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2,140,658

RIVETING MACHINE

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2 Sheets-Sheet 1

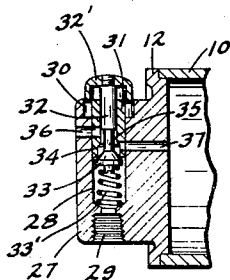
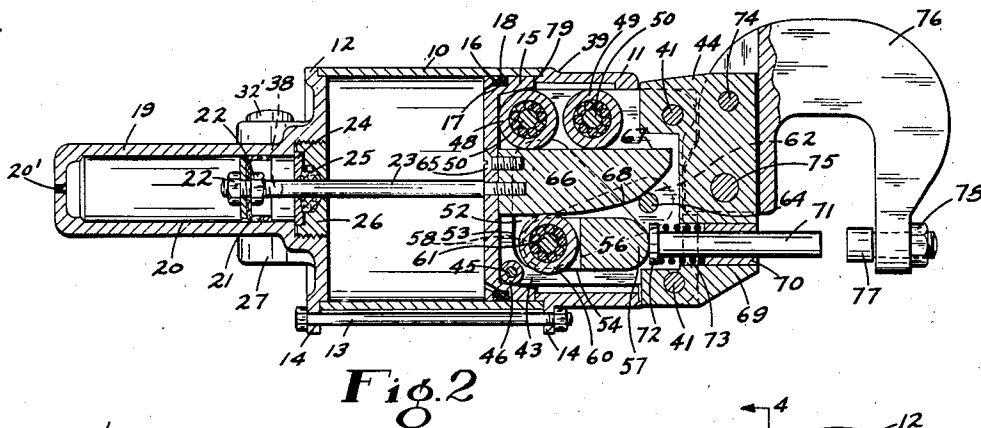
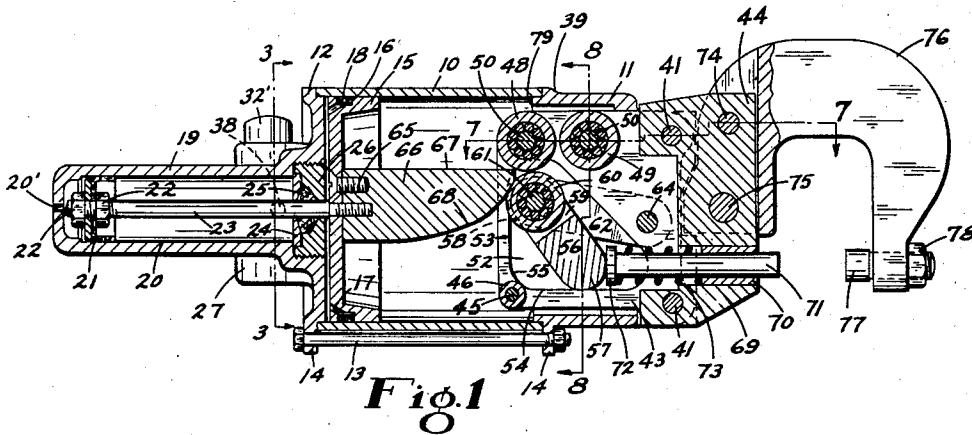


