US00RE39582E

(19) **United States**

(12) **Reissued Patent**

Luhm

(10) **Patent Number: US RE39,582 E**

(45) **Date of Reissued Patent: *Apr. 24, 2007**

(54) **METHOD FOR REPLACING A TACKING FASTENER**

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(*) Notice: This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/131,629**

(22) Filed: **Mar. 6, 2002**

Related U.S. Patent Documents

Reissue of:

(64) Patent No.: **5,689,873**
Issued: **Nov. 25, 1997**
Appl. No.: **08/746,132**
Filed: **Nov. 6, 1996**

U.S. Applications:

(60) Continuation of application No. 09/444,537, filed on Nov. 22, 1999, which is a division of application No. 08/584,111, filed on Jan. 11, 1996, now abandoned.

(51) **Int. Cl.**
F16B 13/04 (2006.01)
B23P 11/00 (2006.01)

(52) **U.S. Cl.** **411/43**; 411/69; 411/70; 411/501; 29/525.11

(58) **Field of Classification Search** ..... 411/69, 411/70, 43, 501; 408/1 R, 84; 29/426.4, 525.11
See application file for complete search history.

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(57) **ABSTRACT**

[A temporary fastener that fastens two adjacent workpieces. The fastener includes a shank that extends through a hole of the workpieces. Extending from one end of the shank is a conical shaped head. The fastener also contains a pull stem which has a head located adjacent to the blind end of the shank. The stem head is pulled through the shank to expand and tightly fasten the shank to the workpieces. The fastener is removed by drilling through the head and the shank. The diameter of the conical shank head is smaller than the diameter of the drill so that part of the head does not become attached to the drill bit and scratch the workpiece. The conical shape of the head also reduces the volume of fastener material to further reduce the size and amount of chips produced during the drilling process. The tightly engaged shank prevents the fastener from rotating during the drilling operation.] *A method of replacing a tacking fastener that temporarily joins two adjacent workpieces with a permanent fastener to permanently join the workpieces. A drill bit is engaged with an inner channel of the temporary fastener at a head of the fastener. The drill bit has a diameter larger than the head diameter. The head, the shank, the first workpiece, and the second workpiece are drilled through to form a hole through the workpieces. The first workpiece and the second workpiece are joined with a permanent fastener through the hole.*

