

**Nov. 3, 1942.**

**M. C. RICCIARDI**

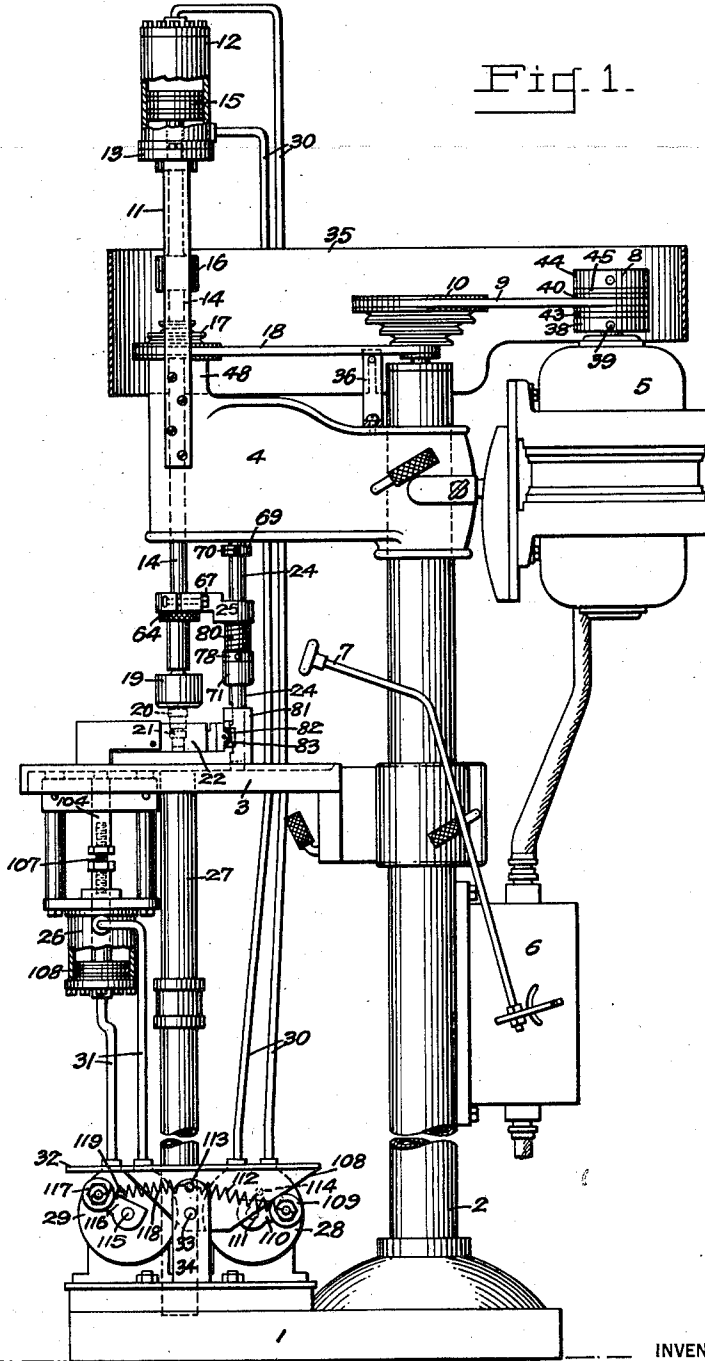
**2,300,435**

# MACHINE FOR ASSEMBLING FUSES

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3 Sheets-Sheet 1

Fig-1-



INVENTOR

Matthew C. Ricciardi

BY

G. Kesemich & J. H. Church

**ATTORNEYS**

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M. C. RICCIARDI

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3 Sheets-Sheet 2

Fig. 2.

