Aug. 11, 1970 W. BELL ETAL 3,523,441

BLIND RIVET AIR TOOL

Filed May 10, 1968 2 Sheets-Sheet 1

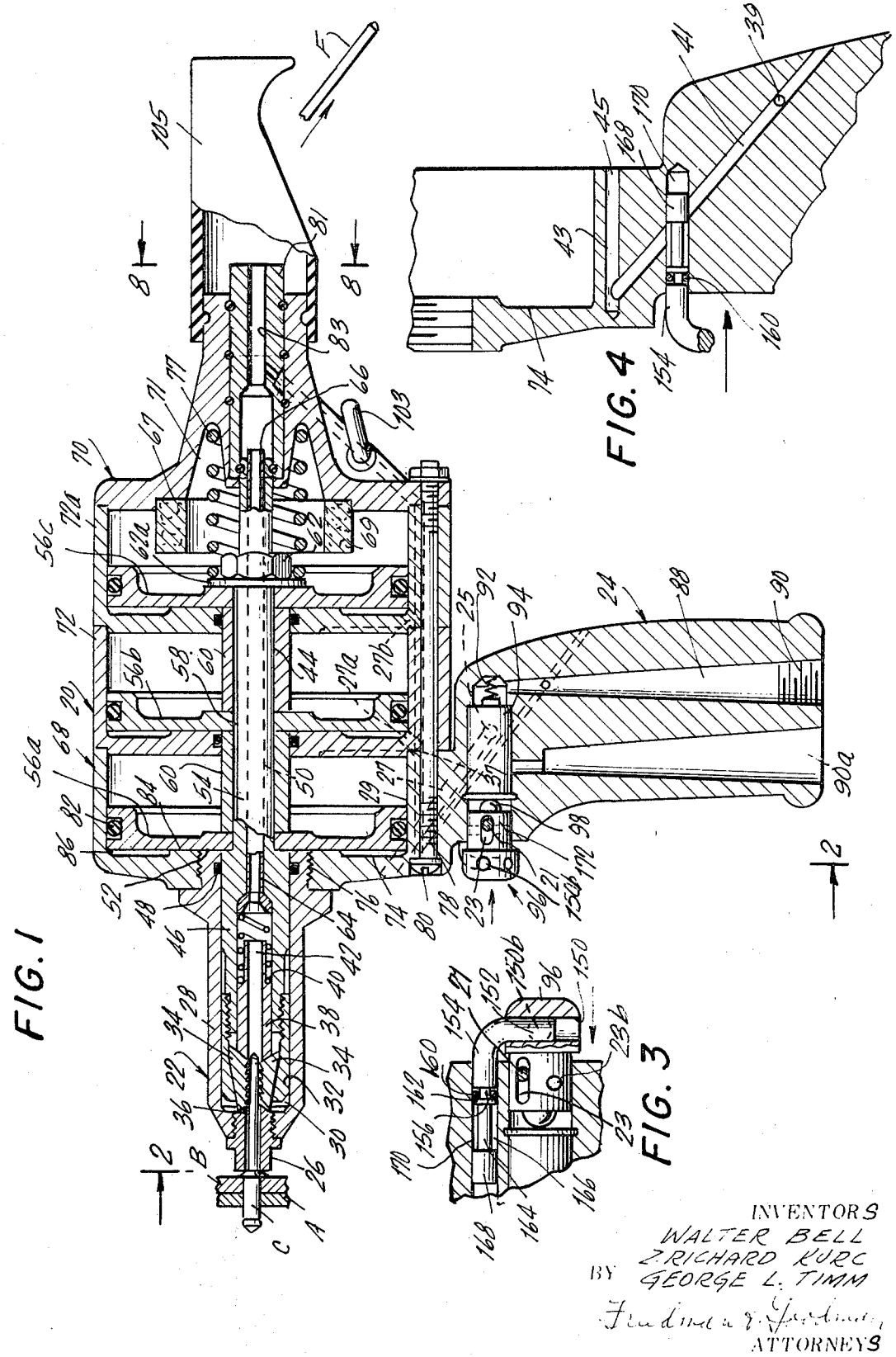

FIG. 1

FIG. 4

FIG. 3

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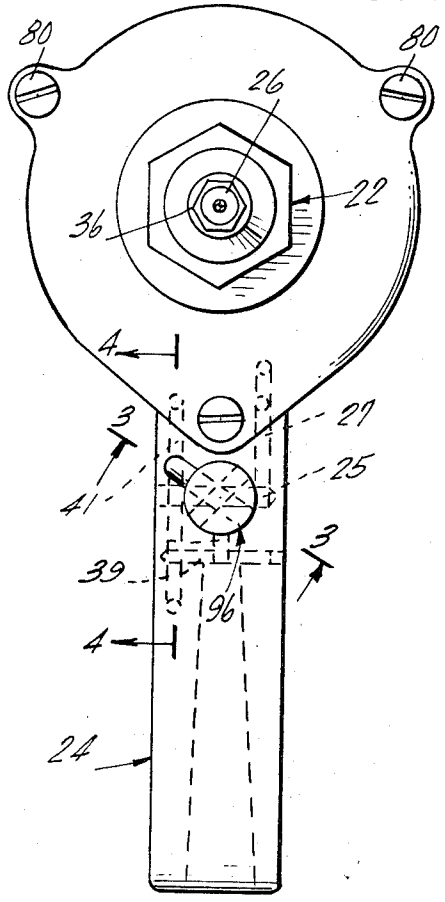
FIG. 2



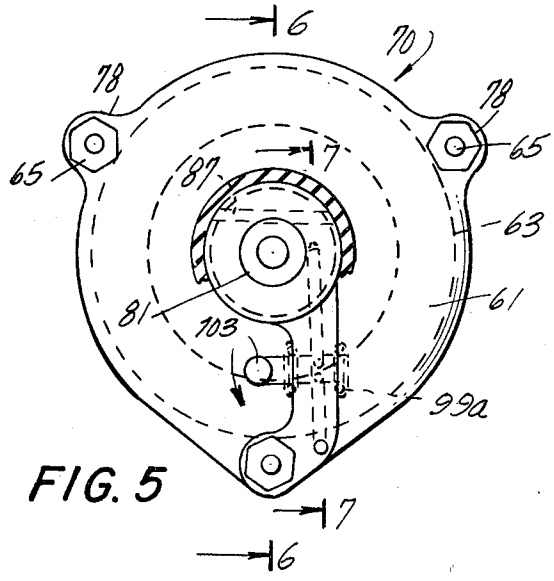


FIG. 5

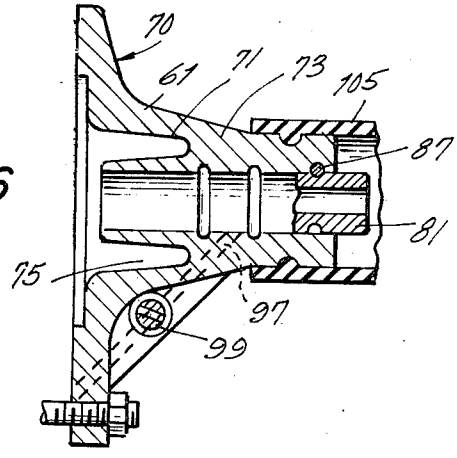


FIG. 6

FIG. 8

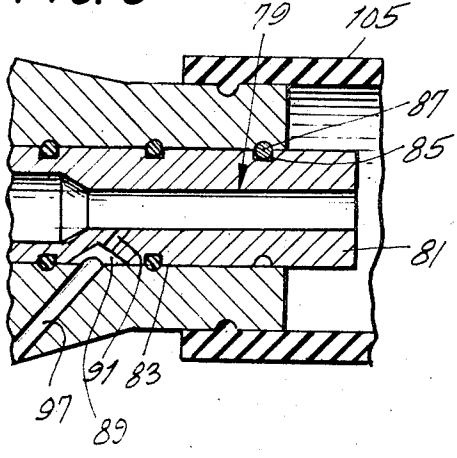
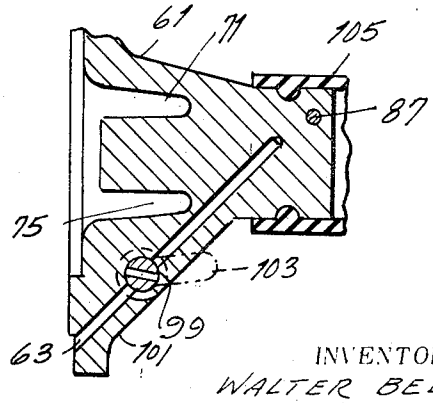


FIG. 7



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3,523,441

BLIND RIVET AIR TOOL

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Int. Cl. B21d 9/05
U.S. Cl. 72—391 8 Claims

ABSTRACT OF THE DISCLOSURE

An improvement in a rivet setting tool which is pneumatically operated wherein the pneumatic means is operable to retain rivets in position and to eject the severed rivet mandrel stems therefrom automatically utilizing a common source of pneumatic power, which improvement resides in a new and unique trigger for the tool which permits ejection of rivet mandrels and air out of the device only when the trigger is at least slightly depressed, said trigger being the same trigger which operates the rivet pulling means of the rivet setting tool.

