United States Patent

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[31] **38,321/68**

[54] **RIVETING TOOL**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **227/59, 72/391**
[51] **Int. Cl.** **B21j 15/18**
[50] **Field of Search** 72/391; 227/51, 52, 53, 55, 58, 59

[56] **References Cited**

UNITED STATES PATENTS

2,403,675	7/1946	Mitchell	72/391 X
3,196,662	7/1965	Simmons	72/391
3,362,211	1/1968	Chirco	72/391
3,412,594	11/1968	Lund	72/391

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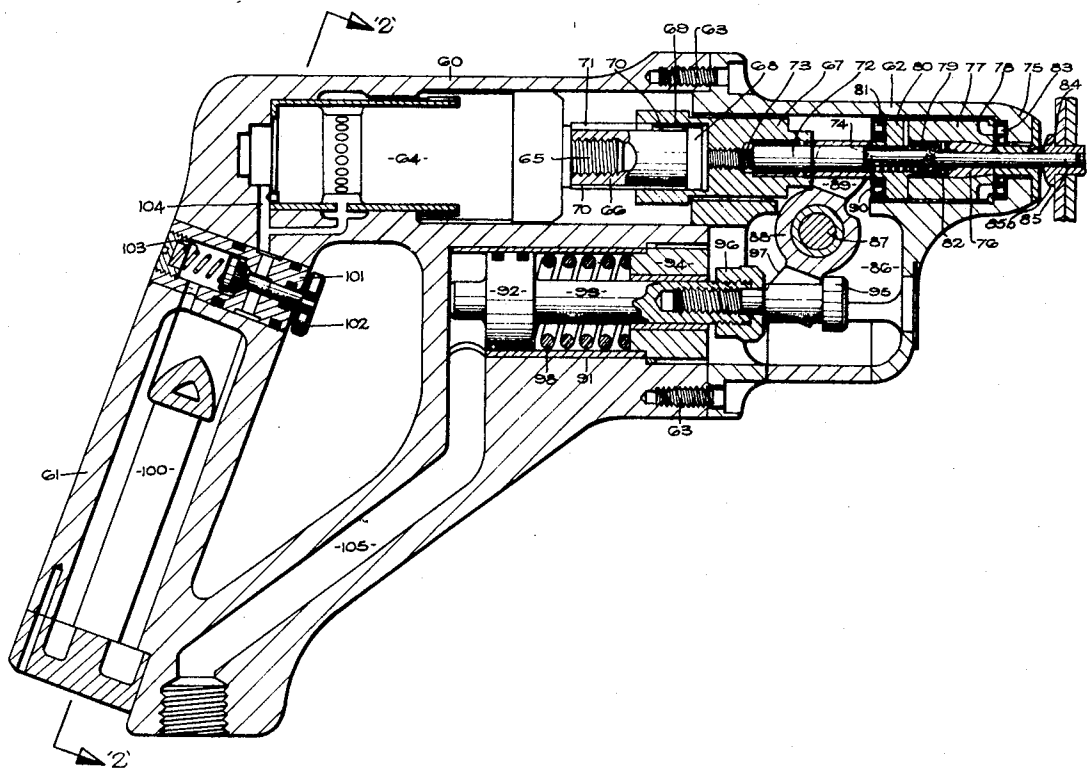
ABSTRACT: A tool for use in a method of riveting two sheets together using a tubular rivet with an enlarged flange at one end and a mandrel having a shank and a head at one end of the shank with the head being provided with a drill point and comprising the steps of placing the rivet upon the shank of the mandrel and driving the mandrel so that its head pierces an aperture in the sheets to be joined, forcing the rivet into said aperture and then applying a retractive force to the mandrel to withdraw the mandrel and cause its enlarged head to expand the end of the rivet radially outwardly. The tool comprises a body containing a collet for gripping the mandrel, a motor for rotating the collet to drive the mandrel and a pneumatic device to act upon the collet to provide retractive force for withdrawing the mandrel.



