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(54) **POSITIVE HOLD WELD STUD**

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(57) **ABSTRACT**

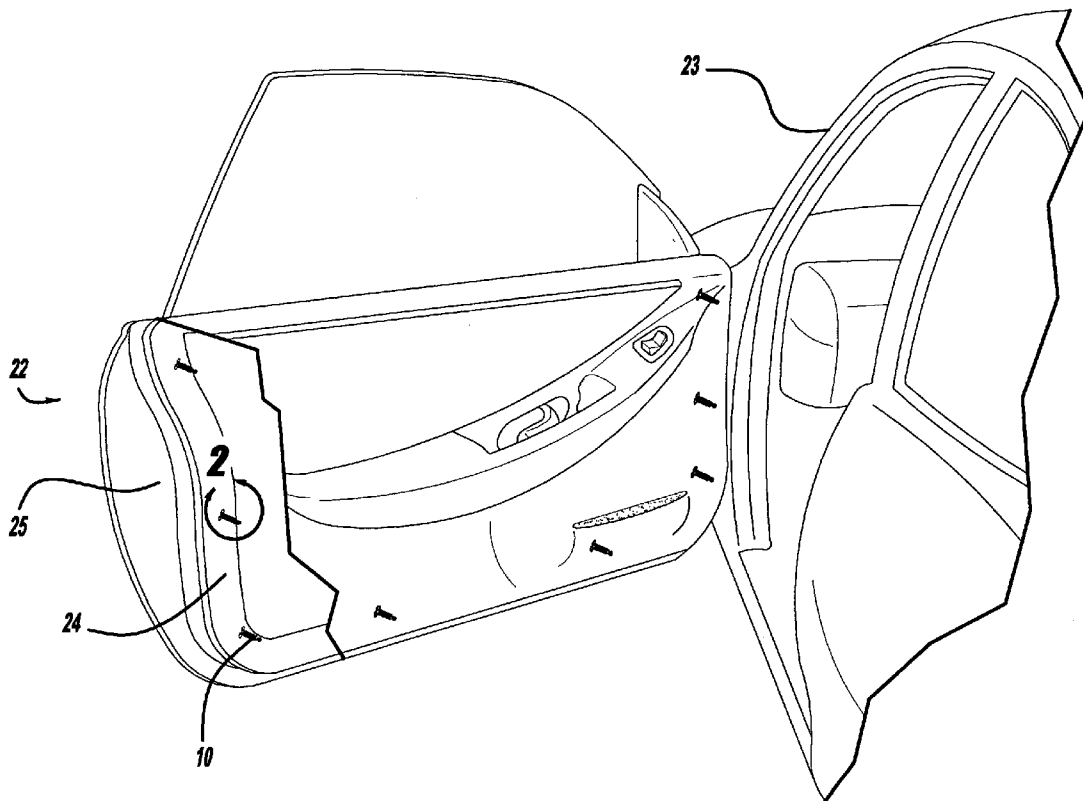
