5 Sheets--Sheet 1.

R. H. TWEDDELL.

Riveting-Machine.

No. 165,135. Patented June 29, 1875.

FIG. 3.

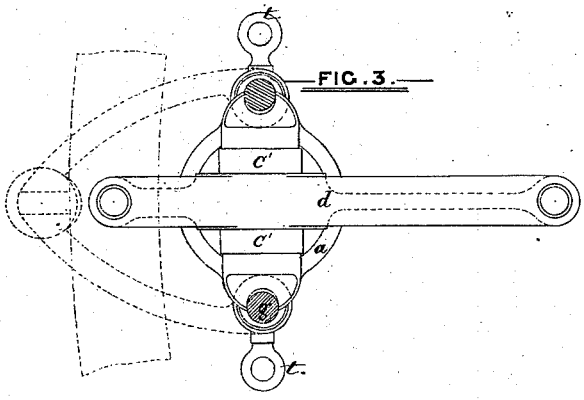
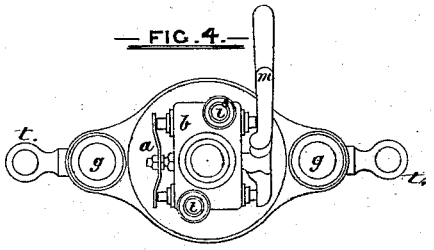


FIG. 4.



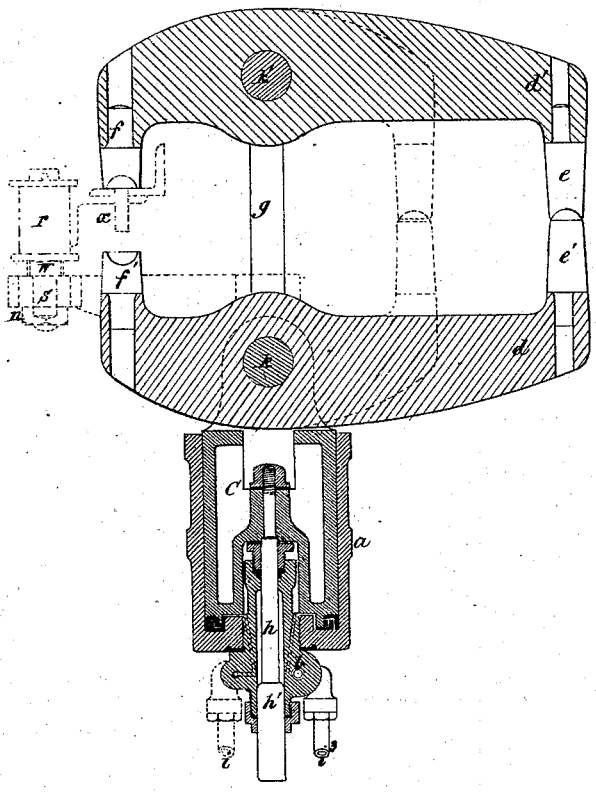


FIG. 1.

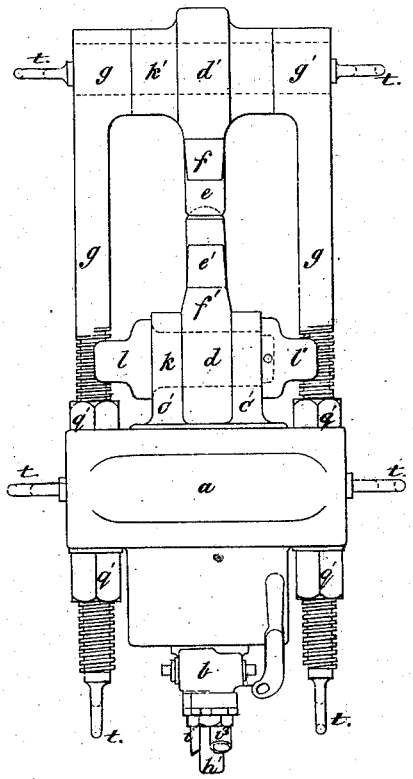


FIG. 2.