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3 Sheets-Sheet 1

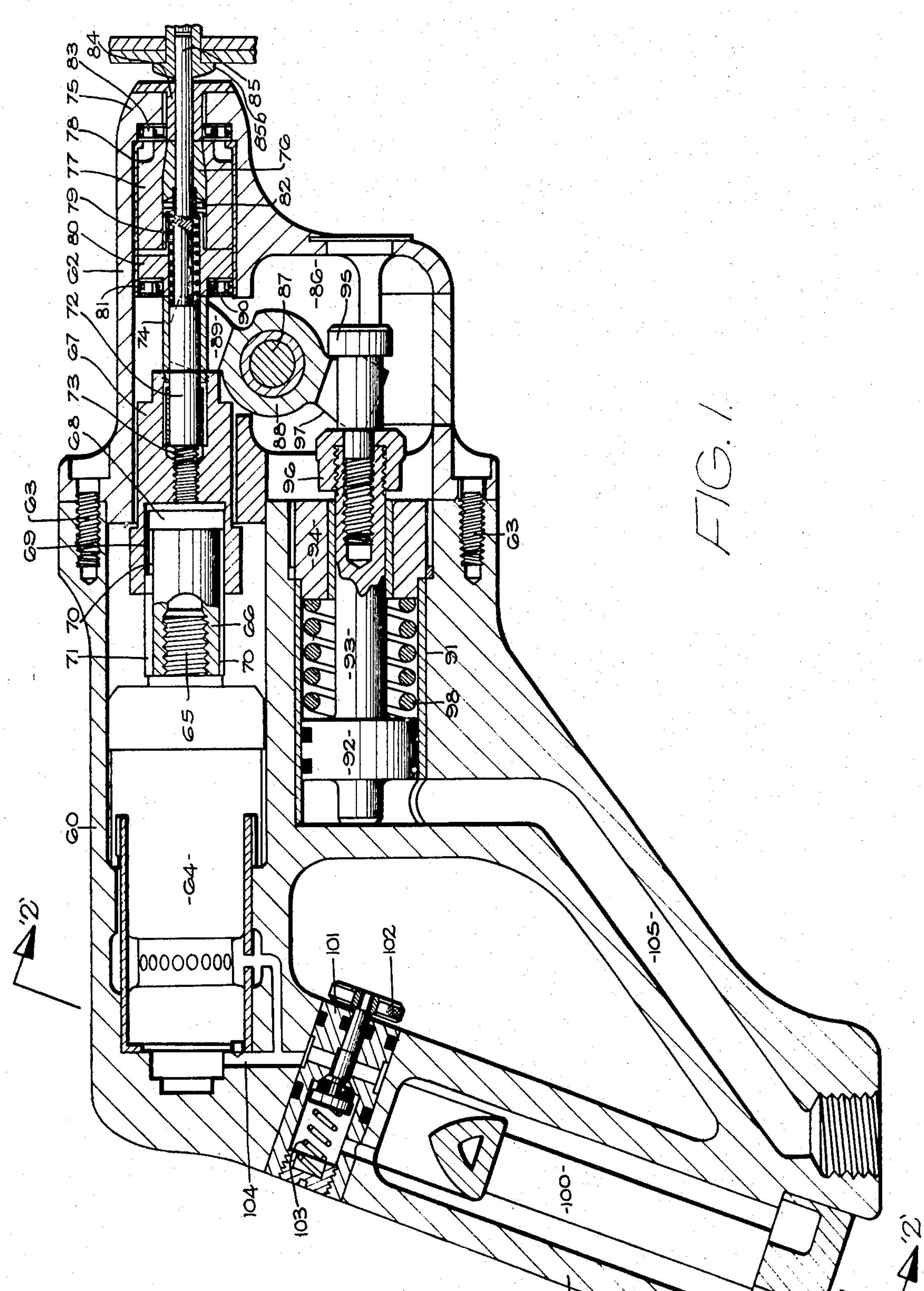

FIG. 1.

