# United States Patent

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## [54] RIVET SLUG INJECTOR


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[73] Assignee: **McDonnell Douglas Corporation**



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[52] **U.S. Cl.** ..... **221/241**, 221/267

[51] **Int. Cl.** ..... **B65h 31/20**

[58] **Field of Search** ..... 227/51, 53; 221/1, 2, 4, 241, 221/239, 255, 258, 267, 268, 233-235, 236, 238, 269, 271-276, 256, 257



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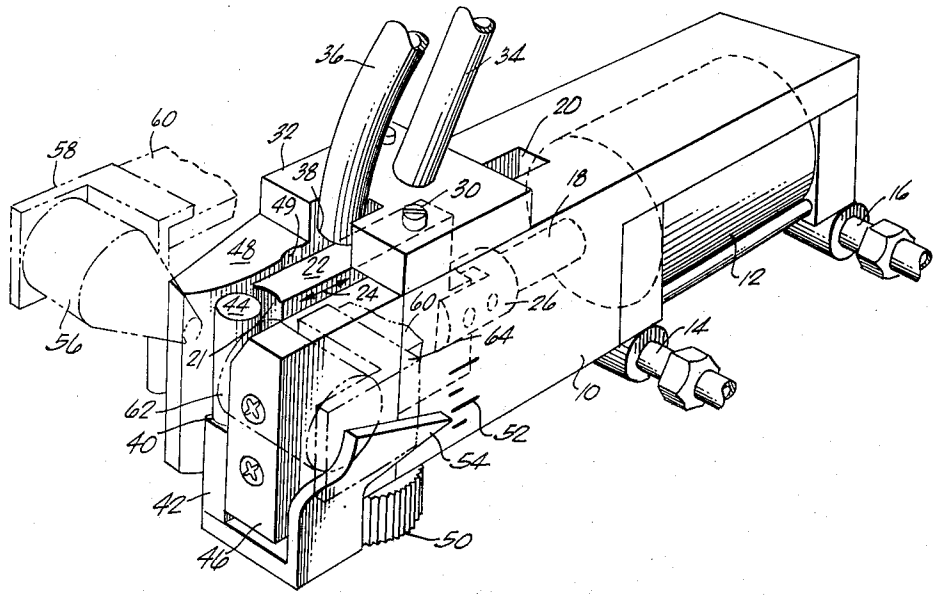
[57] **ABSTRACT**

An intermittent acting mechanism receiving rivet slugs from the delivery tube of a rivet dispenser for injecting each slug into a spring loaded finger mechanism which, in turn, inserts the slug into a previously drilled hole for a rivet upsetting action by an automatic riveting machine. A photoelectric cell verifys insertion of the rivet slug into the finger mechanism and signals for the next step in the drilling operation. An adapter unit permits rapid and accurate conversion for slugs of different diameters and lengths without extensive alignment and readjustment.