10 Claims, 2 Drawing Sheets

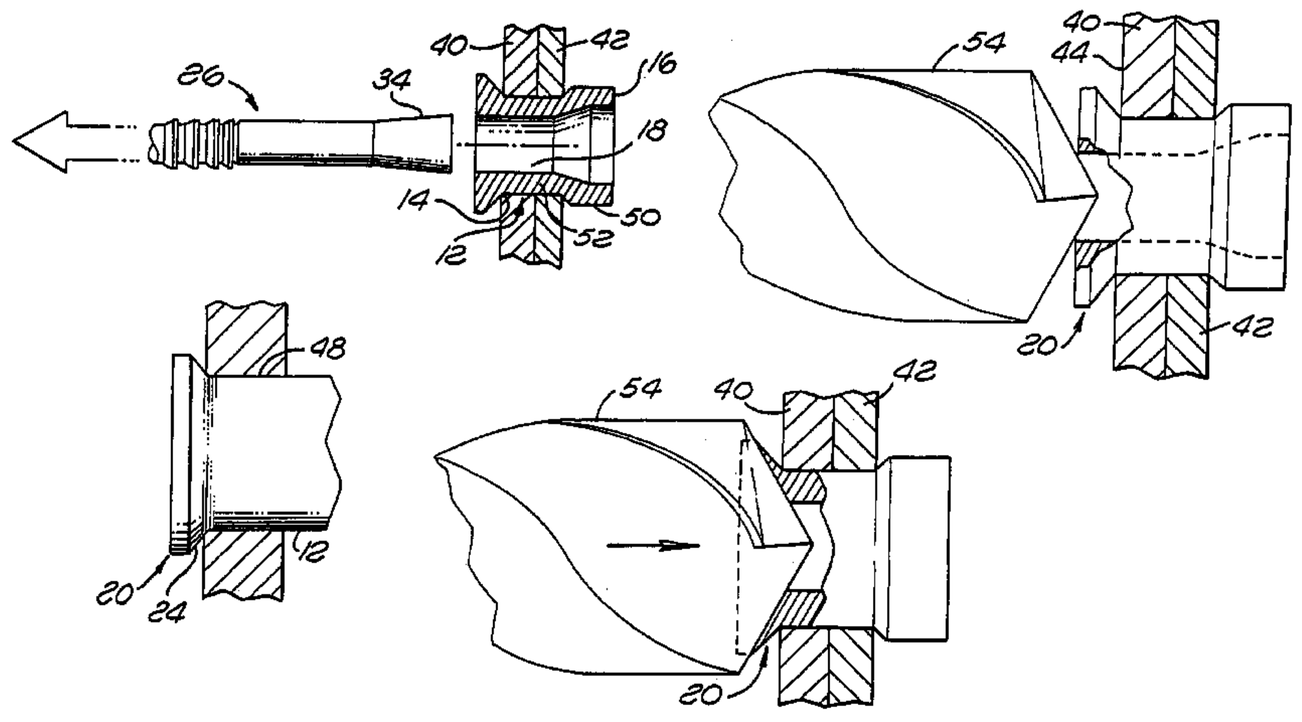

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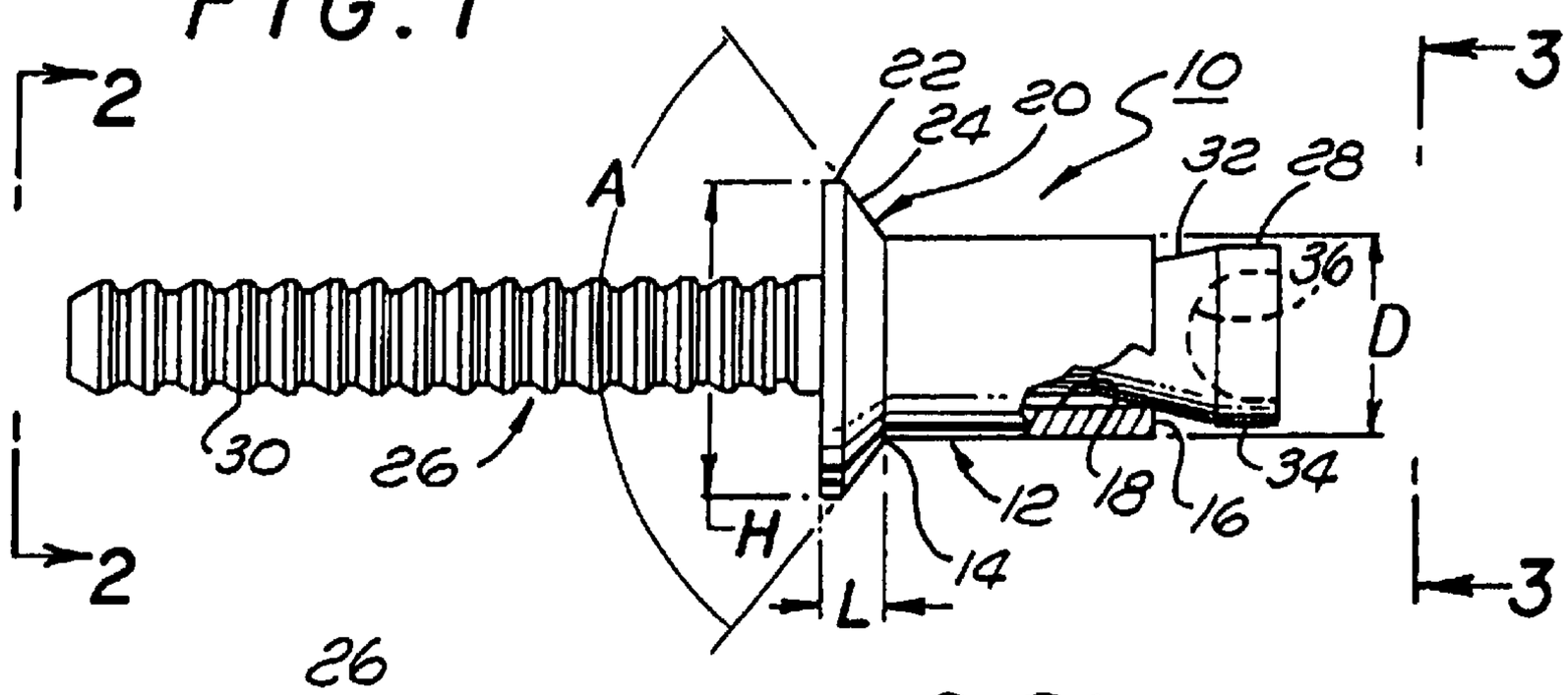
FIG. 1