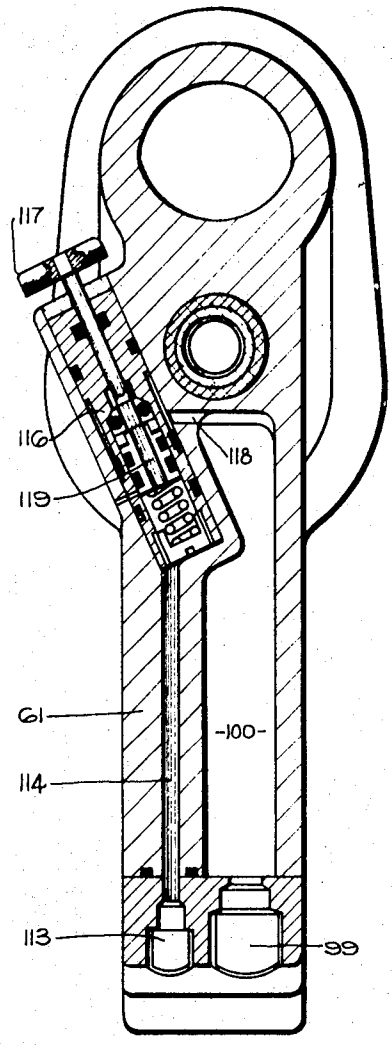

FIG. 2

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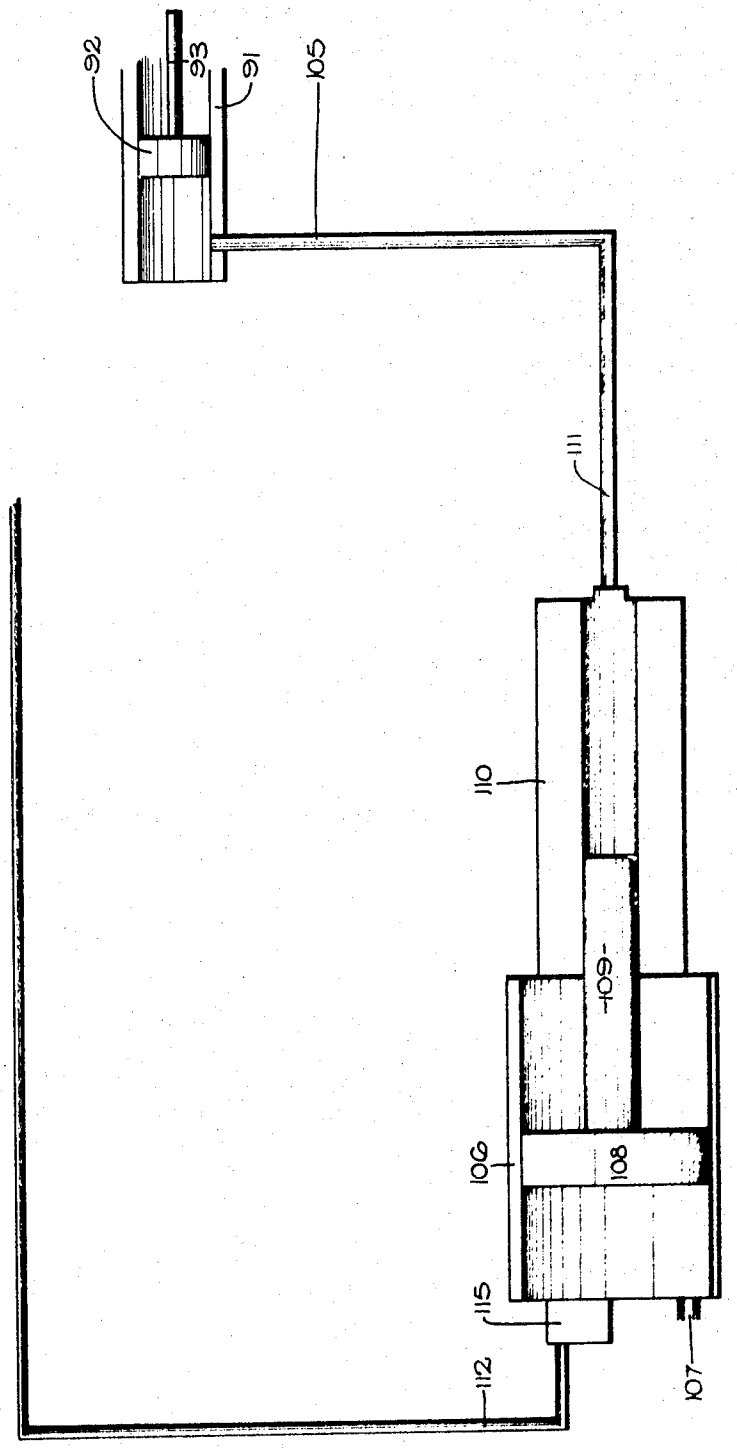

FIG. 5

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RIVETING TOOL

BACKGROUND OF THE INVENTION

The invention relates to a tool for use in a method of riveting making use of a tubular rivet for joining together two or more sheets. Such tubular rivets are particularly useful in blind side applications where sheets are to be joined together and it is not possible to obtain access to the remote side of the sheets so that the operation of applying the rivet fastening has to take place from the front side of the sheets.