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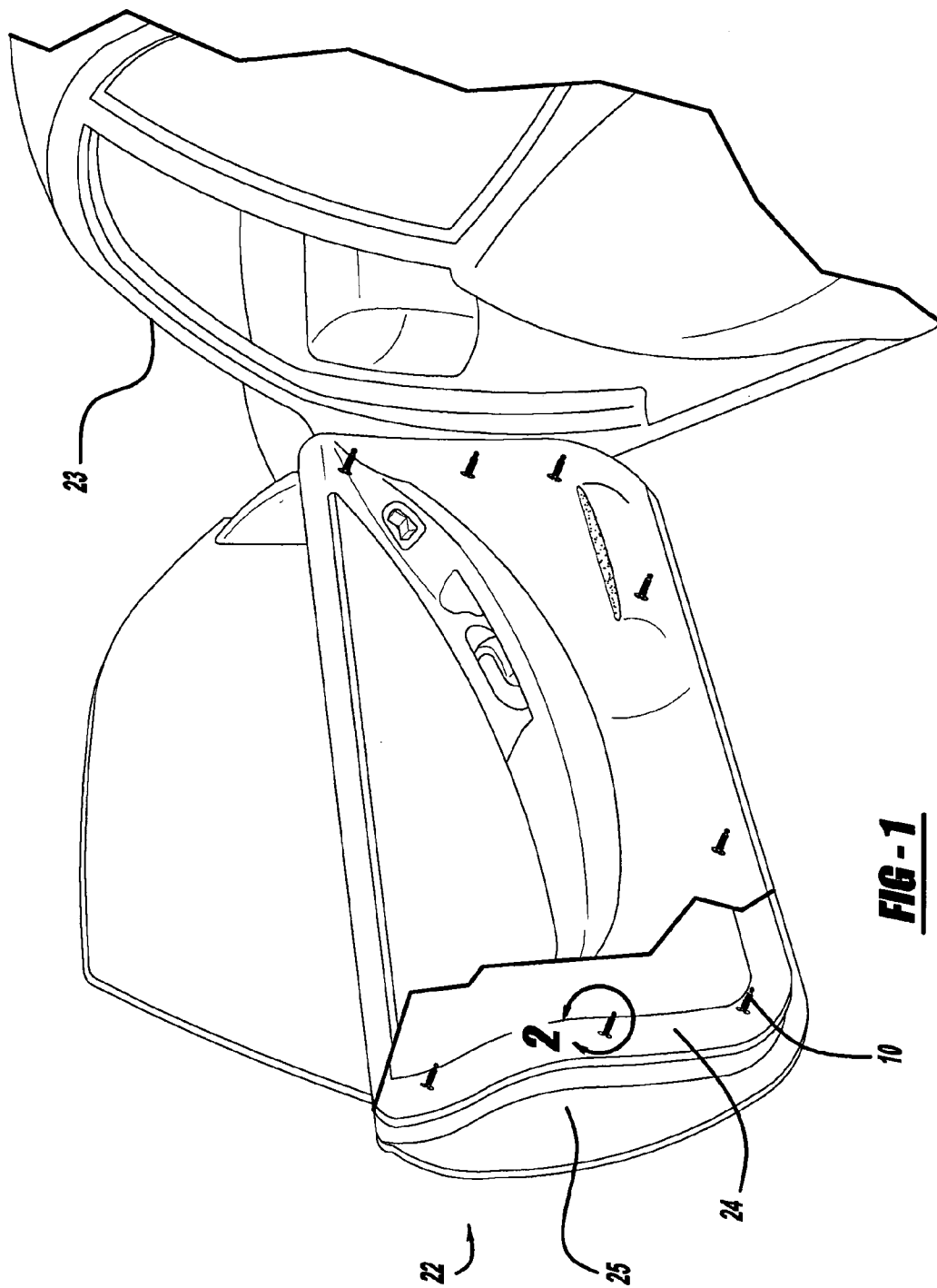
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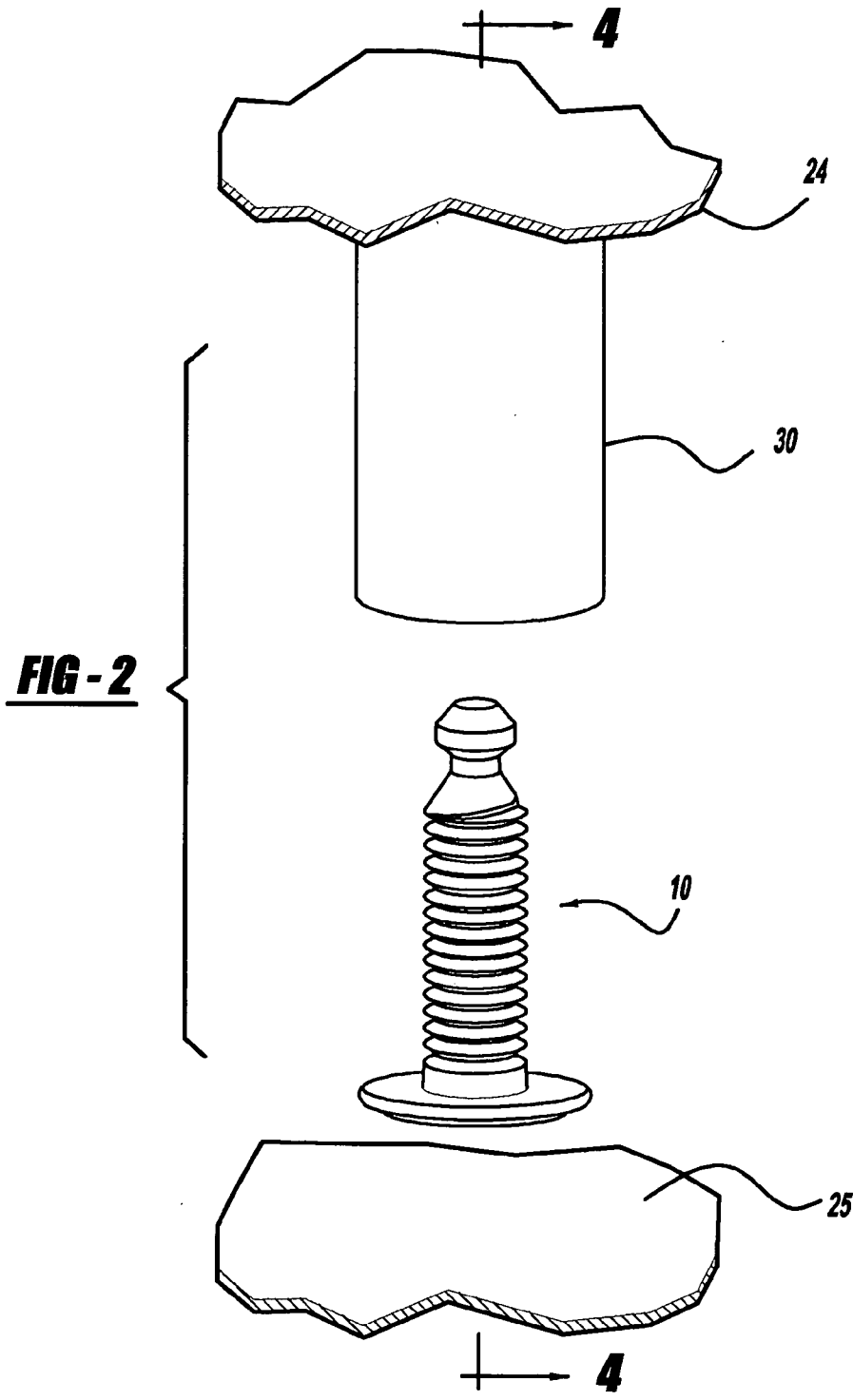
Publication Classification