Fig. 5

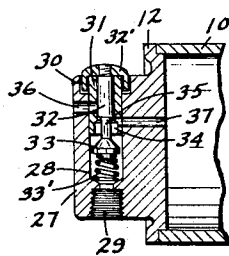


Fig. 4

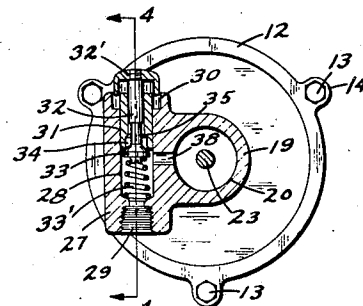


Fig. 3

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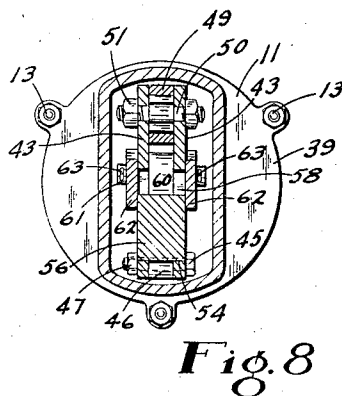
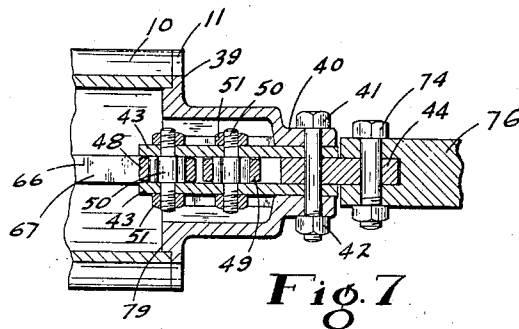
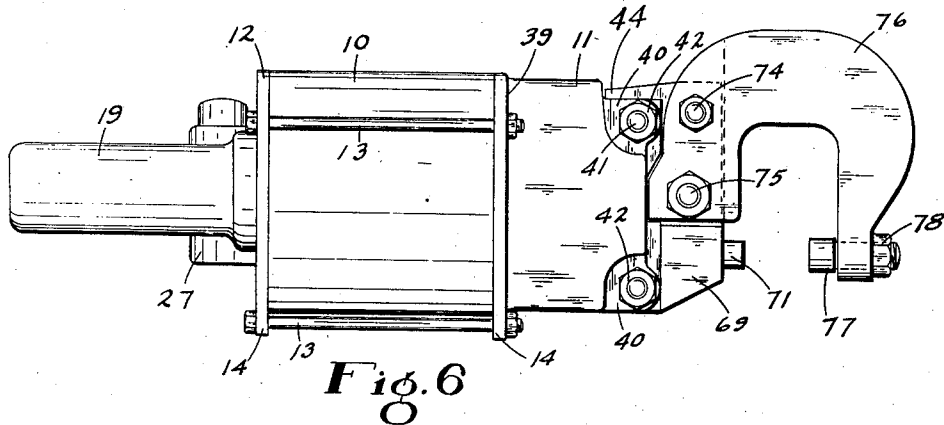
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RIVETING MACHINE

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2 Sheets-Sheet 2



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2,140,658

RIVETING MACHINE

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17 Claims. (Cl. 74-110)

This invention relates broadly to machines for performing such work as riveting, stamping, punching, shearing or pressing. More particularly, this invention relates to riveting machines, wherein pressure rather than impacts is applied against the rivet.

One object of this invention is to produce an improved portable riveting machine of the squeezer type wherein the initial pressure applied on the rivet is effected by a relatively rapid travel movement of the working plunger, which movement is gradually made slower to increase the pressure applied on the rivet as the pressure required to continue the riveting operation increases.

Another object of this invention is to provide a riveting machine of the wedge type with a mechanism for multiplying the riveting power normally delivered by the wedge.

Another object of this invention is to produce an improved portable riveting machine of simple construction forming a compact assembly which is strong, durable and efficient.

Another object of this invention is to provide a portable riveting machine of the squeezer type with means for effectively reducing the frictional resistance between the engaging movable parts of the machine.

Other objects and advantages more or less ancillary to the foregoing and the manner in which the various objects are attained reside in the specific construction and aggroupment of the elements peculiar to this structure, as will become apparent from a more complete examination of this specification, in the claims of which there are assembled certain specific combination of parts and specific constructions indicative of the scope and spirit of the invention.

In the drawings:

Fig. 1 is a longitudinal sectional view of a riveting machine illustrating a preferred form of the invention.

Fig. 2 is a view similar to Fig. 1 showing the movable parts in a different position.

Fig. 3 is a cross sectional view taken through the line 3-3 in Fig. 1.

