake, and while the rivet is being upset by the riveting-post against the inner surface of the skelp.

When the actuating fluid is admitted to the pipe 55 it depresses not only the ram but
 20 also the piston 58' on which it acts through the pipe 59, and on which it exerts a greater force than that by which the piston is sustained, since the area of the top of the piston is greater than that of the annular surface
 25 on which the fluid acts upward under the piston. The pawl 66' is thereupon drawn backward until it engages with the next tooth of the ratchet-wheel 65'. As the pressure is withdrawn from the ram after the
 30 rivet has been upset, it is also withdrawn from the top of the piston 58'. The ram, which in its descent has pulled downward the front end of the lever 35, is retracted in the head by the action on the lever of
 35 the weight 37, and the front ends of the stakes descend until their movement is arrested by the tie-rod 19. The piston 58' is raised, after it is released from the pressure above it, by the fluid which constantly acts
 40 upon it through the pipe 59', and the ratchet-wheel 65' is accordingly turned by the pawl, and from the ratchet-wheel motion is imparted to the shaft 64 and thence to the carriage 20. The carriage is moved, each
 45 time the ratchet-wheel is turned, through a distance equal or approximately equal to that from the axis of a rivet-hole to the axis of the next rivet-hole, the gearing connecting the ratchet-wheel with the shaft 64
 50 and that connecting this shaft with the carriage being such as is required to properly regulate the movements of the carriage. If a rivet should not be brought by the carriage exactly into alinement with the riveting-
 55 tools, the work may be moved forward or backward by turning the screw 88 with the hand-wheel 88', and thereby forcing the bars 28 and 29 forward or backward in the blocks 26 and 27. The length of the rod 23' is such that during the last inward move-
 60 ment which the carriage can make without forcing the bars 89, or the cross-bar supported by them, against the base of the main stake, the rear end of this rod meets the bar
 65 23. The rod then pushes the upper end of

this bar backward, and this bar pushes the bar 67 off the projection 15', whereupon the longer and heavier part of the bar 67 descends, and the pawl 66' is drawn by the chain 67' out of engagement with the
 70 ratchet-wheel 65'. Hence another movement will not be imparted to the carriage after the operation on the next rivet, or until the pawl is reengaged with the ratchet-wheel. After the last rivet of the first row
 75 has been upset, the skelp is turned on the rollers and properly adjusted to be fed forward and riveted with the second row of rivets.

If the diameter of the skelps is more than
 80 eight but not over eighteen inches, the attachments 83 are fixed below the height at which they are shown in Fig. 1. If it is twenty or twenty-two inches, the packing-plates 25 and 25' are not used, the blocks 26
 85 and 27 being bolted on the packing-plates 24 and 24'. If it is twenty-four inches the attachments 83 are not used but all of the packing-plates are used, and then the skelps lie on the rollers 80' of the cross-pieces 8 and
 90 8'. If it is thirty inches neither the attachments 83 nor the upper packing-plates are used. If it is thirty-six inches the attachments 83 are not used, nor are either the upper or lower packing-plates used, the
 95 blocks 26 and 27 being bolted immediately on the carriage. If it is forty-two inches, then the trunnions are attached to the base of the main stake six inches below the positions in which they are shown, so that the
 100 elevation of the riveting-machine proper is six inches greater than it is when the machine operates on smaller skelps. Whenever the cross-pieces 8 and 8' are lowered or raised the bars 89 are detached from the
 105 cross-piece 8', to which they are afterwards reattached at different places.

The hollow post 31 and the compressor-sleeve 46 are interchangeable respectively
 110 with other similar posts and sleeves which fit skelps of different diameters, and when skelps larger than that shown are riveted, then a post 31 and a compressor-sleeve which fit the outer and inner surfaces of the larger
 115 skelps are used.