BACKGROUND OF THE INVENTION

Field of the invention

This invention resides in the field of pneumatic power operated rivet setting tools particularly adapted for the setting of blind rivet assemblies of the type wherein the rivet barrel is set in a workpiece by the tensioning of a mandrel stem having an enlarged rivet setting head engageable with the blind end of the rivet barrel. Further, this tool can be effectively employed for the tensioning of a mandrel in a rivet assembly wherein upon completion of the rivet setting operation the mandrel stem is designed to sever or break as a result of the tensioning stress applied by the setting tool.

Discussion of the prior art

Pneumatically operated power tools for upsetting, power tools are generally and broadly known in the art. Recently, a blind rivet setting tool which is pneumatically operated has been proposed which is provided with means for pulling and thereby severing rivet mandrels and with means for ejecting the severed mandrels automatically using a common pneumatic power source. The mandrels are ejected due to creation of at least a partial vacuum. When the tool is operated, valve means are provided to direct incoming air into a number of cylinder units employed for severing the rivet mandrel. A direct passage carries air constantly toward the rearward portion of the tool to create the vacuum. This means that air is constantly passing through the device and out the rearward exit even when the rivet pulling operation is not being performed. This is undesirable for reasons of noise and the like. It is desired to perform the rivet mandrel severing operation at the same time or as close to the same time as the rivet ejecting operation and to limit the ejection of rivet mandrels and air to a time in which the main rivet setting function is being performed.

SUMMARY OF THE INVENTION

Objects of the invention

It is an object of this invention, therefore, to provide a rivet setting tool which functions to sever rivet mandrels thereby setting the rivet and to eject the severed mandrel from the tool which functions are performed using a common source of pneumatic power wherein the rivet ejecting function and any air used therefore is prohibited from being emitted from said tool at any time other than

between commencement and termination of the rivet severing function.

This and other objects and advantages will become apparent from the following description and claims.

STATEMENT OF THE INVENTION

Broadly, this invention contemplates an improvement in a blind rivet setting tool which is pneumatically operated, said tool operable to set rivets by severing rivet mandrels and to eject the severed mandrel from said tool using a common source of pneumatic power, said tool provided with means of directing incoming air toward a cylinder assembly and means for directing incoming air toward the rearward portion of said tool and into a Venturi passage and out of said tool whereby the vacuum created due to passage of said air out of said tool causes severed mandrels to be ejected out of said tool, said improvement comprising a trigger operable to operate a valve in the power air line and a valve in an ejecting air line.

In a particularly desirable embodiment, the invention contemplates such an improvement wherein the trigger operates to open the valve in the ejecting air line prior to opening the valve in the power air line and, preferably, holds the valve in the ejecting air line open after the valve in the power air line is closed.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be more readily understood and appreciated by reference to the accompanying drawings in which:

FIG. 1 is a sectional view partly broken away showing the tool in the extended, normal, at rest position and a rivet disposed therein;

FIG. 2 is a front elevational view of the tool partly broken away;

FIG. 3 is a sectional view taken along line **3—3** of FIG. 2;

FIG. 4 is a sectional view taken along line **4—4** of FIG. 2;

FIG. 5 is a rear elevational view of the tool showing the deflecting boot in section;

FIG. 6 is a sectional view taken along line **6—6** of FIG. 5;

FIG. 7 is a sectional view taken along line **7—7** of FIG. 5; and

FIG. 8 is a sectional view taken along line **8—8** of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings and in particular to FIG. 1, the rivet pulling tool therein illustrated is provided with a rivet engaging and pulling assembly, indicated in general by the numeral **22**, a cylinder assembly, indicated in general by the arrow **20**, within which is housed the pneumatic motor mechanism to provide the requisite reciprocative linear motion for the operation of the pulling assembly; and a handle portion **24** providing the requisite means for connecting the tool to a source of compressed air as well as constituting a support for trigger operated valve **94** means for controlling the operation of the tool.