**2 Claims, 5 Drawing Figures**



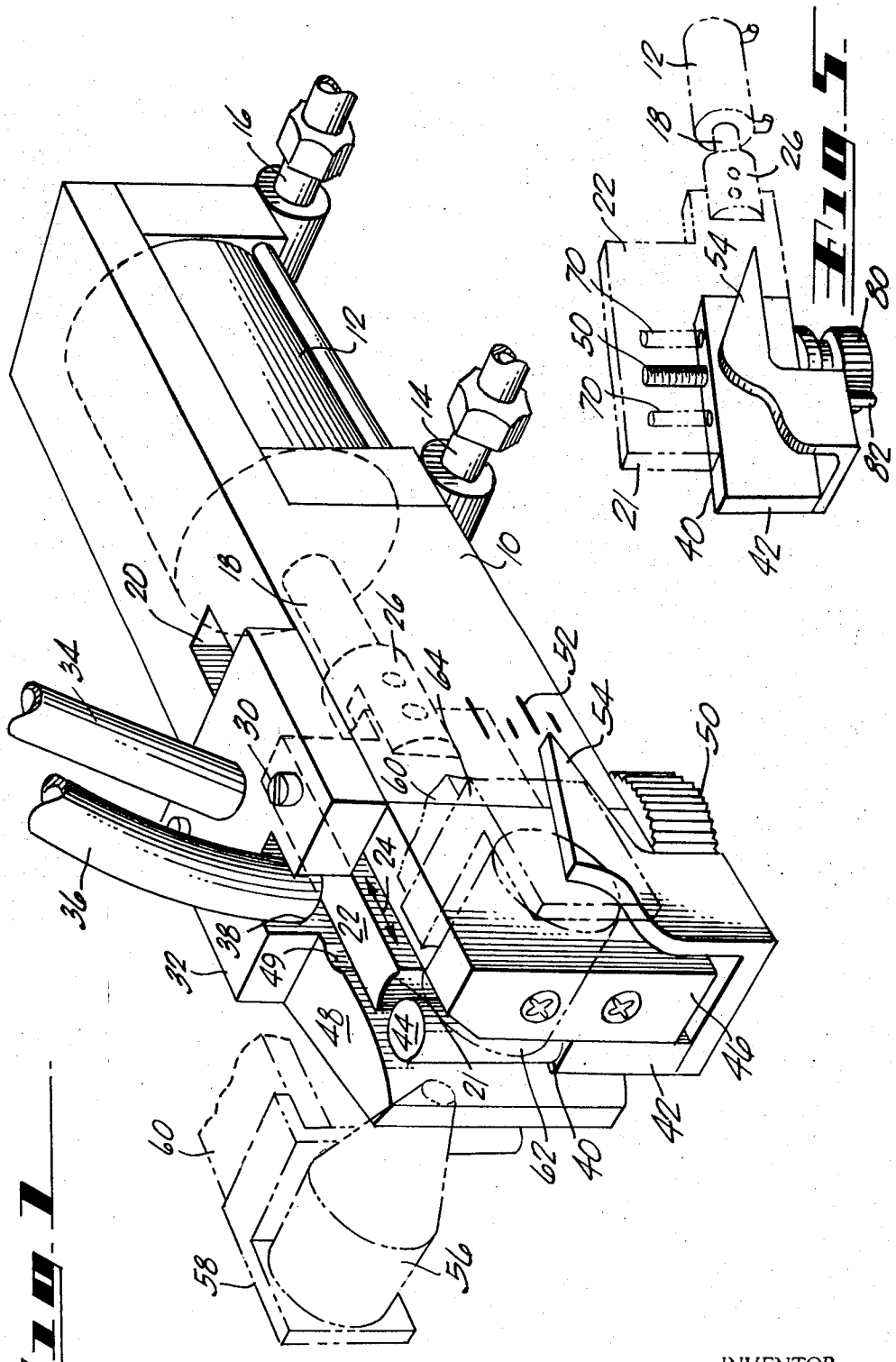


FIG. 1



FIG. 5

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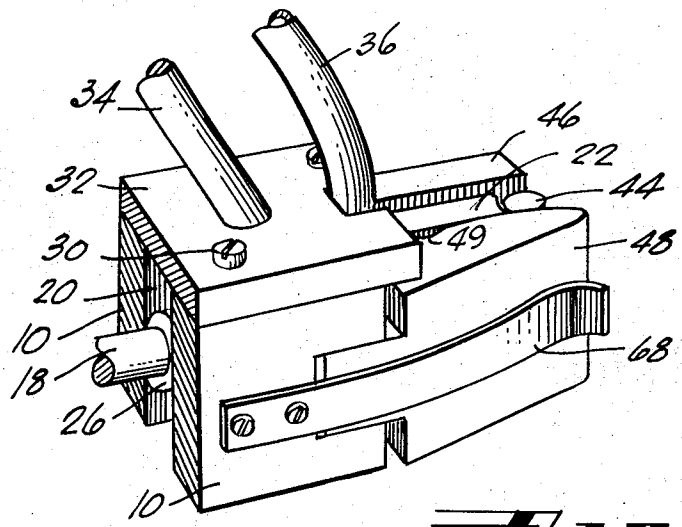


