Dec. 5, 1933. F. O'BRIEN 1,937,908

EQUALIZING RIVETING MACHINE

Filed June 11, 1928 2 Sheets-Sheet 1

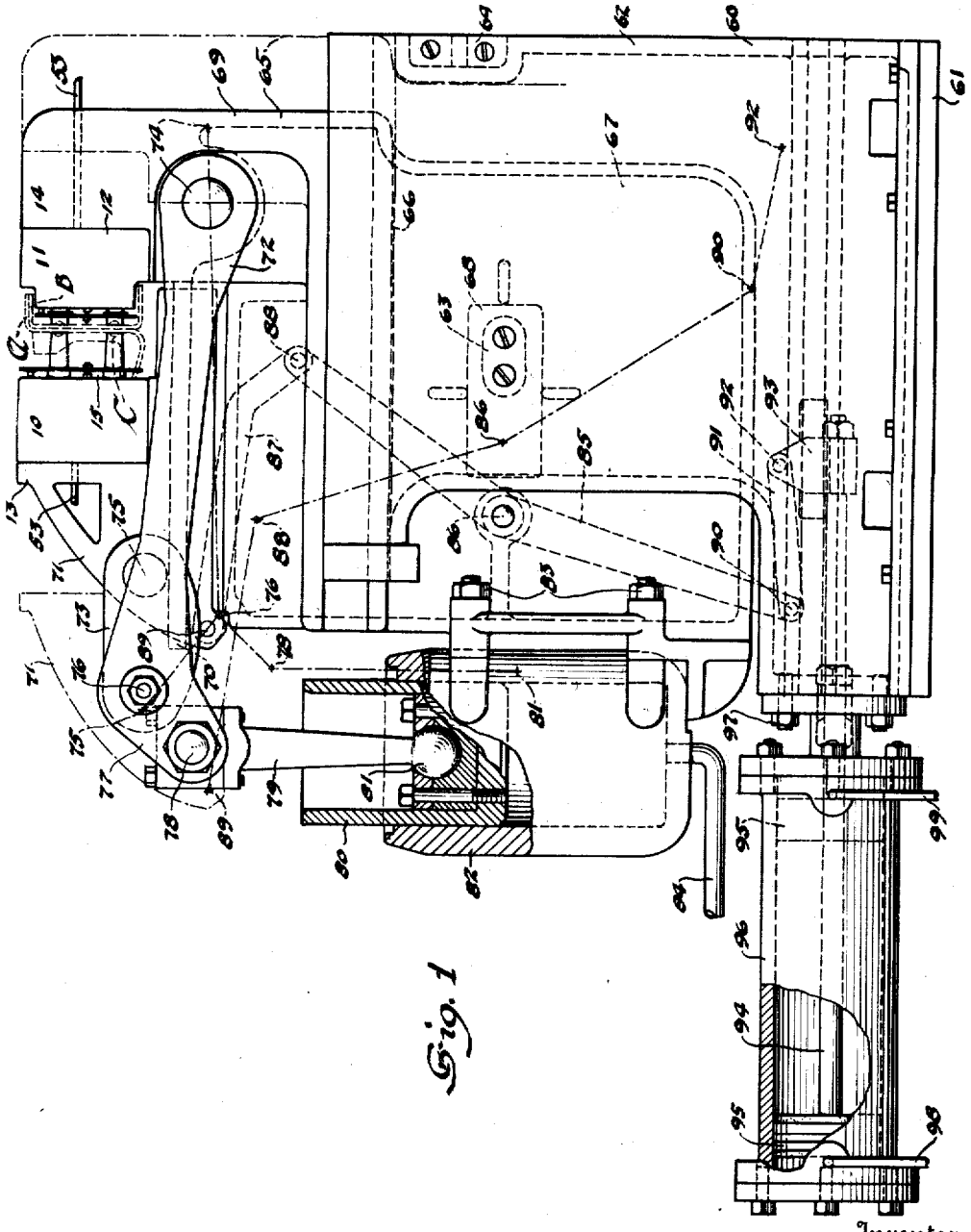


Fig. 1

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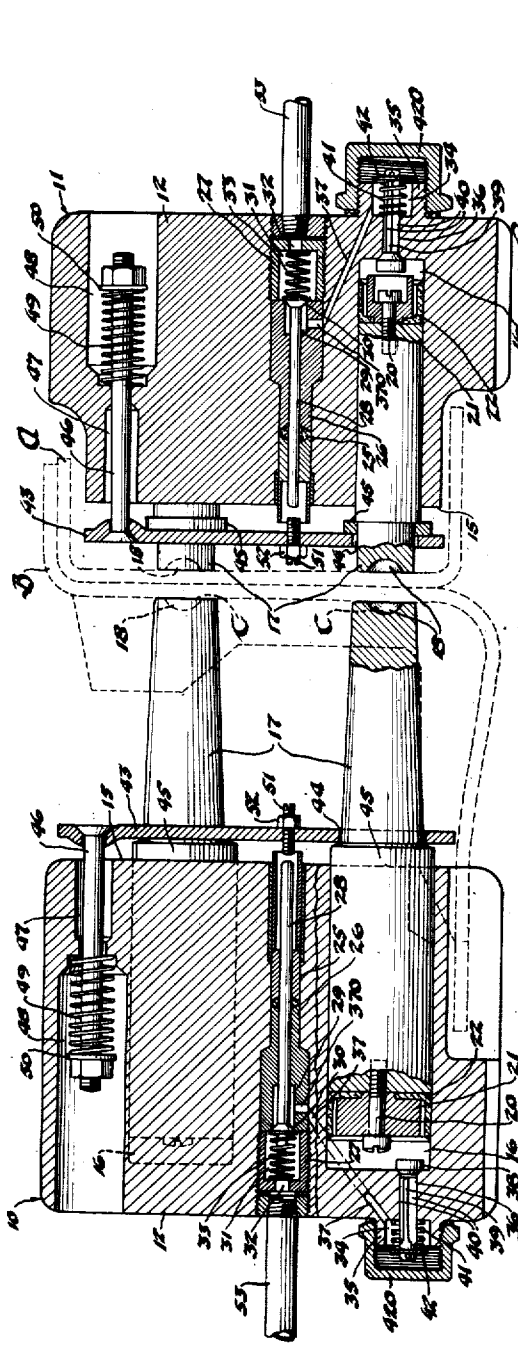


Fig. 2

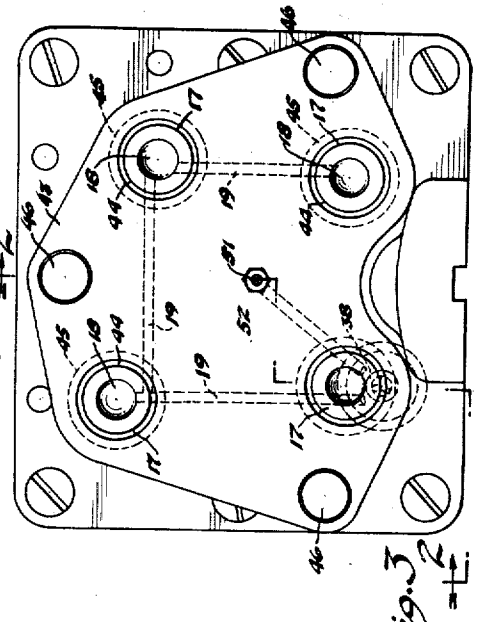


Fig. 3

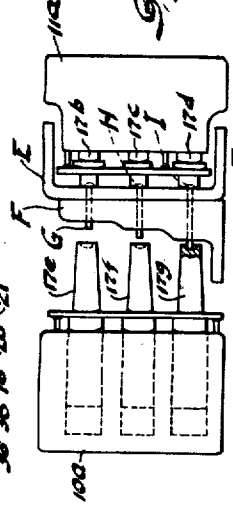


Fig. 4

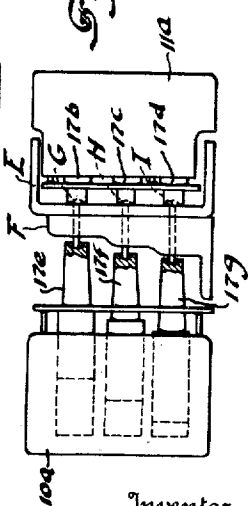


Fig. 5

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Patented Dec. 5, 1933 1,937,908

UNITED STATES PATENT OFFICE

1,937,908

EQUALIZING RIVETING MACHINE

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Application June 11, 1928. Serial No. 284,374

13 Claims. (Cl. 78—48)

This invention relates to means for securing fastening devices, and particularly, to riveting machines.

When two members are to be secured together by a plurality of securing devices in a group, time and expense can be saved if all of the securing devices can be fastened in a single operation. To accomplish this end in the art of riveting, it has been proposed to fix a plurality of heading dies and anvil dies to the opposed jaws of a press in such positions that each heading die will engage one end, and each anvil die the opposite end, of one of the group of rivets to be headed when the jaws of the press are moved together. The rivet joint formed by the type of apparatus last mentioned has been found to be generally unsatisfactory for the reason that when, as is frequently the case, the total effective thickness of the members to be secured together was even slightly greater or less than that presupposed at one or more of the points at which a rivet was to be inserted therethrough, due to either an actual variation in thickness from the presupposed, or distortion of one or more of the members, at this point or these points, one or more of the rivets of the group would not be drawn up tightly and/or one or more of the members to be secured together would be distorted or broken.