DESCRIPTION OF THE PRIOR ART

Such tubular rivet fastenings as used hitherto have comprised, in combination, a tubular rivet having a tubular body and at one end thereof an enlarged flange or other form of abutment member adapted to engage the exposed face of one of the sheets to be joined on the front side and a mandrel which is used to insert the rivet through prepared aligned drilled holes in the sheets which are to be joined. In such combination the mandrel has an enlarged head on its forward end and the tubular rivet is positioned behind this head so that the mandrel with the rivet in position can be passed through the prepared holes until the flange or other abutment on the rivet engages the exposed face of one of the sheets to be joined. With the rivet being held against axial withdrawal the mandrel is pulled outwardly through the rivet with the result that the enlarged head of the mandrel engaging the end of the rivet causes this end to expand or bulge outwardly to a transverse dimension greater than the diameter of the prepared hole so as to lock the rivet firmly in position.

Subsequently, the portion of mandrel projecting outwardly from the front of the rivet is broken off or the mandrel may be such that it breaks off under a predetermined tension at a position inside the rivet and the portion of the mandrel left on the blind side may be knocked inwardly so that it drops out of the inner end of the rivet. In some cases the head of the mandrel is so shaped that it locks itself within the expanded wall of the rivet and remains permanently in position when broken away from the remainder. Hitherto, the use of a mandrel and rivet fastening as above-referred-to has required the drilling or punching of the holes in all the sheets being fastened together and this entails the expense of separate preliminary operations and also means that the sheets must be accurately assembled together prior to riveting in order to accurately align the prepared holes in the sheets. This involves the use of jigs and other equipment.

The object of the invention is to provide a riveting tool which will eliminate the aforesaid separate preliminary operations and will facilitate the assembly of the sheets together for the riveting operation without the necessity of jigs or other equipment.

SUMMARY OF THE INVENTION

According to the invention the tool comprises a body having mounted therein a motor rotating a drive shaft, a sleeve which is nonrotatably connected to the drive shaft and capable of axial sliding movement in the body relatively to the drive shaft in the axial direction thereof, a collet device adapted to grip one end of the mandrel, slidably and rotatably mounted in the body and connected to said sleeve so as to be rotated thereby and moved axially therewith, a fluid pressure piston and cylinder unit mounted in or on the body of the tool and means connecting the piston of said unit with said sleeve whereby axial movement of the piston, within its cylinder, produces axial sliding movement of said sleeve.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention is now described in more detail with reference to the accompanying drawings wherein:

FIG. 1 is a section on the centerline of a tool according to the invention,

FIG. 2 is a section on the line 2—2 of FIG. 1, and

FIG. 3 is a diagrammatic illustration of the pneumatic and fluid pressure circuit connected with the tool shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One embodiment of tool according to the invention is shown in the figures and is for use with a mandrel having a drilling point and the tool itself is generally in the shape of a gun with a main body part **60** which has formed integrally therewith a hand grip portion **61** and there being a forward body part **62** secured to the part **60** by appropriate screws indicated at **63**. Mounted within the main body part **60** is a known form of air turbine motor **64** which has a drive shaft **65** extending from one end thereof and having screw-threaded engagement with a sleeve **66**.

Coaxially aligned with the sleeve **66** is a further sleeve **67** which has a counterbore **68** at one end provided with an internal keyway **69** and this end fits over the sleeve **66** which is provided with a number of external keyways **70** so that the keyway **69**, upon assembly, can be made to register with one of the keyways **70** in the sleeve **66** and a key **71** inserted so that the sleeve **67** is then nonrotatably connected to the sleeve **66** but is capable of sliding within the body upon the exterior of the sleeve **66**.

At its other end the sleeve **67** has a smaller diameter counterbore in which is disposed the one end of a shaft **72** axially aligned with the driving shaft **65** and having its extreme end **73** in screw-threaded engagement with the passage within the sleeve **67** and surrounding the shaft **72** is an external sleeve or tubular member **74** which also has screw-threaded engagement with the counterbore in this end of the sleeve **67**.

