United States Patent

Sheffer, Jr.

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[54] MACHINE FOR RIVETING NUTPLATES TO SUPPORT STRUCTURES

[72] Inventor: **Ralph L. Sheffer, Jr.**, Arcadia, Calif.

[73] Assignee: **Omark-Winslow Aerospace Tool Co.**, Portland, Oreg.

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[52] **U.S. Cl.** **29/243.53**

[51] **Int. Cl.** **B23p 11/00**

[58] **Field of Search** 29/243.53, 243.54

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Primary Examiner—William S. Lawson

Attorney—Forrest J. Lilly

[57] **ABSTRACT**

A machine for riveting nutplates to workpieces. A clamp means acts under hydraulic pressure to hold a workpiece down against a horizontal work table. A pair of drills rise from the work table to drill holes in the workpiece to receive the rivets which will secure the nutplate thereto, and are then retracted. An elevator then rises from the workhead to elevate the workpiece a short distance, after which the retracted drills are rotated out of position and replaced by a pair of anvils against which the lower rivet heads can be upset. The nutplate with a pair of rivet slugs in the holes thereof is then fed into position over the holes in the workpiece. Upsetting rams are then lowered against the upper ends of the rivet slugs, moving the slugs first down against the anvils, and then forced on down, the elevator under this force progressively lowering the workpiece to its original level at the workhead while heads are upset on both end portions of the rivet slugs.

9 Claims, 17 Drawing Figures

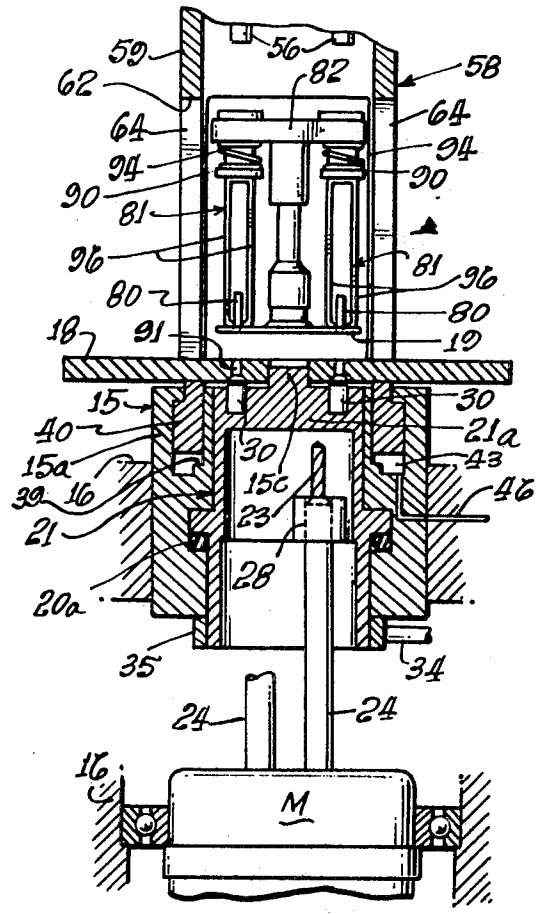


FIG. 1.