It is an object of this invention to provide a machine so constructed and arranged that all of the securing devices of a group may be fastened simultaneously, and each securing device of the group properly tightened, regardless of variations from the presupposed total effective thickness of the members to be secured together at one or more of the several points at which the securing devices are to be inserted therethrough, without distortion or breakage of one or more of the members to be secured together.

More specifically, it is an object of this invention to provide a riveting die holder, which is adapted to be secured to one of the movable jaws of a press, and which includes a plurality of relatively movable riveting dies of which each is adapted to engage one end of one of a group of rivets to be headed, and which are so interconnected that equal pressure is applied to all of the rivets of the group at all times during the riveting operation, regardless of whether or not the total effective thickness of the members to be secured together is equal at all points, so that all of the rivets of a group may be headed simultaneously and each drawn up tightly without distorting or breaking one or more of the members to be secured together.

It is a further object of the invention to provide a mechanism of the class described, which includes a pair of opposed relatively movable jaws, of which each is adapted to carry one or a plurality of fastening dies of which each is arranged to engage one end of a securing means to be fastened, which is particularly adapted for use in securing together two members supported independently of the jaws, and which is so constructed and arranged that the opposed dies will automatically arrange themselves in the proper positions on the opposite sides of the members to be secured together before beginning to fasten the securing means so that equal pressure will be applied to each of the several securing means to be fastened, and strains on the members to be secured together will be prevented during the entire operation.

Other important objects of the invention which are too numerous to mention specifically, will be obvious from a perusal of the following specification wherein is described the embodiment of my invention, which is shown in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation, with parts broken away and in section, of a riveting machine in which is embodied my invention.

Figure 2 is an enlarged view, mainly in longitudinal section on the line 2—2 of Figure 3, of the opposed riveting die holders shown in Figure 1.

Figure 3 is a die-end elevation of one of the holders.

Figures 4 and 5 illustrate diagrammatically two stages of the riveting operation performed by my machine.

To attain the objects of my invention, I utilize in the illustrated embodiment thereof, a pair of riveting die holders, of which one is a heading die holder and the other an anvil die holder. It is not necessary for the purposes of this case to designate which is the heading die holder and which the anvil die holder, as the two are essentially identical and either may act in either capacity. Each of these holders 10 and 11 includes a heavy block 12 of suitable metal and is adapted to be secured to one of the opposed, relatively movable jaws 13 and 14, or other suitable frame members, of a power press, so as to present to each other opposed parallel faces 15, as shown in Figures 1 and 2.

Extending into each of the blocks 12 from the face 15 thereof are a plurality of bores 16, each of the bores in one of the blocks being, when the two blocks are arranged in the press, axially

aligned with one of the bores in the other block. In each of the bores, there is slidably arranged a plunger die 17 which extends outwardly beyond the face 15 of the block and on whose outer extremity there is formed a parti-spherical die recess 18 coaxial with the bore.

For the purpose of illustration, I have shown in Figures 1 and 2, between the opposed riveting dies, two members A and B, which are, respectively, a side member of the chassis frame of an automotive vehicle and a rear spring hanger, and which are adapted to be secured together by four rivets C, of which each extends through an opening in the hanger and an opening in the frame member. It is obvious that the invention is not limited to any particular number and arrangement of plunger dies, but that the number and arrangement will be governed by the number and arrangement of the rivets to be headed in a given piece of work. For the purpose of heading all of the rivets on the particular job to be done by the apparatus shown in Figures 1–3, there are provided in each of the blocks 12 four of the plunger dies 17 so arranged that the head of each of the four rivets C is adapted to be seated in the die recess formed in the extremity of one of the plunger dies in the holder selected as the anvil die holder, and that the end of the shank of each of the rivets is adapted to be received in the die recess formed in the extremity of one of the plunger dies in the holder selected as the heading die holder.

The inner ends of all of the plunger dies 17 are normally, as shown in the drawings, positioned so that they are at an appreciable distance from the inner ends of the bores 16. The inner ends of all of the bores 16 in each block 12 are inter-connected by cross-bores 19, so that the cross-bores 19 and the portions of the bores 16 not occupied by the plunger dies, 17 form, in effect, a single closed chamber, which is filled with oil or other suitable fluid. To prevent loss of this fluid by leakage past the plunger dies, there is secured to the inner end of each of the plunger dies, by means of the screw 20 and the washer 21, a cup-shaped washer 22 of leather or other suitable material.

