IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

BÖLLHOFF SYSTEMTECHNICK GMBH & CO. KG a German corporation Plaintiff, v. HENROB LIMITED a United Kingdom corporation Defendant.	Case No. 05-C-3037 Judge Manning Magistrate Judge Nolan **JURY DEMANDED**

FILING OF FIRST AMENDED COMPLAINT PURSUANT TO RULE 15(a)

Plaintiff, Böllhoff Systemtechnick GmbH & Co. KG ("Böllhoff"), hereby files its First Amended Complaint for Declaratory Judgment and Other Relief ("First Amended Complaint"), pursuant to Fed. R. Civ. P. 15(a), and states as follows:

1. On May 20, 2005, Böllhoff filed its Complaint for Declaratory Judgment and Other Relief ("Complaint").

2. Subsequent to the filing of its Complaint, Böllhoff discovered a few errors in the Complaint, which have been corrected in the First Amended Complaint, attached hereto as Exhibit A.

3. Defendant, Henrob Limited, has not yet been served with summons and a copy of the Complaint and, accordingly, Henrob Limited has not yet filed any responsive pleading to Böllhoff's Complaint.

4. As such, pursuant to Fed. R. Civ. P. 15(a), Böllhoff may amend the Complaint as a matter of right.

Accordingly, Böllhoff files the attached First Amended Complaint for Declaratory Judgment and Other Relief, pursuant to Fed. R. Civ. P. 15(a)

DATED: May 24, 2005

Respectfully submitted,

BÖLLHOFF SYSTEMTECHNICK GMBH & CO. KG

By: _____
One of Its Attorneys

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BÖLLHOFF SYSTEMTECHNICK GMBH & CO. KG a German corporation Plaintiff, v. HENROB LIMITED a United Kingdom corporation Defendant.	)	Case No. 05-C-3037 Judge Manning Magistrate Judge Nolan **JURY DEMANDED**

FIRST AMENDED COMPLAINT FOR DECLARATORY JUDGMENT AND OTHER RELIEF

Plaintiff, Böllhoff Systemtechnick GmbH & Co. KG, a German corporation ("Böllhoff"), through its attorneys and for its First Amended Complaint for Declaratory Judgment and Other Relief against Defendant, Henrob Limited, a United Kingdom corporation ("Henrob"), states as follows:

NATURE OF ACTION

This action seeks a declaratory judgment, pursuant to the Declaratory Judgment Act, 28 U.S.C. § 2201, from this Court that: 1) a product imported into the United States which was made with Böllhoff's apparatus and method for riveting sheet metal with a self-piercing rivet does not infringe U.S. patent no. 5,752,305 under 35 U.S.C. § 271(g); 2) Böllhoff's apparatus and method for riveting sheet metal with a self-piercing rivet that is used, made, sold, offered for sale or imported into the United States does not infringe U.S. patent no. 5,752,305; and 3) U.S. patent no. 5,752,305 is invalid under 35 U.S.C. §§ 102, 103, 112, 132, and/or 305. This action

EXHIBIT
A

further seeks relief from this Court for unfair competition under Section 43 of the Lanham Act, 15 U.S.C. § 1125, and state common law, stemming from Henrob's false allegations, false descriptions of facts, and misrepresentations to others relating to Böllhoff's apparatus and method for riveting sheet metal with a self-piercing rivet.

THE PARTIES

1. Plaintiff Böllhoff is a corporation organized and existing under the laws of Germany and has a principal place of business at Archimedesstraße 1-4, 33649 Bielefeld, Germany.

2. Upon information and belief, Defendant Henrob is a corporation organized and existing under the laws of the United Kingdom and has a principal place of business at Second Avenue, Deeside Industrial Park, Flintshire, United Kingdom CH5 2NX.

JURISDICTION AND VENUE

3. This Court has jurisdiction over this matter pursuant to: 1) 28 U.S.C. § 2201, in that it is an action seeking a declaratory judgment with respect to allegations of patent infringement, that have been asserted by Henrob, and patent validity, under the United States Patent Act, 35 U.S.C. § 101 *et. seq.*; 2) 28 U.S.C. §§ 1331 and 1338(a) in that this matter arises under an Act of Congress relating to patents; 3) 28 U.S.C. § 1331 in that this matter arises under Section 43 of the Lanham Act, 15 U.S.C. § 1125; and 4) supplemental jurisdiction over Böllhoff's common law claim stated herein under 28 U.S.C. § 1367.

4. This Court has personal jurisdiction over Henrob pursuant to: 1) 735 ILCS 5/2-209 in that Henrob has alleged that products made outside of the United States, but sold within

this jurisdiction and elsewhere, specifically BMW automobiles, by riveting machines which are made and sold by Böllhoff, infringe US patent no. 5,752,305, thereby inherently alleging that Böllhoff either is contributorily infringing or inducing infringement of US patent no. 5,752,305 within this jurisdiction; 2) Fed. R. Civ. P. 4(k)(2), in that the exercise of personal jurisdiction is consistent with the Constitution and the laws of the United States and Henrob is an alien corporation which is not subject to the jurisdiction of the courts of general jurisdiction of any state, but has consistent contacts with the United States as a whole; and 3) 35 U.S.C. § 293, in that Henrob does not reside within the United States and it has designated a domestic representative located within this jurisdiction for service and notice. This Court also has *in rem* jurisdiction over this action in that it involves a United States Letters Patent, which was issued pursuant to the United States Patent Act, 35 U.S.C. § 101 *et seq.*

5. Venue is proper in this judicial district pursuant to 28 U.S.C. § 1391(d) in that Henrob is an alien corporation without a normal place of business within any state in the United States.

FACTS COMMON TO ALL COUNTS

6. Böllhoff makes, uses, sells, and offers to sell machines for riveting sheet metal with self-piercing rivets ("Böllhoff's Riveters"), which necessarily use a method of riveting sheet metal with self-piercing rivets ("Böllhoff's Riveting Method"), to customers located inside and outside of the United States, including customers that use Böllhoff's Riveters and Böllhoff's Riveting Method on products imported into the United States.