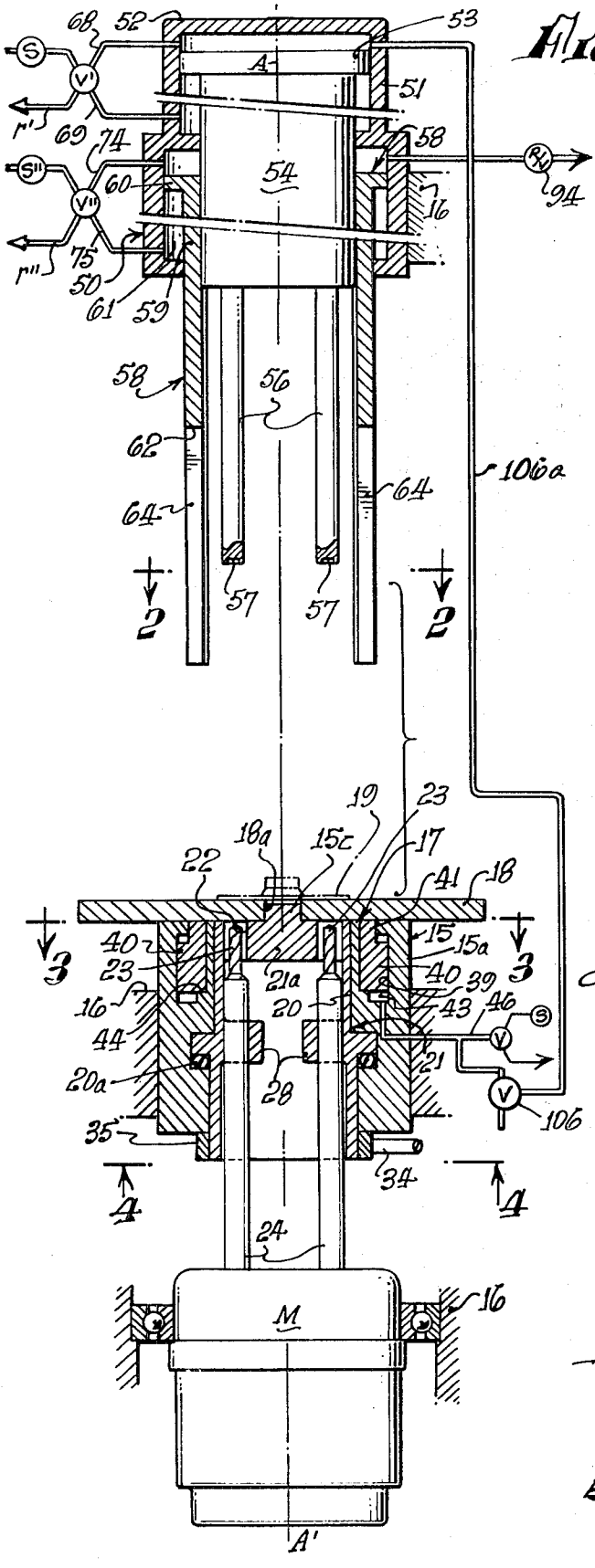


FIG. 2.

FIG. 3.

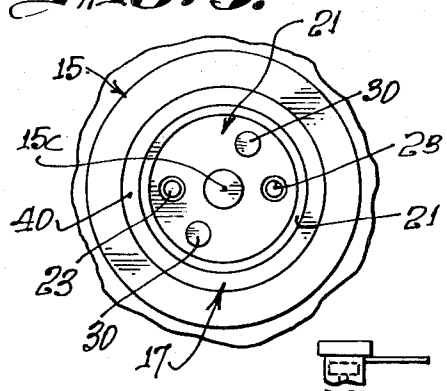
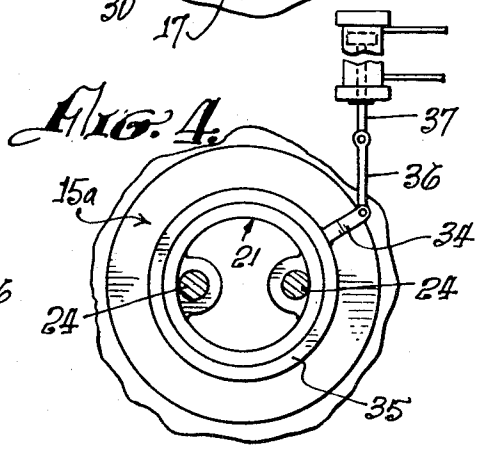


FIG. 4.



INVENTOR.
RALPH L. SHEFFER, JR.,
By Jarvis J. Lilly
ATTORNEY.

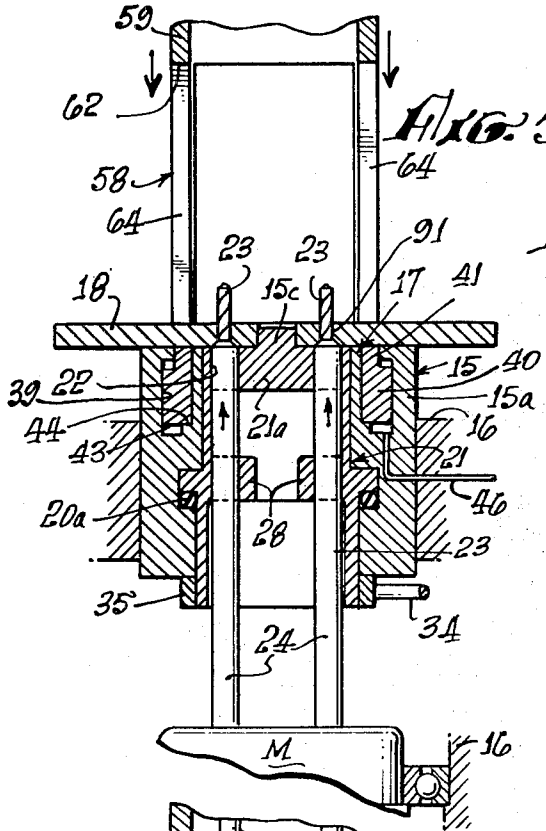


FIG. 5.

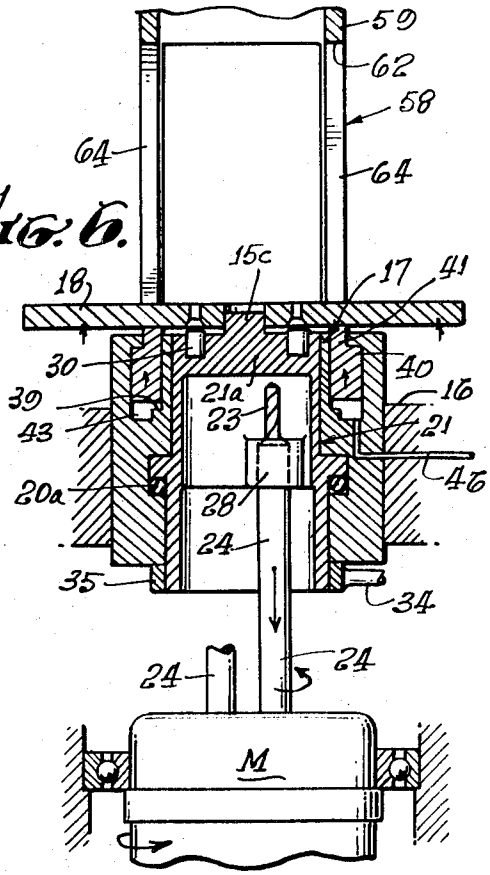


FIG. 6.