Figs. 4 and 5 are cross sectional views taken through the line 4-4 in Fig. 3 and showing the valve in different positions.

Fig. 6 is a longitudinal side view of the machine.

Fig. 7 is a longitudinal sectional view taken through the line 7-7 in Fig. 1.

Fig. 8 is a cross sectional view taken through the line 8-8 in Fig. 1.

Referring to the drawings in which like symbols designate corresponding parts throughout the several views, 10 represents a cylinder clamped between a front housing 11 and back head 12 by three bolts 13, which extend through apertured lugs 14 projecting laterally of the housing 11 and back head 12. Reciprocally mounted within the cylinder 10, there is a piston 15 formed with an annular groove 16 which communicates with the rear end of the piston through a small port 17. Within the groove 16 is mounted an annular packing 18 assuring a fluid tight engagement of the piston with the inner wall of the cylinder.

The back head 12 is provided with a rearwardly extending portion constituting a cylindrical handle 19. This handle is formed with a cylindrical bore or auxiliary cylinder 20, disposed coaxially with the cylinder 10, and constantly open to the atmosphere through a small vent 20'. Within the cylinder 20, there is reciprocally mounted an auxiliary piston 21 having secured thereto by nuts 22 a piston rod 23, which rod extends into the cylinder 10 where it is secured to the piston 15 for movement therewith. Terminating the inner end of the auxiliary cylinder 20, there is a plate 24 supporting packing material 25 which is disposed around the piston rod 23. This packing material may be adjustably compressed by a nut 26 screwed within the back head 12.

On one side of the handle 19, the back head 12 is formed with a boss 27 having a bore 28 extending therethrough and terminated at one end by a screw threaded connection 29 through which pressure fluid may be admitted into the bore 28. The other end of the bore 28 is enlarged to form a counterbore 30. Pressed within the counterbored end portion of the bore 28, there is a stationary bushing 31 having a throttle valve 32 slidably mounted therein, and formed with a beveled head 33. This throttle valve extends to the exterior of the bushing to receive an operating button 32' slidably mounted within the counterbore 30. Adjacent the head 33, the bore of the bushing 31 accommodating the valve 32 is slightly enlarged to form an annular passage 34, while the beveled head 33 is engageable with the outer edge of this enlargement to prevent communication of the latter with the bore 28. Disposed within the bore 28, there is a compression spring 33' acting on the valve for constantly urging it in a closed position. Adjacent the annular passage 34, the valve 32 is reduced in diameter to form a neck around which communication may be had be-

tween a port 36 leading from inside of the bushing 31 to the atmosphere and a port 37 leading from the annular passage 34 into the rear end of the cylinder 10. Leading from the bore 28 into the end of the auxiliary cylinder 20 adjacent the plate 24, there is an inlet port 38.

The front housing 11 is formed with a circular flange 39 corresponding to the contour of the adjacent end of the cylinder 10. Below this flange, the cross sectional shape of the front housing is substantially rectangular as shown in Fig. 8, with the four front corners depressed to form apertured lugs 40. Clamped within the front end of the front housing 11 by bolts 41 extending through the apertured lugs 40 to receive nuts 42, there are two parallel plates 43 spaced from each other by a connecting block 44 which extends exteriorly of the housing. The two plates extend through the front housing into the adjacent end portion of the cylinder 10, where they are again tied to each other by a bolt 45 carrying a spacer 46 and extending through the plates to receive a nut 47. Toward one side, the plates 43 carry between them two roller or antifriction bearings 48 and 49, each mounted on a shaft 50 which extends through the plates to receive the nuts 51 by which the shafts are locked against axial movement. Each plate is provided with a triangular opening 52 having two sides 53 and 54 disposed at right angle with each other and united by an arcuated wall 55. Movably mounted within the opening 52, there is a link or driving member 56, which extends laterally from the external wall of one plate 43 to the external wall of the other. This driving member has a rounded or driving end 57 slidably engaging the side wall 54 of the openings 52, which side wall constitutes a guide for the link 56. The other end of the link 56, hereinafter denoted as driven end 58, is formed with a slot 59 of a width equal to the space between the plates 43, within which slot is mounted a roller bearing 60 carried by a shaft 61 extending through the member. This last shaft is of sufficient length to extend beyond the side walls of the driving member 56 to pivotally receive the rear end portion of two links 62 retained on the shaft 61 by cotter pins 63. These two links are mounted in straddle relation with the driving member 56, and extend forwardly outside of the plates 43 where they have their front end portion pivotally connected to the front end portion of the plates by a pin 64.