Witnesses

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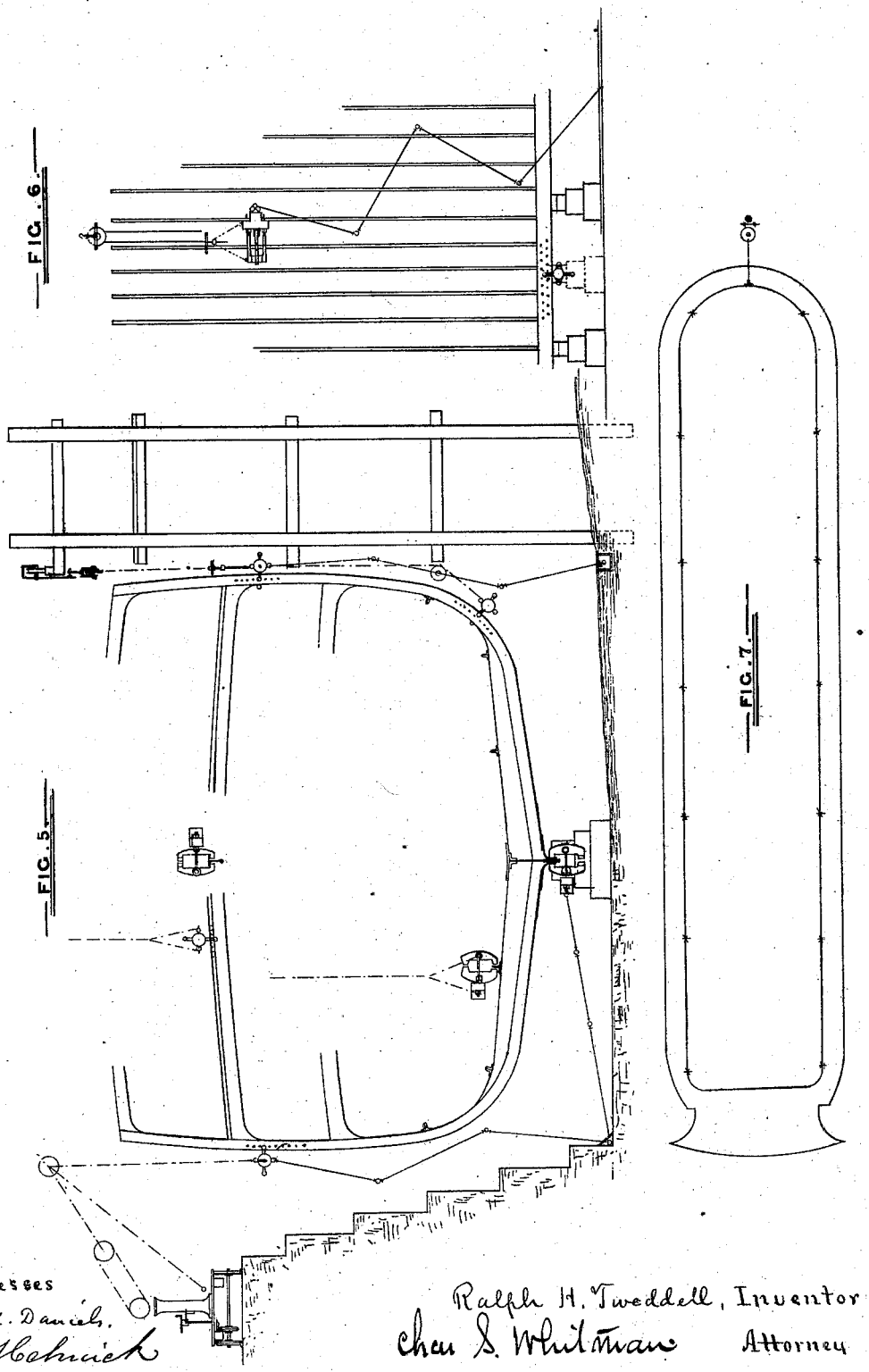
Riveting-Machine.

No. 165,135. Patented June 29, 1875.



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Riveting-Machine.

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FIG. 8.

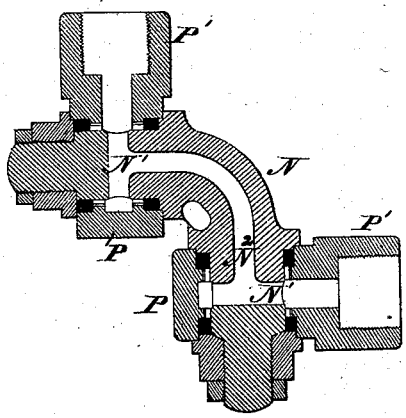
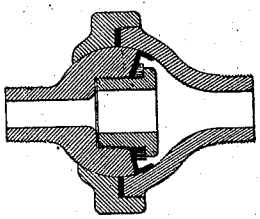


FIG. 9.