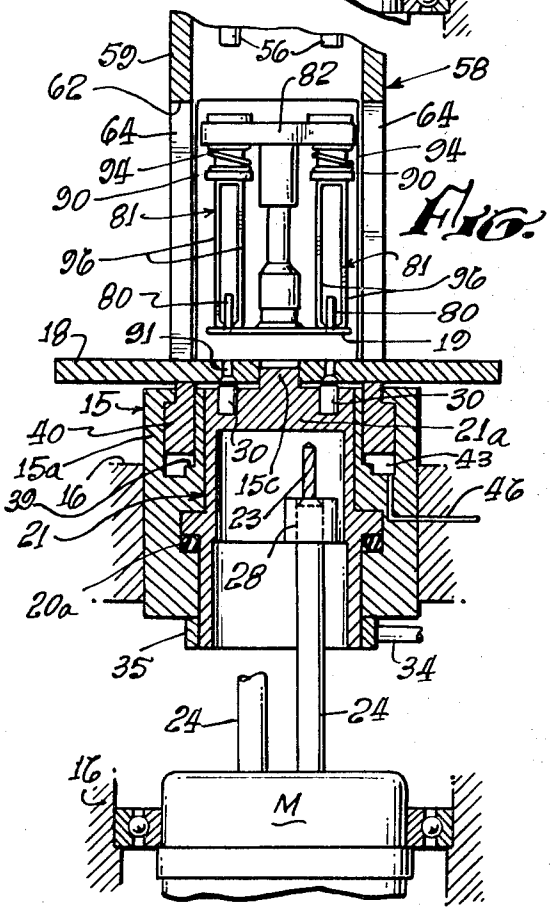


FIG. 7.

INVENTOR.
RALPH L. SHEFFER, JR.,
By Thomas J. Sillo
ATTORNEY.

FIG. 7a.

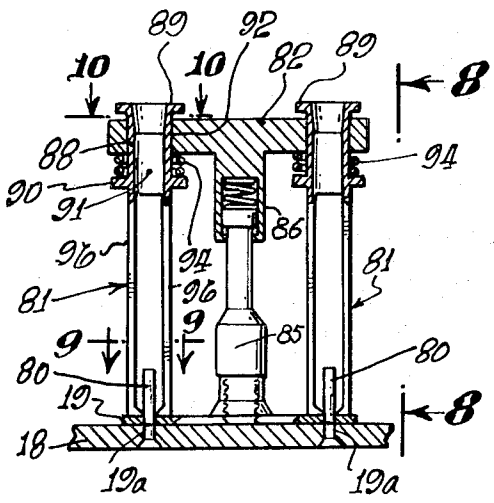


FIG. 8.

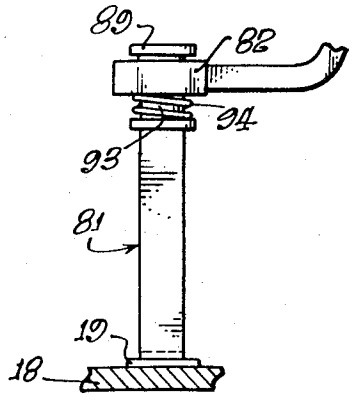


FIG. 9.

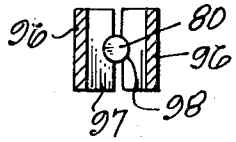


FIG. 10.

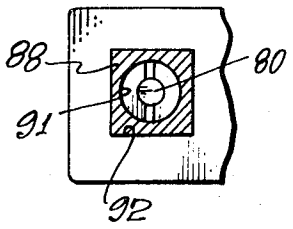
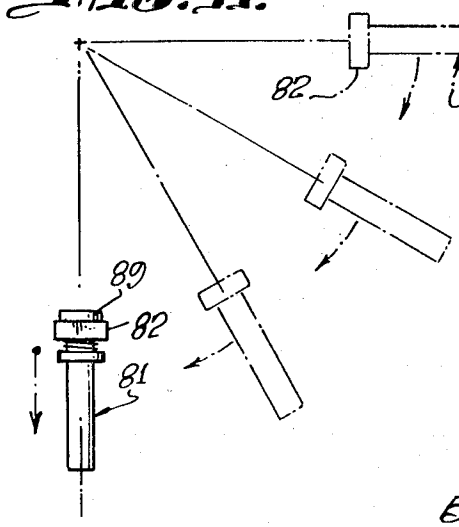


FIG. 11.



INVENTOR.
RALPH L. SHEFFER, JR.,
By Forrest J. Lilly
ATTORNEY.

FIG. 12.

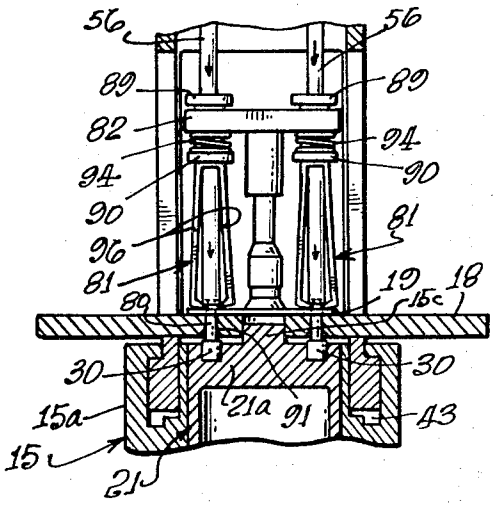


FIG. 16.