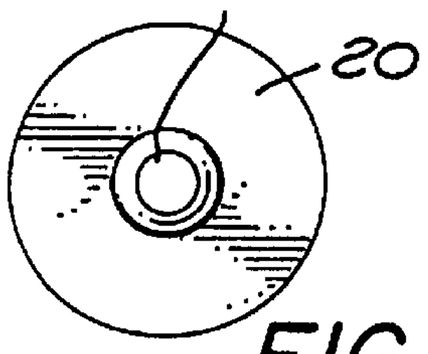


FIG. 2

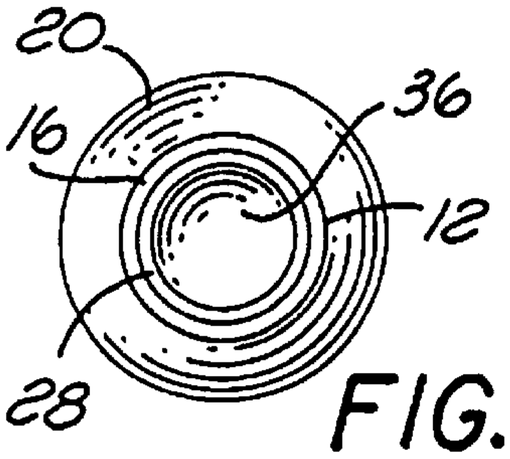


FIG. 3

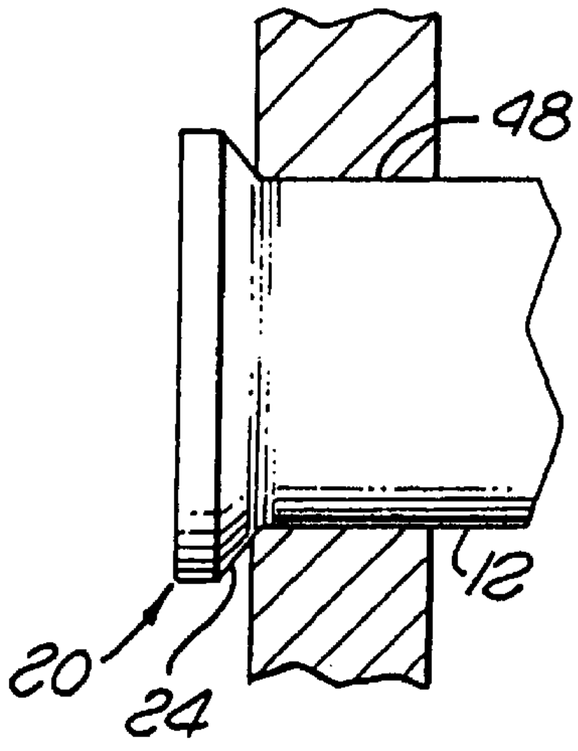


FIG. 6

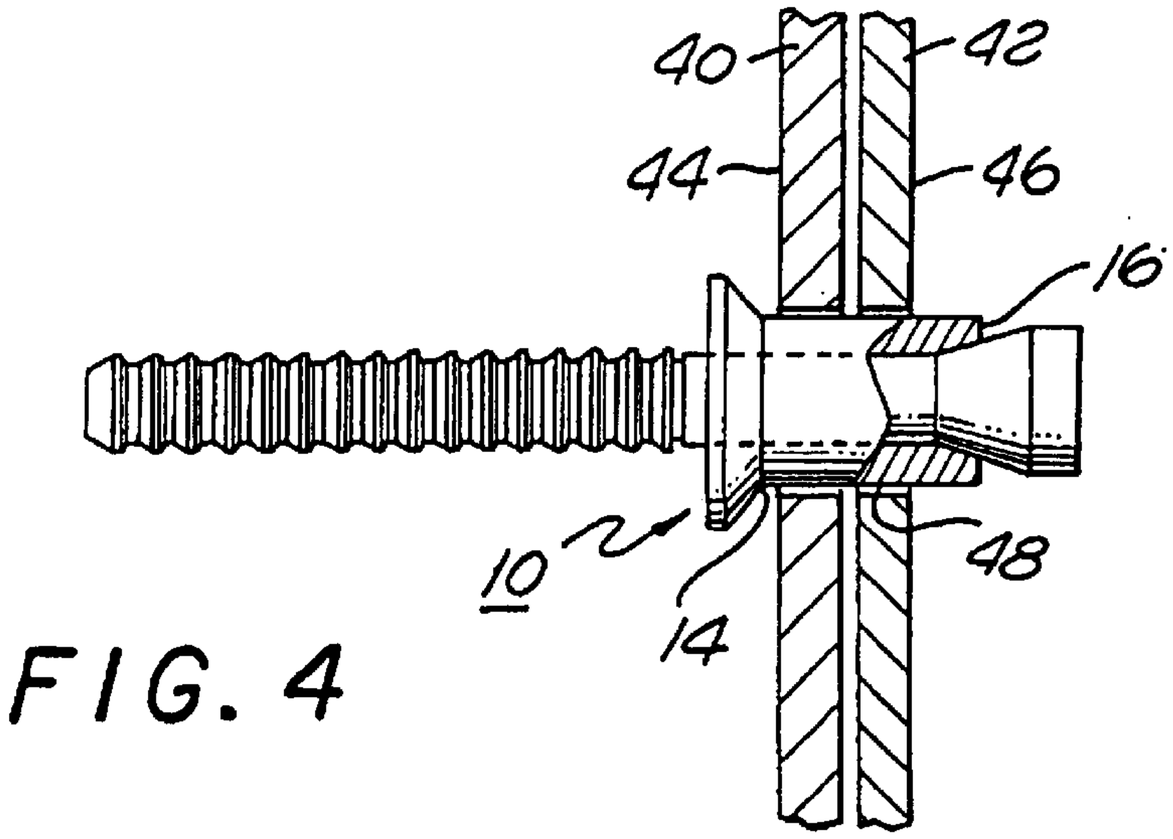


FIG. 4

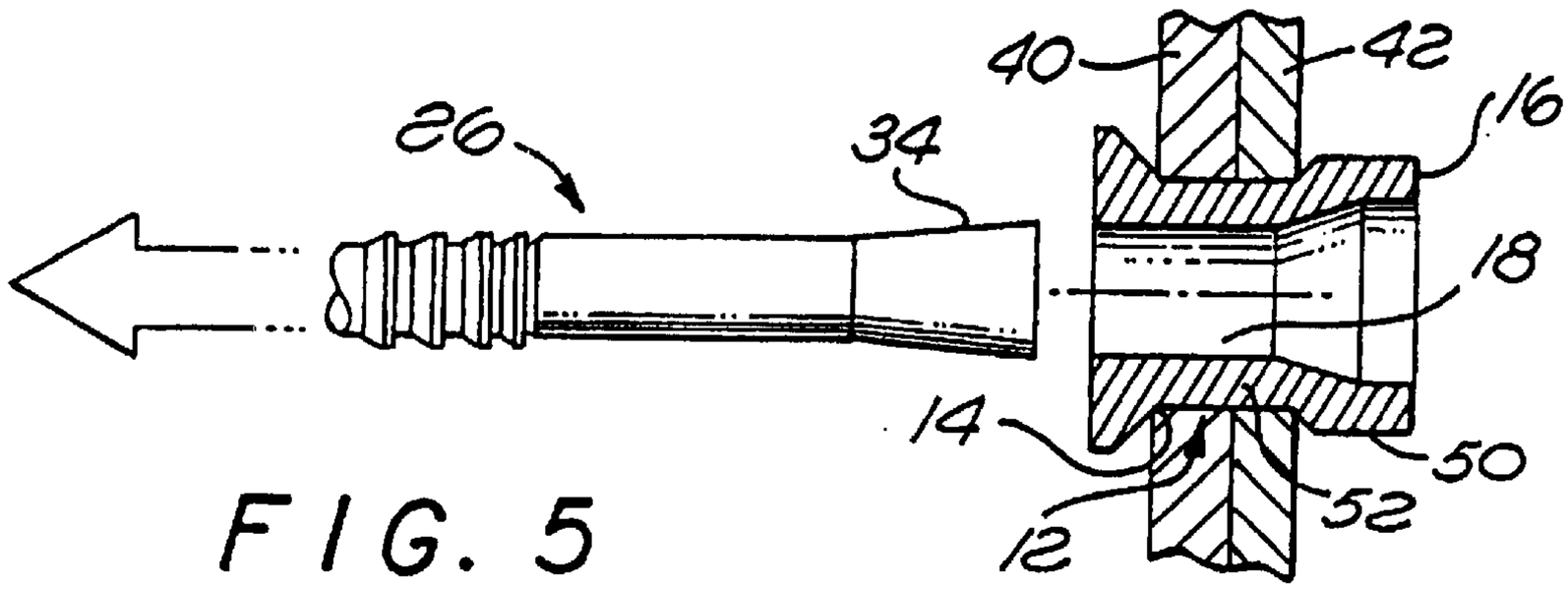


FIG. 5