Rigidly secured to the front face of the piston 15 by screws 65, there is a wedge 66 having a straight back wall 67 engageable with the roller bearings 48 and 49, and an especially shaped actuating front wall 68 engageable with the roller bearing 60. In thickness, this wedge is somewhat smaller than the space between the plates 43, thus permitting the slidable movement of the former between the plates.

Exteriorly of the front housing 11, the connecting block 44 is formed with an aperture boss 69 having a bushing 70 fastened therein through which slides a plunger or tool 71 having a rectangular head 72 slidably mounted between the plates 43. This head is constantly urged into engagement with the driving end 57 of the movement transmitting member 56 by a compression spring 73 interposed between the head 72 and the bushing 70.

Detachably secured to the connecting block 44 by cross bolts 74 and 75, there is a yoke 76 carrying a removable anvil or work engaging element

77 which is secured thereon coaxially with the plunger 71 by a nut 78.

In the operation of the machine, pressure fluid is admitted into the back head bore 28 through the inlet connection 29. From the bore 28, the pressure fluid is constantly admitted into the auxiliary cylinder 20 through the port 38 for urging the auxiliary piston 21 as well as the piston 15 toward the position shown in Fig. 1. When the throttle valve 32 is positioned as shown in Fig. 4, the pressure fluid from the bore 28 will flow into the cylinder 10 through the annular passage 34 and port 37 to exert pressure on the piston 15 for driving it forwardly.

Simultaneously, the pressure fluid will flow into the piston groove 16 through the port 17 for acting under the packing 18 to assure a fluid tight joint of the piston with the inner wall of the cylinder 10. When the piston 15 is positioned as shown in Fig. 1, that is at the beginning of its forward stroke, it will be noted that the lever 56 is positioned at substantially 45 degrees with respect to the guides 54. As the piston 15 moves forwardly, the actuating wall 68 of the wedge 66 engaging the bearing 60, will effect the pivotal movement of the driven end 58 of the lever or member 56. This predetermined movement is assured through the guiding effect of the links 62 pivotally supporting the driven end of the member 56. Simultaneously, the driving end of the member 56 will slide forwardly on the guides 54, and thereby transmit the slidable movement of the wedge 66 to the tool or plunger 71. During the early part of the piston's forward stroke, the actuating wall of the wedge 66 engaging the roller bearing 60 is formed with a relatively abrupt curvature, which will cause a quick movement of the link 56 along the guides 54, and the consequential rapid movement of the plunger 71 into contact with the rivet. As the piston 15 continues its forward travel, it will be understood that the link 56 is gradually moved into coaxial alignment with the plunger 71, thus causing the driving end 57 of the link 56 to move forwardly at a gradually reduced rate of speed. This gradual speed variation of the end 57 of the link 56 will also cause the plunger 71 to move forwardly at a gradually decreasing rate of speed, and therefore gradually increasing the upsetting or riveting power of the plunger. To further increase the power transmitted to the plunger 71, the remaining portion of the actuating wall 68 is shaped to form a relatively slow curvature gradually merging with the front straight edge of the wedge 66, thus gradually reducing the rate of speed of the driving end 58 of the link 56 during a constant rate of speed of the piston 15 and wedge 66. As the upsetting operation of the rivet proceeds, the plunger 71 is subjected to a gradually increasing resistance developed by an enlargement of the cross section of the rivet to be upset. The shape of the actuating wall 68 and the disposition of the link 56 within the opening 52 of the plates 43 is calculated to transmit a gradually increasing power to the plunger 71 in a manner proportional to the increased resistance to which the plunger is subjected. The links 56 and 62 form a linkwork or a system of interconnected links having one end of the system pivotally connected to the housing 11 by the plates 43 carrying the shaft 64, while the other end of the system rests on the plunger 71. During the transmission of power, the load is carried by the linkwork and its component shafts 61 and 64. The load to which the