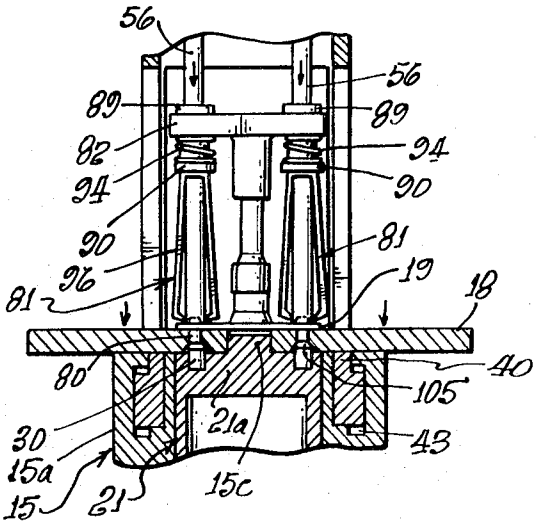


FIG. 13.

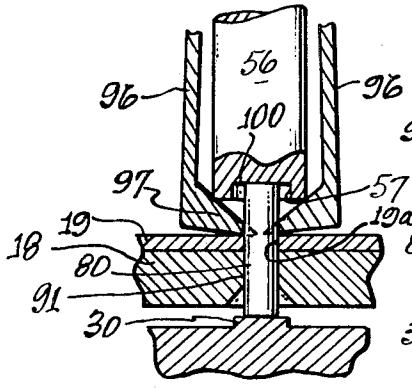


FIG. 14.

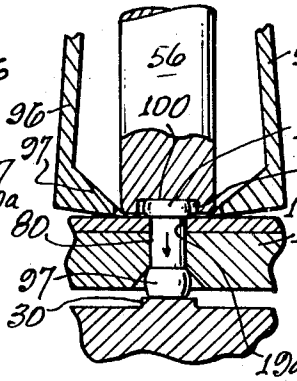
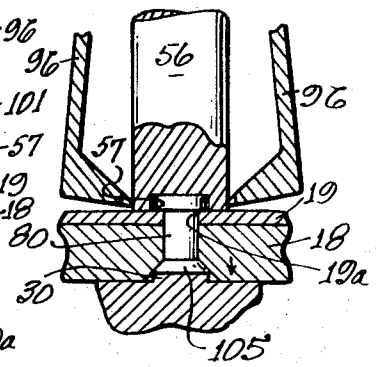


FIG. 15.



INVENTOR.

RALPH L. SHEFFER, JR.,

By Forrest J. Lilly

ATTORNEY.

MACHINE FOR RIVETING NUTPLATES TO SUPPORT STRUCTURES

FIELD OF THE INVENTION

This invention relates generally to riveting machines, and more particularly to machines for riveting nutplates on flat bars, plates, sheets or flanges. It may also be used in other applications, e.g., in riveting flat bars, sheets, or other workpieces, to one another. The invention further is particularly directed to riveting processes using slug-type rivets which are inserted in one or more aligned rivet holes in two workpieces clamped face to face, the rivet slugs then being upset to form heads by squeezing rather than hammering.

BACKGROUND OF THE INVENTION

Large numbers of nutplates are used in the aerospace industry, each requiring two rivets to fasten the nutplate to a workpiece. These are generally installed one at a time. The present invention is directed to the provision of a machine which will automatically undergo a working cycle by which the workpiece is drilled simultaneously for two rivets, and the two rivets are thereafter automatically simultaneously installed by an effective "squeeze" upsetting process. The events of the cycle are to be such as can be carried out effectively and efficiently with minimum time consumption.

BRIEF SUMMARY OF THE INVENTION

Assuming the case of the installation of a nutplate, the machine of the invention, in an illustrative embodiment, undergoes a cycle including, first, clamping of a workpiece down against the top side of a workhead by an upper pressure clamp, drilling the workpiece from below to form two countersunk rivet holes, retracting the drills, elevating the workpiece a short distance above the workhead by an elevator or elevating support which rises a short distance from below, rotating the drills out of position and replacing them by a pair of anvils spaced a short distance below the workpiece, feeding a nutplate with two rivets held in the two rivet holes thereof into position on the workpiece, with the two holes thereof aligned with the two holes drilled in the workpiece, and lowering a pair of rivet sets or rams against the upper ends of the rivet slugs so as to move these slugs down against the anvils, then continuing the downward movement of the rams and so squeeze-forming heads on the upper and lower ends of the rivet slugs, the elevator lowering back down to its original level as the rivets are upset at both ends. The upper pressure clamp is finally elevated to release the workpiece and nutplate riveted thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

A present illustrative embodiment of the invention will now be described in connection with the accompanying drawings, wherein:

FIG. 1 is a diagrammatic view, largely in vertical medial section, showing an illustrative embodiment of the invention;

FIG. 2 is a section taken on line 2—2 of FIG. 1;

FIG. 3 is a section taken on line 3—3 of FIG. 1;

FIG. 4 is a schematic view showing diagrammatically one illustrative means for rotating a drill and anvil supporting barrel within the workhead;

FIG. 5 is a view similar to FIG. 1, but showing a subsequent position of the operating cycle of the machine;