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The present invention provides a weld stud that includes a base, a shank that has a thread and that is smaller in diameter than the base, a head that is on the opposite end to the base, and a neck located between the shaft and the head wherein the neck has a smaller diameter than either the head or the shank. Another aspect of the present invention includes a retention angle that is located between the head and the neck of the stud.







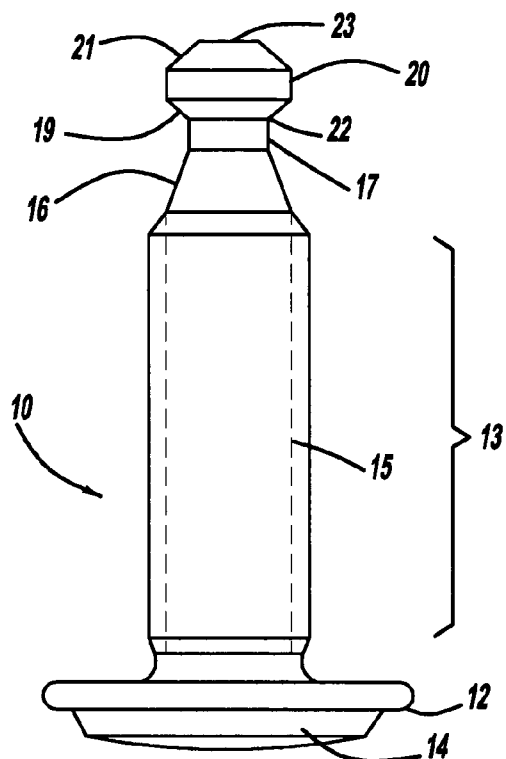


FIG - 3

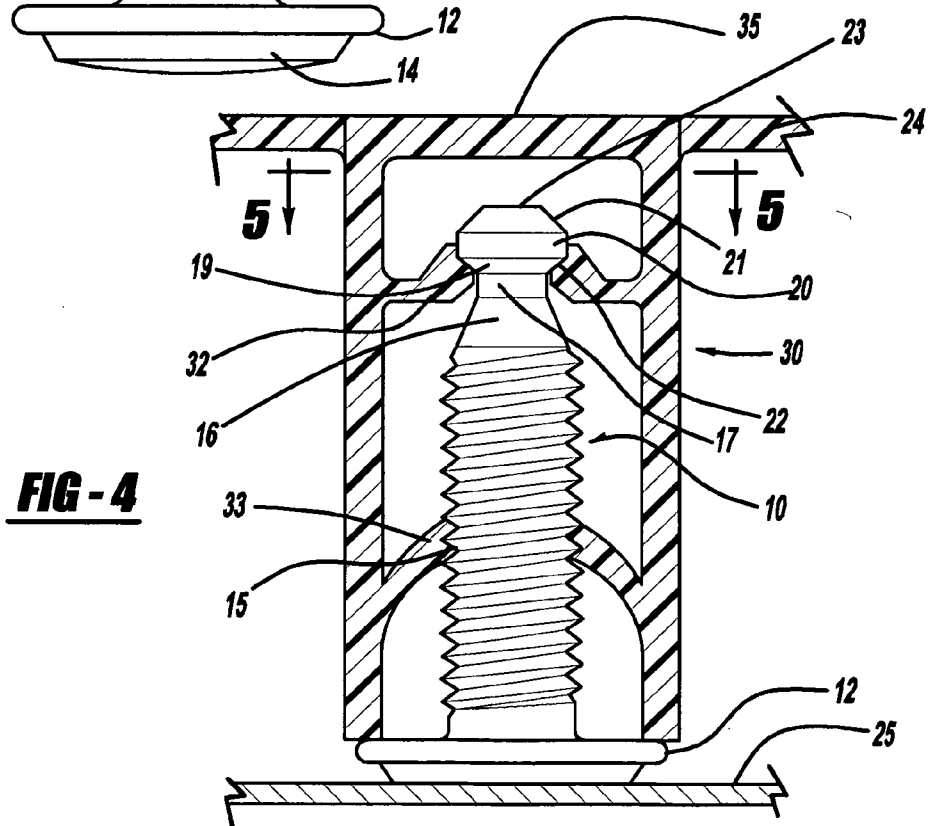


FIG - 4

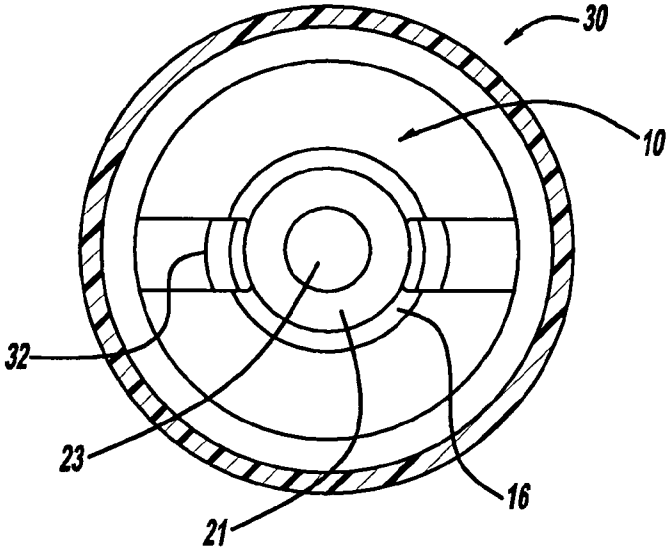


FIG - 5

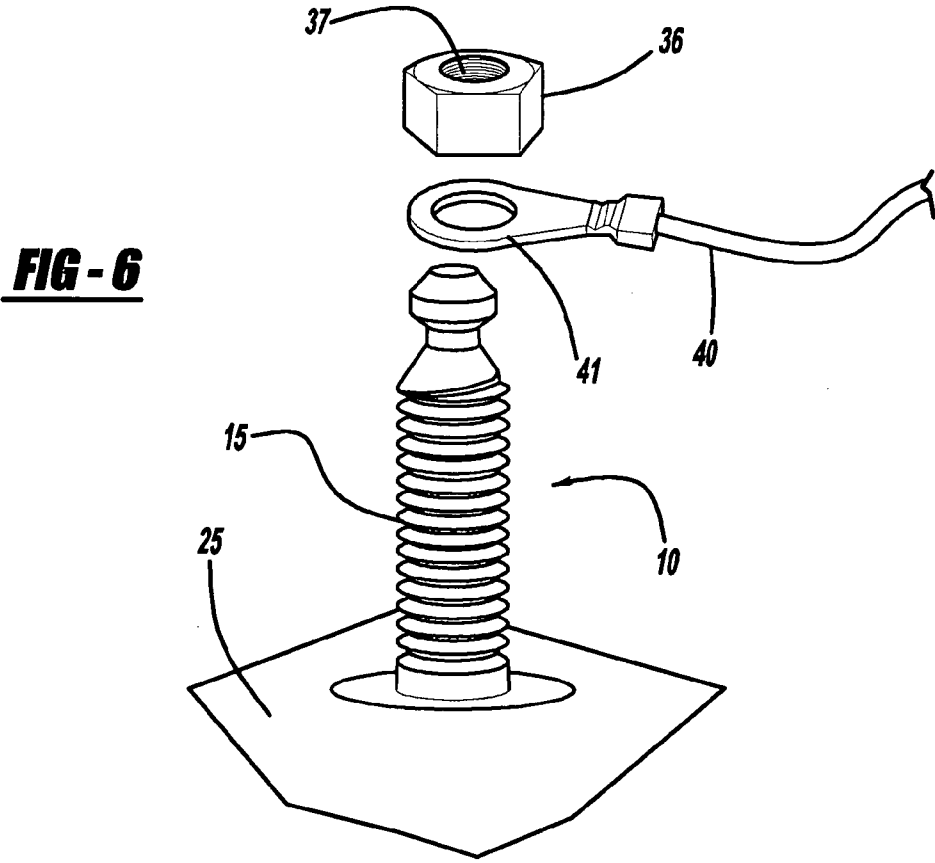


FIG - 6

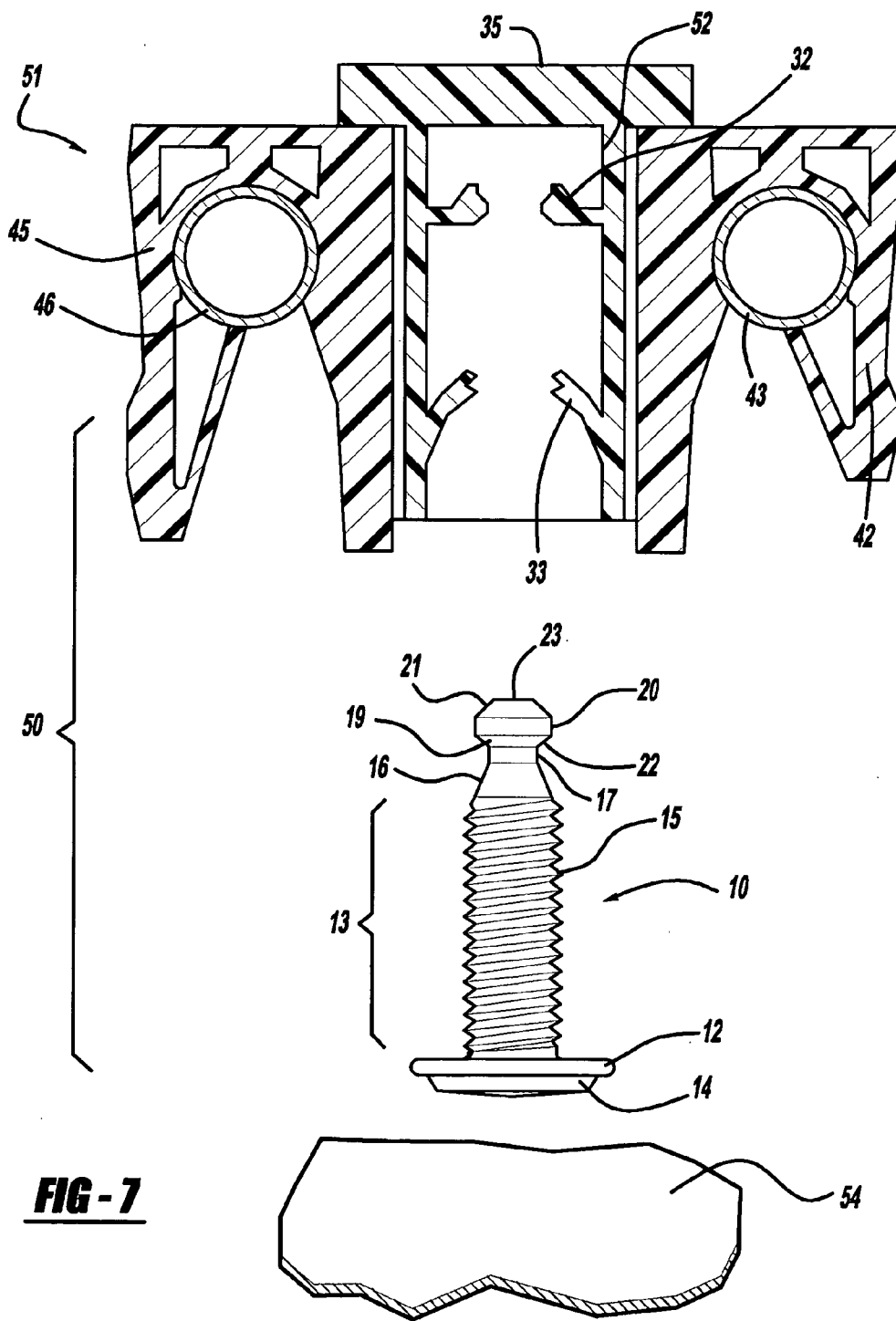
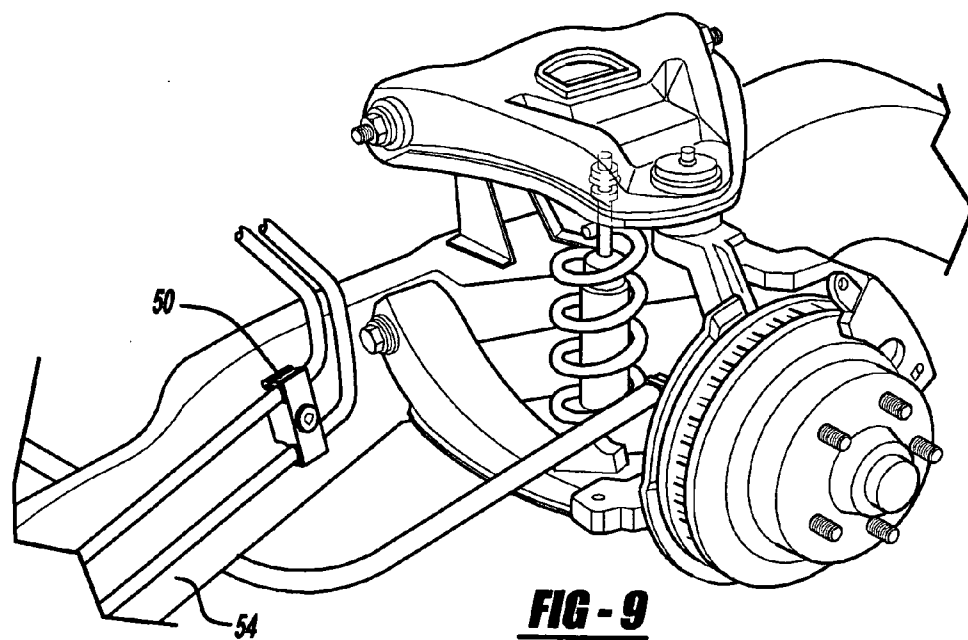
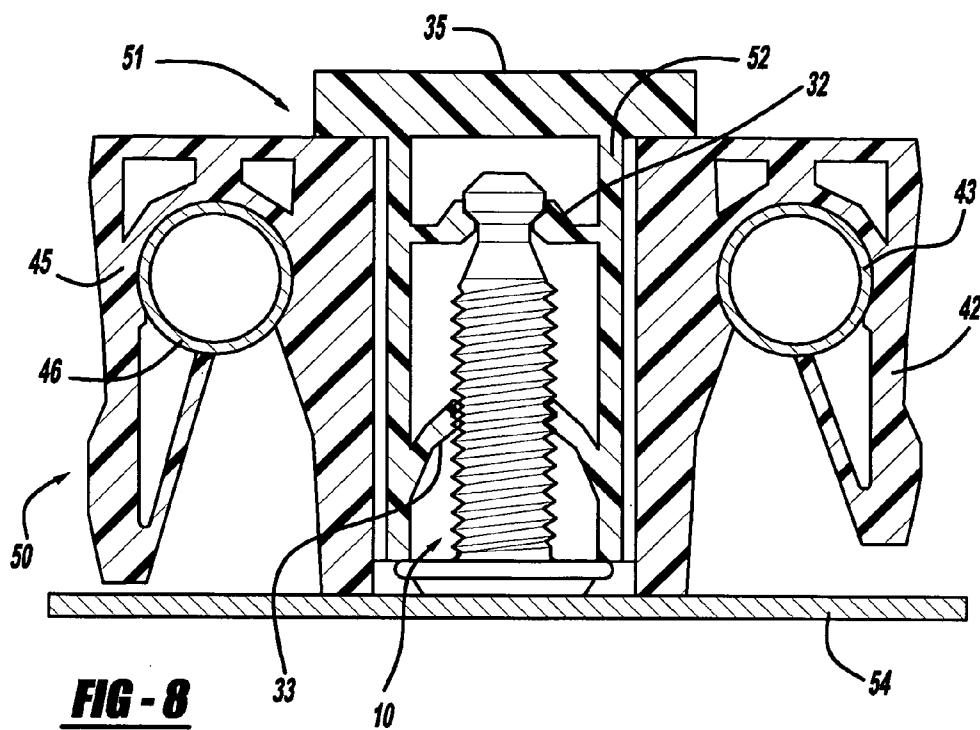