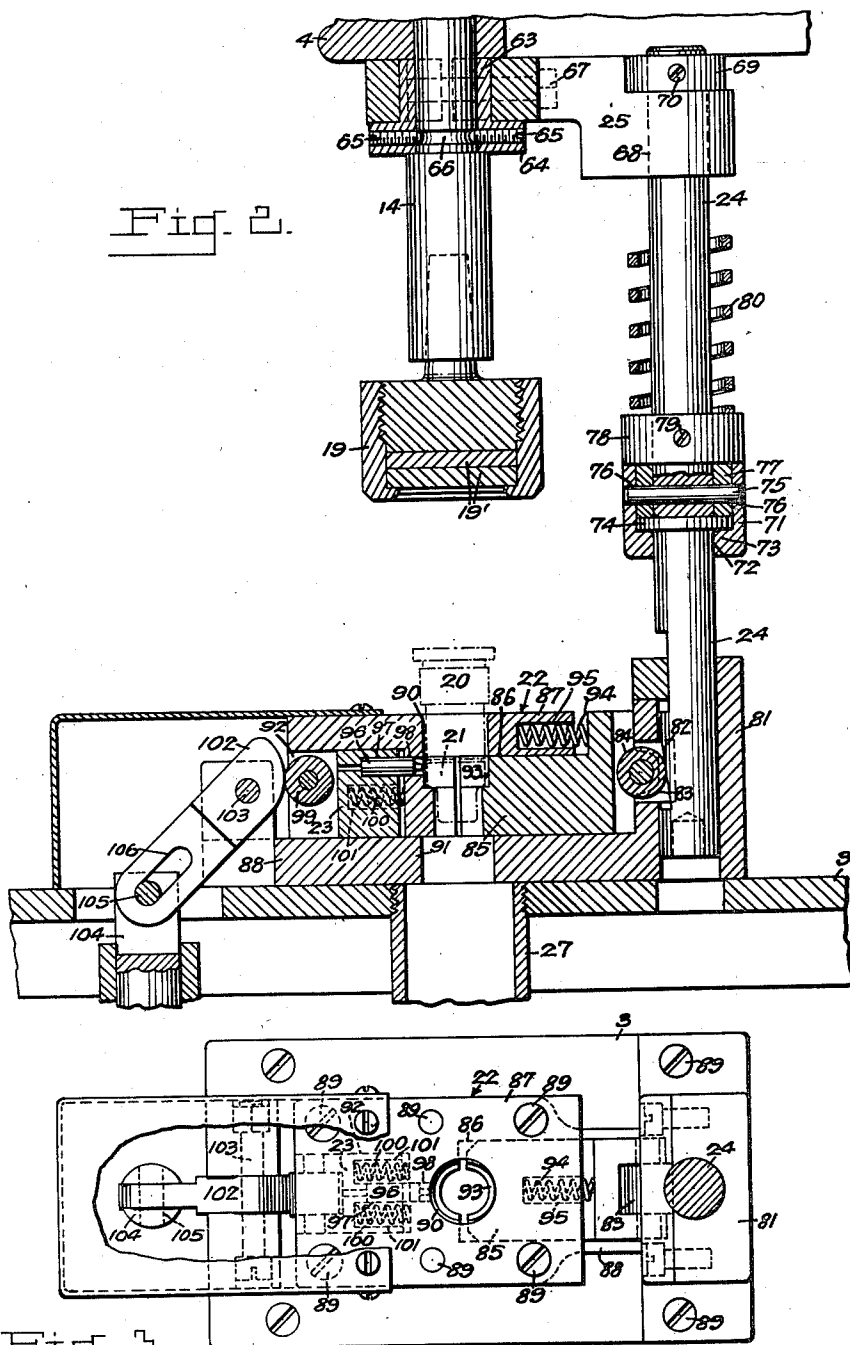


Fig. 3.