FIG. 6 is a view similar to FIG. 5, but showing a subsequent position of the operating cycle;

FIG. 7 is a position similar to FIG. 6, but showing a subsequent position of the operating cycle;

FIG. 7*a* is a view similar to a portion of FIG. 7, to an enlarged scale showing a subsequent position;

FIG. 8 is a view of the device shown in FIG. 7*a*, looking from the right;

FIG. 9 is a detailed section taken on line 9—9 of FIG. 7a

FIG. 10 is a view taken on line 10—10 of FIG. 7*a*;

FIG. 11 is a diagram showing a succession of positions of the rivet and nutplate-holding device as it is delivered into the machine;

FIG. 12 is a view similar to FIG. 7, showing the rams as having engaged the rivet slugs and moved them down into engagement with the anvils;

FIG. 13 is an enlarged fragmentary, diagrammatic view taken from FIG. 12;

FIG. 14 is a view similar to FIG. 13, but with the ram further descended, and the head on the upper end of the rivet shank about 90 percent completed;

FIG. 15 is a view similar to FIG. 13, but with the parts moved to a position wherein the rivet is completely upset at both ends; and

FIG. 16 is a view similar to FIG. 12, showing the rivet at the completion of the upsetting operation.

DESCRIPTION OF A PREFERRED EMBODIMENT

The invention can, with the skill available in the art, be fully understood from a simple, largely diagrammatic disclosure, showing an illustrative practice of the invention.

Reference is directed first to FIG. 1. A cylindrical workhead is designated at **15**, and, in the illustrative embodiment, this workhead comprises a cylindrical part **15***a* stationarily mounted in the machine frame, represented at **16**. The cylindrical workhead part **15***a* is vertically oriented, and has a flat top **17**. A flat workpiece **18**, to which a nutplate **19** (phantom lines in FIG. 1) is to be riveted, is shown to have been placed flat down on the top **17**, a predrilled hole **18***a* in the workpiece receiving a positioning pin **15***a* on the workhead **15**. Workhead part **15***a* has an axial bore **20** in which is rotatably mounted, and axially supported as by bearing **20***a*, a central cylindrical core or barrel part **21** which, in effect, forms a second but relatively rotatable component of the workhead **15**. The workhead parts **15***a* and **21** have coplanar upper faces comprising, in effect, one supporting surface for the workpiece **18**. The barrel **21** has a head wall **21** formed with a pair of bores **22** to pass the countersink twist drills **23** on the upper ends of a pair of drill spindles **24**. The drills **23** are spaced and aligned, in one position of the barrel, to drill a pair of holes through the workpiece **18** in alignment with the conventional two rivet holes **19***a* of the nutplate. The interior of the barrel **21** is furnished with bearings **28** for the drill spindles; and it will be seen that the barrel **21** is open to permit fallout of chips cut by the drills.

At an angular spacing from the plane of the drill holes, e.g., 60°, the barrel head is provided with a pair of hardened steel anvils **30** with flat, horizontal upper ends raised a few thousandths of an inch above the surface of the barrel head. These anvils are spaced so that, by rotation of the barrel, with the workpiece slightly elevated, they can be aligned with the holes just drilled in the workpiece. The barrel may be rotated between the described positions by any suitable means, conventionally indicated here as including an arm **34** extending from a collar **35** tightly mounted on the lower end of the barrel, and which can be swung manually or, as in FIG. 4, through a link **36** pivoted thereto and to a plunger rod **37** extending from a piston in a hydraulic cylinder controlled through conventional valve means from a source of hydraulic fluid under pressure, not shown.

The drill spindles **24** project upwardly from a drill motor M rotatably mounted in the stationary machine frame. This drill motor may be of the type which advances and retracts the drill spindles while the drill motor housing stands axially stationary, or it could be of the well-known type in which the drill spindles and motor housing are fed axially as a unit. The rotatable mounting for the drill motor permits rotation of the barrel to turn the latter between the position for drilling, and the position for riveting, wherein the drills are turned away from the holes drilled in the workpiece.

Mounted for limited vertical reciprocation in an annular channel **39** in the workhead is an elevator ring **40** which rises

to elevate the workpiece above the workhead and to function then as a support for the workpieces. This ring **40**, acting together with subsequently described clamp means descending from above, also serves as a lower clamp for the lower workpiece. The ring **40** has a reduced upper portion **41** movable vertically through a reduced close-fitting upper extent **42** of the channel **39** between a lower position flush with the upper ends of the workhead parts **15a** and **21**, and an elevated position typically 0.025 inch above the common level of the workhead part **15***a* and the barrel head. A reduced lower extent **43** of the annular channel **39** affords or leaves a lower seat **44** for the clamp ring **40**, positioning the latter normally in the lower position of FIG. **1**, its upper edge flush with the tops of the workhead and barrel head parts **15a** and **21**. The overhanging seat at **45** limits upward travel of the clamp ring to a rise of about 0.025 inch, as earlier mentioned. The lower channel portion **43** communicates with a source of pressure fluid via a conduit and/or passage represented at **46**. A source S of pressure fluid and a conventional three-way valve V deliver pressure fluid to the channel portion **43** to elevate the ring **40** and hold it and the workpiece up with a predetermined force relative to forces applied to it from above, as subsequently explained. Return is indicated at *r*.