Two stages in the operation of an apparatus in which is embodied the heretofore described invention are illustrated more or less diagrammatically in Figures 4 and 5, wherein the parts E and F to be riveted together (in this case by three rivets) are, for purposes of illustration, shown to have substantially different total thickness at the three points where the three rivets G, H and I pass through them. The first step in the operation, which may be effected either before or after the rivets have been inserted through the openings through the members E and F, is to position the members E and F between the pair of riveting die holders 10*a* and 11*a*, either with the heads of the rivets seated in the die recesses in the ends of the plunger dies 17*b*, 17*c* and 17*d* on the anvil die holder or with the members E and F spaced from both of the sets of plunger dies, and so arranged that each of the rivets is aligned with one pair of the plunger dies.

In the next step of the operation, the holders are moved bodily toward each other preferably, if they are not already in engagement with the heads of the rivets, so that the plunger dies of the anvil die holder will come into engagement with the heads of the rivets before the plunger dies 17*e*, 17*f*, 17*g* of the heading die holder engage the ends of the shanks thereof.

In Figure 4, the parts of the holders are shown in the positions which they occupy when each of the dies of the anvil die holder is in contact with the head of one of the rivets and one of the dies, 17*g*, of the heading die holder has come into contact with the rivet I through the greatest total thickness of material. It will be noted that, at this stage of the operation the outer ends of all of the dies of the heading die holder are still in a straight line parallel to the face of the holder. Further movement of the holders toward each other causes the heading plunger die 17*g* to move back into its bore in the heading die holder, which causes a flow of fluid from the bore in which the die 17*g* is located into the bores in which the plunger dies 17*e* and 17*f* are located through the cross-bores connecting the plunger die bores. This flow of fluid into the bores in which the plunger dies 17*e* and 17*f* are located continues until the die 17*f* contacts with the end of the shank of the rivet H, after which, upon further movement of the holders toward each other, fluid will flow from the bores in which the plunger dies 17*g* and 17*f* are located into the bore in which the plunger die 17*e* is located until the parts come into the relative positions in which they are shown in Figure 5, in which all of the dies of both holders are in contact with the rivets. After this, further movement of the holders toward each other will effect the heading of all of the rivets, and since there may be a constant shifting of the fluid from one or more of the plunger die bores in one holder into the other plunger die bores or bore in the same holder, the pressure on each of the rivets will at all times be equal, whereby it is assured that all of the rivets will be headed simultaneously and each one drawn up tightly in a single operation.

For the sake of simplicity in the description of the operation heretofore given, I have assumed that the outer ends of all of the dies of the heading die holder are in a straight line parallel to the face of the holder at the beginning of the operation, but it is obvious that in the simple form of the holders heretofore described this is not necessarily true. It is, however, not essential that this be true or that the dies of the heading die holder come into contact with the several rivets in the order described. The equalization of pressure on the several rivets will be effected whether or not the assumptions made are true. I have further assumed, for the sake of simplicity in description of the operation, that all of the equalization of pressure on the several rivets was effect- by movement of the dies in the heading die holder, but it is obvious that a part or all of the equalization may be effected by movement of the dies of the anvil die holder.

To insure that the desired volume of fluid will be maintained in the bores in the blocks or die holders, some of which will be lost by leakage despite any precautions which may be taken to prevent it, I provide means whereby the supply of fluid in each of the blocks or die holders will be automatically replenished after each riveting operation if any has been lost during that particular operation. To this end, I provide in each of the blocks or holders a bore 25 extending therethrough and counterbored from the back of the block. The outer end of the counterbore is internally threaded for a purpose which is hereinafter mentioned.

In this bore and counterbore, there is located a bushing 26 having a reduced portion in the bore and an enlarged portion in the counterbore. The bushing has a shoulder between its enlarged and

reduced portions engaging the shoulder between the bore and the counterbore, and is maintained in position in the block or holder by means of an externally threaded bushing 27 which is screwed into the threaded end of the counterbore. The reference character 28 indicates a poppet valve having a stem guided in the bushing 26 and extending slightly beyond the forward end of the block or holder. The enlarged end of the bushing 26 is counterbored, as indicated at 29, to form an annular chamber around the portion of the stem of the valve 28 adjacent the head thereof which is adapted to engage a valve seat 30 formed on the end of the bushing 26. The bushing 27, it will be noted, has in its inner end a bore 31 somewhat larger in diameter than the head of the valve 28, into which the head of the valve is adapted to move upon opening movement of the valve. Extending into the bushing 27 from the outer end thereof, there is an orifice 32, which is somewhat smaller in diameter than the bore 31, whereby a shoulder is provided within the bushing 27. Bearing at one end against this shoulder and at its opposite end against the head of the valve 28 is a coil spring 33 which urges the valve toward its seat.