In FIG. 1 there is shown a pair of workpieces A and B, such as metal plates each having a drilled opening into which a rivet body C to be set has been inserted. The mandrel portion D of the rivet assembly is then inserted into the nosepiece of the pulling head assembly until the anvil throat **26** of the nose piece is in firm contact with the flanged portion of the rivet body. The pulling head assembly **22** is of well known type in its operation. The following brief description will suffice to explain

the cooperative interrelation of the pulling head assembly with the rest of the tool.

PULLING HEAD ASSEMBLY

The pulling head assembly **22** is of a hollow tubular construction and includes a tubular housing **28** having a bore **30** within which a jaw case or retainer **32** is slidably mounted for axial reciprocation. Three toothed jaw members **34** are cooperatively arranged in a circle within jaws retainer **32**, so that forward pressure of the jaws against the inner end **36** of the nosepiece **26** will force the jaws apart to receive or release the mandrel stem D. The separation of the jaws is additionally accomplished by the tubular jaw expander **38**, the forward or proximal end of which is provided with beveled surfaces which are in camming engagement with the complementary surfaces of the rear end surfaces of the jaw members, thereby forcing the jaw members apart under the resilient action of the compression spring **40**. It will be noted that the bore **42** forms a continuation of the mandrel receiving bore defined by the juxtaposed faces of the jaw members. Rearward retractive movement of the jaws retainer **32** causes the jaws to grip and to tension the mandrel stem D as the jaws are moved rearwardly toward the remote end of the tool.

In this connection it will be noted that the anvil throat end of the nosepiece **26** forms an abutment means for the flanged end of the rivet body. It will be further noted that the jaw case or retainer **32** is provided with a bore having a tapered or frusto-conical forward portion. The jaw members **34** taper in a forward direction in a manner complementary to the frusto-conical surface defined by the bore of the jaw retainer **32**. The retainer and jaws held thereby are power-operated rearwardly by means of draw barrel **44** which is in threaded engagement with the jaws retainer **32**. The draw barrel **44** in turn forms part of a pneumatically operated piston assembly to be hereinafter described. It will be noted at this point that the forward or proximal end **46** of the draw barrel **44** is enlarged and is slidably journaled in housing **28** and bears against the sealing O-ring **48** which provides an air seal therefor during the reciprocation thereof. The bore **50** extending throughout the length of the draw barrel is coaxial with the bores defined by the jaws **34** and the tubular jaws expander **38** and forms a continuation thereof.

PISTON HEAD ASSEMBLY

The draw barrel **44** is provided with a shoulder **52** from which a reduced diameter piston rod portion **54** extends rearwardly and effectively supports a plurality of circular piston heads **56***a*, *b* and *c*. The piston heads **56***a*, *b* and *c* are provided with a central bore **58**. The piston heads are similar in construction and are equidistantly spaced along said piston rod portion **54** of the draw barrel **44** by means of intermediate spacer bushings **60**.

The remote or rear end of the piston rod portion **54** of the draw barrel is threaded and mounts a clamping nut **62**. A washer **62***a* is interposed between the nut **62** and the raised boss formed on the rear face of the piston head **56***c* surrounding the bore **58**. As a consequence of this arrangement the tightening of the nut **62** effectively clamps the piston heads **56***a*, *b* and *c* in position and thus forms a unitary piston assembly comprised of the draw barrel and the piston heads mounted thereon. It will be noted that the draw barrel is provided with a liner **64** which includes a funnel shaped forward portion at its forward end and a tail portion **66** which extends beyond the draw barrel **44**. The opening of the funnel is reinforced against end **46** by reinforcing material **64***a*.

CYLINDER ASSEMBLY

The piston assembly is disposed within the cylinder assembly **20** of the tool for reciprocative movement therein. The cylinder assembly is comprised of a front cylinder unit designated generally by the numeral **68**, a rear end plate designated generally by the numeral **70**, and intermediate cylinder units designated generally by the numerals **72** and **72***a*. It will be understood, as will more clearly appear hereafter, that the end plate **70** may be mounted directly upon the front cylinder unit **68** or one or more intermediate cylinders may be interposed therebetween in accordance with the power requirements of the particular application. As will be seen from said FIG. 1, the front cylinder unit **68** is comprised of a cylinder shell portion having an integrally formed handle portion **24** depending therefrom. The cylinder head **74** of front cylinder unit is provided with a threaded central bore **76** within which the tubular housing **28** of the rivet engaging and pullling assembly **22** is received so as to threadedly mount the same. A plurality of circumferentially spaced apertured ears **78** are provided on the external surface of the unit for receiving the clamping bolts **80**. The cylinder shell of the front cylinder unit has disposed therein piston head **56***a* of the piston assembly for reciprocation therein under pneumatic pressure. In order to provide for an air seal an O-ring **82** is disposed within a circumferential groove found in each of the piston heads **56***a*, *b* and *c* and comprises a piston ring therefor.