Supported in the stationary frame structure **16**, over the workhead **15**, and axially aligned therewith, on the vertical axis A–A′, is a hydraulic cylinder structure **50**. This cylinder structure **50** includes a top cylinder **51**, with a top closure **52**, in which is mounted, for sliding reciprocation, a piston head **53** on a downwardly extending piston **54**. Depending from the piston **54** are a pair of rams **56**, coaxially aligned with the holes in the nutplate and the holes in the workpiece **18** drilled by the drills **23**. The lower ends of the rams **56** are formed with sockets **57** within which the rivet heads are formed on the upper ends of the rivets, the depth of the sockets being equal to the thickness of the rivet heads to be formed, as will appear.

Slidable on the piston **54** below the cylinder **51** is a clamp piston **58** comprising a barrel **59** whose upper end has a piston head **60** reciprocating in a cylinder **61** forming a part of the cylinder structure **50**, below the cylinder **51**. The barrel protrudes downwardly from the cylinder **61** and terminates at **62** in a pair of clamp bars or legs **64** adapted at their lower ends for clamping engagement with the workpiece **18**, just outside the nutplate position.

The motion and force of ram piston **54** are controlled by hydraulic lines **68** and **69** leading from a four-way valve V′ and a pressure source S′, a return line being indicated at *r*′, all in a conventional arrangement. The clamp piston **58** is similarly controlled by hydraulic lines **74** and **75** leading from four-way valve V″ with hydraulic source at S″ and a return at *r*″.

FIG. **7** shows a nutplate **19** and rivet slugs **80** clamped thereby being fed into position for riveting. The present invention is directed primarily to the riveting process and machine, and, broadly speaking, any means may be provided for feeding the nutplates and rivet slugs into position in the machine for commencement of riveting. In fact, the nutplates and rivet slugs could be fed into the machine manually. However, a portion of a preferred nutplate and rivet feeding mechanism has a novel and advantageous cooperative functional association with the rams and clamping means of the riveting machine, and is disclosed as a part of the inventive subject matter.

Thus, as illustratively shown in FIGS. **7–10**, inclusive, there is shown to have been moved into position between the two clamp bars or legs **64**, in coaxial alignment with and below the lower extremities of the elevated rams **56**, a pair of rivet and nutplate feeding devices **81**, mounted in a crosshead **82**. This crosshead **82** is on the front end of a support **84** (FIG. **8**) which is guided and moved by suitable track and feed means, not shown, through a succession of positions, as represented in the diagram of FIG. **11**, from a loading station, where nutplates and rivet slugs are loaded therein, to the final position shown in FIG. **7a**, wherein the nutplate and rivet slugs have been fully delivered into the machine. The nutplate **19** will be seen to be supported and positioned on the workpiece **18**, with its rivet holes in alignment with the countersunk rivet holes bored through the workpiece by the drills **23**, the rivet slugs **80** being held by the devices **81** so that they are just within the holes in the nutplate in the relationship clearly shown in FIGS. **7** and **7***a*. The nutplate is releasably held up against the devices **81** by a permanent magnet **85** having a shank part represented in FIG. **7***a* as springseated in a socketed stem **86** depending from the crosshead **82**. Since the guiding means, feed means, and initial loading means for the rivet and nutplate supporting and positioning devices **81**, **82**, **84** form no part of the present invention, and can be readily supplied by those skilled in the art, no illustration thereof is deemed necessary herein.

Considering the devices **81** per se in more particular, each has a tubular upper portion **88** (square in cross section in this example) with an enlarged head **89** at the top, a flange **90** below, and a cylindrical ram guide bore **91**, somewhat flared at the top for ram entry guidance, extending downwardly to the bottom of the flange **90**. The square, tubular upper portion **88** of the device, between head **89** and flange **90**, is fitted for free sliding movement in an aperture **92** of similar noncircular section extending through the crosshead **82** (FIGS. **7**, **7***a* and **8**). The square sections are here shown as one conventional means to prevent the devices from rotating out of position relative to the crosshead. Between the crosshead and the flange **90** the tubular portion **88** has a cylindrical section **93** encircled by a coil spring **94** acting between the crosshead **82** and the flange **90** to urge the head **89** of the tubular portion **88** down against the crosshead. Below the flange **90** the structure merges into two parallel, flat, spring fingers **96**, formed at their lower extremities with opposed wedge-shaped projections **97** having notches or jaws **98** to receive and grip the rivet slugs **80**. The spring fingers will be understood to be so formed that they must be elastically bent away from one another a short distance to receive the rivet slugs, and will then yieldingly spring-clamp the rivet slugs when released.

In operation, with the parts, including the crosshead **82** and fingers **96**, moved down from the position of FIG. **7** to that of FIG. **7***a*, the springs **94** have been compressed to a degree, head **89** having become spaced from the crosshead by a short distance; and the spring fingers **96** are thus forced by the compressed springs **94** down against the nutplate, thus clamping the nutplate against the workpiece **18**.

The full operating cycle is as follows:

FIG. **1** shows a position at the beginning of the operation, the workpiece **18** having been positioned on the workhead, but no nutplate or rivet slugs being in position over the workpiece. The workpiece has been centered in the machine by engagement of its hole **18***a* with the pin **15***c*. The rams **56** and clamp legs **64** are elevated, the elevator ring **40** is in lowered position, and the barrel **21** has been rotated to position the drills **22** directly beneath the points on the workpiece which are to be drilled to receive the nutplate rivets.