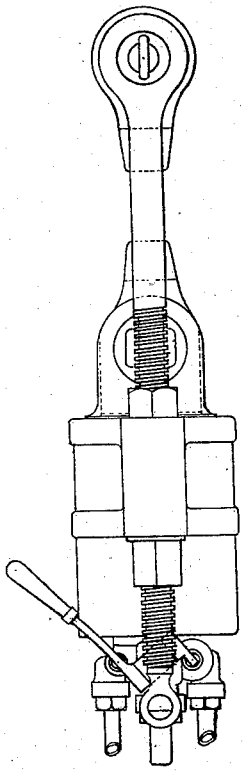


FIG. 10.

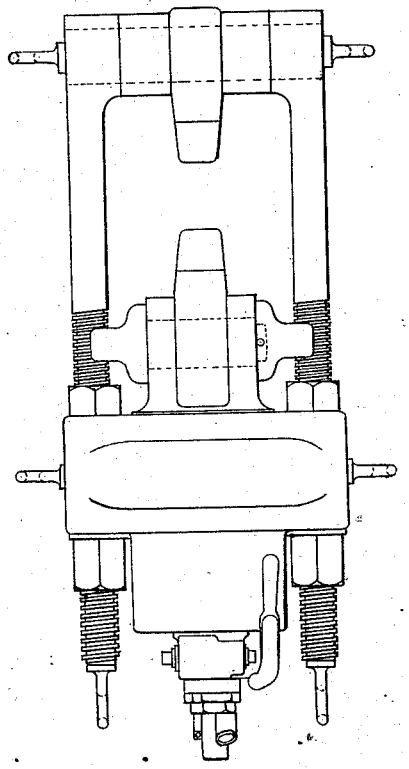


FIG. 11.

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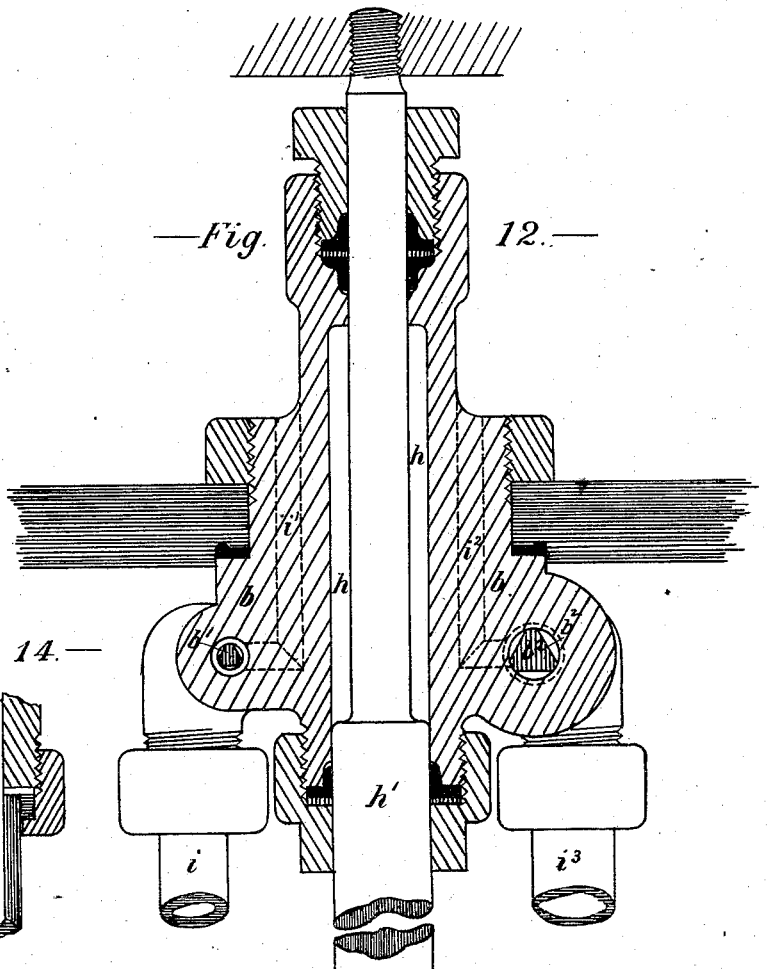
Riveting-Machine.

No. 165,135. Patented June 29, 1875.