Extending from one of the bores 16 to the outside of the block or holder and into an enlarged bore 34 in a cylindrical boss 35 formed integrally with the block is a valve-controlled passage 36. The bore 34 and the annular space 29 are interconnected by a duct 37 extending diagonally and connecting with a port 370 opening through the wall of the bushing 26. A poppet valve 38 is provided with a head normally engaging a valve seat formed at the inner end of the passage 36, and has a stem 39 extending through the passage 36 and provided with a plurality of longitudinally extending grooves 40 extending from its end within the bore 34 to a point adjacent its head. The valve 38 is urged toward its seat by a coil spring 41 which surrounds the stem thereof and is located within the bore 34 in the boss 35, bearing at one end against the block or holder and at its opposite end against a washer 42 fastened to the stem 39. To close the outer end of the bore 34, there is provided a screw cap 420.

A plate 43, having therethrough openings 44 through which the outer portions of the plunger dies 17 extend, is seated on shoulders or collars 45 provided on the dies outside of the block. Extending through the plate 43 and having heads seated on the outside thereof are a plurality of bolts 46 of which each extends through a bore 47 in the block into an enlarged bore 48 therein, and within the enlarged bore is surrounded by a coil spring 49 which bears at its opposite ends against the shoulder between the reduced and enlarged bores and against a washer 50 fastened to the bolt and tends to draw the plate 43 toward the block or holder. A set-screw 51, which is adapted to engage the projecting end of the stem of the valve 28, is threaded through the plate 43 and is adapted to be locked in adjusted position by a nut 52.

A pipe or other suitable conductor 53 opens into each of the blocks or holders and communicates at its inner end with the orifice 32 in the bushing 27 therein. Each of the conductors 53 communicates at its outer end with a source of fluid under pressure, and is so constructed and/or arranged that the flow of fluid therethrough will not be affected by movement of the block or holder.

When the fluid supply in the bores 16 is large enough that the set-screw does not contact with the end of the stem of the valve 28, the valve will remain closed and no fluid from the source of supply can pass the valve. The springs 49 tend at all times to draw the plunger dies inwardly in the bores 16, and, if at any time the volume of fluid in the bores 16 in either of the blocks or holders becomes so low that the set-screw 51 contacts with the end of the stem of the valve 28 in that block or holder, fluid will flow past the valve 28 and into the space 29 and the duct 37 in that block or holder. If this takes place during a riveting operation, the fluid will not be able to flow past the valve 39 and into the bore 16, since the pressure in the bore will be much greater than that under which the fluid at the source of supply is. It will be obvious that the valve 39 also prevents loss of fluid from the bores 16 at this time.

If at any other time than during a riveting operation the fluid supply is diminished below a predetermined volume, and the set-screw 51 consequently contacts the stem of the valve 28 and moves the valve 28 off its seat 30, fluid will flow from the pipe 53 into and through the orifice 32 and the bore 31, thence past the head of the valve 28 into the annular space 29, thence through the port 370 into the duct 37, thence into the bore 34, and thence into the longitudinal grooves 40 in the stem of the valve 39. The pressure of the fluid on the ends of the grooves 40 will cause the valve 39 to open against the pressure of the spring 41 and the pressure of the fluid in the bores 16, which is quite low at this time, and fluid will flow into the bores 16 until the supply is sufficiently increased that the outward movement of the plunger dies moves the plate 43 and the set-screw 51 sufficiently that the set-screw no longer contacts with the stem of the valve 28, allowing the valve to be closed by the spring 33, after which no more fluid can enter the bores 16 until the supply is again decreased below the predetermined volume.

In certain circumstances, as in riveting together parts, such as the members of the chassis frame, where it is desirable to support one or more of the parts to be riveted together independently of the press itself, I have found it desirable to employ a press of the type shown in Figure 1, wherein the jaws which carry the riveting die holders and the riveting die holders themselves, will automatically adjust themselves to the proper positions on the opposite sides of the members to be riveted together before the heading operation is begun.

To this end, I have designed a press which includes a main frame 60, comprising a bottom plate 61, adapted to be secured to a suitable support, and a pair of parallel side members 62 secured to the bottom plate and to one another, and spaced apart by transverse members 63 and 64, which constitute stops to limit the amplitude of movement of the primary jaw-carrying frame which is hereinafter described.

A primary jaw-carrying frame 65, which is mounted on the main frame, as indicated at 66, so as to be capable of sliding thereon in a direction parallel to the side members 62, includes a depending portion 67 located between the side members of the main frame, and having therethrough an opening 68 through which the transverse member 63 extends, and an upstanding portion 69. On the upstanding portion, there is formed a table or guide portion 70, and at one end of the guide or table portion the upwardly extending jaw or shoulder 14 which has been

previously mentioned. On the guide or table portion 70, there is mounted to slide toward and away from the jaw 14, in a direction parallel to that in which the primary jaw-carrying frame 65 slides on the main frame, a secondary jaw-carrying frame 71 having formed thereon, in opposed relation to the jaw 14, the before-mentioned jaw or shoulder 13.