bearing 60 is subjected during the transmission of power from the wedge 66 to the link 56, is calculated to be the maximum load which a bearing of this type can safely carry. From the bearing 60 to the plunger 71, the power is again increased due to the reduced rate of speed at which the driving end 57 of the link 56 travels on the guides 54. It will also be noticed that during the movement of the piston, the straight back edge 67 of the wedge 66 is resting against the roller bearings 48 and 49, thus preventing possible binding of the piston 15 within the cylinder 10.

The forward stroke of the piston 15 is limited by its engagement with the front housing as at 79. When the piston reaches the end of its forward stroke, the upsetting or riveting operation is completed. Thereafter the operator will remove the manual pressure exerted on the operating button 32' of the throttle valve 32, thereby allowing the throttle valve, due to the action of the compression spring 33', to return into the position shown in Figs. 3 and 5 for preventing the admission of the pressure fluid into the cylinder 10. In this last position of the throttle valve, the pressure fluid is free to exhaust from the cylinder 10 via the port 37, the annular passageway 34 and the exhaust port 36. Thereafter, the pressure fluid constantly admitted into the auxiliary cylinder 20 through the port 38 will drive the auxiliary piston 21 rearwardly. Since the piston 21 is connected to the piston 15 by the piston rod 23, the piston 15 will also be driven rearwardly or into the position shown in Fig. 1.

The above description is primarily directed to a riveting machine wherein the yoke 76 or the anvil 77 may be changed at will to meet any conditions and suit any kind of work to be riveted. However, it will be understood that by changing the plunger or tool 71 and the anvil 77, the riveting machine may be transformed into a stamping, punching or shearing machine, and it will also be understood that various rearrangements of parts and modifications of structural detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In a tool of the character described, a housing, a plunger longitudinally movable with respect to said housing, a linkwork having one end pivotally connected to said housing and the other end bearing on said plunger, and a longitudinally movable power driven wedge within said housing engaging said linkwork for imparting longitudinal movement to said plunger.

2. In a tool of the character described, a housing, a plunger slidable relative to said housing, a system of interconnected links having one end of the system pivotally connected to said housing and the other end engaging said plunger, and a fluid actuated member engaging said system at a place intermediate the ends thereof for imparting slidable movement to said plunger at a gradually decreasing rate of speed relative to the rate of speed of said member.

3. In a tool of the character described, a housing, an element slidable relative to said housing, a system of interconnected links having one end of the system engaging said element, stationary supporting means carried by said housing having the other end of said system pivotally connected thereto, antifriction bearings carried by said system and said supporting means, and a power driven wedge insertable between said bear-

ings for effecting the slidable movement of said element.

4. In a tool of the character described, a housing, a pair of parallel plates detachably secured to said housing, a plunger slidable between said plates, a system of interconnected links having one end of the system pivotally connected to said plates and the other engaging said plunger, and a power driven wedge engaging said plates for slidable guided movement therebetween and acting on said system for effecting the slidable movement of said plunger.

5. In a tool of the character described, a housing, a pair of parallel plates rigidly secured to said housing, an opening through said plates, a plunger slidable between said plates, a duality of interconnected links one pivotally connected to said plates and the other slidably guided within said opening in engagement with said plunger, and a power driven wedge slidable between said plates and acting on said last mentioned link for effecting the slidable movement of said plunger.