7. On information and belief, Henrob is the owner, by assignment, of all rights, title and interest in and to U.S. patent no. 5,752,305, issued on May 19, 1998, having a reexamination certificate issued on April 19, 2005, and titled "Self-piercing riveting method and apparatus." (the "'305 Patent")(attached hereto as Exhibit A).

8. Henrob has alleged and misrepresented to Böllhoff's existing and/or prospective customers ("Böllhoff's Customers") that Böllhoff's Riveters and Böllhoff's Riveting Method cause such customers to infringe the '305 Patent.

9. For example, on or about May 12, 2005, Henrob, through its counsel, alleged and misrepresented to BMW, one of Böllhoff's Customers, that BMW automobiles manufactured with Böllhoff's Riveters and Böllhoff's Riveting Method and imported into the United States cause BMW to infringe the '305 Patent. (See e.g., letter from Henrob's counsel to BMW AG, attached hereto as Exhibit B).

10. Henrob has threatened at least one of Böllhoff's Customers with legal proceedings for patent infringement by alleging that products imported into the United States, specifically BMW automobiles, that are made with Böllhoff's Riveters and Böllhoff's Riveting Method infringe the '305 Patent. (See Exhibit B).

11. Due to such allegations and threats made to Böllhoff's Customers, Henrob has raised a justiciable controversy in that: 1) Böllhoff is being irreparably harmed because Böllhoff's Customers a) are not using, purchasing and/or importing, or are contemplating not using, purchasing, and/or importing, Böllhoff's Riveters and Böllhoff's Riveting Method in the United States, or b) are not purchasing and/or using, or are contemplating not purchasing and/or

using, Böllhoff's Riveters and Böllhoff's Riveting Method to make products which are imported into the United States, due to fear of Henrob initiating legal proceedings; 2) Böllhoff is being irreparably harmed because Henrob is misrepresenting and falsely describing Böllhoff's Riveters and Böllhoff's Riveting Method to others in commerce; and 3) Henrob's allegations and threats to others inherently allege that Böllhoff is contributorily infringing or is inducing the infringement of the '305 Patent.

COUNT I
DECLARATION OF NON-INFRINGEMENT

12. Böllhoff repeats and realleges paragraphs 1 through 11 of this Complaint as if fully set forth herein.

13. A product made with Böllhoff's Riveters, or Böllhoff's Riveting Method, and imported into the United States does not infringe any claims of the '305 Patent.

14. Böllhoff's Riveters made, used, sold, offered for sale, or imported into the United States do not infringe any claims of the '305 Patent.

15. Böllhoff's Riveting Method used within the United States does not infringe any claims of the '305 Patent.

16. Henrob's actions have caused damages to Böllhoff, in an amount to be determined at trial. Henrob's allegations of infringement of the '305 Patent to Böllhoff's Customers has caused irreparable injury to Böllhoff, and, unless and until Henrob's actions are enjoined by this Court, Böllhoff will continue to suffer irreparable injury because of Henrob's meritless allegations. Böllhoff has no adequate remedy at law.

COUNT II
DECLARATION OF INVALIDITY

17. Böllhoff repeats and realleges paragraphs 1 through 11 of this Complaint as if fully set forth herein.

18. The '305 Patent is invalid because it does not comply with the statutory requirements of patentability enumerated in, among other things, 35 U.S.C. §§ 102, 103, 112, 132, and/or 305.

19. Henrob's actions have caused damages to Böllhoff, in an amount to be determined at trial. Henrob's allegations of infringement of the '305 Patent to Böllhoff's Customers has caused irreparable injury to Böllhoff, and, unless and until Henrob's actions are enjoined by this Court, Böllhoff will continue to suffer irreparable injury because of Henrob's meritless allegations. Böllhoff has no adequate remedy at law.

COUNT III
SECTION 43 OF THE LANHAM ACT

20. Böllhoff repeats and realleges paragraphs 1 through 19 of this Complaint as if fully set forth herein.

21. Henrob has misrepresented and falsely and misleadingly described, in commerce and through commercial communications, the nature, characteristics, properties and qualities of Böllhoff's Riveters or Böllhoff's Riveting Method to others, in violation of 15 U.S.C. § 1125(a)(1).

22. Henrob's misrepresentations and false and misleading descriptions of facts to others regarding Böllhoff's Riveters or Böllhoff's Riveting Method are material and are likely to

influence Böllhoff's Customers' purchasing decisions or are likely to cause confusion or mistake.

23. Henrob's actions have caused damages to Böllhoff, in an amount to be determined at trial. Henrob's misrepresentations and false and misleading descriptions of facts to others relating to Böllhoff's Riveters or Böllhoff's Riveting Method have caused irreparable injury to Böllhoff, and, unless and until Henrob's actions are enjoined by this Court, Böllhoff will continue to suffer irreparable injury because of Henrob's misrepresentations. Böllhoff has no adequate remedy at law.

COUNT IV
COMMON LAW UNFAIR COMPETITION

24. Böllhoff repeats and realleges paragraphs 1 through 19 of this Complaint as if fully set forth herein.

25. Henrob has misrepresented and falsely and misleadingly described, in commerce and through commercial communications, the nature, characteristics, properties and qualities of Böllhoff's Riveters or Böllhoff's Riveting Method to others.

26. Henrob's misrepresentations and false and misleading descriptions of facts to others regarding Böllhoff's Riveters or Böllhoff's Riveting Method are material and are likely to influence Böllhoff's Customers' purchasing decisions or are likely to cause confusion or mistake.

27. Henrob's misrepresentations and false and misleading descriptions of facts to others relating to Böllhoff's Riveter's or Böllhoff's Riveting Method constitute unfair competition under the common laws of the State of Illinois.