There is provided on each of the opposite sides of the jaw-carrying frames a toggle linkage. The two linkages are duplicates and each includes a lever 72 pivotally mounted on the primary jaw-carrying frame, as indicated at 74, and a lever 73 pivoted to the secondary jaw-carrying frame, as at 75. The levers 72 and 73 of each linkage are pivoted together between the ends of the lever 72, as indicated at 76. Between the extensions 77 of the levers 72, there is pivoted, as indicated at 78, one end of a connecting rod 79, whose opposite end is connected to a piston 80 by means of a universal joint 81. The piston 80 is slidably mounted in a cylinder 82 which is secured to the depending portion 67 of the primary jaw-carrying frame 65, as indicated at 83. Opening into the cylinder 82 below the piston, there is a pipe or other fluid conductor 84, through which a suitable fluid under pressure may be introduced into the cylinder to actuate the piston. It will be understood that the conductor 84 will be connected to a suitable source of fluid under pressure, and so constructed and/or arranged that the flow of fluid therethrough will not be affected by movement of the primary jaw-carrying frame.

The reference character 85 indicates a lever which is pivoted on the primary jaw-carrying frame 65, as indicated at 86. The lever 85 is also pivoted at its upper end to a link 87, as indicated at 88, which link is pivoted at its opposite end to the secondary jaw-carrying frame 71, as indicated at 89. At its lower end, the lever 85 is pivoted, as indicated at 90, to a link 91 which is pivoted at its opposite end, as indicated at 92, to a block or crosshead 93 which is slidably mounted in the main frame 60 and secured to the piston rod 94. To the opposite end of the piston rod 94, there is secured a piston 95 which is slidably mounted in a cylinder 96 which is secured, as indicated at 97, to the main frame 60. Into the opposite ends of the cylinder open pipes 98 and 99 through either of which fluid under pressure from a suitable source may be introduced into the cylinder 96 to actuate the piston 95.

In Figure 1 of the drawings, the dot-and-dash lines indicate the positions of the several movable parts of the machine when the jaws or shoulders 13 and 14 are separated as far as possible, i. e., when the parts are in the positions in which they are located prior to the beginning of a riveting operation. The solid lines and the dash lines indicate the positions of the parts of the machine at the completion of a riveting operation. The parts A and B, which are to be riveted together, are shown in dash lines between the die holders in the position in which they are located at the completion of a riveting operation.

To bring the riveting dies carried by the holders 10 and 11 which are secured to the jaws 13 and 14 into juxtaposition with the opposite ends of the rivets C extending through the two parts A and B to be riveted together, which are assumed to be supported between the jaws 13 and 14 independently thereof, fluid under pressure is admitted to the cylinder 96 through the pipe 99. The pressure exerted by the fluid on the piston 95 causes it and the piston rod 94 and the lower end of the link 85 to be moved to the left, as shown in the drawings.

It may be assumed that, as a result of this movement of the lower end of the lever 85 to the left, the lever will first swing about the pivot 88 as a fulcrum, though, under certain conditions, it may first swing about the pivot 86 as a fulcrum, or about both of the pivots 86 and 88 as fulcra simultaneously. The order is, however, not important as the final result is the same in any event. If it be assumed that, as a result of the movement of the lower end thereof to the left, the lever 85 first swings about the pivot 88 as a fulcrum, this movement of the lever will cause the primary jaw-carrying frame 65 to slide bodily on its guides 66 on the main frame from its dot-and-dash line position to the left until the dies in holder 11 come into contact with the rivets C, or, in the absence of any work between the jaws 13 and 14, until the end wall of the opening 68 in the depending portion of the primary jaw-carrying frame 65 comes into contact with the transverse member 63.

When further movement of the primary jaw-carrying frame to the left is prevented by the work or the member 63, the fulcrum of the lever 85 shifts from the pivot 88 to the pivot 86. After this occurs, further movement of the piston 95 to the left will cause the secondary jaw-carrying frame 71 to be slid to the right on the guide or table 70 until the dies of the holder 10 carried thereby come into contact with the rivets C. As a consequence of this movement of the secondary jaw-carrying frame 71 on the primary jaw-carrying frame 65, the toggle linkage 72—73, the connecting rod 79, and the piston 80 will move to positions just slightly below the solid line positions which they are shown occupying in the drawings. It will be obvious that, during this latter-described movement, the primary jaw-carrying frame 65 is free to slide on the main frame 60 by reason of which when the jaws 13 and 14 reach a position in which the dies of the holders 10 and 11 contact opposite ends of the rivets C, there will be no strain on the members to be riveted together or on the supports on which they are carried.