This invention is apparently shown in Letters Patent of the United States No. 656,815, granted August 28, 1900, to Stanton Foreman, the machine of this applica-
 120 tion being in nearly all respects the same as the machine described in that patent. But since certain parts of the machine are designated in the patent by other terms than are applied to such parts in the foregoing description, and since it is desired to embody
 125 in this application exactly the claims of the patent, excepting only the 11th, 12th, 14th and 15th, it is to be understood that in any of the following claims the terms "mandrel", "upper section", "concave and con-
 130

vex socket pieces", and "rivet-forming heads" mean respectively "anvil-stake", "main stake", "hollow post" and "compressor-sleeve", and "riveting tools", and that the term "plate-closing device" or "plate-closer" or "yielding pressure device" means "compressor-sleeve" and supplemental mechanism.

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

15 1. In a riveting-machine the combination of a ram, riveting-tools one of which is attached to the ram, a work-carriage movable under the riveting-tools, carriage-driving mechanism including a reciprocating device operative to actuate the rest of said driving-mechanism only when said device is moved in one direction, a piston connected with said reciprocating device, and means for applying hydraulic pressure to the ram and piston, said means including a fluid-passage and connections extending therefrom to the cylinders of the ram and piston.

25 2. In a riveting-machine the combination of a ram, riveting-tools one of which is attached to the ram, a work-carriage movable under the riveting-tools, carriage-driving mechanism including means to reverse the action thereof and including a reciprocating device operative to actuate the rest of said driving mechanism only when said device is moved in one direction, a piston connected with said reciprocating device, and means for applying hydraulic pressure to the ram and piston, this means including a fluid-passage and connections extending therefrom to the cylinders of the ram and piston.

40 3. In a riveting-machine the combination of a ram, riveting-tools one of which is attached to the ram, a work-carriage movable under the riveting-tools, carriage-driving mechanism including a reciprocating device operative to actuate the rest of said driving mechanism only when said device is moved in one direction, a piston connected with said reciprocating device, and means for applying hydraulic pressure to the head of the ram and both ends of the piston, said means including a main fluid-passage, a connection extending therefrom to the ram-cylinder, and branches extending from the main passage to the ends of the cylinder of the piston.

55 4. In a riveting-machine the combination of a ram, riveting-tools one of which is attached to the ram, a work-carriage movable under the riveting-tools, carriage-driving mechanism, a piston connected with the carriage-driving mechanism, and means for constantly subjecting said piston to hydraulic pressure at one end and for applying hydraulic pressure thereto at its other end and to the ram simultaneously, said means including a main fluid-passage, a connection extending therefrom to the ram-

cylinder, and branches extending from the main-passage to the ends of the cylinder of the piston, one of said branches being in constant communication with the main passage.

70 5. The combination of a hydraulic riveting machine proper mounted on a fixed axis, its center of gravity being on one side of the axis, means to prevent its movement from its normal position by gravity, and a work-support forming an unyielding base for the work and movable with the work in directions transverse to the axes of the riveting-tools, the parts of said combination being arranged to cooperate as described.

80 6. The combination of a hydraulic riveting machine proper mounted on a fixed axis, its center of gravity and the riveting-tools being in front of the axis, and the tools being movable upward and downward, means to prevent the movement of said machine from its normal position by gravity, and a horizontally movable work-support forming an unyielding base for the work, the parts of said combination being arranged to cooperate as described.

90 7. The combination of a hydraulic riveting machine proper mounted on a fixed axis, its center of gravity and the riveting-tools being in front of the axis and the tools being movable upward and downward, means to prevent the movement of said machine from its normal position by gravity, a horizontally movable work-support forming an unyielding base for the work, and actuating mechanism connected with the work-support and with the hydraulic apparatus of the riveting machine proper, the parts of said combination being arranged to cooperate as described.

105 8. A hydraulic riveting-machine comprising the combination of, a hydraulic riveting-machine proper having an anvil-stake over which the tubular skelps may be fed; a work-supporting carriage below the anvil-stake; pawl-and-ratchet mechanism; and rack-pinion and other gearing connected therewith and with the carriage and operative to impart to the carriage intermittent movements through distances equal to that between two successive rivets, said gearing including means by which the motion of the carriage may be reversed.

115 9. A hydraulic pipe-riveting machine comprising the combination of, a riveting-machine proper having an anvil-stake over which the tubular skelps may be fed; a carriage with work-holding devices fixed thereon below the anvil-stake; carriage-driving mechanism comprising a ratchet and pawl; and hydraulic apparatus to actuate the ratchet and pawl.