28. Henrob's actions have caused damages to Böllhoff, in an amount to be determined at trial. Henrob's misrepresentations and false and misleading descriptions of facts to others relating to Böllhoff's Riveters or Böllhoff's Riveting Method have caused irreparable injury to Böllhoff, and, unless and until Henrob's actions are enjoined by this Court, Böllhoff will continue to suffer irreparable injury because of Henrob's misrepresentations. Böllhoff has no adequate remedy at law.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff, Böllhoff Systemtechnick GmbH & Co. KG, respectfully requests that this Court enter a judgment:

a. declaring that a product made with Böllhoff's Riveters and/or Böllhoff's Riveting Method and imported into the United States does not infringe any claims of the '305 Patent under 35 U.S.C. § 271(g);

b. declaring that Böllhoff's Riveters made, used, sold, offered for sale, and/or imported into the United States do not infringe any claims of the '305 Patent under 35 U.S.C. § 271;

c. declaring that Böllhoff's Riveting Method used within the United States does not infringe any claims of the '305 Patent under 35 U.S.C. § 271;

d. declaring that the '305 Patent is invalid;

e. preliminarily and permanently enjoining Henrob from threatening others with legal proceedings, or otherwise representing or describing to anyone that 1) Böllhoff's Riveters made, used, sold, offered for sale or imported into the United States would infringe the '305 Patent; 2) Böllhoff's Riveting Method used within the United States would infringe the '305 Patent; or 3) a product imported into the United States which is made with Böllhoff's Riveters or Böllhoff's Riveting Method would infringe the '305 Patent;

f. ordering Henrob to pay Böllhoff the damages that it has incurred as a result of the acts complained of herein, including, but not limited to, an award to Böllhoff of its lost profits, sales and reputational harm as a result of the acts complained of herein;

g. ordering Henrob to pay Böllhoff its interest, costs and expenses of this action, and its reasonable attorneys' fees, as a result of the acts complained of herein; and

h. awarding Böllhoff any other relief that this Court deems just and fit.

DATED: May 24, 2005

Respectfully submitted,

BÖLLHOFF SYSTEMTECHNICK GMBH & CO. KG

By: _____
One of Its Attorneys

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US005752305A

United States Patent [19]

Cotterill et al.

[11] Patent Number: 5,752,305

[45] Date of Patent: May 19, 1998

[54] **SELF-PIERCING RIVETING METHOD AND APPARATUS**

[75] Inventors: **Alf Cotterill**, Buckley, United Kingdom; **Stuart Edmond Blacket**, Brisbane, Australia; **Sumanjit Singh**, Gamersheim-Lippersthofen, Germany

[73] Assignee: **Henrob Limited**, United Kingdom

[21] Appl. No.: **454,296**

[22] PCT Filed: **Dec. 20, 1993**

[86] PCT No.: **PCT/GB93/02608**

§ 371 Date: **Mar. 1, 1996**

§ 102(e) Date: **Mar. 1, 1996**

[87] PCT Pub. No.: **WO94/14554**

PCT Pub. Date: **Jul. 7, 1994**

[30] **Foreign Application Priority Data**

Dec. 19, 1992 [GB] United Kingdom 9226517

[51] **Int. Cl.**[6] **B23P 11/00**

[52] **U.S. Cl.** **29/432.2**; 29/525.06; 29/243.53; 29/798

[58] **Field of Search** 29/432.1, 432.2, 29/525.06, 243.53, 798; 227/52, 55, 77

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Primary Examiner—David P. Bryant
Attorney, Agent, or Firm—Rudnick & Wolfe

[57] **ABSTRACT**

A method of riveting comprises inserting a self-piercing rivet into sheet material without full penetration such that the deformed end of the rivet remains encapsulated by an upset annulus of the sheet material. The sheet material is clamped with a substantial force during the riveting operation in the region around the rivet insertion location. The clamping force is maintained constant throughout at least the major part of the riveting operation and has a magnitude of up to 1.5 tonnes. A riveting machine for carrying out the method comprises a punch, means for feeding rivets successively to the punch for insertion into sheet material to be riveted, a die aligned with the punch for deforming the rivet inserted thereby, and clamping means for clamping the sheet material with a substantial force during the riveting operation in the region around the rivet insertion location.