—Fig. 12.—



—Fig. 14.—

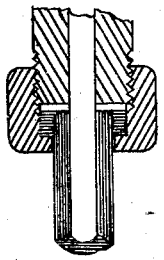
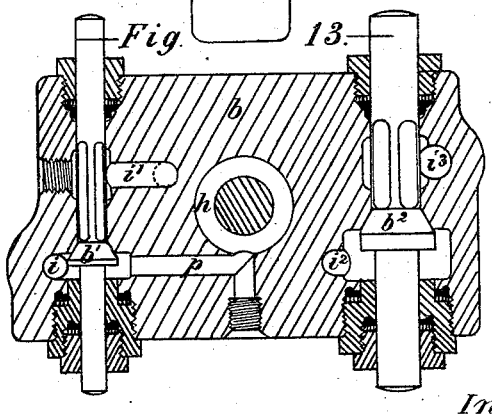


Fig. 13.



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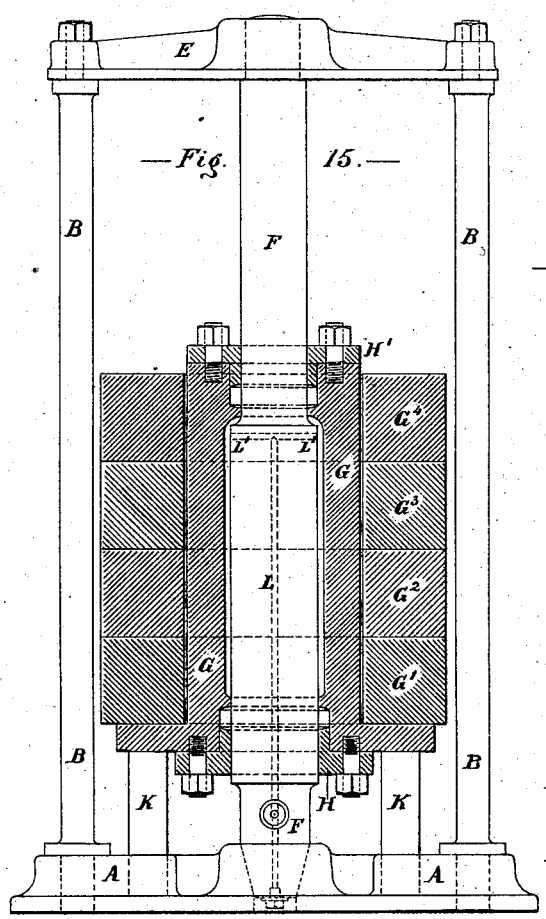
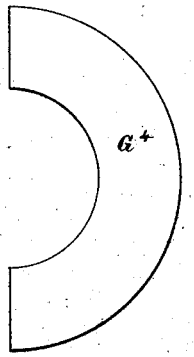
Riveting-Machine.

No. 165,135. Patented June 29, 1875.

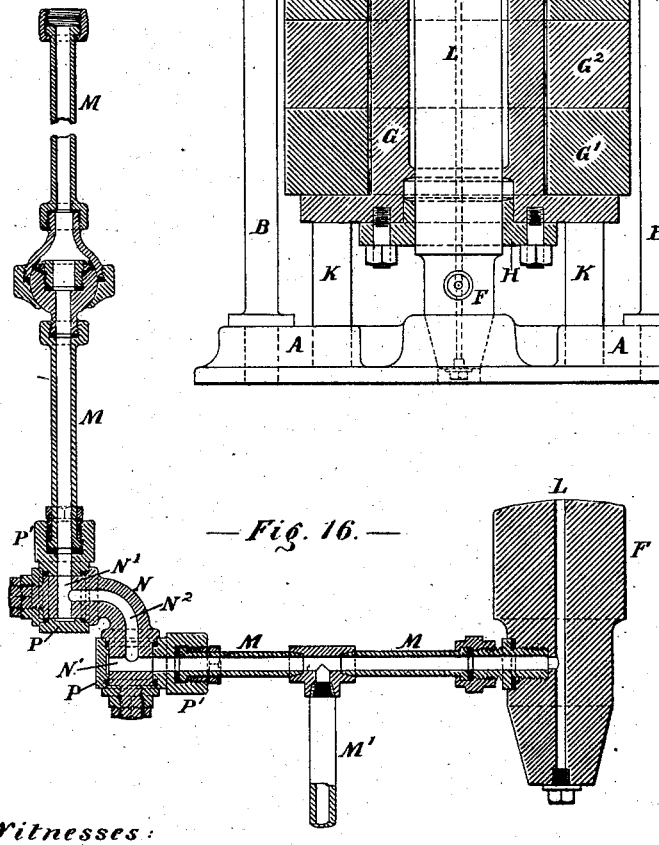
— Fig. 15. —



— Fig. 17. —



— Fig. 16. —



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Inventor:

by Henry Baltzer Jr.