INVENTOR  
Matthew C. Ricciardi  
BY *E. Kessanich & J. H. Church*  
ATTORNEYS

**Nov. 3, 1942.**

**M. C. RICCIARDI**

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3 Sheets-Sheet 3

Fig-4-

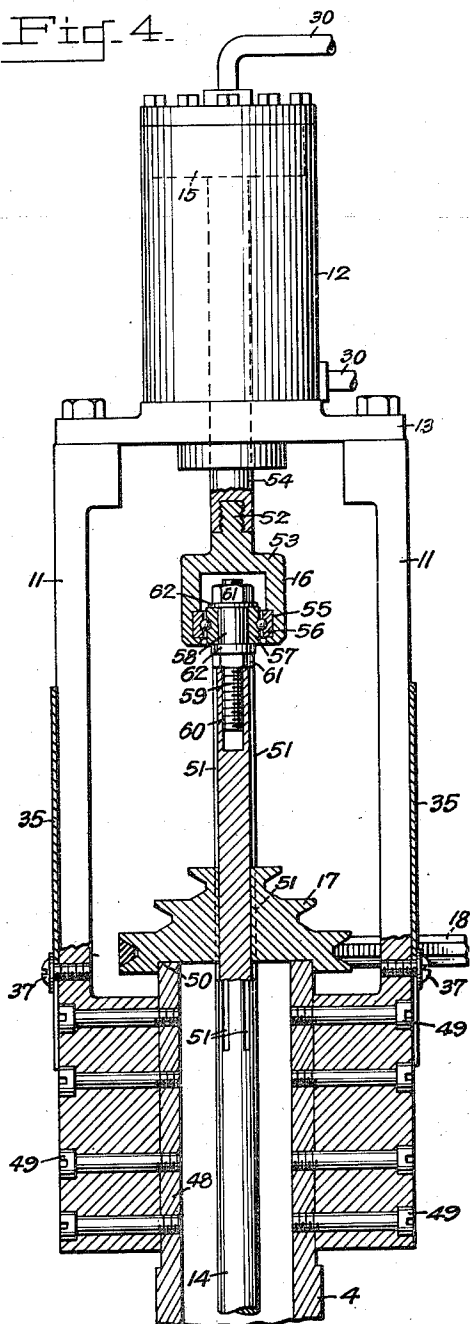


Fig-5-

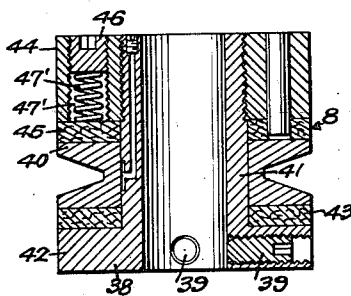
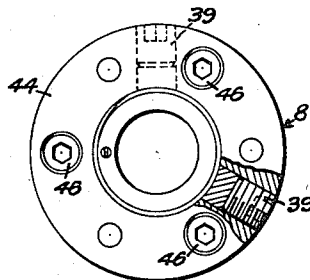


Fig- 6.



INVENTOR

INVENTOR  
Matthew C. Ricciardi

**BY**

BY *G.J. Kessmich & J.W. Church*  
ATTORNEYS

ATTORNEYS

## UNITED STATES PATENT OFFICE

2,300,435

## MACHINE FOR ASSEMBLING FUSES

Matthew C. Ricciardi, Dover, N. J.

Application August 6, 1941, Serial No. 405,677

1 Claim. (Cl. 29—84)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to an assembling machine and more particularly to a device for assembling two or more threaded parts.

An object of the invention is to provide a safe, reliable machine for rapidly assembling threaded articles and positively locking their engaging portions after the assembly operation.

A further object of the invention is to provide a safe, fast machine for assembling threaded ordnance articles which are loaded with an explosive.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a side elevational view of the machine with parts broken away to show details of construction,

Fig. 2 is an enlarged side elevational view with parts in section showing the article holding fixture, the staking mechanism, and the rotary chuck,

Fig. 3 is a plan view of the article holding fixture and the staking mechanism with a portion cut away for clearer illustration,

Fig. 4 is an enlarged front elevation with parts in section of the reciprocating spindle mechanism for actuating the rotary chuck,

Fig. 5 is a vertical longitudinal sectional view of the adjustable torque pulley, and

Fig. 6 is a plan view of the pulley with a portion cut away to show a locking screw.

Referring now to the drawings, a base 1 supports a vertical column 2 which carries a horizontal table 3 positioned at a convenient working height above the level of the floor. A rigid supporting arm 4 is attached to column 2 above the table 3. An electric motor 5 is adjustably mounted on arm 4, but is disposed to one side of table 3. Hung on column 2 below the motor 5 is a starting box 6 which contains a conventional safety switch. The motor 5 is connected to a source of power through the starting box 6. A switch operating lever 7 extends upwardly near the table 3 and is within convenient reach of the operator. The drive shaft of motor 5 is provided with an adjustable torque pulley 8 which is interconnected by a V-belt 9 with a multiple sheave 10 on the column 2.

The outer end of arm 4 has attached thereto a pair of uprights 11 which support a fluid motor 12 on a horizontal plate 13, see Figs. 1 and 4. A reciprocating spindle 14 is connected to the operating piston 15 of the fluid motor 12 by a special coupling 16 which will be described later. Spindle 14 carries a drive sheave 17 which is connected to the multiple sheave 10 by V-belt 18. The lower end of spindle 14 carries a rotary chuck 19 which is adapted to be presented to a threaded work piece 20 which is being assembled to another threaded member 21. Chuck 19 is equipped with suitable disks 19' of friction material.

Table 3 supports a work holding fixture 22 and a tool slide or staking mechanism 23 (see Fig. 2) beneath the axis of spindle 14. The work holder 22 is actuated periodically to clamp the work piece 21 by a cam plunger 24 which is influenced by a bracket 25 on the reciprocating spindle 14. A fluid motor 26 suspended from the table 3 actuates the staking mechanism 23. A pipe 27 is suspended from table 3 directly below the work holder 22 and serves as an explosion chamber.