It will be noted that in the at rest or normal position of the tool the front face of the piston head abuts the raised boss **84** formed on the interior face of the front cylinder head **74** and that a circular depressed area surrounds said boss. There is thus formed a pocket **86** into which compressed air may be introduced to initiate the power stroke of the tool as will more particularly appear hereinafter.

The front cylinder unit **68** is also provided with conduit means for connection to a source of compressed air supply and for introducing the same at the desired locations in the tool. Thus the handle portion **24** has formed therein an air inlet conduit **88** which is provided with a threaded mouth **90** suitable for connection to the coupling element of an air supply hose and an exhaust conduit **90***a* through which the spent compressed air from the cylinders may be exhausted.

As may be seen from FIGS. 1 and 4, the handle also has formed therein as by means of suitably drilling the same through the body of the unit and plugging the undesired openings, a plurality of air passages. Since, after the initial introduction of air into the front cylinder unit the flow is utilized for two independent purposes, namely, for providing air power to the cylinders on the one hand, and for producing a vacuum by means of a Venturi arrangement, the air or passages for the former will be designated as power air and passages, while the air or passages for the latter will be designated as Venturi air or passages.

Thus air introduced into the air inlet conduit passes into the rear portion of a valve chamber as indicated **92** and thence into the body of a cartridge valve **94** disposed within a portion of said chamber. Cartridge valve **94** controls the flow of power air and is of conventional design and will not be described in detail. The valve **94** is operated by means of a reciprocable trigger or plunger **96** which is provided with a hemispherical end **98** which bears against the valve end. The movement of the trigger is limited by means of a cross-pin **21** which is disposed within a larger diameter transverse bore **23** formed in the body of the trigger. This same trigger is operative to open and close the valve in the Venturi air passage as more fully described below. When the trigger is depressed, power air from chamber **92** is permitted to pass through the valve into the opening **25** of power passage **27**. Power passage **27** is diagonally disposed within the handle body and extends into the cylinder portion of the front cylinder unit. As may be seen from FIG. 1, power passage **27** traverses the juncture of the front cylinder head **74** with the cylinder wall **29** to thus form a power air port into the interior of

the front cylinder. It will be noted that the port opens into the depressed area of the interior of the cylinder head.

It will also be noted that power passage **27** also intersects an axially extending power passage, not shown, which passage is open at the rear face of the cylinder wall **37**. It will thus be apparent that compressed air introduced through conduit **88** is passed into the front cylinder under the control of a manually operable valve and is then conducted into the cylinder proper and that a further power air passage is provided in the cylinder wall for feeding power air into the next adjacent cylinders in the same manner, a power passage **27***a*, **27***b* or conduit provided therefor and at each cylinder head an air inlet so as to enable cylinder units **72** and **72***a* to act similarly. The power passages **27**, **27***a*, **27***b* are also utilized for exhausting spent air from the cylinders on the return stroke of the pistons. The return stroke of the pistons is initiated by the release of finger pressure upon trigger **96** which permits the cartridge valve to return to its normal position shutting off communication between the opening **25** of passage **27** and the rear portion of valve chamber **98**. The valve simultaneously opens communication between the opening **25** of passage **27** and the reduced portion **37** of exhaust conduit **90**, the bottom of which is open to the atmosphere. The spent power air may thus pass through exhaust conduit **90***a* via the aforementioned passages.

The vacuum forming Venturi arrangement requires a source of compressed air which is introduced through opening **39** as may be seen in FIGS. 1 and 3 and more particularly in FIGS. 4, 6 and 8. Opening **39** communicates with diagonally extending Venturi air passage **41** which in turn intersects and therefore communicates with axially extending Venturi air passage **43** disposed in the front cylinder wall and is open at the rear face of cylinder wall **37** as indicated at **45**, so that it will provide for a flow of Venturi air to the next adjacent cylinder. It will be noted that the axially extending power passage for the cylinders which is not visible in the drawings and passage **43** is disposed in parallel relation along opposing sides of the bore within which a clamping bolt **80** is disposed.