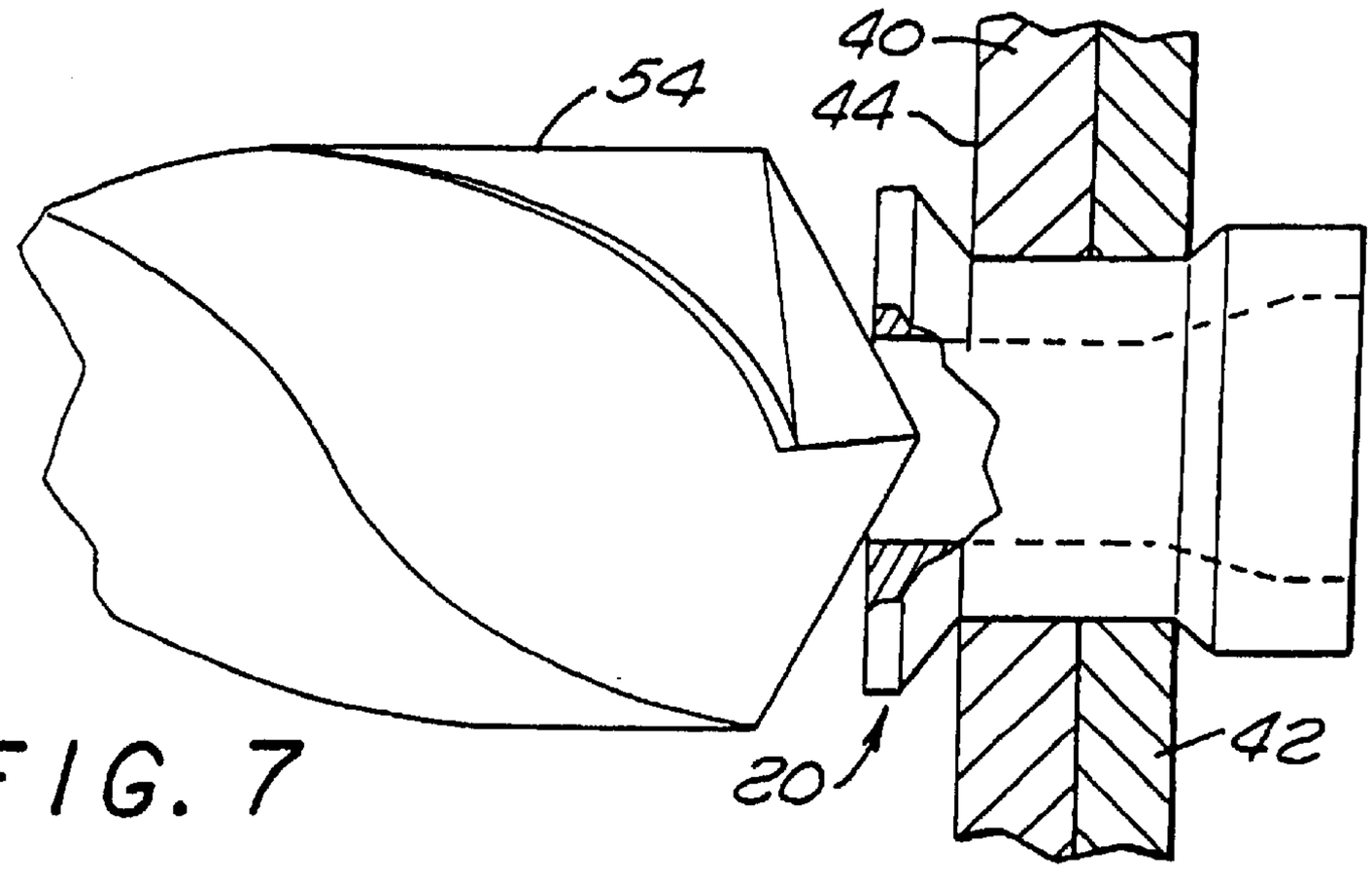


FIG. 7

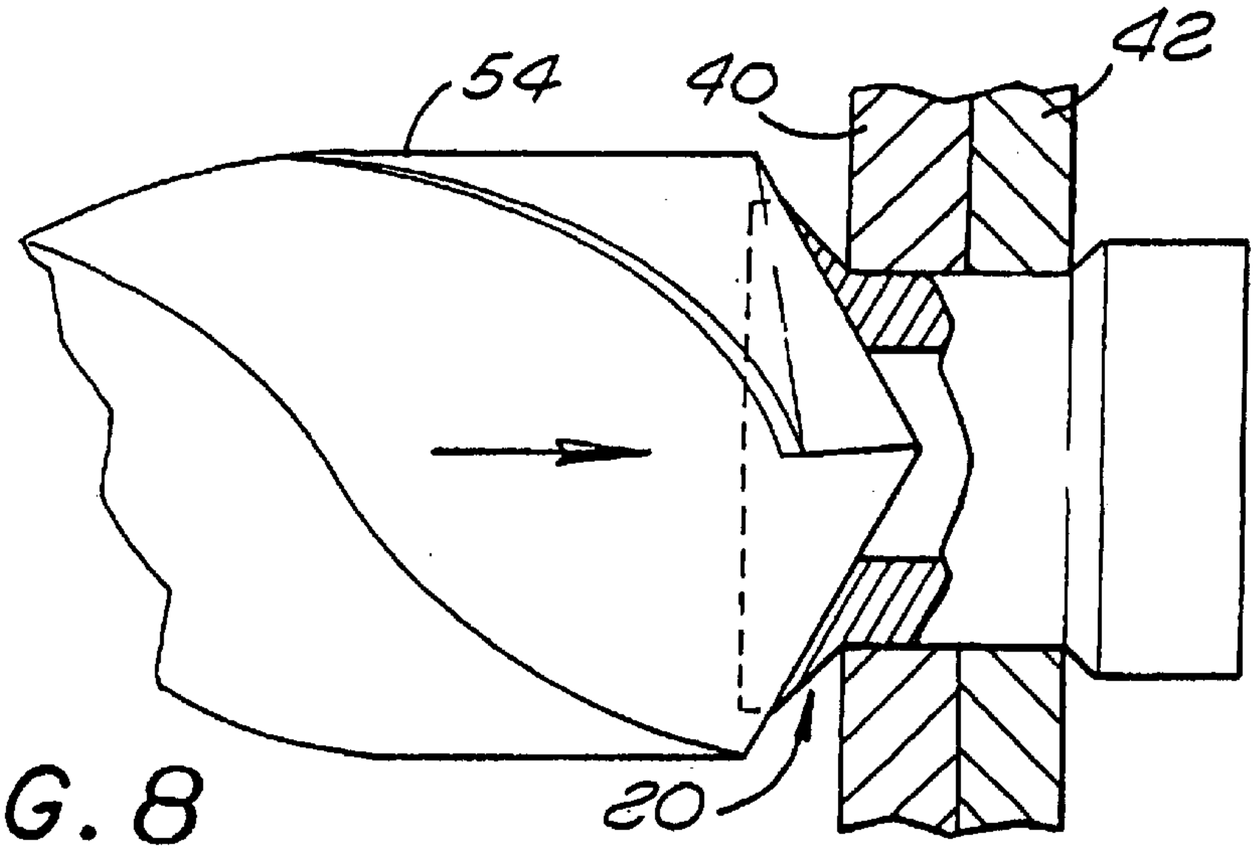


FIG. 8

METHOD FOR REPLACING A TACKING FASTENER

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

Notice: More than one reissue application has been filed for the reissue of U.S. Pat. No. 5,689,873. The reissue applications are application Ser. Nos. 09/444,537 and 10/131,629 (the present application) which is a continuation of Ser. No. 09/444,537, all of which are reissues of U.S. Pat. No. 5,689,873.