Valves 28 and 29 on the base 1 control the fluid motors 12 and 26 respectively. Conduits 30 and 31 complete the fluid circuits between the valves and the motor mechanisms. Speed control valves (not shown) for regulating the flow of fluid may be employed in these conduits. A treadle 32 pivoted at 33 to a support 34 controls the valves 28 and 29 and will be described more fully in another part of the specification. Valves 28 and 29 are connected in a convenient manner to a source of fluid pressure (not shown).

A guard 35 in the form of a flat metal band encloses the V-belt drive as shown in Fig. 1 and is attached to the arm 4 by a bracket 36 and to uprights 11 by fasteners 37.

Fig. 5 illustrates a preferred form of the adjustable torque pulley 8. The driving element 38 is attached to the drive shaft of motor 5 by a pair of set screws 39. The driven member 40 rotates on the sleeve portion 41 of the driving element 38 and is separated from its flange 42 by a friction ring 43. A nut 44 is threaded on the sleeve portion 41 of driving element 38 and is separated from the driven member 40 by a friction ring 45. The torque which may be delivered by pulley 8 is regulated by adjusting screws 46 which bear upon compression springs 47 in suitable bores 47' in the nut 45. The amount of pressure exerted by these springs on the friction disk assembly determines the slip and hence the maximum deliverable torque.

Sheave 17 on the reciprocating spindle 14 is driven by pulley 8 through belt 9, sheave 10, and

a belt 13. Arm 4 supports a hollow cylindrical bearing 43 attached by fasteners 49 as shown in Fig. 4. Sheave 17 has a cylindrical depression 50 on its lower face which engages the bearing 43. Spindle 14 has splineways 51 extending for some distance parallel to its axis in the vicinity of the cylindrical bearing 43. Sheave 17 is provided with an axial bore having splines which conform to the splineways 51 on spindle 14 and provide a running fit which permits axial relative movement.

The upper end of spindle 14 is journaled in coupling 16. The coupling 16 is an inverted cup-like member having a central stem 52 attached to its base 53. Stem 52 is attached to piston rod 54 in any convenient manner. The inner periphery of the cup is provided with an annular groove 55 which clamps a bearing race 56. The inner collar 57 of the race 55 envelopes a smooth shank 58 on a threaded stem 59 which is attached to the hollow internally threaded upper end 60 of the spindle 14. Suitable nuts 61 and washers 62 lock the assembly together. The coupling 16 permits the rotation of the spindle 14 by the multiple sheave 17 and in addition allows the fluid motor 12 to reciprocate the spindle simultaneously.

The lower end of spindle 14 projects below arm 4 and carries the chuck 19. Above chuck 19 is a sleeve 63 which is free to rotate on spindle 14, see Fig. 2. Sleeve 63 has a flange portion 64 which is keyed to the spindle 14 by pins 65 which rest in an annular groove 66 in the spindle. The pin and groove assembly prevents axial movement between the sleeve 63 and the spindle 14 but does allow relative rotation. Clamped to the sleeve 63 by pins 67 is the bracket 25 having a bore 68 at the opposite extremity. Bore 68 receives the upper end of cam plunger 24 in a running fit. Collar 69 is secured to the top of plunger 24 by a set screw 70 and enables the spindle 14 and bracket 25 to lift the plunger for a portion of the upward stroke.

Cam plunger 24 is composed of two vertically aligned sections coupled together by a cup-like collar 71 with an aperture 72 in its base. Shoulders 73 on the collar 71 engage the flange 74 on the lower plunger section and a pin 75 is pressed fitted in diagonally disposed apertures 76 in the collar 71, bushing 77, and the lower end of the upper plunger component, see Fig. 2. An adjustable collar 78 is mounted on the upper cam plunger member above collar 71 and is secured by a set screw 79. A coiled spring 80 encircles the upper cam plunger component and rests on the adjustable collar 78. A clearance or gap exists between the base of bracket 25 and the top of coiled spring 80 when the chuck is in its retracted position as shown in Fig. 2. This gap may be reduced by moving the adjustable collar up on plunger 24 and clamping the collar in the desired position. This causes the bracket 25 to engage the spring 80 a little sooner on the down stroke of the chuck 14.