Atty.

UNITED STATES PATENT OFFICE.

RALPH H. TWEDDELL, OF SUNDERLAND, GREAT BRITAIN, ASSIGNOR TO WILLIAM SELLERS, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN RIVETING-MACHINES.

Specification forming part of Letters Patent No. **165,135**, dated June 29, 1875; application filed June 26, 1872.

To all whom it may concern:

Be it known that I, RALPH HART TWEDDELL, of Sunderland, in the county of Durham, England, have invented a new and Improved Apparatus for Riveting, Punching, and Shearing Metal, of which invention the following is a specification:

Prior to the date of my invention riveting has been done by machinery. In the first-known machines the riveting-die was actuated either by a crank or a cam, so that the traverse of the die was uniform, and determined by this driving mechanism, and the rivet, whether large or small, long or short, was compressed to the same length. Sometimes, therefore, the rivet did not fill the hole; sometimes the plates to be riveted were strained. The work was performed by gradual compression, in itself desirable, but the uniform traverse, operating upon irregular quantities in the rivet, failed to produce regular work.

In the next machine steam was employed to act directly upon a large piston which carried the riveting-die. The riveting was done by a single blow, the shock of which was destructive to the machine, and liable to damage some classes of work, but the traverse was determined by the performance of the work, so that, with irregular quantities in the rivet, regular work could be produced.

In the next machine hydraulic pressure was employed to act directly upon a compressing-piston which carried the riveting-die, but in all of these hydraulic machines, prior to my invention, a pump was employed to produce the pressure in the compressing-cylinder, which cylinder was in communication with the pump-chamber through a valve which was opened by the fluid whenever the pressure in the pump-chamber exceeded that in the cylinder; consequently the compressing-piston which carried the die was moved only when the pump moved to force the fluid through this valve, and rested when the pump was taking water for its next stroke. Hence the die might be stationary, while a rivet was but partially headed. Moreover the compressing piston and die did not move at the will of the operator, but with the motion of the pump, which might be worked either by hand or power. If by hand, the workman had no means of controlling the pressure but by his judgment or strength. If by power, a valve to release the pressure was provided, which could be opened by the operator whenever, in his judgment, a sufficient pressure had been exerted, but no means of determining this with any degree of accuracy was provided in either case, so that, although the pressure was gradual, and the traverse limited only by the performance of the work, the want of means to determine the latter produced irregular results.

By my invention I combine in one machine all of the advantages, while avoiding all of the difficulties, which have characterized previous machine systems—that is to say, I compress without a blow, and with a uniform pressure, modifying this pressure at will; I drive each rivet with a single progressive movement, controlling this movement at will; I maintain the pressure upon the rivet after it is driven, or retract the riveting-die at will; and to this combination I add features of construction not heretofore found in any riveting-machine.

The machine consists of a riveting-die and a holder, one or the other attached to and moved by a piston in a cylinder, which I call the compressing-cylinder, this cylinder communicating with an accumulator through any proper known valve, not self-acting, but moved by the operator, and its construction and combination with the compressing-cylinder and the accumulator being such that when the valve is opened the piston to which the die or the holder is attached invariably moves until the rivet is headed, with a force that is positively defined by the pressure in the accumulator. Hence the work is performed without a blow; the pressure is uniform whether the rivets are long or short; it can be modified by the weight applied to the accumulator; it is continuous for each rivet, and may be maintained as long as desired, or the riveting-die can be retracted as soon as the rivet is finished, whether the pump is taking water, delivering it, or at rest.

In all riveting-machines there must be a die and a holder, the one acting upon one end,

the other upon the other end, of the rivet. The holder is usually stationary, and the die approaches it; but both or either of them may be movable.

The accumulator is a chamber of variable capacity, in which water is kept under pressure by means of a pump, or otherwise, such chamber being usually closed at one end by a head, and at the other by a stuffing-box, through which a weighted piston-rod rises or falls as the quantity of water in the chamber increases or diminishes; or the piston is stationary, and the chamber, properly weighted, rises and falls with the varying quantity of water. In the latter case the two ends of the chamber are sometimes provided with stuffing-boxes, through which the piston-rod or plunger plays freely. The upper part of this rod is smaller than the lower part, and the displacement in the chamber is proportioned to the difference in diameter between the upper and lower parts of the stationary plunger or piston-rod.