This is *a Continuation of Reissue application Ser. No. 09/444,537, filed Nov. 22, 1999 pending, for reissue of U.S. Pat. No. 5,689,873, filed Nov. 6, 1996 and issued Nov. 25, 1997, which issued from* a Divisional application of application Ser. No. 08/584,111, filed Jan. 11, 1996 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to *metal working and more particularly to a method for assembling that includes disassembling by destroying a temporary connector to create a hole for* a *permanent separate* fastener for temporarily fastening two adjacent workpieces.

2. Description of Related Art

The fuselage of an airplane is constructed from a number of individual panels that are fastened to a frame by a plurality of rivets. Temporary fasteners are typically installed into adjacent parts to insure that the workpieces do not become separated during the installation of the permanent rivets. The temporary fasteners are eventually removed and replaced with a permanent rivet.

Some areas of the aircraft are not fully accessible, thereby requiring the use of a blind rivet which can be installed from only one side of a workpiece. Temporary blind fasteners typically contain a shank which extends through a hole drilled through the workpieces. The shank has a head which prevents the fastener from falling into the "blind" side of the assembly. The fastener also contains a pull stem which has a stem head located at the blind end of the shank. The stem head is pulled through the shank to expand the shank and secure the fastener to the workpieces. The temporary fastener is eventually removed by drilling through the head and the shank with a drill of the proper diameter for the shank of the permanent rivet to be installed.

It has been found that drilling temporary blind fasteners of the prior art may create splinters and portions of the head that can scratch the surface of the outer workpiece. Additionally, although the head and enlarged shank end prevent the fastener from falling out of the hole, it has been found that the shank may rotate with the drill bit before the head is totally drilled out, preventing further penetration of the drill. Also the rotation of the shank and head remnants spins the splinters and drill chips to further scratch the surface of the workpiece. It would therefore be desirable to provide a temporary fastener that is easy to remove and does not create scratches on the workpiece surfaces.

SUMMARY OF THE INVENTION

[The present invention is a temporary fastener for fastening two or more adjacent workpieces. The fastener includes a shank that extends through a hole of the workpieces. Extending from one end of the shank is a conical shaped head. The fastener also contains a pull stem which has a head located adjacent to the blind end of the shank. The stem head is pulled through the shank to expand and tightly fasten the shank to the workpieces. The fastener is removed by drilling through the head and the shank.**]** *The present invention is a method of replacing a tacking fastener that temporarily joins two adjacent workpieces with a permanent fastener to permanently join the workpieces. A drill bit is engaged with an inner channel of the temporary fastener at a head of the fastener. The drill bit has a diameter larger than the head diameter. The head, the shank, the first workpiece, and the second workpiece are drilled through to form a hole through the workpieces. The first workpiece and the second workpiece are joined with a permanent fastener through the hole.*

[The diameter of the conical shank head is smaller than the diameter of the drill so that part of the head does not become attached to the drill bit and scratch the workpiece. The conical shape of the head also reduces the volume of fastener material to further reduce the size and amount of chips produced during the drilling process. The tightly engaged shank prevents the fastener from rotating during the drilling operation.**]**

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, wherein:

FIG. **1** is a side view of a tacking fastener of the present invention;

FIG. **2** is a front end view of the tacking fastener of FIG. **1**;

FIG. **3** is a rear end view of the tacking fastener of FIG. **1**;

FIG. **4** is a side sectional view showing the fastener inserted into a hole of two adjacent workpieces;

FIG. **5** is a side view similar to FIG. **4** showing a stem pulled through a shank of the fastener;

FIG. **6** is an enlarged side view of the shank head pressed into the workpiece;

FIG. **7** is a side view showing a drill positioned to initiate drilling;

FIG. **8** is a side view similar to FIG. **7** showing the drill drilling through the shank head.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings more particularly by reference numbers, FIGS. **1** through **3** show a tacking fastener **10** of the present invention. The tacking fastener **10** is typically used to temporarily fasten together two adjacent workpieces. The fastener **10** includes a shank **12** which has a first end **14**, a second end **16** and an inner channel **18** that extends through the shank **12**. Extending from the first end **14** of the shank **12** is a conical shaped head **20**. The head **20** has an annular lip portion **22** that is separated from the first end **14** by a tapered portion **24**.