15 Claims, 3 Drawing Sheets

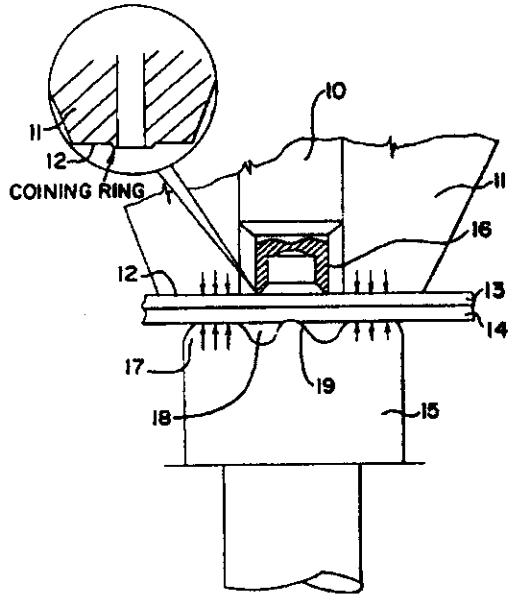

EXHIBIT
A

FIG. 3

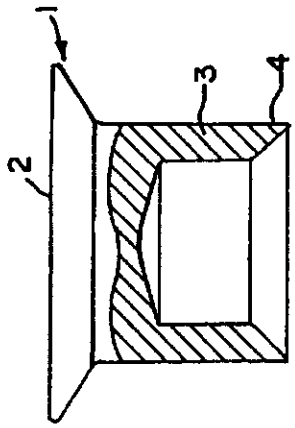

FIG. 1

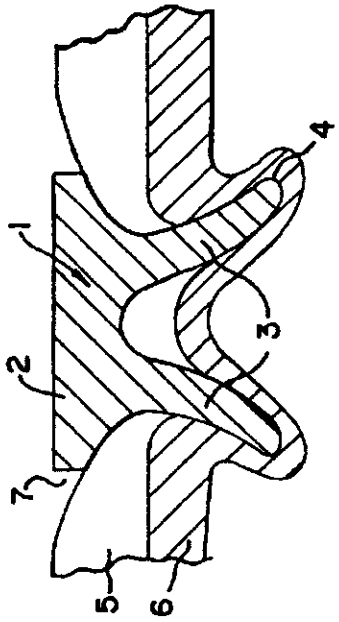

FIG. 2

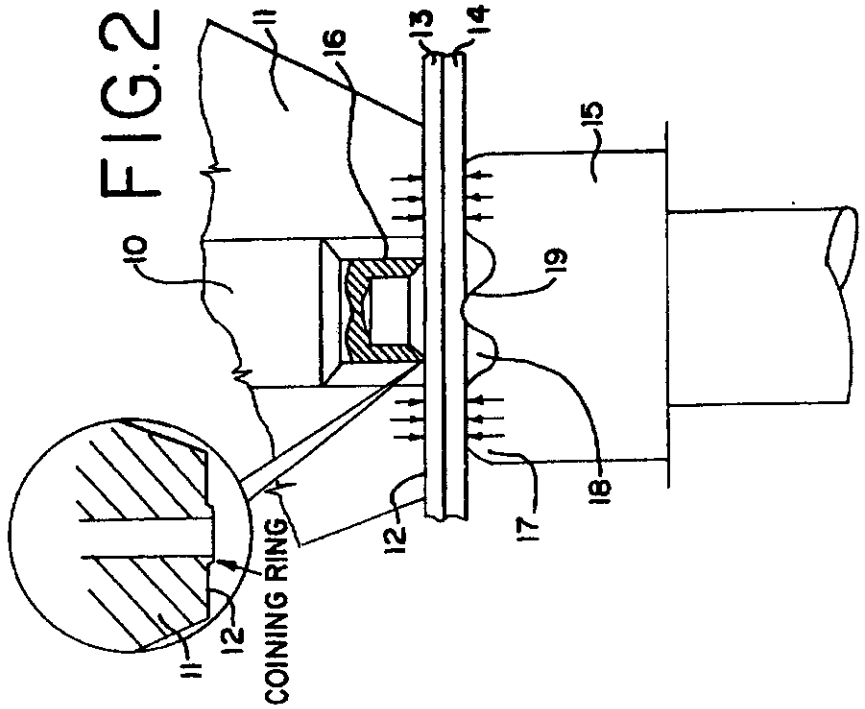

FIG. 2A

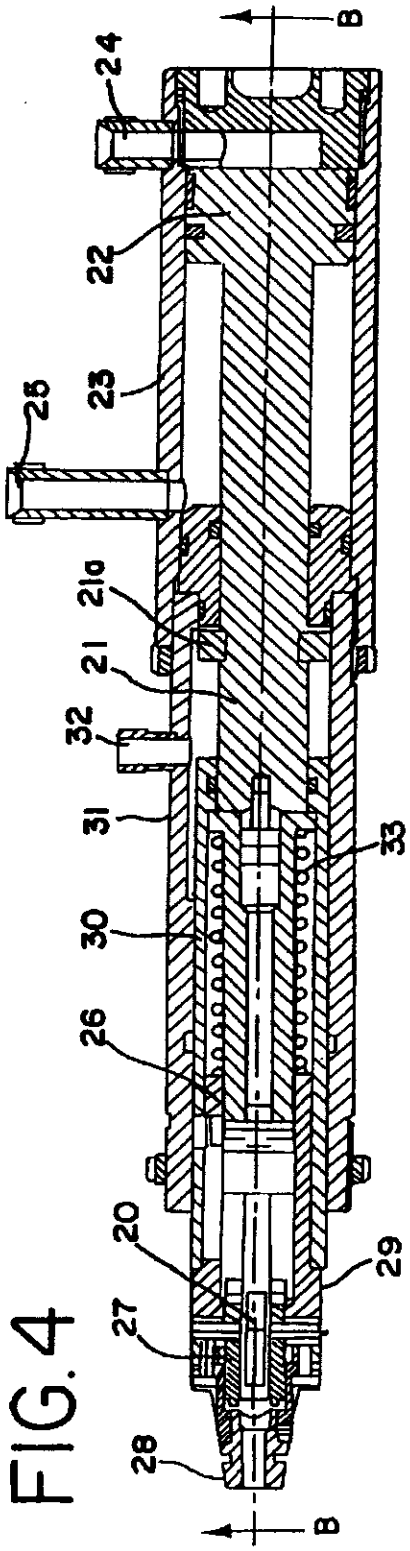

FIG. 4

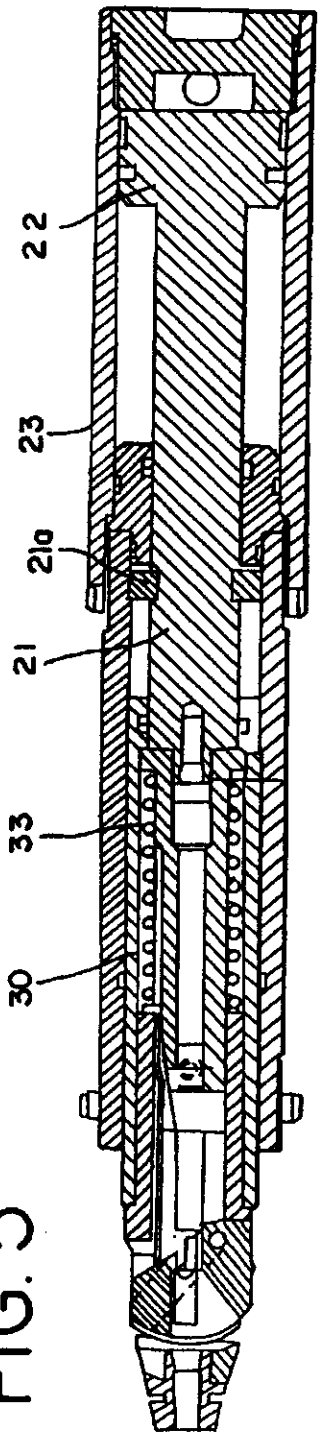

FIG. 5

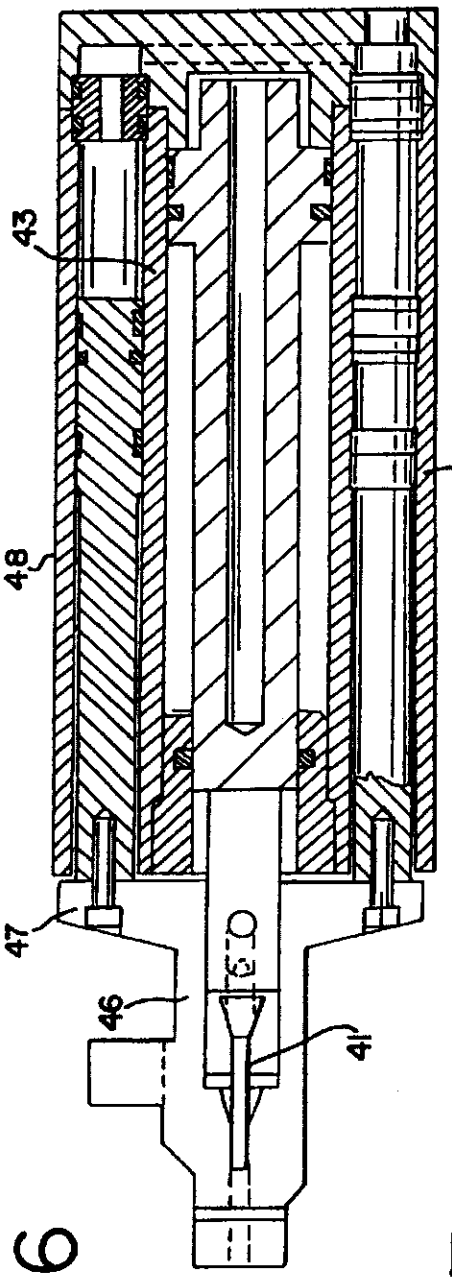

FIG.6

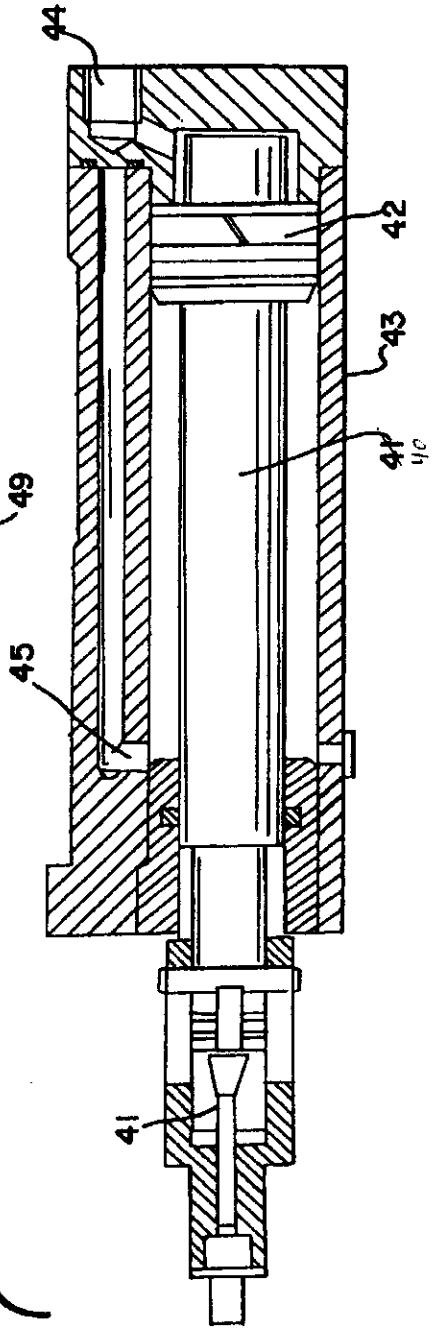

FIG.7

SELF-PIERCING RIVETING METHOD AND APPARATUS

This invention relates to self-piercing riveting and more particularly to a method of and apparatus for riveting of the kind in which a self-piercing rivet is inserted into sheet material without full penetration, such that the deformed end of the rivet remains encapsulated by an upset annulus of the sheet material.

FIG. 1 is a diagrammatic section of an example of a riveted joint made by such a riveting method in accordance with the invention. A rivet 1 has a head 2 and a shank 3 terminating in an annular edge 4. The shank 3 is initially cylindrical but is flared outwardly into the illustrated shape as the rivet is driven into two overlapping sheets 5, 6 located on a suitably shaped die. As shown, the shank 3 and the edge 4 of the rivet remain embedded in the sheet material 5, 6 after the rivet has been set.

Hitherto, riveted joints of the kind illustrated in FIG. 1 have had various imperfections. Desirably, the head 2 of the rivet 1 is flush with the surrounding surface of the sheet 5 which should remain undeformed, and the annular valley 7 between the sheet 5 and the rivet head 2 should be as shallow as possible. In reality, however, the riveting stresses may cause substantial deformation of the upper sheet 5, for example in the form of a circular depression or dimple around the rivet location, and the valley 7 may be unacceptably deep. Although unobjectionable in many applications, such surface distortions are often unacceptable, e.g. for visible joints of motor vehicle body panels, in particular the curved portions of said panels. On the concealed side of the joint, the appearance is immaterial but unevennesses in the thickness of the sheet material 6 encapsulating the rivet end 4 may affect the strength of the joint and permit breakthrough of the rivet end thereby encouraging corrosion.

It will be appreciated that self-piercing riveting is not confined to rivets of the kind shown in FIG. 1. Thus, for example, flat head and pan head style rivets may be used but riveted joints using such alternative rivets have hitherto suffered from at least some of the imperfections mentioned above.