120 10. A hydraulic riveting-machine comprising the combination of: a riveting-machine proper; a carriage; blocks fastened on 130

the carriage; parallel bars held by the blocks; and work-holding devices secured on the bars; substantially as described.

11. A hydraulic riveting-machine comprising the combination of: a riveting-machine proper; a carriage; blocks fastened on the carriage; parallel bars held by the blocks; and cross-pieces on the bars; substantially as described.

12. A hydraulic riveting-machine comprising the combination of: a riveting-machine proper; a carriage; blocks fastened on the carriage; parallel bars held by the blocks; cross-pieces on the bars; and work-holding devices secured on the cross-pieces; substantially as described.

13. A hydraulic pipe-riveting machine comprising the combination of, a hydraulic riveting-machine proper having an anvil-stake over which the tubular skelps may be fed; a work-carriage and driving mechanism connected therewith; a horizontally adjustable support on the carriage; and vertically adjustable work-holding devices mounted on said support.

14. A hydraulic riveting-machine comprising the combination of, a riveting-machine proper; work-supporting and feeding mechanism, composed of movable work-holding apparatus, and driving mechanism connected therewith and comprising a ratchet and pawl; and devices operative by said work-holding apparatus to disengage the pawl from the ratchet.

15. A hydraulic riveting-machine comprising the combination of: a ram with a riveting-tool secured to it at its lower end; a pivoted lever whose front arm projects over the ram; a weight on the rear arm of the lever; a cross-beam pivoted to the front arm of the lever; a bar fixed in and projecting from the ram; and rods connecting the bar with the cross-beam; substantially as described.

16. A hydraulic riveting-machine comprising the combination of: a piston having a transverse slot extending through it; a bar extending through the slot, the width of the bar being less than the length of the slot; a post on the bar, on the axis of the piston; and a compressor-sleeve affixed to the piston and surrounding the post; substantially as described.

17. A hydraulic riveting-machine comprising the combination of: an anvil-stake; a block secured thereon; a piston in the block; a bar extending through the slot in the piston; a post on the bar, on the axis of the piston; and a compressor-sleeve affixed to the piston and surrounding the post; substantially as described.

18. In a hydraulic riveting-machine, the combination of a mandrel and an upper section united at the rear said mandrel adapted to receive pipe-sections, a fluid-pressure

ram carried by the upper part of the yoke, a plate-closing pressure device carried by the mandrel and rivet-heading tools acting in unison therewith for first closing the plates together and afterward heading the rivet therethrough, passages through which fluid is supplied to the ram and pressure devices from a common source, a feed-carriage and a pawl-and-ratchet mechanism actuated by the movement of the riveting mechanism for operating the carriage.

19. In a hydraulic riveting-machine, the combination with means for supporting the pipe-sections, of means for riveting said sections, fluid-pressure connections for operating the riveting mechanism, a feed-carriage, and a pawl-and-ratchet mechanism actuated by the fluid-pressure connections for operating the carriage step by step.

20. In a hydraulic riveting apparatus, the upper section and pipe-carrying mandrel, a fluid-pressure ram carried upon one section, a plate-closing device carried upon the other section and having pressure applied thereto in opposition to that of the ram, means through which fluid is supplied to the ram and opposing plungers from a common source, a socket-piece carried by the ram-plunger and carrying the upper riveter, said socket-piece having its face transversely concaved and having a radius corresponding to that of the pipe, an inner socket-piece or sleeve through which the inner riveter is movable, said socket-piece having its face correspondingly convex transversely whereby the pipe is compressed between said two faces previous to the rivet being headed, a feed-carriage for advancing the pipe and a pawl-and-ratchet-mechanism connection with the carriage and actuated by the fluid-pressure devices, for operating said carriage.

21. In a hydraulic riveting-machine, a mandrel and upper section united at their rear, a fluid-pressure ram carried by one part, a yielding pressure device carried by the other and operating in opposition to the pressure of the ram and in a less degree whereby the plates are closed together before the rivet is headed, passages through which fluid is supplied to the ram and opposing plungers from a common source, concave and convex socket-pieces carried respectively by the ram and the interior plate-closer, guides whereby the parts are retained in their line of reciprocation when in operation, a feed-carriage for advancing the pipe and a pawl-and-ratchet mechanism connected with the carriage and with the fluid-pressure devices for operating the carriage step by step.