Fig. 2

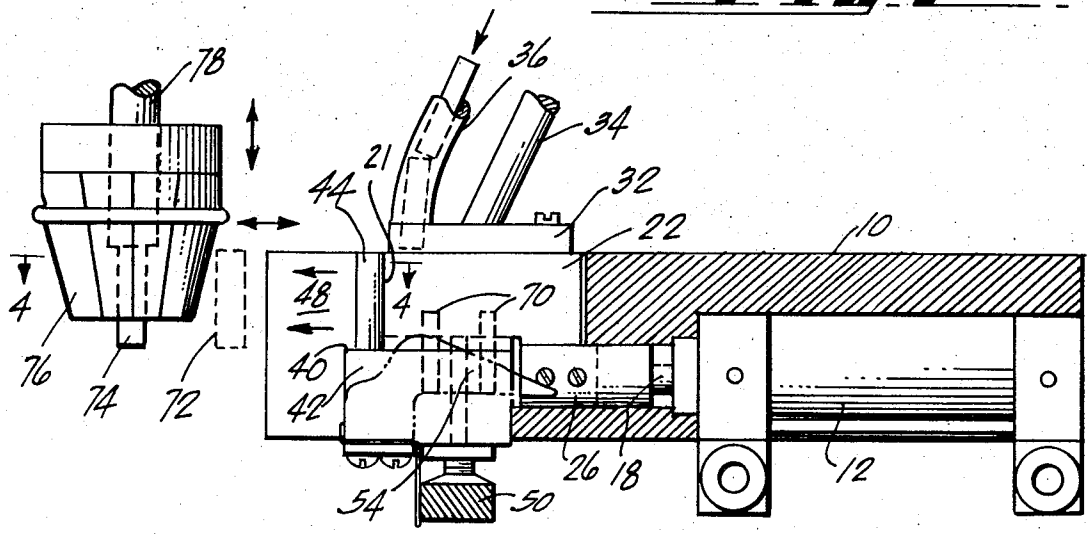


Fig. 3

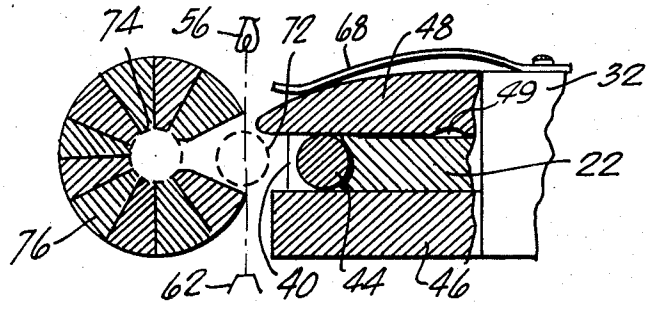


Fig. 4

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# RIVET SLUG INJECTOR

## BACKGROUND OF THE PRESENT INVENTION

For automatic riveting machines, a quantity of rivet slugs are placed in a rivet dispenser which, in turn, channels the slugs into a tube in end-to-end relationship. Each slug is then moved by a rivet slug injector from this dispenser tube into a finger mechanism which, in turn, inserts the slug into a previously drilled hole and the riveting action takes place. Since rivets are of various sizes and lengths, adjustments must be made when converting from one size to another.

Much non-productive time occurs when rivet slug injectors of present design are used and it is desired to change rivet slug diameters. Trail and error adjustments are presently required by such a conversion and time losses are attributable to the malfunction of the present injectors. In the conversion of a riveting machine to drive rivet slugs of another size, the type of injector now in use must be removed and replaced with a similar unit of appropriate capacity. The photoelectric cell obstructs access to the injector mechanism and must be removed, replaced and realigned. Alignment of the cell for proper operation is critical and the conversion also entails bending the rivet slug delivery tube to achieve proper alignment with the alternate injector. These adjustments are of a trial and error nature and when not properly made cause a malfunction. This can result in damage, hand operation and further loss of time.

In addition to this conversion problem, the present injectors frequently failed to insert the rivet slug into the finger mechanism, in which case the slug falls to the work surface and the photoelectric interlock halts the automatic cycle. The operator must actuate the injector under manual control to insert another slug into the finger mechanism and resume the automatic mode of operation. An unreliable return spring may fail to complete the reciprocating action of the injector mechanism and the cycle may be repeated without the slug in proper position. Repetitive manual operation is again necessary to pick up the next slug from the delivery tube.

## SUMMARY OF THE PRESENT INVENTION

The improved rivet slug injector of the present invention provides for interchangeable adapter units to quickly, easily and accurately convert the injector for use from rivets of one diameter to rivets of another diameter. The same basic injector unit may thus remain intact and the conversion problems of previous injectors are thus eliminated. Proper alignment is maintained without trail and error adjustments and the need to remove and replace the photoelectric interlock structure. No dismantling and realignment is necessary. The injector has a body to which is fastened a double acting air cylinder which extends and retracts a blade between an extension block and spring closed gate. Slugs from a delivery tube drop down onto the adapter and in front of this blade for movement past a photoelectric cell and into the fingers of a finger mechanism which inserts the slug into a hole drilled on a workpiece. A pointer for the corresponding rivet slug diameter is permanently attached to each adapter and indicates slug length adjustment on the appropriate scale stamped on the side of the body.



## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the injector with hidden parts in dashed lines and related apparatus in phantom lines;

FIG. 2 is a perspective view of the front portion of the injector;

FIG. 3 is an elevational view;

FIG. 4 is a partial sectional plan view taken along the line showing the relationship of the end of the injector with the finger mechanism; and

FIG. 5 is a perspective view of the replaceable adapter unit with its associated blade shown in phantom lines.

## DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to FIG. 1 there is shown a body **10**. This body preferably is a rectangular machined part or casting having a rear portion removed so that a double acting air cylinder **12** may be fitted therein. This cylinder **12** has the usual pneumatic conductors **14** and **16** at either end of the cylinder for longitudinal movement of a piston rod **18** in the oscillatory actuation of the injector blade. A vertical slot **20** within the body **10** permits a blade **22** to move with the piston rod **18** in an oscillatory motion shown by the double arrow **24**. A clevis **26** interconnects the blade **22** with the piston rod **18** for actuation.

Affixed to the body **10**, such as by screws **30**, is a tube base **32** having a further mounting support **34** affixed thereto. A rivet slug delivery tube **36** is secured to the tube base **32** such as by welding, for example and has its end **38** terminating at a point above the lower surface of the tube base **32**. Rivet slugs are fed through this delivery tube by a gravity feed and dropped down from the delivery tube end **38** onto the upper surface **40** of an adapter unit **42** in front of the leading edge **21** of blade **22** when the blade **22** has moved rearwardly of the delivery tube **36**. In FIG. **1** the blade **22** is shown in an intermediate position after having moved a rivet slug **44** forwardly in its forward stroke. When blade **22** is in its rearwardmost position, an extension block **46** forwardly of body **10**, and a spring loaded gate **48**, with a vertical groove **49** therein and pivotally mounted to the front portion of body **10** prevent the rivet **44** from falling off the shelf **40** of the adapter **42** prior to the forward movement of the blade **22**. This extension block **46** formerly was removable to provide access in replacing the injectors when a change in rivet size was desired. Spring gate **48** is pressed outwardly by the adapter **42** and blade **22** in their forward movement. A captive screw **50** is used in making a vertical adjustment of the adaptor **42** relative to the blade **22** to accommodate the various lengths of the rivet **44**. There are indicia markings **52** on the side of the body **10** and a pointer **54** connected to the adapter **42** is used in determining the vertical height to accommodate the predetermined rivet lengths.

Although not part of the present invention but used in conjunction therewith, is an electric eye mechanism that insures that a rivet has been passed by the blade **22** to a spring finger mechanism, not shown. This photoelectric mechanism is shown in phantom lines as consisting of a light source **56** secured to a support arm **58** attached to a mounting bracket **60** and a photoelectric cell **62** attached to a support arm **64** on bracket **60**.

In one embodiment mounting bracket **60** extends rearwardly of tube base **32** and is fastened to the top of the injector body **10**. The light source **56** projects a light onto the cell **62** in the well known manner, and this light source is interrupted upon the passage of the rivet **44** therebetween. This, in turn, actuates appropriate structure to accomplish the riveting operation. In one embodiment the electric eye signal starts a drilling operation.

A perspective view of the front portion of the injector is shown in FIG. **2**. Here is shown piston rod **18** and clevis **26** for attachment to the blade **22**. The piston and blade move longitudinally through a slot **20** between the outer walls of body **10**. Tube base **32** is mounted on the top of body portion **10** by means of screws **30**. A support **34** interconnects the tube base to other mounting structure. The rivet slug delivery tube **36** is connected to the base **32**. A leaf spring **68** urges gate **48** inwardly into contact with the extension block **46** and is pried outwardly upon the passage of rivet **44** and blade **22** in the forward stroke.