If it be assumed that the lever 85 swings about the pivots 86 and 88 as fulcra in the reverse of the order described above, the dies carried by the holders 10 and 11 will come into contact with the rivets C in the reverse of the order described above, the contact of the die 10 with rivets C in this event determining the point at which the shifting of the fulcrum point occurs.

The pressure with which the opposed jaws, holders and dies can be moved together by means of the piston 95 and the mechanism operated thereby, may not be sufficient to head the rivets C. In this event, to perform the operation of heading the rivets after the jaws have been moved to the above-described positions, fluid under pressure is introduced into the cylinder 82 through the pipe 84, whereby the piston 80 is caused to move upwardly in the cylinder. This upward movement of the piston 80, through the toggle linkage 72—73, causes the opposed jaws, holders and dies to move toward each other, whereby the dies are caused to exert great pressure on the opposite ends of the rivets, with the result that the shank ends of the rivets are headed and the parts A and B thereby secured together.

It will be obvious that, since the pair of die holders can move as a unit with respect to the members to be riveted together by virtue of the fact that the primary jaw-carrying frame on

which they are both mounted is free to slide on the main frame at all times, the opposed holders are at all times during the riveting operation free to adjust themselves about the work whereby it is assured that there will be no strain on the work or on its support at any time during the riveting operation, thereby eliminating the possibility of faulty joints from this cause.

When it is desired to separate the jaws to free the work from the riveting dies after a riveting operation has been completed, the fluid pressure on the piston 80 is released and fluid under pressure introduced into the cylinder 96 through the pipe 98, whereby the piston 95 is caused to move toward the right, which causes the piston rod 94 and the lower end of the lever 85 to move in the same direction.

The operation of freeing the dies from the work occurs in two stages, in one of which the jaw 14 is moved away from the work, and in the other of which the jaw 13 is moved away therefrom. These movements may occur in either possible order, or simultaneously, depending upon whether the lever 85 fulcrums first about the pivot 86, or about the pivot 88, or about both pivots simultaneously. The order in which these two movements occur is, however, not important as the final result in either case is the same. If it be assumed that the lever 85 first fulcrums about the pivot 88, movement of the lower end thereof to the right will cause the primary jaw-carrying frame 65 and the jaw 14 carried thereby to slide in the same direction on the main frame 60, thus moving the jaw 14 away from the work until the primary jaw-carrying frame assumes the dot-and-dash line position shown in Figure 1, after which the transverse members 63 and 64 prevent further movement of the primary jaw-carrying to the right. When the primary jaw-carrying frame comes into contact with the stops 63 and 64, the fulcrum of the lever 85 shifts from the pivot 88 to the pivot 86, after which continued movement of the piston 95 to the right causes the secondary jaw-carrying frame 71 and the jaw 13 carried thereby to slide to the left on the primary jaw-carrying frame 65 until it and the lever 85 assume the dot-and-dash line positions in which they are shown in Figure 1, at which time the piston 95 reaches the limit of its movement in the cylinder 96. It will, of course, be obvious that during the above-described movements of the frames 65 and 71, movement of the toggle linkage 72, 73, the connecting rod 79, and the piston 80 also occurs, these parts assuming, when the frames 65 and 71 have reached their dot-and-dash line positions, the dot-and-dash line positions in which they are shown in the drawings. Consequently, when jaws 13 and 14 have been separated as described, all of the parts of the mechanism are in position for the beginning of another riveting operation.

If it be assumed that the lever 85 first fulcrums about the pivot 86, then the primary jaw-carrying frame and the secondary jaw-carrying frame and the jaws 14 and 13 carried thereby move to their dot-and-dash line positions in the reverse of the order described above, the contact of the links 73 with the primary jaw-carrying frame in this case determining the point at which the fulcrum of the lever 85 shifts.

It will be obvious that the riveting dies and holders described and shown in the accompanying drawings are not limited to use in the particular press shown and described, but may be used in any suitable type of press. It will also be obvious that the press shown and described is not limited to use with the riveting dies and holders shown, but may be used with other dies and for other purposes than as a riveting machine. The invention is not limited to a construction in which both the heading die holder and the anvil die holder of a pair are of the equalizing type shown and described, since in many cases an entirely satisfactory joint can be made when one of the holders and the dies carried thereby are rigidly interconnected.

Although I have shown and described a preferred embodiment of my invention, it is to be understood that this has been done merely by way of example and not with the intention of limiting my invention thereto, and that the scope of my invention is limited only by the appended claims.

I claim:

1. In a mechanism of the class described, a block having therein a bore, a plunger slidably mounted in the bore and extending outwardly beyond a face of the block, a fluid medium in said bore, means to automatically replenish the fluid supply in said bore, including means constantly urging the plunger into the bore, a passage extending from said bore to the outside of the block, a fluid supply line opening into said passage, a valve in said passage, and means whereby the valve is automatically opened by the second mentioned means when the volume of fluid in said bore is reduced below a predetermined quantity, and a second valve in said passage adapted to prevent escape of fluid from said bore.