The shaft **72** extends forwardly through the front body part **62** of the tool towards the nose end **75** of the tool and adjacent its forward end a number of collet fingers **76** are held within an outer collet sleeve **77** rotatably and slidably mounted in this forward part of the body of the gun in an internal lining sleeve **78**. The collet fingers **76** are spring loaded by a coil spring **79** which is mounted about a reduced diameter portion of the shaft **72** and contained in the annular space between this reduced diameter part of the shaft and the tubular member **74**. The member **74** has a radially extending flange **80** bearing against the outer collet sleeve **77** and at its forward end is in screw-threaded engagement with the member **77**. A roller bearing assembly **81** is mounted about the member **74** adjacent the flange **80** of this sleeve and the spring **79** bears against a washer **82** which itself bears against the inner ends of the collet fingers **76** to keep these urged forwardly into engagement with the interior of the exterior collet sleeve **77**.

A further roller thrust bearing **83** is mounted in the forward nose **75** of the tool and there is also fitted at this end a flanged guide sleeve **84** through which passes the shank **85** of the mandrel with the drill point which is to be used with a rivet to be inserted by the tool and the outer end of this mandrel **85** engages within a counterbore in the forward end of shaft **73** and is gripped so as to hold it firmly in the tool by the collet fingers **76**. The other end of the drill mandrel, is provided with any suitable form of drill point.

In a chamber **86**, formed in the front body part **62** below the shaft **73**, there is pivotally mounted upon a pivot pin **87** a two-armed lever **88**, each arm of which is bifurcated and the upper bifurcated arm **89** engages on opposite sides of the member **74** while one side of the bifurcated arm engages the forward end of the sleeve **67** and the other side of the bifurcated arm engages a plate **90** forming part of the thrust bearing assembly **81**.

Housed in the main body part **60** of the tool, below the motor **64**, is a fluid pressure piston cylinder device comprising a cylinder **91** having working therein a piston **92**, the piston rod **93** whereof extends outwardly through the forward end **94** of the cylinder and has, at its extreme end, an enlarged head **95** and spaced therefrom an abutment nut **96** which is screwed on to the exterior of the piston rod **93**. The other bifurcated arm **97** of the two-armed lever embraces this forward end of

the extension of the piston rod and engages between the enlarged head **95** on one side and the abutment nut **96** on the other side. A strong coil spring **98** surrounds the piston rod **93** and urges the piston **92** towards the left hand end of the cylinder, as shown in the drawings, which is the normal position of the tool when being operated for the drill mandrel **85** to drill the hole through the sheets which are being fastened by a rivet.

Referring to FIG. **2**, air under pressure from a suitable source of supply is supplied to the handgrip part **61** through a suitable connection **99** and air passes into the chamber **100** in the handgrip part. Mounted in the upper part of the handgrip **61** is a known form of control valve **101** operated by a press button **102** which, when pressed inwardly against the pressure of its spring **103**, admits air from the chamber **100** via the passage **104** to operate the air turbine motor **64**, causing rotation of the drive shaft **65** and simultaneous rotation therewith of the shaft **72** and thus the mandrel **85** of the drill to drill the required hole through one or more of the sheets being fastened together.

In practice, the supply of compressed air to the tool will be obtained from the normal compressed air supply provided in industrial establishments but this would not be of sufficiently high pressure to operate the piston **92** and provide the necessary force required to withdraw the mandrel **85** through the rivet and cause expansion of the rivet to lock it in position. The much higher pressure required to operate the piston **92** is obtained from a pneumatic/fluid pressure intensifier which is indicated diagrammatically in FIG. **3**, which shows diagrammatically the piston **92** and piston rod **93** in the cylinder **91** within the body of the gun and being supplied with fluid under pressure, via the passage **105**, through the handgrip part of the body. The intensifier comprises a pneumatic cylinder **106** supplied with air under pressure via the inlet **107** from the same source of supply as supplies the air to the air motor of the tool and the piston **108** of the cylinder has a piston rod **109** extending into a fluid pressure cylinder **110** and constituting the piston of this cylinder **110** which has suitable fluid within its cylinder and supplies the fluid under pressure via a flexible pipe **111** to the passage **105** in the tool.