It is an object of the present invention to provide a method of self-piercing riveting of the kind defined in which the aforesaid disadvantages are obviated or mitigated.

The invention also relates to a riveting machine for setting self-piercing rivets in the manner described. A known riveting machine for setting self-piercing rivets is described in U.S. Pat. No. 4,615,475 by Nietek Pty. Ltd. the disclosure of which is incorporated herein by reference.

It is a further object of the present invention to modify the known riveting machine so as to improve the riveted joint produced thereby.

According to a first aspect of the present invention there is provided a method of riveting comprising inserting a self-piercing rivet into sheet material without full penetration such that the deformed end of the rivet remains encapsulated by an upset annulus of the sheet material characterised in that the sheet material is clamped with a substantial force during the riveting operation in the region around the rivet insertion location.

According to a second aspect of the present invention there is provided a riveting machine for inserting a self-piercing rivet into sheet material without full penetration such that the deformed end of the rivet remains encapsulated by an upset annulus of the sheet material, said machine comprising a punch, means for feeding rivets successively to the punch for insertion into sheet material to be riveted, a die aligned with the punch for deforming the rivet inserted thereby, and clamping means for clamping the sheet material with a substantial force during the riveting operation in the region around the rivet insertion location.

The invention will now be further described by way of example only with reference to the accompanying drawings in which:

FIG. 1 is a section of a riveted joint made by the riveting method of the invention;

FIG. 2 is a diagram showing the operative components of a riveting machine of the invention at the start of a riveting operation;

FIG. 3 is a part sectional side elevation of a rivet suitable for use in the riveting method of the invention;

FIGS. 4 and 5 are longitudinal sectional views on mutually perpendicular planes of one embodiment of riveting machine according to the invention, and

FIGS. 6 and 7 are corresponding views of a second embodiment of riveting machine according to the invention.

Referring now to the drawings, the riveted joint of FIG. 1 has already been described as an example of the kind of joint that is produced by the riveting method of the invention. The undeformed rivet is shown in FIG. 3 and is given the same reference numerals. It will be noted that the shank 3 is initially cylindrical and the free end 4 has an internal taper to define a cutting edge facilitating insertion and spreading of the rivet.

FIG. 2 shows a punch 10 of a riveting tool surrounded by a preclamping element 11 having an annular clamping surface 12 urging two overlapping sheets 13, 14 against a die 15. The surface 12 may have a rough finish provided for example by knurling or annular grooving in order to improve the grip on the sheet material and prevent material being pulled laterally into the joint. A coining ring may be provided on the surface 12 as shown in the inset to FIG. 2. The coining ring functions to prevent material flow and also to regulate distortion adjacent to the rivet head so as to give a uniform appearance. A rivet 16 of the kind shown in FIG. 3 is located at the end of the plunger 10 ready for insertion into the sheets 13, 14. The die 15 has an annular surface 17 (which may be roughened in the same way as the surface 12) cooperating with the clamping surface 12 and surrounding a semi-toroidal cavity 18 around a central projection 19 which is preferably above the level of the clamping surface 17 but may also be below or at the same level as said surface. The clamping element 12 exerts a constant clamping force on the sheets 13, 14. An electronic pressure switch senses the clamping pressure and main riveting process pressure and is used as a control device coordinated by a programmable logic controller. The clamping force, which remains constant during the riveting process, can be accurately set at any value up to approximately 1.5 tonnes. In a hydraulically operated riveting machine the control of the clamping force may involve topping up of the oil in the clamping cylinder to maintain the clamping pressure as the riveting process takes place. This is required because the frame of the riveting machine, which is a C-Frame in the machine shown in U.S. Pat. No. 4,615,475 deflects during the riveting operation and the clamp cylinder must therefore advance to maintain the clamping force constant.

The tapered end 4 of the rivet 1 provides a cutting ring which shears the top sheet 13 with minimal draw of the sheet material as a result of the clamping force. The taper angle on the end of the rivet provides a taper surface which can be thrust radially outwards by the reaction of the die and punch giving reliable spreading of the rivet as it is forced into the die by the punch. The rivet is preferably heat treated to improve its self-piercing quality.

The riveting machine is preferably constructed as shown U.S. Pat. No. 4,615,475. Alternative designs of the clamping and punching part of the machine are shown in FIGS. 4, 5 and FIGS. 6, 7. Referring to FIGS. 4, 5, a punch 20 is carried by a plunger 21 terminating in a double-acting piston 22 slidable in a main cylinder 23 having inlet/outlet connections 24, 25 at opposite sides of the piston 22. The lower part of the plunger 21 (to the left in FIGS. 4 and 5) is slidable in a guide bush 26 which carries an actuator 27 and terminates in a nose 28 the end face of which provides the clamping surface 12 of FIG. 2. The mode of operation of the actuator 27, plunger 21 and punch 20 is fully described U.S. Pat. No. 4,615,475. The machine of FIGS. 4 and 5 differs from that described in U.S. Pat. No. 4,615,475 by virtue of the fact that the head 29 of the guide bush 26 has a shoulder which is engaged by a clamping sleeve 30 which is slidable in a hydraulic cylinder 31 having an inlet/outlet connection 32 for hydraulic fluid.

In use, the nose 28 of the tool is advanced to contact the workpiece by introducing fluid under pressure through the connection 32. A predetermined clamping force is then exerted on the nose 28 by pressurising the cylinder 31 so as to advance the sleeve 30. A constant clamping force is pre-set in the manner already described and the punch 20 is then operated to insert the rivet in the manner fully described in U.S. Pat. No. 4,615,475. Because the central projection 19 of the die 15 (FIG. 2) is above the level of the annular surface 17 of the die 15 the clamping force exerted on the workpiece, i.e. sheets 13, 14, before insertion of the rivet 16 results in pre-indentation of the lower sheet 14 causing improved geometry of material flow during rivet setting.