The lower end of cam plunger 24 is received in a guide 81 mounted on the table 3. A portion of the periphery of plunger 24 is provided with an angular cam face 82 which is directed toward the work holder 22. Cam face 82 engages a roller 83 on a shaft 84 fixed to a sliding jaw 85. This jaw is adapted to reciprocate in a guide channel 86 in a fixed block 87 which constitutes the immovable portion of the work holder 22.

Block 87 rests on an apron extension 88 to the guide 81. Both the block and apron are attached

to the table 3 by suitable fasteners 89. The block 87 and apron 88 are provided with apertures 90 and 91 respectively which are disposed beneath the axis of spindle 14 and in alignment therewith. Aperture 96 is somewhat larger than the work pieces 20 and 21 which are to be assembled and is shaped to receive them as shown in Fig. 2. A guide channel 92 is located in block 87 adjacent aperture 93 opposite guide channel 86 and receives the tool slide 23. Jaw 85 has an arcuate engaging portion 93 conditioned to engage and clamp the lower work piece 21 against rotation and downward movement in a manner to be presently described.

When cam plunger 24 descends, cam face 82 thrusts the roller 83 on the sliding jaw 85 to the left against the resistance of coil spring 94 in a bore 95 in the fixed block 87. Sufficient downward movement of the plunger 24 will force the jaw 85 against the work piece 21 and clamp the work piece in the fixed block 87. The movement necessary to actuate jaw 85 can be regulated by the position of collar 78 on the plunger 24. Work piece 20 is free to rotate in aperture 90 and may thereby be tightened on work piece 21 by the influence of rotary chuck 19.

A staking pin 96 is press fitted in a passage 97 in the tool slide 23 and is in alignment with an aperture 98 in the fixed block 87. Pin 96 is adapted to reciprocate in aperture 98. Slide 23 has a roller 99 mounted on its left hand end and the slide is normally held to the left by a pair of springs 100 resting in bores 101. When the slide 23 is moved to the right against the resistance of springs 100, the staking pin 96 is forced into the previously clamped work piece 21.

Cam lever 102 is pivoted at 103 to the fixed apron 88 on the table 3. Lever 102 is connected to a piston rod 104 through a pin 105 and a slot 106. Piston rod 104 is a divided member of adjustable length. Length adjustment is accomplished by a turnbuckle arrangement 107 between the two portions, see Fig. 1. Piston rod 104 is secured to the piston 108 of the lower fluid motor 26. Upward movement of the piston rod 104 rotates the cam lever 102 and forces the tool slide 23 and its staking pin 96 through the aperture 98 into the work piece 21. Depth control of the staking device is accomplished by the turnbuckle arrangement 107.

Control valve 28 is opened to permit fluid to act on the top of piston 15 of fluid motor 12 when the treadle 32 is rocked clockwise to the position shown in Fig. 1. This forces the spindle 14 and chuck 19 toward the work holder 22. Treadle 32 has a cam face 108 which engages a roller 109 on a lever 110 attached to a valve stem 111 of the valve 28. A spring 112 is attached to the lever 110 and to a pin 113 on the support 34 and is adapted to return the lever and treadle to their normal positions when foot pressure is released. A stop pin 114 on the valve 28 limits the counterclockwise movement of the lever 110. When the lever 110 is in engagement with the stop pin 114, fluid pressure is applied to the under side of piston 15 and lifts the spindle 14 and chuck 19 away from the work holder 22 to the position shown in Fig. 2.

Coupled to the valve stem 115 of valve 29 is an operating lever 116, a roller 117, and a return spring 118. Stop 119 limits the clockwise movement of valve lever 116. When the lever 116 engages the stop 119, fluid pressure is applied to the top of piston 108 of motor 26 so that the piston is in the bottom of its cylinder as shown

in Fig. 1. When the treadle 32 is swung counterclockwise, roller 117 is engaged by the treadle, the valve lever 116 is depressed and valve 29 is actuated to reverse the flow of fluid and force piston 108 upward. When all pressure is released from the treadle 32, the springs 112 and 118 carry the levers 110 and 116 against their respective stop pins 114 and 119 and the treadle 32 is returned to its normal position.

The operation of the device is as follows: The motor 5 is energized by closing the safety switch in the starting box 6 with the switch operating lever 7. The motor is permitted to rotate throughout the entire period in which articles are to be assembled. Chuck 19 is rotated by the previously described V-belt drive. Work pieces 20 and 21 which were previously manually started into threaded engagement are placed in the aperture 90 of the work holder 22. At this time the members 20 and 21 rest loosely in the aperture 90 and the rotating chuck is disposed as shown in Fig. 2.