The elevational view in FIG. **3** more clearly shows the operation of the rivet slug injector. As previously explained, the body **10** has a double acting air cylinder **12** mounted therein. Tube base **32** is shown mounted on the top and underneath this base is the blade **22** fastened by the clevis **26** to the piston rod **18** for longitudinal movement under the rivet slug delivery tube **36**. Adapter **42** is fastened to the blade **22** by means of a captive screw **50**, the rotation of which makes a vertical adjustment between the adapter and the blade. Guide bars **70** permit vertical relative movement while carrying the adapter **42** with the blade **22** in its longitudinal movement. Adapter **42** extends forwardly from the blade **22** to provide a shelf **40** upon which the rivet **44** is positioned when it drops down from the tube **36** when blade **22** is retracted rearwardly of the tube. When forward movement is imparted by the piston rod **18**, the leading edge **21** of blade **22** pushes rivet **44** from groove **49** forwardly past the spring retained gate **48**. The adapter **42** and pointer **54** are carried with the blade **22**. An intermediate position of the rivet movement is shown by dotted line **72** and its full forward position is shown at **74** where it is retained by a spring biased finger mechanism **76**. This finger mechanism frictionally retains the rivets in the position shown by rivet **74** while hammer **78** performs the riveting operation. The actuation of the air cylinder **12** to initiate the forward movement of the blade **22**, in one embodiment, is caused by a limit switch, not shown, tripped by a horizontal movement of the finger mechanism **76** toward the blade to receive the injected rivet.

As can be seen in the plan view in FIG. **4**, the electric eye has its light source **56** and photoelectric cell **62** between the finger mechanism **76** and the end of gate **48** and extension block **46** so that as the blade **22** pushes the rivet **44** past the position shown by dotted line **72**, appropriate signals are generated so that the riveting operation may be made after the rivet has been positioned within the fingers at position **74**. The fingers of this finger mechanism **76** are outwardly urged by the rivet slug which is frictionally retained by them until the riveting operation has taken place.

The adapter unit is shown in FIG. **5**. Here the double acting air cylinder **12** appears in phantom lines with the piston rod **18** and the blade **22** that is interconnected with the piston rod by means of clevis **26** for longitudinal actuation. The adapter **42** is a rectangular plate positioned forwardly and below the forward edge of the blade and is connected thereto by guide bars **70** which permit vertical adjustment therebetween. The vertical adjustment is accomplished by a captive screw **50** whose head **80** is frictionally retained by a leaf spring lock **82**. Upon manual rotation of the head **80**, the screw **50** moves the adapter **42** vertically relative to the blade **22** and thus raises or lowers the table **40** upon which the rivet slug is positioned for actuation. As can be seen from FIGS. **5** and **1**, the pointer **54** is fastened at the bottom of adapter **42** and extends outwardly beyond the extension block **46** of the body **10**.

In contrast to the prior art, difficulties of replacing and aligning ejector units for the various sizes of rivets, the only adaptation in the present invention is the replacement of the adapter units **42** complete with spare associated pointers **54**. The various adapters vary from each other in the thickness of the adapter or in the vertical elevation of the table **40** with respect to the blade **22**. The injector unit thus is a simpler mechanism with greater reliability and in its applicability to a variable operating need where formerly separate devices were necessary. Interchangeable adapters permit rapid conversion to accept alternate slug diameters without replacing the entire ejector assembly and realigning critical parts by a trial and error process.

Having thus described one form of the invention, it is to be understood that various modifications will readily occur to one skilled in the art and that it is to be understood that these variations are to be considered as art of the present invention.

I claim:

**1.** A rivet slug injector comprising a body having an open ended vertical slot therein,

a blade longitudinally movable within said slot,

means for actuating said blade,

a rivet slug delivery tube affixed to said body over said slot and adapter to drop rivet slugs therein in upstanding orientation,

said blade having an adapter unit affixed thereto to provide an upper horizontal surface forwardly of said blade to receive the base ends of said rivet slugs, said adapter unit being movable with said blade and vertically adjustable relative thereto,

said blade being horizontally movable to a first position out of vertical alignment with said tube with said upper surface being positioned thereunder, said blade being horizontally movable under said tube to prevent further droppage of rivet slugs until said blade returns to said first position, said blade being horizontally movable under said tube to a second position where the rivet slug carried thereby may be removed, and

a spring biased gate closing said open end of said slot when said blade is in said first position, said gate having a vertical groove along the inner surface thereof into which said rivet slug is positioned upon dropping from said delivery tube.

**2.** A rivet slug injector as in claim **1**, said adapter unit being connected to said blade through guide bars and a captive screw for adjusting vertical spacing therebetween,

said guide bars fitting into vertical apertures in the top of said adapter unit and in the bottom of said blade,

said adapter unit having indicating means thereon overlying indicia on said body to indicate vertical adjustment of said adapter unit for selected lengths of rivet slugs.

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