In the more compact design of riveting machine shown in FIGS. 6 and 7, a plunger 40 is connected at one end to a punch 41 and at its other end to a piston 42 slidable in a main cylinder 43 having hydraulic fluid inlets 44, 45 at opposite sides of the piston 42. A guide bush 46 is connected by a cross member 47 to the pistons of a pair of clamping piston-and-cylinder devices 48, 49 flanking the main cylinder 43. In this case, in contrast to the embodiment of FIGS. 4 and 5 and the design shown in U.S. Pat. No. 4,615,475, the rivet feed to the head of the machine is pneumatic rather than mechanical.

The clamping function is identical in both tools—the nose of the tool is advanced forward to contact the work piece and clamp the work between the nose and the die of the riveting tool at a pre-set pressure. Next, the primary hydraulic cylinder operates to set the rivet during which time the pre-clamping is maintained. As the punch retracts by means of the primary cylinder then the clamp cylinder(s) are also retracted. The signal that the pre-clamping operation has occurred is generated by a pressure switch which monitors the clamping pressure. As soon as the pre-set pressure is reached the pressure switch signals the main cylinder to advance for the riveting operation. In the case of the standard stroke tool the forward movement of the clamp pulls forward the plunger and piston of the main hydraulic cylinder. There is no positive pressure on the main hydraulic cylinder as this occurs. On both versions the clamping pressure is maintained by a check valve and the circuit componentry allows for a topping-up of the volume of hydraulic fluid that is maintained under pressure by the check valve. This top-up is to compensate for the small additional advance movement that the clamp components must make in order to maintain pressure on the workpiece as the C-Frame deflects during the riveting process.

A riveted joint may be strengthened by use of an adhesive between adjacent surfaces of the joint, e.g. between the sheets 5, 6 in FIG. 1. The adhesive may be applied in the form of a strip which is then spread evenly over the mating surfaces by application of pressure by means of the pre-clamping mechanism which is adjusted to deliver a low initial pressure for this purpose.

The strength of the riveted joint may be further enhanced by increasing the clamping pressure at the end of the riveting operation. This may be achieved by using the rear (right hand in FIG. 4) end of the clamping sleeve 30 as an abutment for the stop ring 21a on the plunger 21 at the end of the riveting stroke. The clamping force is thus momentarily increased e.g. to about 5 tonnes. A similar effect may be achieved by making the coining ring (shown in FIG. 2 as an integral part of the clamping surface 12) a separate component which is urged by suitable actuating means (e.g. mechanical actuating means operated by the plunger mechanism) into its operative position at or towards the end of the riveting operation with an insertion pressure which effectively enhances the clamping pressure acting on the workpiece.

It has been found that clamping of the workpiece, particularly when using a die having a raised central projection for pre-indenting the workpiece, results in greatly improved strength and appearance characteristics of the riveted joint.

We claim:

1. A method of riveting in which first and second superimposed sheets of material are interconnected by driving a self-piercing rivet through the first sheet into non-piercing engagement with the second sheet comprising the steps of:

a) locating a die defining a recess beneath the second sheet in alignment with a punch located above the first sheet;

b) positioning a rivet having an end adapted to expand when driven into a sheet of material between the punch and the first sheet;

c) clamping the sheets together before the rivet is driven into the first sheet with a clamping force applied immediately adjacent the rivet, the clamping force being sufficiently substantial to prevent sheet material from being drawn laterally inwards towards the rivet as the rivet is driven into the sheets; and

d) advancing the punch to drive the rivet into the first and second sheets so that the sheets are interconnected.

2. A method as claimed in claim 1, wherein the clamping force is maintained constant throughout at least a major part of the riveting operation.

3. A method as claimed in claims 1 or 2, wherein the clamping force is initially low to assist uniform spread of adhesive in a joint to be riveted.

4. A method as claimed in claims 1 or 2, wherein the die has a semi-toroidal cavity in a die surface against which the second sheet is clamped, the cavity surrounding a central projection extending above said surface for the purpose of pre-indenting the second sheet during initial clamping prior to rivet insertion.

5. A method as claimed in claims 1 or 2, wherein the clamping force is momentarily increased at the end of the riveting operation.

6. A method as claimed in claim 5, wherein the momentary increase in the clamping force is achieved by a coining operation.

7. A method as claimed in claim 6, wherein the die has a semi-toroidal cavity in a die surface against which the second sheet is clamped, the cavity surrounding a central projection extending above said surface for the purpose of pre-indenting the second sheet during initial clamping prior to rivet insertion.

8. A method as claimed in claim 1 or 2, wherein the clamping force has a magnitude of up to 1.5 tonnes.

9. A riveting machine for interconnecting a first sheet of a material and a second sheet of a material by driving a self-piercing rivet through the first sheet into non-piercing engagement with the second sheet comprising:

a) a punch;

b) means for feeding rivets successfully to the punch for insertion into the sheets;

c) a die aligned with the punch for deforming the rivet inserted thereby; and

d) clamping means for clamping the sheets during the riveting operation around a location wherein the rivet is inserted, the clamping force being sufficiently substantial to prevent the material of the first sheet from being drawn laterally inwards towards the rivet as the rivet is being driven into the sheets.

10. A machine as claimed in claim 9 wherein the punch is guided in a clamping head having an annular clamping surface coacting with a die surface upon the die to clamp the sheets in use.

11. A machine as claimed in claim 10, wherein said annular clamping surface and the die surface are knurled or otherwise roughened to improve the grip on the sheet material during clamping.

12. A machine as claimed in claim 10 or 11, wherein separate fluid-pressure operated actuating means are provided for exerting a clamping force on the clamping head and for driving the punch in the rivet insertion direction, and the clamp actuating means provides a stop for the punch actuating means so as to cause a momentary increase of the clamping force at the end of the riveting operation.

13. A machine as claimed in claim 10 or 11, wherein a displaceable coining ring has actuating means for carrying out a coining operation at the end of the riveting operation thereby causing a momentary increase of the clamping force at the end of the riveting operation.