22. In a hydraulic riveting apparatus, a mandrel over which the pipe-sections are fitted, an upper part forming a yoke therewith, one part carrying a fluid-pressure ram with socket-piece and riveting-head, the

other part carrying a yielding plate-closer and a correspondingly - curved socket - piece with the other riveting-head, supports for pipe consisting of adjustable yokes, a longitudinally movable carriage upon which said yokes are supported so that a pipe can be moved along the mandrel during the process of riveting, and a pawl-and-ratchet mechanism connected with the carriage and with the fluid-pressure devices for operating the carriage.

23. A hydraulic riveting machine consisting of a mandrel and upper section, a fluid-pressure ram and a yielding plate-closing device with rivet-forming heads carried respectively by the ram and mandrel, and a pawl-and-ratchet mechanism connected therewith and with the fluid-pressure devices whereby the pipe is automatically advanced a distance equal to that between the rivet-holes after the setting of each rivet.

24. In a hydraulic pipe-riveting machine, a mandrel, a carriage upon which the pipe is supported and movable with relation to the mandrel, a fluid-pressure ram and heads whereby the rivets are set, a ratchet-wheel mounted upon a shaft, a pawl actuated by the movements of the riveting mechanism to rotate said shaft, gears connected with the shaft and a rack and pinion through which motion is transmitted to advance the pipe-supporting carriage the required distance at each movement.

25. The combination with a hydraulic riveting-machine of a pawl-and-ratchet mechanism, rack-pinion and intermediate gearing whereby the pipe-supporting carriage is advanced a distance equal to that between the rivet-holes after the setting of each rivet, and mechanism by which the movement of the carriage is reversed after one line of rivets has been set and the pipe returned beneath the riveter to set the second line of rivets.

26. In a hydraulic riveting-machine, a supporting-standard including an upper section, a mandrel carried thereby, a fluid-pressure ram fixed to the outer end of the section, a socket-piece and riveting-tool carried thereby, an opposing plate-closer and riveting-tool against which the rivet is set, and a counterweighted lever and connections between it and the plunger of the ram where-

by the latter is raised when the fluid-pressure above its plunger is relieved.

27. In a hydraulic riveting-machine, the standard including the upper section, the mandrel, a fluid-pressure cylinder fixed to the outer end of the section having the plunger and plunger-rod, a socket-piece and riveting-tool carried thereby and shaped to fit the exterior of the pipe with guides to prevent their turning, a yielding plate-closer and a riveting-tool carried by the outer end of the mandrel, curved to fit the interior of the pipe, a plunger and means for applying fluid-pressure in unison with the pressure upon the upper riveting-tool whereby the plate-closing socket-piece is forced upward to close the plates between itself and the upper socket-piece, said inner socket-piece yielding to the superior pressure from above to allow the closed plates to descend and the rivet to be headed, and a guide-bar extending transversely through a slot in the movable plunger whereby the parts are prevented from turning.

28. In a hydraulic riveting-machine, a supporting-standard including an upper section, a mandrel, a fluid-pressure cylinder with piston or plunger movable therein, a socket-piece and riveting-tool carried by the plunger-rod, a second riveting-tool mounted upon the outer end of the mandrel and a yielding fluid-pressure plunger and plate-closing socket-piece carried thereby, a carriage upon which the pipe is supported, and means for moving it in the line of the rivet-holes consisting of a rack fixed to the carriage, gear and reversible mechanism by which it may be moved in either direction, a ratchet fixed upon the shaft through which motion is transmitted to the gear and rack, a pawl engaging the teeth of the ratchet, a fluid-pressure cylinder having a plunger and connections with the source of pressure-supply whereby pressure is alternately applied to the upper and lower surfaces of the plunger and connections between the plunger-rod and the pawl-carrying mechanism whereby the latter is reciprocated to turn the ratchet.

CARL WIGTEL.

In presence of—

HENRY A. SOHL,
JOHN F. SOHL.