FIG - 7



POSITIVE HOLD WELD STUD

FIELD OF THE INVENTION

[0001] The present invention generally relates to studs and fasteners and, more specifically, to a positive hold weld stud and a fastener designed to fit on the stud.

BACKGROUND OF THE INVENTION

[0002] It is well known in the automotive industry to attach a metal weld stud having an enlarged base and a shaft with a single thread to a piece of sheet metal. Traditional threads spiral around the shaft in a continuous manner at least 14 times between the distal end of the shaft and the base. It is also common in the art to engage a nut with the threaded shaft to retain a component to the stud which is fixed to a metal portion of the vehicle body. It is also known in the art that a metal weld stud may not have threads and may be used with a push on type fastener. However, such push on fasteners are not easily removable from the stud and typically must be broken to be removed. Such breaking makes the fastener unable to be reused and, in many cases, a part which the fastener is attached to is worthless since it is unable to be reinstalled. What is needed is a weld stud that may employ a push on fastener that is self locking on engagement and easily removable without breaking.

SUMMARY OF THE INVENTION

[0003] Accordingly, the present invention is a new approach to the use of push on fasteners for weld studs. The approach is based upon the use of a positive hold weld stud and a specially designed fastener.

[0004] Thus, in various embodiments, the present invention provides a weld stud that includes a base, a shank that has a thread and that is smaller in diameter than the base, a head that is on the opposite end to the base, and a neck located between the shaft and the head wherein the neck has a smaller diameter than either the head or the shank. Another aspect of the present invention includes a retention angle that is located between the head and the neck of the stud. In other aspects of the present invention, the stud includes a welding pedestal that is attached to the base and is opposite of the shank, such a pedestal enables the stud to be attached to a metal sheet.

[0005] In other embodiments, the present invention provides a fastening system that includes a stud that has a threaded body, a head, and a neck that is between the head and the body and a fastener that has at least one pair of tabs for fastening to the body and at least one pair of clips for fastening to the neck. A further aspect of the present invention includes the stud attached to a body panel of a motor vehicle and the fastener attached to a trim piece. In other aspects of the invention, the fastener has a recess in the top of the fastener that is designed for a tool, such as a Phillips head screwdriver, an Allen keyed wrench, or the like that is used to unscrew the fastener from the stud.