In the accompanying drawings forming part of this specification, Figure 1 represents a sectional elevation of a portable riveting apparatus upon a plane passing through the axes of the compressing and retracting cylinders, the riveting die and holder, and the ball-and-socket supports; Fig. 2, a plan of the same; Fig. 3, a front elevation; Fig. 4, a rear elevation. Figs. 5, 6, and 7 show end section, side elevation, and plan of ship-frames, showing application of portable riveter for riveting up ship-work. Figs. 8 and 9 show two forms of hydraulic-pressure joints, flexible and self-packing, to connect the pipes from the accumulator to the riveter. Fig. 10 is a side elevation of a direct-riveting machine, in which the action of the compressing-cylinder is transmitted directly to the rivet without the intervention of any levers. Fig. 11 is a front elevation of the same. Fig. 12 is an enlarged section of the retracting-cylinder, to show the position of the induction and eduction valves with their passages. Fig. 13 is a cross-section of the same in the plane of the axes of the valves, and Fig. 14 is a section of the coupling-joint, whereby the supply and exhaust pipes are connected to the respective valve-passages. Fig. 15 is a sectional elevation of an accumulator, showing the differential plunger in full. Fig. 16 is a longitudinal section of the lower end of the differential plunger and its supply and delivery pipes with the joint-connections. Fig. 17 is a plan of one of the semicircular weights of the accumulator.

In the drawings, a represents the compressing-cylinder, and C the piston of the same. h is the retracting-cylinder, and h' its piston. b is the valve-case; b^1, the inlet, and b^2 the outlet valve; i^1, the inlet, and i^2 the outlet, passage between the valves and the compressing-cylinder; i, the inlet pipe or passage between the accumulator and the chamber of the inlet-valve. From this chamber a branch, p, leads to the retracting-cylinder, so that whatever pressure is employed to work the riveter will be exerted continuously upon the retracting-cylinder without the interposition of any valve between this cylinder and the accumulator. i^3 is the outlet passage and pipe from the machine. Upon one side of the valve-case b, Fig. 4, a lever, m, is provided, having its fulcrum between the two valve-stems b^1 and b^2, so that moving the handle of this lever toward or from the valve-case will raise the induction or eduction valve at the will of the operator, while a spring pressing upon the two opposite ends of the valve-stems, and secured to the valve-case b between the valve-stems, serves to seat either valve when the pressure from the lever upon the opposite end of the stem is removed. The valve-stems pass out of the case through suitable packings, and I prefer so to proportion the areas of the opposite stems as to give a closing tendency to the valve when there is a fluid pressure in the valve-case.

In the preferred construction the compressing-cylinder a has two projections upon its exterior, through which the connecting-rods g g pass, and are adjustable therein by means of their screwed ends and the nuts q' q' q' q', the outer ends of these rods being enlarged cylindrically to receive the pin k', which, passing through the ends of the rods g g, and the lever d', attach this lever and the cylinder a firmly together, but in such manner that the lever can vibrate about the connecting-pin, and its distance from the compressing-cylinder can be adjusted.

Upon the outer end of the compressing-piston C two projections or lugs, C′ C′, with the pin k, serve to connect this piston with the lever d, in such manner that the lever can vibrate about the connecting-pin, but its distance from the piston C is fixed. One end of the pin k is provided with a head, l, so formed as to partially embrace the rod g, and the opposite end, projecting through the lug C′, is provided with a washer, l', formed like the head of the pin, the two serving to maintain the axis of the piston C and the axes of the rods g g in the same plane. The washer l' is secured to the pin k by means of a small pin, which passes through both. The corresponding ends of the levers d and d' are provided with ball-and-socket supports e and e', to maintain these ends of the levers a suitable distance apart, which distance must be varied to suit the different thicknesses of work to be riveted. These supports should be maintained in contact, or nearly so, so that the opposite ends of the levers alone shall move toward and from each other as the pins k and k' are made to approach and recede from each other, and for this purpose a small cord or strap is sufficient, which may be secured in any convenient manner to the ends of the two levers. The opposite ends of the levers d and d' are provided with the socket-dies f and f', one of which is the die, and the other the holder, between which the rivet is to be compressed.

The machine may be suspended conveniently in any position by means of the rings t

t t t, which are securely attached to the projections upon the compressing-cylinder, and to both ends of the pin *k'*.

To prevent oscillation, an apparatus shown by the dotted lines in Figs. 1 and 3 may be conveniently employed, in which S represents a frame-work attached to the connecting-rods *g g*, and projecting beyond the work to be operated upon, so that a pin, *w*, attached to its outer end by the nut *n*, may carry a roller, *r*, which has a free motion in the direction of and about the axis of the pin. This roller is covered with india-rubber or other elastic material, and is adjusted to rest against the work.