The intermediate cylinder unit is also provided with air passage means whereby it is connected to the source of air power for actuating the piston disposed therein. Thus, an axially disposed power air passage extends from face to face of the cylinder wall in registry with the power air passage which runs parallel to passage **43**. A short diagonal bore **27***a* and **27***b* at the convergence of the interior of the cylinder head with the side wall provides communication with the exterior of the cylinder in the recessed area of the cylinder head without interfering with the continuity of the power air passage employed so that the next adjacent unit can be supplied therethrough. It will be apparent that when the intermediate cylinder unit is brought into clamping engagement with the cylinder head, a power air supply passage therefor is automatically established as well as with a next succeeding unit, if needed. The aforementioned power air passage also functions as an exhaust passage for the spent air upon the return stroke of the piston. In like manner, the intermediate cylinder unit when clamped in position automatically forms part of a continuous passage for the supply of air to the Venturi or vacuum arrangement. Thus there is provided a through passage which registers with the opening **45** of Venturi air passage **43** of the front cylinder head unit thus forming a continuity thereof for supplying the desired air to the ultimate point of application.

As heretofore stated intermediate cylinder unit **72***a* is in all respects similar in construction to unit **72** and serves to illustrate the modular character of the instant invention. Any desired number of intermediate cylinder units may be assembled and interposed between the front cylinder unit and the end plate assembly depending upon the power requirements of the particular application. With the addition of intermediate power units an increase in effective power of the tool is readily accomplished. It will of course be understood that a change in the number of intermediate cylinder units also involves a change in the piston assembly to accommodate the same.

END PLATE ASSEMBLY

The tool is enclosed by means of an end plate assembly designated generally by the numeral **70**. The said end plate assembly may be more particularly seen from FIGS. 1 and 5. It comprises an end wall **61** which is of the same general conformation as the cylindrical shell portions of the front and intermediate cylinder units. It is similarly provided with a circumferential recess **63** which receives the end of the preceding cylinder wall. Registering, circumferentially spaced apertured ears **78** are adapted to receive the ends of the clamping bolts **80** so that it may be assembled therewith and clamped thereto to form a unitary structure. The clamping action is accomplished by means of the nuts **65** in engagement with the threaded ends of the clamping bolts **80**. The end wall portion **61** of the end plate **70** is provided with a circular recess **67** within which a ring **69**, formed of rubber or the like, is disposed. The ring **69** forms a bumper or shock absorbing pad for the piston head **56***c* as it abuts against the same upon reaching the limit of its rearward movement during the power stroke of the tool. A considerably deeper circular recess or groove **71** is formed in the neck portion **73** of the end plate and defines a sleeve **75** about which the return spring **77** is disposed. Said return spring **77** is of the compression type, one end of said spring abutting washer **62***a* and being disposed about nut **62** which thus prevents it from being dislocated, while the other end of said spring is seated at the bottom of groove **71** and is retained against dislocation by means of sleeve **75**. Spring **77** is compressed during the retractive or power stroke of the tool and serves to return the piston assembly to its extended, normal or at rest position by reason of the resilient action thereof.

The neck portion **73** of the back plate **70** houses a Venturi type vacuum device which serves to retain a rivet disposed within the pulling head of the tool as it is manipulated into position with respect to a workpiece, and also serves to withdraw and eject the severed portion of the rivet mandrel from the tool proper. It is a significant feature of this invention that the vacuum forming means is integrated with the tool and is rendered operative by the same supply source of compressed air as is used to actuate the tool and that a common trigger is operative to operate the valves for the Venturi vacuum assembly and the power assembly.

The Venturi type vacuum forming arrangement is more particularly illustrated in FIGS. 1 and 8. As will be seen from said figures said arrangement designated generally by the numeral **79** is comprised of an outer tube **81** and an inner tube **83** disposed therein. Outer tube **81** is provided with a peripheral groove **85** into which a portion of a transverse locking pin **87** extends to lock the same in position with respect to the neck portion of the back plate as seen in FIGS. 5 and 6. Said outer tube wall is also provided with a recessed portion **89** having a triangular configuration in cross section. The tube wall defined by said recess is provided with spaced aperture **91** which provides air passage from the space defined by the recessed portion into the interior of the outer tube.