14. A machine as claimed in claims 9, 10 or 11, wherein the die has a semi-toroidal cavity in a die surface against which the second sheet is clamped, the cavity surrounding a central projection extending above said surface for the purpose of pre-indenting the second sheet prior to rivet insertion.

15. A machine as claimed in claims 9, 10 or 11, wherein said clamping means includes a fluid-pressure operated means for exerting a clamping force and, further comprising fluid-pressure operated means for driving the punch, wherein said fluid operated means for exerting a clamping force and said fluid-pressure operated means for driving the punch are arranged in side-by-side relationship to reduce the overall length of the machine.

* * * * *

US005752305C1

(12) EX PARTE REEXAMINATION CERTIFICATE (5098th)

United States Patent
Cotterill et al.

(10) **Number: US 5,752,305 C1**
(45) **Certificate Issued: Apr. 19, 2005**

(54) **SELF-PIERCING RIVETING METHOD AND APPARATUS**

(75) Inventors: **Alf Cotterill**, Buckley (GB); **Stuart Edmond Blacket**, Brisbane (AU); **Sumanjit Singh**, Gamersheim-Lippersthofen (DE)

(73) Assignee: **Henrob Limited**, Clwyd (GB)

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Reexamination Certificate for:

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(2), (4) Date: **Mar. 1, 1996**

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PCT Pub. Date: **Jul. 7, 1994**

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(51) **Int. Cl.**[7] **B23P 11/00**
(52) **U.S. Cl.** **29/432.2**; 29/525.06; 29/243.53; 29/798
(58) **Field of Search** 29/432.2, 525.06, 29/243.53, 798

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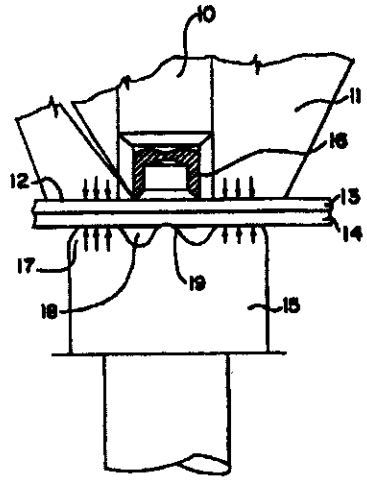
Primary Examiner—Eric Compton

(57) **ABSTRACT**

A method of riveting comprises inserting a self-piercing rivet into sheet material without full penetration such that the deformed end of the rivet remains encapsulated by an upset annulus of the sheet material. The sheet material is clamped with a substantial force during the riveting operation in the region around the rivet insertion location. The clamping force is maintained constant throughout at least the major part of the riveting operation and has a magnitude of up to 1.5 tonnes. A riveting machine for carrying out the method comprises a punch, means for feeding rivets successively to the punch for insertion into sheet material to be riveted, a die aligned with the punch for deforming the rivet inserted thereby, and clamping means for clamping the sheet material with a substantial force during the riveting operation in the region around the rivet insertion location.



EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims **9–15** is confirmed.

Claim **1** is determined to be patentable as amended.

Claims **2–8**, dependent on an amended claim, are determined to be patentable.

New claim **16** is added and determined to be patentable.

1. A method of riveting in which first and second superimposed sheets of material are interconnected by driving a self-piercing rivet through the first sheet into non-piercing engagement with the second sheet comprising the steps of:

a) locating a die defining a recess beneath the second sheet in alignment with a punch located above the first sheet;

b) positioning a rivet having an end adapted to expand when driven into a sheet of material between the punch and the first sheet;

c) clamping the sheets together before the rivet is driven into the first sheet with a clamping force applied immediately adjacent the rivet, the clamping force being [sufficiently substantial] *sufficient* to prevent sheet material from being drawn laterally inwards towards the rivet as the rivet is driven into the sheets, *said clamping force being larger than a clamping force merely required to hold said sheets against each other in a generally non-moving relation*; and

d) advancing the punch to drive the rivet into the first and second sheets so that the sheets are interconnected.

16. A method of riveting in which first and second superimposed sheets of material are interconnected by driving a self-piercing rivet through the first sheet into non-piercing engagement with the second sheet comprising the steps of:

a) locating a die defining a recess beneath the second sheet in alignment with a punch located above the first sheet;

b) positioning a rivet having an end adapted to expand when driven into a sheet of material between the punch and the first sheet;

c) clamping the sheets together before the rivet is driven into the first sheet with a clamping force applied immediately adjacent the rivet, the clamping force being sufficient to prevent sheet material from being drawn laterally inwards towards the rivet as the rivet is driven into the sheets; and

d) advancing the punch to drive the rivet into the first and second sheets so that the sheets are interconnected.

* * * * *

Via Telefax (in advance)

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EXTREMELY URGENT!

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Bielefeld · Hamm · Düsseldorf
Berlin · Potsdam

Your ref.:

Our ref.: GC 49-L20054DE00

May 12, 2005
FE/ek

Henrob Ltd. ./. Böllhoff GmbH

Dear Mr. Dirscherl,
Dear Mr. Bücken,

We refer to our meeting of today concerning SPR-systems. We notified you formally of our client's claims that a significant number of BMW cars, manufactured using Böllhoff equipment and imported into the USA, are infringing our client's US patent 5752305.

Our client has been advised to commence legal proceedings against you in the USA. These proceedings would include ITC proceedings and also wilful patent infringement proceedings seeking triple damages and injunctions. Our client's US lawyers are ready to commence proceedings by July 1st 2005.

We understand that you have to notify Böllhoff of any claim, because, according to your information, you will look to Böllhoff for a full indemnity in respect of your liability.

EXHIBIT
B

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Our client is willing to make an attempt to resolve these matters amicably with Böllhoff direct.

We understand that you will ask Böllhoff to contact us on or before May 13, 2005.

Böllhoff shall indicate whether they are prepared to negotiate with Henrob. The period 23.5.05-27.5.05 is available for a negotiation meeting.

Yours sincerely,

Jürgen Feldmeier