6. In a tool of the character described, a housing having a pair of parallel plates rigidly secured thereto, a work performing plunger slidable between said plates, a system of interconnected links including a driving link engaging said plunger for effecting the working stroke thereof and a supporting link pivotally connected to said plates, guiding means for said driving link assuring a predetermined movement thereof resulting in the working stroke of said plunger, and a power driven wedge acting on said driving link for effecting the aforesaid movement thereof.

7. In a tool of the character described, a housing having a pair of parallel plates secured thereto, a plunger slidable relative to said plates, a driving member having one end engaging said plunger, a link pivotally supporting the other end of said member, guiding means within each of said plates slidably engaged by said member for assuring a predetermined movement of the latter resulting in the slidable movement of said plunger, and a power driven wedge acting on said member for effecting the aforesaid movement thereof.

8. In a tool of the character described, the combination of a housing, of a bushing carried thereby having a tool slidable therethrough, of a power actuated member slidable relative to said tool, power transmitting means between said member and tool for effecting the working stroke of said tool including a movable element mounted for end engagement with said member and tool, and guiding means slidably engaged by said element for causing the engaging end thereof with said tool to travel at a lesser rate of speed than that of its engaging end with said member.

9. In a tool of the character described, a work performing element, a power driven wedge movable relative to said element, and pressure multiplying means between said wedge and element for effecting the work performing movement of said element including a member having a driven end acted upon by said wedge and a driving end acting on said element, said driven and driving ends having independent guiding means effecting predetermined movement of said ends resulting from the action of said wedge on said driven end.

10. In a tool of the character described, a work performing element, a power driven wedge movable relative to said element, a work performing movement transmitting member between said element and wedge having a driven end acted upon by said wedge and a driving end acting on said element, and pressure multiplying means for

said member including guiding means effecting individual movement of the ends of said member due to the action of said wedge on said driven end.

- 5 11. In a tool of the character described, a work performing element mounted for slidable movement, a power driven member slidable parallelly of said element, and means for transmitting the slidable movement of said member to said element at a reduced rate of speed including a wedge 10 carried by said member.

12. In a tool of the character described, a housing having a work performing element slidable relative thereto, a power driven wedge capable 15 of limited slidable movement lengthwise of said element, means for transmitting the slidable movement of wedge to said element at a reduced rate of speed including a member interposed diagonally between said wedge and element during the initial slidable movement of said wedge, 20 and guiding means engaged by said member for causing the latter to assume a position substantially perpendicular to said element toward the end of the slidable movement of said wedge.

- 25 13. In a tool of the character described, a reciprocable plunger, means for effecting a working stroke to said plunger including a power driven wedge movable parallelly to the axis of movement of said plunger, a movement transmitting member between said wedge and plunger 30 having one end movable transversally and the other end perpendicularly relative to said plunger, and guiding means for said member assuring the transversal and perpendicular movements 35 aforesaid.

14. In a tool of the character described, a slidable working element, a power actuated slidable wedge, and means responsive to the slidable

movement of said wedge for imparting a power stroke to said element including a guided member interposed between said wedge and element having one end slidable transversally and the other end slidable parallelly to the axis of movement of said wedge. 5

15. In a tool of the character described, a slidable working element, a power actuated slidable wedge, and means responsive to the slidable 10 movement of said wedge for imparting a working stroke to said element including an elongated member interposed between said wedge and element and movable by said wedge from an initial oblique position relative to said element to a final substantially coaxial position relative thereto for effecting the working stroke of said element 15 at a gradually reducing rate of speed.

16. In a tool of the character described, a slidable working element, a power actuated slidable wedge, and means responsive to the slidable 20 movement of said wedge for imparting a working stroke to said element including a member interposed between said wedge and element, guides angularly disposed relative to each other and engaged by said member for predetermined movement thereof effecting the working stroke of said element at a lesser rate of speed than that of 25 said wedge.

17. In a tool of the character described, a housing, a slidable plunger, a linkwork having 30 one end pivotally connected to said housing and the other end bearing on said plunger, and a power driven member within said housing slidable lengthwise of said plunger and engaging said linkwork for imparting slidable movement 35 to said plunger.

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