[0006] In still other embodiments, the present invention provides methods for attaching a fastener to a weld stud that includes the steps of pushing the fastener on the stud and locking at least two tabs located inside the fastener onto the neck of the stud. In still other embodiments, the present invention provides methods for attaching a fastener to a

piece of metal sheet which includes the steps of welding a stud that has a retention angle to the sheet, pushing the fastener onto the stud, engaging at least one fastener tab to the threads of the stud and locking at least one fastener clip to the neck of the stud.

[0007] The positive hold weld stud and fastener of the present invention is advantageous over conventional devices in that the weld stud may be used with the fastener of the present invention or with conventional fasteners such as threaded bolts. Other advantages of the present invention are that the fasteners of the present invention may be easily removed from the positive hold weld stud without breaking, thus making it able to be reinstalled by either screwing or pushing the fastener onto the stud. Additional advantages and features of the present invention will become apparent from the following description and independent claims taken in conjunction with the accompanying drawings.

[0008] Further areas of applicability of the present invention will become apparent from the detailed description provided herein. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] FIG. 1 is a perspective view showing an automotive vehicle door assembly employing an embodiment of a weld stud of the present invention;

[0011] FIG. 2 is an exploded perspective view showing an embodiment of a weld stud, a metal sheet, an automotive vehicle panel, and a fastener of the present invention;

[0012] FIG. 3 is a side elevational view showing an embodiment of the weld stud;

[0013] FIG. 4 is a cross sectional view taken along lines 4-4 of FIG. 2 showing a weld stud, a metal sheet, a panel and fastener of the present invention;

[0014] FIG. 5 is a cross sectional view taken along lines 5-5 of FIG. 4 showing the weld stud and the fastener of the present invention;

[0015] FIG. 6 is an exploded perspective view showing another embodiment of the weld stud, an electrical conductor and a threaded fastener;

[0016] FIG. 7 is an exploded view showing a third embodiment of the weld stud, fluid lines and a threaded fastener;

[0017] FIG. 8 is a cross-sectional view showing the third embodiment of the weld stud, fluid lines and a threaded fastener; and

[0018] FIG. 9 is a perspective view showing an automotive frame rail assembly applying the third embodiment of the weld stud of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The following description of the preferred embodiments is merely exemplary in nature and is in no way

intended to limit the invention, its application, or uses. The present invention provides a welding stud and a fastener along with methods of use.

[0020] The present invention relates to a welding stud **10** which may be employed with a fastener **30** for a plurality of applications including holding body interior trim parts to body panels, securing brake lines and other fluid lines, fastening exterior panels to a vehicle, and any other applications that the stud **10** and fastener **30** may be useful in the art. **FIG. 1** shows the positive hold weld stud **10** of the present invention employed in a vehicle **23** having a door **22** which has a metal surface **25** to which stud **10** is welded. Trim panel **24** is fastened to weld stud **10** securing it to body panel **25**. Referring to **FIG. 2**, interior panel **24** includes fastener **30** of the present invention that engages weld stud **10** and locks onto weld stud **10**. Weld stud **10** is welded by any applicable welding method known in the art, to a metal sheet **25** which may, in some embodiments, be a body panel.

[0021] Referring to **FIGS. 3 and 4**, the weld stud includes a head **20**, a reduced diameter neck **17**, a shank **13**, and a base **12**. The shank **13** has a diameter that is larger than the head **20**. The base **12** has a diameter that is larger than the shank **13** and the base **12** includes a pedestal **14** which is opposite the shank **13**. The pedestal **14** is larger in diameter than the shank **13** but smaller in diameter than the base **12**. A first tapered section **16** connects the larger diameter shank **13** with the neck **17**. A second tapered section **19** connects the neck with the larger diameter head **20**. The second tapered section **19** is the location to which fastener **30** is locked onto stud **10** and has a defined retention angle **22**. The retention angle **22** is greater than 90° . In some embodiments of the present invention, the retention angle **22** is about 135° and in other embodiments, the retention angle **22** is about 150° . In a preferred embodiment of the present invention, the range that is useful for the retention angle **22** is from about 125° to about 160° . A third tapered section **21** is between the larger diameter head **20** and the flat tip **23** of the stud **10**. The shank **13** has a thread **15** and may be any standard rolled thread pattern that is known in the art. The portion of the stud **10** from the first tapered section **16** to the tip **23** is smooth and has no threads.

[0022] Referring to **FIG. 4**, the present invention includes a fastener **30** that comprises a pair of at least one pair of tabs **33** that attach to the threads **15** of weld stud **10**. In this embodiment, the fastener **30** includes at least one pair of clips **32** that snap below the retention angle **22** of the stud **10**. The clips **32** snap over the head **20** and are locked into place at retention angle **22**. Tabs **33** have internal threading that match the thread **15** of the stud **10**. To install the fastener **30**, the fastener **30** is pushed onto weld stud **10** so that the clips **33** engage with the thread **15** and the clips **32** lock onto retention angle **22** of weld stud **10**. To remove fastener **30** from weld stud **10**, the fastener **30** is unscrewed from weld stud **10** employing the tabs **33** along the thread **15**. This unscrewing force moves the fastener **30** up and forces the clips **32** over retention angle **22** and past the head **20**. The fastener **30** is unscrewed until the tabs **33** are clear of thread **15**. In a preferred embodiment, the stud **10** is painted along with panel **25**. In such embodiment, the paint does not inhibit the installation of push on fastener **30**.

[0023] In another preferred embodiment, a recess **35** is formed in the top of the fastener **30**. In such an embodiment,

the recess **35** may have the form of a Philips head, torx, slotted, Allen key or the like, such that a tool may be engaged in recess **35** to facilitate unscrewing fastener **30** from stud **10**. The fastener **30** may be made from a plastic material. The fastener **30** may be made from resin materials or blends of resin-like materials. The fastener **30** may be made of a material that is fiber reinforced. The fastener **30** may be made from a material that is conductive to electricity.