2. In a mechanism of the class described, a main frame, a primary jaw-carrying frame slidably mounted on the main frame, a secondary jaw-carrying frame slidably mounted on the primary jaw-carrying frame, a plurality of tools mounted on each of the opposed jaws of the jaw-carrying frames, means so arranged as to allow shifting of the jaw-carrying frames as a unit at all times during the operation, for bringing the opposed tools into juxtaposition with the opposite sides of a piece of work positioned between the jaws and supported independently of the jaw-carrying frames, and pressure equalizing means interconnecting the several tools on one of said jaws.

3. In mechanism of the class described, a support, a primary jaw carrying frame mounted on the support, a secondary jaw carrying frame mounted on the primary jaw carrying frame, means capable of moving the primary jaw carrying frame on the support or the secondary jaw carrying frame on the primary jaw carrying frame so as to move the jaws toward or away from each other, and means capable of moving the secondary jaw carrying frame on the primary jaw carrying frame so as to move the jaws toward each other.

4. In mechanism of the class described, a support, opposed jaws carried by the support and arranged so as to be capable of being moved with respect to each other and as a unit with respect to the support, means for moving the jaws with respect to each other while allowing them to move freely as a unit with respect to the support so as to bring the jaws into juxtaposition with the opposite sides of a piece of work positioned therebetween, and means whereby when the jaws have been so positioned work performing pressure may be applied to the work therethrough.

5. In mechanism of the class described, a holder, a plurality of plungers slidably mounted in intercommunicating bores in the holder and extending

outwardly beyond a face of the holder, a fluid medium in the bores, and means resiliently tending to move the plungers to predetermined relative positions in the bores.

6. In mechanism of the class described, a holder, a plurality of plungers slidably mounted in intercommunicating bores in the holder and extending outwardly beyond a face of the holder, a fluid medium in the bores, means resiliently tending to move the plungers to predetermined relative positions in the bores, and means associated with the last-mentioned means for replenishing the supply of fluid medium in the bores when the plungers reach predetermined positions.

7. In mechanism of the class described, a support, a primary jaw carrying frame movably mounted on the support, a secondary jaw carrying frame movably mounted on the primary jaw carrying frame, means mounted on the support for moving the jaws with respect to each other while allowing them to move freely as a unit with respect to the support so as to bring the jaws into juxtaposition with the opposite sides of a piece of work positioned therebetween, and means mounted on the primary jaw carrying frame whereby when the jaws have been so positioned work performing pressure may be applied to the work therethrough while allowing the jaws to move freely as a unit with respect to the support.

8. In mechanism of the class described, a plurality of relatively movable fastener setting tools of which each is adapted to engage one end of one of a plurality of fasteners, means for causing movement of said tools so as to apply to fasteners sufficient pressure to set them, and means so interconnecting the tools that engagement thereof with work may effect a relative adjustment thereof and that the pressure between the tools will be equalized irrespective of the relative positions thereof.

9. In mechanism of the class described, a plurality of relatively movable fastener setting tools of which each is adapted to engage one end of one of a plurality of fasteners, a plurality of relatively movable fastener setting tools of which each is adapted to engage the opposite end of one of said fasteners, means for causing movement of one of said sets of tools toward the other so as to apply to fasteners sufficient pressure to set them, and means so interconnecting the tools of each set that engagement thereof with work may effect a relative adjustment thereof and that the pressure between the tools will be equalized irrespective of the relative positions thereof.

10. In mechanism of the class described, a tool holder, a plurality of fastener setting tools slidably mounted in bores in the tool holder, passages interconnecting the bores in the holder, a fluid medium in the bores and passages, and means for causing movement of the tools so as to apply to fasteners sufficient pressure to set them.

11. The invention claimed in claim 10 plus means for automatically replenishing the supply of fluid in the bores and passages when the volume thereof is reduced below a predetermined amount.

12. In mechanism of the class described, opposed pressure members, means for causing movement of one of said members toward the other so as to set fastening devices, a plurality of relatively movable fastener setting tools mounted on one of said members, and means so interconnecting the tools that engagement thereof with work may effect a relative adjustment thereof and that the pressure between the tools will be equalized irrespective of the relative positions thereof.

13. In mechanism of the class described, a support, opposed jaws carried by the support and arranged so as to be capable of being moved with respect to each other and as a unit with respect to the support, means for moving the jaws with respect to each other while allowing them to move freely as a unit with respect to the support, a plurality of tools on one of the jaws, and pressure equalizing means interconnecting the tools.

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