The portion of the inner tube juxtaposed to said aperture **91** is of reduced diameter and provides a constructed circular orifice in conjunction with the interior wall of the outer tube thereby creating a Venturi effect in a well known manner. When a flow of air is introduced into the interior of the Venturi arrangement in the manner indicated, the air is moved in the direction of the arrow E thereby inducing a pressure drop downstream of the air flow. In order to induce the vacuum

downstream of the Venturi arrangement, means are provided for conducting a flow of air thereto. To this end the back plate is provided with a diagonal Venturi air passage **97** through web **101**, the lower end of which is open at the front face of the end wall portion **61** of the end plate **70** and registers with a Venturi air passage from intermediate cylinder **72***a*. The upper end of Venturi air passage **97** tangentially opens into the bore of the end plate neck **73** into the space defined by the recessed portion **91** in the peripheral surface of the outer tube **81**, from whence it may enter the interior of the Venturi tube arrangement through aperture **91** causing a vacuum to be created throughout the length of the axial bore defined throughout the length of the tool. The flow of air supplied to the Venturi may be regulated by means of a rotatable metering valve **99** interposed in passage **97**. Rotation of the valve element causes the cross bore in the valve to register in varying degree with the passage and may thus be used to regulate the air flow or to shut it off completely. FIGS. 6 and 7 showing the valve in closed position, when rotated in the direction indicated by the arow in FIG. 7, alignment of the cross bore with the axis of the passage will open the same. A sealing arrangement is provided comprising of a pair of O-rings **99***a* which are held in position on each side of web **101** by means of push nuts so that the valve arm **103** may be rotated without leakage of air. This valve is provided so that the operator can choose if he wishes to use the ejecting device and, if not, close this valve.

A deflecting boot **105** preferably formed of a hard rubber or the like is mounted on the neck of the end plate as by means of a rib and groove arrangement. The deflecting boot directs the severed mandrel stem away from the operator as indicated at F in FIG. 1.

THE TRIGGER-VALVE MECHANISM

The trigger-valve assembly is illustrated in FIGS. 1, 3 and 4. As seen therein, a plunger **96** is provided for operation of the cartridge valve above referred to. Embedded within plunger **96** in a recess **150** is a vertical portion **152** of the Venturi valve which portion bends and extends into the handle portion **24** horizontally at **154**. A decreased diameter extension member **156** is provided around which is an O-ring **160** which sits between the end wall of the horizontal portion **154** and the wall **162** to which member **156** is attached. In the horizontal portion **168**, small passage **164** permits air flow into Venturi pasage **45**. At the end of the second horizontal portion **154** there is integral therewith piece **168** filling the bore **170**. This entire assembly is rideable in the bore **170**. Piece **168** lies in the path of Venturi passageway **41** when the tool is in rest. When the plunger **96** is actuated, the Venturi valve is pushed inwardly in bore **170** so that the passage **164** is in the path of Venturi passageway **41** and, air is permitted to flow through the valve into Venturi passage **45** and into the Venturi assembly to perform the exhausting or vacuuming operation wherein severed rivet stems are ejected from the tool.

It will be observed that this can be done without opening the power cartridge valve to begin setting rivets. This is due to the fact that the power valve is not immediately responsive to movement of the plunger **96** but requires movement of the plunger sufficient for the wall **172** to move sufficiently forward to open the power valve. Conversely, when the trigger is released slightly the power valve closes sufficiently to prevent air from going to the cylinders. Nevertheless, air can still pass through the Venturi valve as long as the plunger **96** remains slightly depressed. Thus, as long as the trigger **96** is not depressed, no air flows to the mandrel ejection device. When the operator depresses the trigger only slightly, say ⅛ inch, air flows to the mandrel-ejection device. This ejects a mandrel, should there be one left in the tool, and also serves to hold in place a new rivet in the nosepiece of the tool. Depressing the trigger slightly further operates the original or power valve which in turn releases air to the cylinders of the tool, and the rivet is installed in the work. The operator can release the trigger only slightly. The original or power valve is thus closed off, and the cylinders return to their passive position, releasing the jaws from their grip on the broken-off mandrel. The mandrel is ejected rearwardly from the tool and the operator releases the trigger fully and all air stops.

This assembly has the advantage that it decreases substantially the amount of high pressure air wasted and decreases the overall noise while providing the operator with full control of all functions through use of a single trigger.