[0024] Stud **10** is formed by a cold headed process through which a blank is fed between a punch and die and is forcefully compressed until the desired shape is formed. The threads **15** are rolled onto the shank **13** of the stud **10** using a standard thread rolled die known in the art. In the preferred embodiment, the thread **15** is a M6X1 metric thread. Other thread patterns that are known in the art may be used on the body **13** of the stud **10** depending on the application of the present invention. The stud **10** may be made from SAE1010 steel with a zinc finish that has a cold rolled thread. The stud **10** may be made from any steel alloy that is known in the art and useful for such a stud **10**. The stud **10** is made from a metal or an alloy that is conductive to electricity.

[0025] The stud welding sequence is as follows. Stud **10** is fed into the collet of a weld head or gun (not shown) and the unit is cycled forward until the stud touches panel **25**, thereby generating a "stud on work" signal to the electronic control unit. The weld gun subsequently lifts the stud approximately 1.2 mm off the panel. A pilot arc is then generated to ionize an air gap between the proximal end of the stud and the panel. Next, the welding current is turned on in order to generate molten material at the proximal end of the stud and at the surface of the panel. Finally, the weld gun then cycles forward to plunge the stud into the molten puddle of material. The molten weld puddle solidifies and the weld gun retracts, whereby the stud is permanently welded to the panel **25**. Welding such a stud **10** to a metal panel **25** is disclosed in U.S. Pat. No. 6,337,457 to Rungheimer; U.S. Pat. No. 6,215,085 to Cummings; U.S. Pat. No. 5,977,506 to von Daniken; U.S. Pat. No. 5,938,946 to Kurz; U.S. Pat. No. 5,277,353 to Budig et al.; and U.S. Pat. No. 4,797,529 to Schmitt et al., all of which are incorporated by reference herein.

[0026] In an alternative embodiment, **FIG. 6** shows weld stud **10** attached to a metal sheet **25** and an alternate fastener **36** is employed. Fastener **36** has an internally threaded female bore **37** which fits onto thread **15**. An advantage of this invention is that weld stud **10** may be used with a fastener with a thread **37** similar to the fastener **36** or may be used with a push on fastener similar to fastener **30**. In an example of the alternate embodiment, electrical connector **40** having an eyelet **41** and a wire **42** may be connected to stud **10** by placing eyelet **41** on stud **10** and fastening electrical component **40** to stud **10** by fastener **36** which is screwed onto stud **10**. According to the present invention, any component that is known in the art to attach to a metal stud may be attached to stud **10** and retained by employing internally threaded fastener **36**. One or more washers or spacers (not shown) may be employed with stud **10** and internally threaded fastener **36**.

[0027] Referring to **FIGS. 7, 8 and 9**, the weld stud **10** includes a head **20**, a reduced diameter neck **17**, a shank **13**, and a base **12**. The shank **13** has a diameter that is larger than

the head 20. The base 12 has a diameter that is larger than the shank 13 and the base 12 includes a pedestal 14 which is opposite the shank 13. Pedestal 14 is larger in diameter than the shank 13 but smaller in diameter than the base 12. The first tapered section 16 connects the larger diameter shank 13 with the neck 17. A second tapered section 19 connects the neck with the larger diameter head 20. The second tapered section 19 is the location to which fastener 52 is locked onto stud 10 and has a defined retention angle 22. The retention angle 22 is greater than 90°. In some embodiments of the present inventions, the retention angle 22 is about 135° and in other embodiments the retention angle 22 is about 150°. In a preferred embodiment of the invention, the range that is useful for retention angle 22 is from about 120° to, about 160°. A third tapered section 21 is between a larger diameter head 20 and the flat tip 23 of the stud 10. The shank 13 has a thread 15 and may be any standard rolled thread pattern that is known in the art. The portion of the stud 10 from the first tapered section 16 to the tip 23 is smooth and has no threads.

[0028] In this embodiment, threaded fastener 52 is part of a fastening assembly 51 which may be used to, for example, to fasten fluid lines to a frame rail of a car. Fastener 51 includes the threaded fastener 52 comprising at least one pair of tabs 32 and at least one pair of clips 33. The threaded fastener 52 is part of fastener system 51 which has a separate clip type fastener 42 which holds in a fluid line 43 such as fuel or a brake fluid and may include a second clip type fastener 45 which holds a second fluid line 46. Weld stud 10 is welded on to frame rail 54. Then fastener system 51 is clipped onto fluid lines 46, 43 and is fastened onto weld stud 10 such that tabs 32 are locked onto retention angle 22. Fastener 52 comprises a pair of at least one pair of tabs 33 that are attached to the threads 15 of the weld stud 10. In this embodiment, fastener 52 includes at least one pair of clips 32 that snap below retention angle 22 of the stud 10. The clips 32 snap over the head and lock into place over retention angle 22. Tabs 33 have internal threading that match the thread 15 of the stud 10. To install the fastener system 51, the fastener system is pushed onto the weld stud 10 so that clips 33 engage with the threads 15 and the clips 32 lock onto the retention angle 22 of weld stud 10. To remove fastener system 51 from weld stud 10, the fastener 52 is unscrewed from the weld stud employing the tabs 33 along the thread 15. This unscrewing force moves the fastener 52 up and forces the clips 32 over the retention angle 22 and past the head 20. The fastener 52 is unscrewed until tabs 33 are clear of thread 15.

[0029] In some embodiments, a recess 35 is formed in the top of the fastener 52. In such embodiments, the recess 35 may have the form of a Phillips head, Torx, slotted, Allen key, or the like, such that a tool may be engaged in recess 35 to facilitate unscrewing fastener 52 from stud 10. The fastener system 51 may be made from a plastic material. The fastener system 51 may be made from resin materials or blends of resin like materials. The fastener system 51 may be made of a material that is fiber reinforced.