The fastener **10** includes a pull stem **26** that extends through the inner channel **18** of the shank **12**. The pull stem **26** has a stem head **28** that is located adjacent to the second end **16** of the shank **12**. The stem **26** also has a serrated pull portion **30** that can be gripped by a pull gun (not shown) to

pull the head **28** through the inner channel **18** of the shank **12**. The stem head **28** may have a tapered portion **32** which leads the head **28** into the inner channel **34**. The tapered portion **32** extends to an annular tip portion **34**. The tip portion **34** typically has a diameter larger than the diameter of the inner channel **18** so that the head **28** expands the shank **12** as the stem **26** is pulled through the channel **18**. The stem head **28** may have an inner cavity **36** which allows the head **28** to contract as the stem **26** is pulled through the shank **12**, particularly as the shank expands tightly into the surrounding hole in the work pieces.

In the preferred embodiment, the shank **12** is constructed from an aluminum material and the pull stem **26** is constructed from a steel material. The fastener **10** preferably has the dimensions listed in Table I. Various embodiments are listed, each embodiment corresponding to a particular size of permanent fastener which will replace the tacking fastener **10**. For example, the first row of values provide dimensions for a tacking fastener **10** that corresponds to a permanent fastener which has a 0.1562 inch diameter, the second row relates to a permanent fastener diameter of 0.1875 inches and so forth and so on. All dimensions are in inches.

TABLE I

PERMANENT FASTENER DIAMETER	SHANK DIAMETER D	HEAD DIAMETER H	HEAD LENGTH L	INSTALLATION HOLE DIAMETER	DRILL SIZE FOR PERMANENT FASTENER
0.1562	0.093–0.097	0.128	0.036	0.098–0.107	#20
0.1875	0.125–0.128	0.170	0.042	0.1285–0.1436	#10
0.250	0.155–0.159	0.212	0.055	0.160–0.178	#F

FIGS. **4** through **8** show the installation of a fastener **10** to temporarily attach a first workpiece **40** to an adjacent second workpiece **42**. The first workpiece **40** typically has an outer flat surface **44**. The second workpiece **42** has a blind surface **46**. The blind surface **46** is typically inaccessible to the operator installing the fastener **10**.

As shown in FIG. **4**, the hole **48** is initially drilled through the first **40** and second **42** workpieces. The hole **48** is typically larger than the diameter of the shank **12** so that the shank **12** and stem head **28** can be easily inserted into the workpieces **40** and **42**. The stem head **26** and second end **16** of the shank **12** extend from the blind surface **46** of the second workpiece **42**.

As shown in FIG. **5**, the stem **26** is pulled through the shank **12**. The stem head **28** initially expands the second end **16** of the shank **12** to create an upset portion **50** which bears against the second workpiece **42**. As the head **28** is pulled through the workpieces, the head **28** expands the inner shank portion **52** into tight engagement with the parts **40** and **42**. Movement of the head **28** through the workpieces also contracts the annular tip portion **34** into the head cavity **36** to reduce the diameter of the stem head **28**. The resultant inner channel **18** is thus smaller in the shank portion **52** than the upset portion **50**.

As shown in FIG. **6**, the conical head **20** is seated into the first workpiece **40** when the stem **26** is pulled through the shank **12**. The tapered surface **24** of the head **20** will center the shank **12** with a hole **48** even when the hole diameter varies from a nominal dimension. The installed fastener **10** typically holds together the first **40** and second **42** workpieces while an operator installs permanent fasteners into the workpieces **40** and **42**. The temporary fastener **10** is eventually removed and replaced with a permanent fastener.

As shown in FIGS. **7** and **8**, a drill bit **54** drills through the head **20**, the shank **12** and the workpieces **40** and **42** to remove the temporary fastener **10** and create a hole for a permanent fastener (not shown). The head **20** has a diameter that is smaller than the diameter of the drill bit **54**. The smaller head diameter reduces the possibility of the head material splintering and otherwise sticking to the drill **54** and scratching the outer surface **44**. Additionally, the conical shape of the head **20** reduces the amount of fastener material that is removed by the drill and thus reduces the amount of drill chips produced during the drilling operation.

The expanded shank **12** is in tight engagement with the workpieces so that the fastener does not spin during the drill process. Additionally, the angle A of the conical head **20** is preferably different than the drill angle of the drill bit **54**. The different angles reduce the amount of slippage between the bit **54** and the head **20**. In the preferred embodiment, the angle A is 100°, with the corresponding angle of the drill being 120°. This assures that the head will finally drill out from outer diameter to inner diameter, thereby preventing the separation of a washer-like section of the head to clog the drill and cause the same to stop drilling, and perhaps to wander to damage the work piece. The present invention thus provides a temporary fastener that does not spin or create scratches on the workpiece when removed by a drill.

While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those ordinarily skilled in the art.