The clamp piston **58** is then lowered through introduction of hydraulic fluid into the upper end of cylinder **61**. The clamp legs **64** thus descend and engage the workpiece **18** (FIG. **5**) holding it with a predetermined total clamping force dependent upon the pressure of source S″ and the area of piston head **60**.

Drill motor M is then operated to drive and axially advance the drill spindles, so as to drill and countersink the holes **91** in the workpiece, as seen in FIG. **5**. The drills are then retracted.

The elevator ring is then subjected to pressurized hydraulic fluid from source S via valve V, and the "up-elevator" force so exerted on the workpiece is made sufficient to overcome the downward force exerted by clamp legs **64** on piston **58**. Upward movement is permitted through relief of excess pressure above the piston **58** via a relief valve **94** (FIG. **1**). Elevator **40**, the workpiece, and the clamp legs **64** thus move up to the position of FIG. **6**.

Barrel **21** is then rotated to carry its anvils **30** into the position formerly occupied by the drills (see FIG. **6**).

The rivet and nutplate feeding device 81, 82, etc., goes through the guide path represented in FIG. 11, and through the position of FIG. 7 to that of FIG. 7*a*, the rivet slugs being aligned with the holes 91 in the workpiece so that they can presently be pushed down through holes 19*a* in the nutplate and the holes 91 in the workpiece until they seat on the anvils 30, as in FIGS. 12 and 13. In the position of FIG. 7*a*, the crosshead 82 has been lowered relative to the spring fingers 96 in the final positioning of the crosshead, the fingers 96 having been stopped owing to engagement of the nutplate with the workpiece. The springs 94 are thus compressed and act downwardly on the spring fingers 96, which are thereby subjected to a certain light clamp pressure acting downwardly against the nutplate which is at this time positioned on the workpiece, with its holes aligned with those in the workpiece. The stem 86 on the crosshead has then lowered relative to the magnet 85, which is against the nutplate, and the shank of the magnet recedes into the socket in the stem against the springs therein to accommodate the final lowering of the crosshead. In this connection, it is to be understood that the crosshead 82 and devices 81 are moved vertically downward after swinging into a position aligned with the center axis A–A′ in the sequence of successive positions represented in FIG. 11.

The ram piston 54 is then driven down at a rate of several inches per second by operation of valve V′ to admit hydraulic fluid under pressure from pressure source S′ to the cylinder space above the piston 54. The rams or rivet sets 56 pass downwardly through the bores 91 of the member 88, and thence on down between the fingers 96 until their socketed lower ends engage the upper ends of the rivet slugs 80. Continuing down, the rams move the rivet slugs down until their lower ends engage the anvils 30 (FIGS. 12 and 13). The slugs then protrude substantially further from the top of the hole through the nutplate then from the countersunk hole in the workpiece, as shown. As the rams continue to descend toward the position of FIG. 14 (at several inches per second), the slugs 80 bulge, as at 97, below the work, and fill up and become seized within the holes in the nutplate and work. With the rivet slugs thus tight in the work, the "bottom" walls 100 of the sockets in the still descending rams do the major part of upsetting of heads 101 onto the upper ends of the rivet slugs 80, such heads being approximately 90 percent completed in the intermediate position represented in FIG. 14. The lower portion of the rivet slug has begun to be upset during this phase, somewhat as represented in FIG. 14. It will be noted that the ram has completed about 90 percent of its stroke toward the nutplate and workpiece in the position of FIG. 14, and is thus almost in engagement with the nutplate.

Upon engagement being made with the nutplate, rivet heads 101 have been completely formed. The rams, however, continue to descend under the piston force developed by the pressure of the fluid supplied above piston 54, causing the elevator 40 and the nutplate 19 and workpiece 18 to descend to their initial level. In this period the upsetting of the lower rivet heads 105 is completed (FIGS. 15 and 16). The heads 105 will be seen to occupy the countersink, in a subflush position. This lowering of the elevator under the force of the rams is preferably permitted by a dump valve 106 connected to the fluid pressure line responsible for the pressure fluid below the elevator, adapted and set to open to exhaust hydraulic fluid from below the elevator in response to rise in pressure of the fluid above ram piston 54. This pressure is delivered to valve 106 to open the latter via a fluid line 106*a*. It will be clear that the clamp legs 64 will advance in continued clamping engagement with the workpiece, as the elevator descends.

As appears in FIGS. 12–16, the rivet-gripping fingers 96 are spread apart by a camming action against the finger projections 97 as the rams descend therebetween.

To aid in the disclosure, typical dimensions of parts will be given with the understanding that they are to be taken as one operative example. Assume, then, a nutplate thickness of 0.025 inch and a workpiece thickness of 0.187 inch, giving a total material thickness of 0.212 inch. Also assume a hole diameter of 0.098 inch and a rivet slug diameter of 0.093 inch to 0.097 inch. The rivet length can now be established by adding a length of from 0.113 inch to 0.145 inch to the thickness dimension 0.212 inch, giving an acceptable range of rivet lengths of 0.325 inch to 0.357 inch. A length of 0.344 inch, or eleven thirty-seconds inch, may be adopted as an example. The rivet slug may have a diameter of 0.093 inch to 0.097 inch for the hole size of 0.098 inch. The socket 57 in the end of the ram should then have a diameter of 0.150 inch, and the socket depth is then 0.050 inch. The workpiece is elevated from the anvils by the elevator by a distance of 0.022 inch. A riveting machine according to the disclosure is capable of successful operation within a wide range of rivet dimensions and materials, and those here given are, as earlier stated, found to be acceptable.