[0030] The examples and other embodiments described herein are exemplary and are not intended to be limiting in describing the full scope of apparatus, systems, compositions, materials, and methods of this invention. Equivalent changes, modifications, variations in specific embodiments, apparatus, systems, compositions, materials and methods

may be made within the scope of the present invention with substantially similar results. Such changes, modifications or variations are not to be regarded as a departure from the spirit and scope of the invention.

1. A weld stud comprising:

a base;

a shank having a thread with an outer diameter smaller than an enlarged base;

a head located distal from the base; and

a neck located between the shank and the head wherein the diameter of the neck is smaller than a diameter of the head and a diameter of the shank.

2. A weld stud according to claim 1 further comprising a welding pedestal projecting from the base opposite the shank, the pedestal being coaxially aligned with the base and the shank, and the pedestal having a diameter smaller than the diameter of the base and larger than the diameter of the shank.

3. A weld stud according to claim 1, wherein the head and neck are substantially free of threads.

4. A weld stud according to claim 1 further comprising a retention angle located between the head and the neck, wherein the retention angle is greater than 90°.

5. A weld stud according to claim 4, wherein the retention angle is at least 125°.

6. A weld stud according to claim 5, wherein the retention angle is about 135°.

7. A weld stud according to claim 8, wherein the stud is welded to a body panel of a motor vehicle.

8. A weld stud according to claim 1, wherein the thread is a M6X1 thread.

9. A weld stud according to claim 1, wherein the shank has a length of less than 25 mm.

10. A weld stud according to claim 1 further comprising a fastener removably attached to the stud.

11. A weld stud according to claim 13, wherein the fastener is part of an interior trim piece of an automotive vehicle.

12. A fastening system comprising:

a stud comprising a threaded body, a head, and a neck the neck being located between the head and the body, wherein a diameter of the neck is less than a diameter of the body and a diameter of the head; and

a fastener comprising first members removably fastening to the body and second members removably fastening to the neck.

13. A system according to claim 12, wherein the stud further comprises a base at an end opposite to the head.

14. A system according to claim 13, wherein the base having a diameter larger than the diameter of the body.

15. A system according to claim 13 further comprising a welding pedestal projecting from the base opposite the body, the pedestal being coaxially aligned with the base and the body and the pedestal having a diameter smaller than the diameter of the base and larger than the diameter of the body.

16. A system according to claim 12, wherein the head is substantially free of threads.

17. A system according to claim 12, wherein the neck is substantially free of threads.

18. A system according to claim 12, wherein the fastener is made of a plastic like material.

19. A system according to claim 12 further comprising a retention angle between head and the neck, wherein the retention angle is greater than 90°.

20. A system according to claim 19, wherein the retention angle is at least 125°.

21. A system according to claim 19, wherein the retention angle is about 145°.

22. A system according to claim 19, wherein the second members are locked into place by the retention angle.

23. A system according to claim 12, further comprising threading on the first members.

24. A system according to claim 12, wherein the thread is an M6X1 thread.

25. A system according to claim 12, wherein the stud is welded to a body panel of a motor vehicle.

26. A system according to claim 12 further comprising unlocking the second members by unscrewing the fastener on the threads of the body.

27. A system according to claim 12, wherein the body has a length of less than 25 mm.

28. A system according to claim 12 further comprising the fastener attached to the stud.

29. A system according to claim 12, wherein the fastener is part of a trim piece of a motor vehicle.

30. A system according to claim 12 further comprising a recess in a top exterior surface of the fastener wherein the recess is designed for the engagement of a tool.

31. A system according to claim 30, wherein the recess is from the group consisting of a Phillips head pattern, a Torx head pattern, a slotted head pattern, and an Allen keyed head pattern.

32. A weld stud comprising:

a base;

a shank including an exterior pattern with a diameter smaller than a diameter of the base;

a welding pedestal projecting from the base opposite the shank;

a head located at an opposite end from the base;

a neck defining a recess located between the shank and the head; and

a retention angle located in the recess between the head and the neck;

wherein the retention angle is greater than 90°.

33. A weld stud according to claim 32, wherein the retention angle is at least 125°.

34. A weld stud according to claim 32, wherein the retention angle is about 135°.

35. A weld stud according to claim 32, wherein the stud is welded to a body panel of a motor vehicle.

36. A weld stud according to claim 32 further comprising a fastener attached to the stud.

37. A method of attaching a fastener to a stud, the stud comprising a retention angle and a thread, the method comprising:

pushing the fastener onto the stud;

engaging at least two clips inside the fastener to the thread; and

removably attaching at least two tabs inside the fastener onto the retention angle.

38. A method according to claim 37, wherein the stud is welded to a body panel of a motor vehicle.

39. A method according to claim 37 further comprising engaging at least one member inside the fastener to the threads.

40. A method according to claim 37 further comprising unscrewing the fastener to detach the fastener from the stud.

41. A method according to claim 37, wherein a retention angle is greater than 90°.

42. A method according to claim 37 further comprising attaching an interior trim panel to the fastener.

43. A method according to claim 37 further comprising attaching a fluid line to the fastener.

44. A method according to claim 37 further comprising coating the stud with paint.

45. A method of attaching a fastener to a metal sheet, the method comprising:

welding a stud comprising a thread and a retention angle to the sheet;

pushing the fastener onto the stud;

engaging at least one fastener tab with the thread; and

removably attaching at least one fastener clip on the retention angle;

wherein the retention angle is greater than 90°.

46. A method according to claim 45, wherein the metal sheet is a body panel of a motor vehicle.

47. A method according to claim 45 further comprising unscrewing the fastener to detach the fastener from the stud.

48. A method according to claim 45, wherein a retention angle is at least 125°.

49. A method according to claim 45 further comprising attaching an interior trim panel to the fastener.

50. A method according to claim 45 further comprising attaching a fluid line to the fastener.

51. A method according to claim 45 further comprising coating the fastener with paint.

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