The fluid-pressure required to operate this machine is derived, as before stated, from an accumulator, by varying the weights upon which the pressure may be graduated. This portion of the apparatus is shown in Fig. 15, and consists of a circular base-plate, A, having two standards, B B, which are connected together at the top by the cross-piece E, through the center of which a hole is provided to receive the upper end of the differential plunger or piston F. The lower end of this plunger is supported and centered in a conical seat in the center of the base-plate A, and it consists of a circular shaft of two different diameters, proportioned to the amount of displacement required, the lower end being the largest. This plunger is surrounded by a strong cylinder, G, which is provided with a heavy flange at its lower end, to sustain the semicircular weights G^1 G^2 G^3 G^4, which are disposed around the cylinder as required. The ends of the cylinder G are closed by stuffing-boxes H and H', fitted, respectively, to the different diameters of the shaft F, and sliding freely thereon, so that when fluid-pressure is exerted within the cylinder the tendency of the cylinder will be to rise upon the shaft, because its capacity to contain the fluid will thereby be increased.

When not in use the cylinder G rests upon the wooden posts K K, which are sustained in sockets provided for this purpose in the base-plate A. These posts are intended to be slightly elastic, to relieve the shock of the descending cylinder in case all the fluid within it should be suddenly withdrawn. The fluid is admitted to and withdrawn from the interior of the cylinder G by means of the hole L and cross-holes L' L', Fig. 15. The connection of the supply and delivery pipe with this hole is shown in section in Fig. 16, the pipe M serving both for supply and delivery, while the pipe M', being connected with the pumps, serves as a supply-pipe only. The pumping machinery and the accumulator being necessarily heavy, they are from this cause alone not well adapted to the requirements of portability, so that I prefer to make this portion of the apparatus stationary, and provide a flexible joint-connecting pipe between the accumulator and the riveter. These joints are exhibited in Figs. 8, 9, and 16. The universal joint shown in Figs. 8 and 16 consists of a short pipe, N, bent at right angles, the ends closed and provided respectively with a nut and washer faced against a shoulder on the pipe, provided for this purpose. A short distance within the washer the exterior of the pipe is turned cylindrical, and is bounded by a collar cast with the pipe and faced true with the washer, so that the pipe is thus provided with a journal at each end. Through the center of each journal, and at right angles to the axis thereof, a hole, N', is drilled, which crosses and connects with the hole N^2 in the pipe, forming a communication through the pipe from the outside of one journal to the outside of the other. Each journal is surrounded by a collar, P, which is fitted to turn freely about the journal, and has a recess to receive a leather ring or other suitable packing at each end, which is covered by the collar and washer respectively. These serve to maintain the packing in place, which prevents the escape of fluid under pressure within the pipe. Upon the outside of this collar a projection, P', is cast, which is fitted to receive the coupling-screw collar and packing of the connecting-pipe, and in the center of which a hole is bored to connect with a groove around the interior of the collar P, which establishes a communication with the hole N', in whatever position the projection P' may be placed. The combination of the two journals at right angles with each other on the pipe N, with their respective collars P P, permits the connecting-pipes to be arranged parallel with or at any angle with each other; but if a traverse of the riveter in one plane only is required, the joint may be rendered more compact by making the pipe N straight, and the journals upon its ends about a common axis. Another form of universal joint, but of more limited angularity, is shown in Figs. 9 and 16, representing a ball-and-socket joint, in which a cup-leather packing is secured to the ball and plays freely against the interior of the socket, the fluid pressure within which forces the packing against the sides of the socket and prevents the escape of fluid at any angle within which the joint can vibrate. One end of the delivery-pipe M is attached, as shown, to the differential plunger F. The number and character of the flexible joints required will be determined by the varying circumstances in which the riveter is required to be used, and the connection of the pipe with the riveter is made with the coupling-joint shown in Figs. 14 and 16. The ball-and-socket universal-joint connection shown in Figs. 9 and 16 is particularly desirable at the end of the pipe next the riveter, as it gives entire freedom of motion within a limited range, without manipulation, while the more rigid, but at the same time more extended, range of motion obtained by the joint shown in Figs. 8 and 16 adapts it to such parts of the pipe as are less frequently moved.