The rivet having been formed, the pressure below the clamp 40 may be relieved by operation of valve V, and the valves V′ and V″ may be operated to elevate the clamp and ram pistons.

The riveting operation is thus completed, and the nutplate tightly and securely riveted onto the workpiece. The cycle is inherently efficient and capable of rapid performance, and hence leads to important cost reduction when large numbers of nutplates are required to be installed.

The present system has been reduced to practice using a hydraulic liquid under pressure, rather than a gas, as the pressure-transmitting medium to the power work cylinder. However, a gaseous fluid such as air under pressure could obviously be used, and is an equivalent within the meaning of the claims.

Many modifications within the scope of the invention are evident or will occur to those skilled in the art. The anvils are here shown as raised a short distance above the top plane of the workhead. This is to accomplish a depressed outer end on the upset rivet head within the countersink in the rivet hole of the lower workpiece. In general, the plane of the anvils preferably departs only very little from coincidence with the top of the workhead, but may be above said plane, giving a depressed rivet head, or may coincide substantially exactly with, or be a little below, the top of the workhead. In the second case, a flush head is obtained, and in the third, the rivet head may bulge out somewhat. It can later be showed flush. Finally, the rivet hole may not be countersunk, and an external head may be formed on the rivet by locating the anvils in a position depressed a distance equal to the thickness of a rivet head below the top of the workhead.

In the foregoing, two rivets are installed simultaneously. In any modified application of the invention in which a single rivet is installed at a time, the total force acting upward on the elevator must be overcome by the total downward force exerted by clamp legs 64 and the single ram used in such a case, as should be clear. Thus, in any case, the pressure acting upwardly on the elevator would be regulated or relieved to assure a superior downward force application through the upper clamp means and the total ram means, whether composed of two rams or one ram.

I claim:

1. In a machine for riveting together two workpieces positioned face to face and having aligned rivet holes therethrough containing a rivet slug, that comprises:

a support on which the two workpieces may rest, one engaged by the support, with the other positioned on top of the first, and with the rivet slug in and protruding at both ends from said rivet holes;

an anvil axially engaged by the end of the rivet slug protruding from the hole in the workpiece engaged by said support;

a ram movable relatively axially into upsetting engagement with the end of the rivet slug protruding from the hole in the other workpiece, and thereafter into interengagement with said workpieces;

power and control means including means for initially effecting relative movement, axially of the rivet slug, of said ram and said support relatively toward one another until

interengagement occurs between said ram and said last mentioned end of said rivet slug, and thereafter with said workpieces, and for simultaneously holding said support and said anvil substantially against axial travel relative to one another; and

means included in said power and control means operable upon interengagement between said ram and the workpieces on said support for thereafter effecting movement axially of the rivet slug of said support and ram relatively toward said anvil.

2. The subject matter of claim 1, wherein the rivet hole in the workpiece engaged by the support is countersunk.

3. The subject matter of claim 1, wherein said anvil is axially fixed, said ram travels longitudinally towards said anvil, and said support comprises an elevator which is moved by said ram between an elevated position spaced from a predetermined distance from said anvil and a predetermined lowered position after engagement of said workpieces on said elevator by said traveling ram.

4. The subject matter of claim 3, wherein said power and control means includes means yieldingly urging said elevator to move toward said elevated position, said means yielding to supervening, oppositely directed ram force.

5. The subject matter of claim 3, including also pressure clamp means for applying clamping pressure to said workpiece to clamp it against said elevator.

6. In a machine for riveting together two workpieces positioned face to face and having aligned rivet holes therethrough containing a rivet slug, that comprises:

a frame;

a workhead mounted in the frame on which the two workpieces may rest, one engaged by the workhead, with the other positioned on top of the first, and with the slug in and protruding at both ends from said rivet holes;

an elevator for picking up and lifting said workpieces, said elevator rising to a fixed position of elevation a predetermined distance above said workhead;

an anvil supported from the frame in alignment with the rivet slug, said anvil being axially engageable by the end of the rivet slug protruding from the hole in the workpiece engaged by said workhead;

a ram axially aligned with the opposite end of the rivet slug, and said ram being movable axially into upsetting engagement with said opposite end of said rivet slug, and thereafter into engagement with said workpieces on said elevated elevator;

fluid pressure power means for lifting said elevator to and yieldingly supporting it in its said fixed position of elevation, and fluid pressure power means for axially moving said ram toward and against said opposite end of said rivet slug, and thereafter said workpieces on said elevator to upset said rivet and to lower said workpieces toward said workhead.

7. The subject matter of claim 6, including also clamp means supported from said frame for pressure application against a workpiece on said workhead.

8. The subject matter of claim 6, wherein the rivet hole in the workpiece engaged by the workhead is countersunk, and wherein said anvil has a workface in a plane raised slightly above the plane of the workhead, and is contoured and dimensioned for entry by a slight distance into said countersink.

9. The subject matter of claim 6, wherein said ram has in its end a socket equal in depth to the thickness of the rivet head desired to be upset on the end portion of a rivet slug engaged by the bottom of the ram socket.

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