In accordance with a preferred embodiment of the present invention as shown in the accompanying drawings, a two-position trigger is provided so that the operator has the option of choosing to have the rivet ejection system operated only when the rivet severing system is in operation i.e. so that the rivet ejecting system is not in operation unless the rivet severing system is operated. To this end, the side wall **172** of the cartridge valve at a point substantially intermediate, the ends of elongated slot **23** of elongated configuration is provided with an opening **23***b* of sufficient size to permit entry therein of pin **21**. Generally speaking, the position of opening **23***b* is just rearward of the forward end of the elongated slot **23** and is correlated so that its distance between that point and a point on the vertical plane passing through the rearward end of the elongated slot **23** corresponds to the distance the trigger must be depressed to engage the rivet severing system. Thus by removing pin **21** and placing opening **23***b* in registry with the transverse bore and reinserting pin **21** into the transverse bore through opening **23***b*, the trigger is caused to operate the cartridge valve and the rivet ejecting valve concurrently, there being no give due to provision of an elongated slot which permits independent operation of the rivet ejecting system. To facilitate the change, a second opening **150***b* having the same shape as first opening **150** is provided so that when the assembly is turned the vertical portion **152** can be inserted in an appropriate recess. Thus it is seen that simply by removing pin **21** and turning plunger **96** including wall **172** and reinserting pin **21** through elongated slot **23** or **23***b*, the operator can choose whether the trigger mechanism is to operate the ejection system and the severing system together or whether the ejection system shall be engaged before the severing system. In the latter case, the pin **21** passes through the elongated slot **23** whereas the simple circular opening **23***b* is used in the first alternative.

It will be seen from the foregoing that a tool is provided which may utilize one or more cylinders for the pneumatic operation. The power applied to the mandrel stem will be in direct proportion to the number of cylinders utilized. By the use of the valve and trigger mechanism shown and described, additional advantages are realized within highly useful tools.

While certain preferred and desirable embodiments have been shown and described above, these have been shown and described merely for purposes of illustration and not for purposes of limitation, as there is no intention in the use of the terms and expressions employed herein of excluding any equivalents thereof, or portions thereof, within the spirit and scope of the invention.

What is claimed is:

1. An improvement in a blind rivet setting tool which is pneumatically operated, said tool operable to set rivets by severing rivet mandrels and to eject the severed mandrel from said tool using a common source of pneumatic power, said tool provided with means for directing incoming air toward a cylinder assembly and means for directing incoming air toward the rearward portion of said

tool and into a Venturi passage and out of said tool whereby the vacuum created due to passage of said air out of said tool causes severed mandrels to be ejected out of said tool, said improvement comprising a trigger operable to operate a valve in the power air line to said cylinder assembly and a valve in an ejecting air line.

2. An improvement according to claim 1 wherein said trigger operates to open the valve in said ejecting air line prior to opening the valve in said power air line.

3. An improvement according to claim 2 wherein said trigger is operable to hold said valve in said ejecting air line in opened position after said valve in said power line is closed.

4. An improvement according to claim 1 wherein said valve in said power air line is a cartridge valve and said valve in said ejecting air line comprising a rod member movable in a bore in said tool and having a portion of decreased diameter whereby movement of said rod is registry with said ejecting air line permits air to pass through said valve.

5. An improvement according to claim 4 wherein said rod member is embedded with said trigger whereby lateral movement of said trigger moves said rod member and said cartridge valve is opened until said trigger has moved a predetermined distance.

6. An improvement according to claim 1 wherein said trigger is adaptable in a first position to operate to open the valve in said ejecting air line prior to opening the valve in said power air line and in a second position to operate the valve in said ejecting air line and the valve in said power air line concurrently.

7. An improvement according to claim 6 wherein said

trigger is adaptable in said second position to hold said value in said ejecting air line in opened position after said valve in said power line is closed.

8. An improvement according to claim 7 wherein the trigger comprises a plunger section and wall provided on its side with an elongated slot and along said wall a second opening just large enough to accommodate a pin passing therethrough, said second opening being between the extremities of the elongated slot and just rearward of the forward extremity, a transverse bore within an interior support portion of said trigger which bore can be in registry with said elongated slot and said second opening and held in registry by said pin, means within said plunger to accommodate means associated with said valve in said ejecting air line when said elongated slot is in registry with said transverse bore and when said second opening is in registry with said bore.

References Cited

UNITED STATES PATENTS

2,088,859	8/1937	Huck	72—391
3,082,898	3/1963	Bosch	72—391
3,196,662	7/1965	Simmons	72—391
3,415,102	12/1968	Elliott	72—391
3,451,248	6/1969	Bell	72—391

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