When treadle 32 is rocked clockwise to a position as shown in Fig. 1, lever arm 110 is swung away from stop 114 and pressure is applied to the top of piston 15 of motor 13 and the rotating spindle 14 is actuated downward. Splines 51 on the spindle 14 slide downward in the splined bore in the sheave 17. The sheave rotates on its bearing 48-50 and the upper end of the spindle rotates in the bearing race 56 in coupling 16.

As the chuck 19 approaches the work piece 20 in work holder 22 bracket 25 depends with it. The bracket comes into engagement with the coiled spring 79 on the cam plunger 24 and proceeds to compress it. When the spring 79 is sufficiently compressed, force is transmitted to the cam plunger 24 through the collar 77 and the plunger descends in its guide 81. The angular face 82 acting through roller 83 cams the sliding jaw 85 to the left against the resistance of spring 94. Jaw 85 engages the lower work piece 21 and forces it against the left wall of aperture 90 and holds it securely whereupon chuck 19 comes into engagement with the rotatable upper work piece 20. Chuck 19 proceeds to turn work piece 20 into member 21 and tightens it thereto. When the components are tightened to the proper degree, slip occurs between the driving element 38 and the driven member 40 of the adjustable torque pulley 8. Chuck 19 ceases to rotate indicating to the operator that the threading operation is completed.

The treadle 32 is swung counterclockwise and lever 116 is depressed from its stop 119 whereupon fluid pressure is applied to the bottom of piston 108. Piston 108 and its rod 104 move upward and rotate cam lever 102 about its horizontal pivot 103. Tool slide 23 which carries the staking pin 96 is forced to the right against the resistance of springs 100. Pin 96 sinks into the work piece 21 in its threaded zone and upsets a thread or threads thus positively locking the two components 20 and 21 together.

When treadle 32 was swung counterclockwise to perform the staking operation, the valve 28 was reversed to start the piston 15 and the spindle upward. Cam plunger 24 does not immediately ascend since bracket 25 on the spindle

14 remains in engagement with the loaded or previously compressed spring 79. Sufficient force is applied to the cam plunger 24 through the loaded spring 79 during the initial upward movement of the spindle 14 to retain the sliding jaw 85 in clamping engagement with the work piece 21. Thus the work piece 21 is securely held during the momentary staking operation by the pin 98.

When the staking operation is completed, the operator's foot is removed from the treadle 32 or pressure is released therefrom and the springs 112 and 118 pull the valve levers 110 and 116 against the stop pins 114 and 119 respectively. Chuck 19 and spindle 14 ascend and near the top of the stroke, bracket 25 is separated from the spring 79 as shown in Fig. 2 and it lifts the cam plunger 24 by the collar 69 on the upper end thereof. Jaw 85 is no longer cammed to the left and spring 94 forces the jaw away from the work piece 21. Tool holder 23 and the staking pin 97 are forced to the left or inoperative position by springs 100 when the piston 108 moves downward.

The assembled work pieces 20 and 21 may be removed and new components inserted in the work holder to be assembled in the manner previously described.

When components which are loaded with explosives are being assembled, there exists the danger of a fortuitous explosion. Maximum protection is provided for the operator by employing the explosion chamber 27 beneath the aperture 90 and the work holder. The disruptive forces of the explosion are directed harmlessly into the chamber 27. Ordnance material such as fuses may be safely and successfully assembled in this machine.

The adjustable torque feature in the drive prevents the assembly of distorted or imperfectly threaded members.

It is evident from the above description that an operator may safely, quickly and accurately assemble threaded work pieces with a minimum amount of effort, thus increasing production and reducing fatigue.

I claim:

In a device for assembling a pair of threaded articles, a work holder having an article receiving aperture therethrough, clamping means for one of said articles and resilient means biasing said clamping means to open position, a shaft carrying a rotary chuck for driving the other of said articles, power means for advancing said chuck into driving engagement with said last-mentioned article and for withdrawing the same, cam means for operating said clamping means, resilient means on said cam means and means on said shaft to operate said cam means through said resilient means, whereby said cam means will lag said shaft and chuck on withdrawal, staking means in said holder positioned to seal the thread joint on the articles, power means and associated means to actuate the staking means, and interconnected control means for the chuck and staking means whereby the staking means is caused to function on withdrawal of said chuck but prior to opening of said clamping means.

MATTHEW C. RICCIARDI.