When it is desired to operate the piston **92** an air signal from the tool is passed to the intensifier via a flexible pipe **112** which is adapted to be connected to a suitable connection **113** on the handgrip of the tool communicating with a passage **114** in the handgrip so that air from the chamber **100** passes through the passage **114** and pipe **112** to a known form of signal device **115** which then is operated to admit the air under pressure via inlet **107** to the cylinder **106** of the intensifier thus causing fluid under pressure considerably higher than that of the air inlet pressure to be forced into the cylinder **91** in the tool and thus operate the piston **92** to move this forwardly in its cylinder against the pressure of its restraining spring **98**.

The air signal to operate the intensifier is sent from the tool by operation of the known form of control valve **116** embodied in the upper part of the handgrip and operated by a press button **117** which, when depressed, admits air from the chamber **100** in the handgrip via a passage **118** into the valve and through a passage **119**, in the piston of the valve, to the passage **114** and thus to the flexible pipe **112** and the signal device **115**.

Thus, after the motor **64** has been operated to rotate the mandrel **85** of the drill and drill the required hole, the forward pressure exerted by the operator on the gun causes the nose end thereof to push the rivet through the hole formed in the sheets to be secured until the flange **85***b* on the rivet engages the forward side of such sheets. The nose end **75** of the tool is maintained in contact with the flange **85***b*. Then the control button **117** is operated to cause, as above described, the piston **92** to move forwardly in its cylinder with the result that the double arm lever **88** is pivoted in the anticlockwise direction as seen in FIG. **1** so that the sleeve **67** is moved to the left in FIG. **1**, sliding over the sleeve **66** and causing the collet fingers and collet sleeve to pull the mandrel rearwardly. Because the nose end **75** of the tool is in contact with the flange **85***b*, the rivet itself cannot be pulled out of the hole formed in the sheets and the reaction of the force exerted by the collet in pulling the mandrel rearwardly is transmitted to the flange **85***b* through the nose end **75**. Thus the rearward movement of the collet fingers and sleeve cause the enlarged drill head of the mandrel to be moved back through the rivet, causing expansion of the wall of the rivet on the blind side of the sheets and firmly anchoring the rivet in position. If the mandrel is provided with a weakened neck portion adjacent the drill head then, upon a predetermined tension being achieved in the shank **85** of the mandrel, this will break off at the said weakened section, leaving the head of the drill to drop out of the blind side of the work, or, if desired, to remain sealed in position within the tubular rivet.

What we then claim is:

1. A tool for riveting two sheets together comprising a body having mounted therein a motor rotating a drive shaft, a sleeve which is nonrotatably connected to the drive shaft and capable of axial sliding movement in the body relatively to the drive shaft in the axial direction thereof, a collet device adapted to grip one end of a mandrel, slidably and rotatably mounted in the body and connected to said sleeve so as to be rotated thereby and moved axially therewith, a fluid pressure piston and cylinder unit mounted in said body of the tool and means connecting the piston of said unit with said sleeve whereby axial movement of the piston, within its cylinder, produces axial sliding movement of said sleeve.

2. A tool according to claim **1** wherein the piston and cylinder unit is housed in the body, in substantially side-by-side relationship with the motor, the piston having a piston rod connected thereto and extending axially from one end of the cylinder, and the means connecting the piston with said sleeve comprises a two-armed lever pivoted in the body with one arm of the lever engaging said sleeve and the other arm engaging the end of the piston rod.

3. A tool according to claim **2** wherein the collet device includes an elongated member one end of which is fixed within the end of said sleeve which is furthest from the motor and the other end of which member engages within an external collet sleeve of the collet device and the one arm of said two-armed lever which engages the said sleeve also engages, on its opposite side, said collet sleeve, the piston of said piston and cylinder unit being spring urged in one direction in its cylinder which pivots the two-arm lever in the direction to move the said collet sleeve in the outwards direction.

4. A tool according to claim **1**, wherein the motor is operated by compressed air, the supply of which to the motor is controlled by a manually operable valve in the body of the tool wherein the piston and cylinder unit is operated by fluid at higher pressure than said compressed air, said fluid being supplied from a fluid pressure intensifier having a pneumatic cylinder, the piston of which has a piston rod extending into a fluid-filled cylinder and acting as the piston therein, and said pneumatic cylinder having an air supply controlled by valve means which is operated by an air signal derived from the compressed air supply to the tool and controlled by a further manually operable valve in the body of the tool.

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