The operation of the machine is as follows:

Water under a pressure graduated, as above mentioned, to the performance of the work being admitted to the valve-case *b*, which is in connection with the accumulator, through the pipe *i*, will exert pressure upon the piston *h'* in the retracting-cylinder, and, until the inlet-valve *b'* is opened, will maintain the parts of the machine in the same relative position represented in Fig. 1, in which the riveting-die and the holder are drawn apart to permit the insertion of the rivet. When this is properly heated and inserted, and the machine is in place, the inlet-valve *b'* is opened by the operator by means of the handle *m*. The water presses upon the piston C, which is forced continuously outward, carrying with it the retracting-piston *h'*, forcing the water out of the retracting-cylinder into the inlet-pipe, and compressing the rivet between the die and holder *f* and *f'*. When the rivet has been compressed the handle *m* is reversed by the operator, so as to shut the inlet and open the outlet valve, this shutting of the inlet-valve being performed in the preferred construction by the spring and fluid pressure. When this has taken place the constant pressure upon the piston C through the retracting-piston *h'* will expel the water from the compressing-cylinder, withdraw the socket-die and holder from the rivet, and open the levers in readiness for the insertion of a second rivet and a repetition of the operation.

I contemplate, under certain circumstances, using direct-acting dies and holders, or a movable die and stationary holder, instead of mounting them upon levers of the third order, as hereinbefore described. Such adaptations, however, being within the skill of the constructor, I only deem it necessary to indicate one form of such modification, which will be found represented in Figs. 10 and 11 of the accompanying drawings. I also contemplate using a single valve, which shall act both as an inlet and an outlet valve, as is well understood; and I also contemplate using any known form of inlet-valve applied between the accumulator and the compressing-cylinder, so long as such valve is so constructed and applied that it may be opened by the operator to admit the pressure upon the piston of the compressing-cylinder, or to close the communication between that cylinder and the accumulator, when desired. I also contemplate using any known form of eduction or outlet valve, provided it can close the compressing-cylinder, or open the same, to let water escape, at the will of the operator; and I also intend to retract the piston of the compressing-cylinder in any known way, by springs, or counterweights, or otherwise; and in using other forms of valves than those herein specially described I intend, at times, to make them independent of each other in their action.

I have shown and described my invention in its application to riveting only, as such work involves all the features of my improvements; but I contemplate substituting for the riveting die and holder a punch and die or a shearing knife or knives, according to requirements, and I claim the combinations hereinafter specified, including such substitutions. In either of these cases it will be necessary to provide a suitable stop to arrest the motion after the performance of the work, as will be readily understood by constructors of such machinery as that to which my invention appertains.

I am aware that in English Letters Patent, No. 1,055, dated April 9, 1867, to Daniel Joseph Fleetwood, there is shown and described a hydraulic press for shaping spoons, forks, &c., in which the dies are brought together by the action of water admitted from a low-pressure accumulator and the shaping pressure is given by a high-pressure accumulator. In this machine the high-pressure accumulator which performs the work communicates with the compressing-cylinder through a self-acting valve, while my machine demands for its operation, as described, a valve not self-acting, but moved by the operator. Moreover, this self-acting valve requires for its operation a pressure in the accumulator greater than is demanded for performing the work, this valve graduating the pressure, while in my machine there is no excess of pressure, and the graduation of the pressure is effected by the accumulator itself. In Fleetwood's machine the pressure cannot be maintained upon the work, nor can the die be withdrawn at will, the self-acting valve operating to withdraw the die as soon as the requisite pressure is reached, while in my machine the pressure is maintained, or the die is withdrawn only at the will of the operator. In Fleetwood's machine the retracting-cylinder is not in constant communication with the accumulator; but the operation requires the interposition of a self-acting valve, while in my machine no valve of any kind is required. I accordingly disclaim the parts and combinations shown and described in Fleetwood's patent, as being essentially different in construction and operation from my system; but

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

1. The combination of a cylinder and a piston, a riveting-die and a holder, an inlet and an outlet valve, and an accumulator, the combination being and operating substantially as set forth.

2. The combination of a cylinder and a piston, a riveting-die and a holder, a retracting-cylinder, and an accumulator, the combination being and operating substantially as set forth.

3. The combination of the compressing-cylinder, its piston, and two levers, one carrying a die and the other a holder, substantially as set forth.

4. The combination of a compressing-cylinder, its piston, two levers, and an adjustable connection, substantially as and for the purposes set forth.

5. The combination of two levers of the third order, provided with ball-and-socket supports at one end, and a die and a holder at the other, substantially as and for the purposes set forth.

6. The flexible self-packing hydraulic-pressure cylindrical-joint connection, substantially as described, and shown in Figs. 8 and 16.

7. The flexible self-packing hydraulic-pressure ball-and-socket-joint connection, substantially as described, and shown in Figs. 9 and 16.

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