What is claimed is:

[1. A method for creating a hole for a permanent fastener which fastens a first workpiece to an adjacent second workpiece, comprising the steps of:

a) providing a tacking fastener that includes a shank which has an inner channel, a first end, a second end and a conical shaped head which extends from said first end, said tacking fastener further includes a stem that extends through said inner channel of said shank and has a head located adjacent to said second end of said shank;

b) drilling a first hole through the first and second workpieces;

c) inserting said shank and said stem into said first hole so that said stem head extends from the second workpiece and said conical shaped head is adjacent to the first workpiece;

d) pulling said stem head through said inner channel to expand said shank and secure said shank to the first and second workpieces; and,

e) drilling said conical shaped head, said shank and the first and second workpieces a drill bit that has a diameter larger than a diameter of said conical shaped head.**]**

[2. The method as recited in claim 1, wherein said stem head is deflected when said stem head is pulled through said inner channel of said shank.]

[3. The method as recited in claim 1, wherein said drill bit has a drill angle that is different than an angle of said conical shaped head.]

[4. The method as recited in claim 1, further comprising the step of inserting a permanent fastener after step (e).]

[5. A method for creating a hole for a permanent fastener which fastens a first workpiece to an adjacent second workpiece, comprising the steps of:

a) providing a tacking fastener that includes a shank which has an inner channel, a first end, a second end and a shank head which extends from said first end, said tacking fastener further includes a stem that extends through said inner channel of said shank and has a head located adjacent to said second end of said shank;

b) drilling a first hole through the first and second workpieces;

c) inserting said shank and said stem into said first hole so that said stem head extends from the second workpiece and said shank head is adjacent to the first workpiece;

d) pulling said stem head through said inner channel to expand said shank and secure said shank to the first and second workpieces; and,

e) drilling said shank head, said shank and the first and second workpieces a drill bit that has a diameter larger than a diameter of said conical shaped head.]

[6. The method as recited in claim 5, wherein said stem head is deflected when said stem head is pulled through said inner channel of said shank.]

[7. The method as recited in claim 5, further comprising the step of inserting a permanent fastener after step (e).]

[8. A method for creating a hole for a permanent fastener which fastens a first workpiece to an adjacent second workpiece, wherein the first workpiece has a flat outer surface, comprising the steps of:

a) providing a tacking fastener that includes a shank which has an inner channel, a first end, a second end and a conical shaped head which extends from said first end, said tacking fastener further includes a stem that extends through said inner channel of said shank and has a head located adjacent to said second end of said shank;

b) drilling a first hole through the first and second workpieces;

c) inserting said shank and said stem into said first hole so that said stem head extends from the second workpiece and said conical shaped head extends from the flat outer surface of the first workpiece;

d) pulling said stem head through said inner channel to expand said shank and secure said shank to the first and second workpieces; and,

e) drilling said conical shaped head, said shank and the first and second workpieces with a drill bit that has a diameter larger than a diameter of said conical shaped head.]

[9. The method as recited in claim 8, wherein said stem head is deflected when said stem head is pulled through said inner channel of said shank.]

[10. The method as recited in claim 8, wherein said drill bit has a drill angle that is different than an angle of said conical shaped head.]

[11. The method as recited in claim 8, further comprising, the step of inserting a permanent fastener after step (e).]

12. A method of replacing a tacking fastener that temporarily joins a first workpiece and a second workpiece with a permanent fastener to permanently join the workpieces, said tacking fastener including a shank of a cylindrical shape with a first end and an opposing second end, a head having a head diameter joined to the shank at the first end, and an inner channel coaxial with and open at the head, said head placed adjacent to the first workpiece, said shank extending through the workpieces, said shank deformed adjacent to the second workpiece to join the workpieces, said method comprising:

engaging a drill bit with the inner channel at the head, said drill bit having a diameter larger than the head diameter;

drilling the head, the shank, the first workpiece, and the second workpiece to form a hole through the workpieces; and

joining the first workpiece and the second workpiece with the permanent fastener, said permanent fastener extending through the hole.

13. The method as recited in claim 12, wherein the head diameter is about 0.13 inches and the drill bit is a #20 size drill bit.

14. The method as recited in claim 12, wherein the head diameter is about 0.17 inches and the drill bit is a #10 size drill bit.

15. The method as recited in claim 12, wherein the head diameter is about 0.21 inches and the drill bit is a #F size drill bit.

16. The method as recited in claim 12, wherein deforming the shank includes expanding the second end.

17. The method as recited in claim 12, wherein expanding the shank includes expanding a portion of the shank that is enclosed by the workpieces.

18. The method as recited in claim 12, wherein:

the shank includes a first portion that is enclosed by the workpieces and a second portion that extends from the second workpiece;

deforming the shank includes expanding the first portion of the shank to tightly engage the workpieces and expanding the second portion to bear against the second workpiece.

19. The method as recited in claim 12, wherein the inner channel of the tacking fastener is a cylindrical opening coaxial with the shank and extending from the second end to a surface of the head that is opposite to and furthest from the second end, and deforming the shank includes expanding the cylindrical opening to provide an open coaxial passage from the head to the second end.

20. The method as recited in claim 12, wherein the tacking fastener is a tubular rivet.

21. The method as recited in claim 20, wherein the tubular rivet is constructed from an aluminum material.

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