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Simon et al.

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(54) **FASTENER POSITIONING DEVICE**

(56) **References Cited**

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(73) Assignee: **Schaeffler Technologies AG & Co. KG**,
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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 449 days.

* cited by examiner

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(65) **Prior Publication Data**

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(57) **ABSTRACT**

Related U.S. Application Data

(60) Provisional application No. 61/288,532, filed on Dec. 21, 2009.

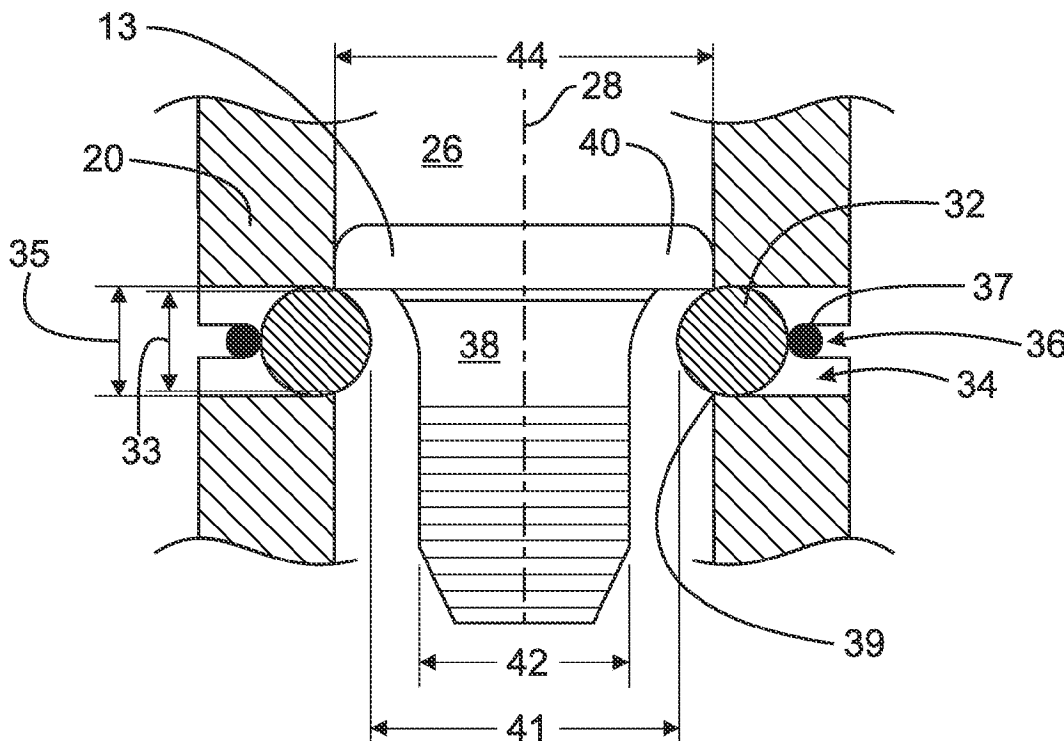
A fastener positioning device for a die block including a punch tube arranged to receive the fastener, at least one aperture extending radially out from the tube, at least one displaceable retainer disposed in the at least one aperture, and a resilient ring urging the at least one retainer towards an axis of the punch tube. In an example embodiment of the invention, the aperture includes a first diameter proximate the punch tube and a second, larger diameter radially outside of the first diameter. The retainer may be a ball, the resilient ring may be an O-ring, and the fastener may be a stud or nut.

(51) **Int. Cl.**
B25B 17/00 (2006.01)

(52) **U.S. Cl.**
USPC **81/57.37**; 29/253; 227/149; 227/70

(58) **Field of Classification Search**
USPC 81/54, 57.37-431, 44; 29/255, 270, 278
See application file for complete search history.

13 Claims, 5 Drawing Sheets



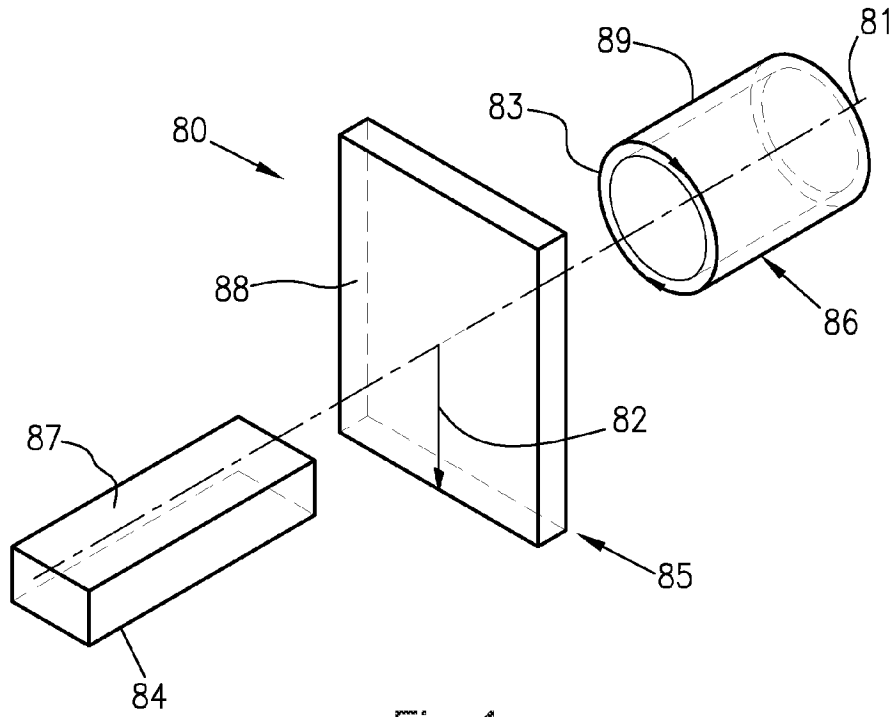


Fig. 1a

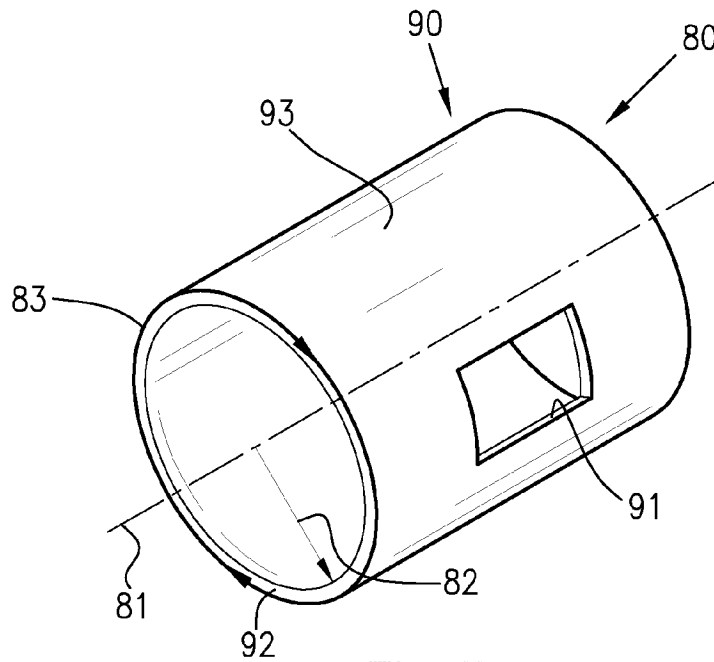


Fig. 1b

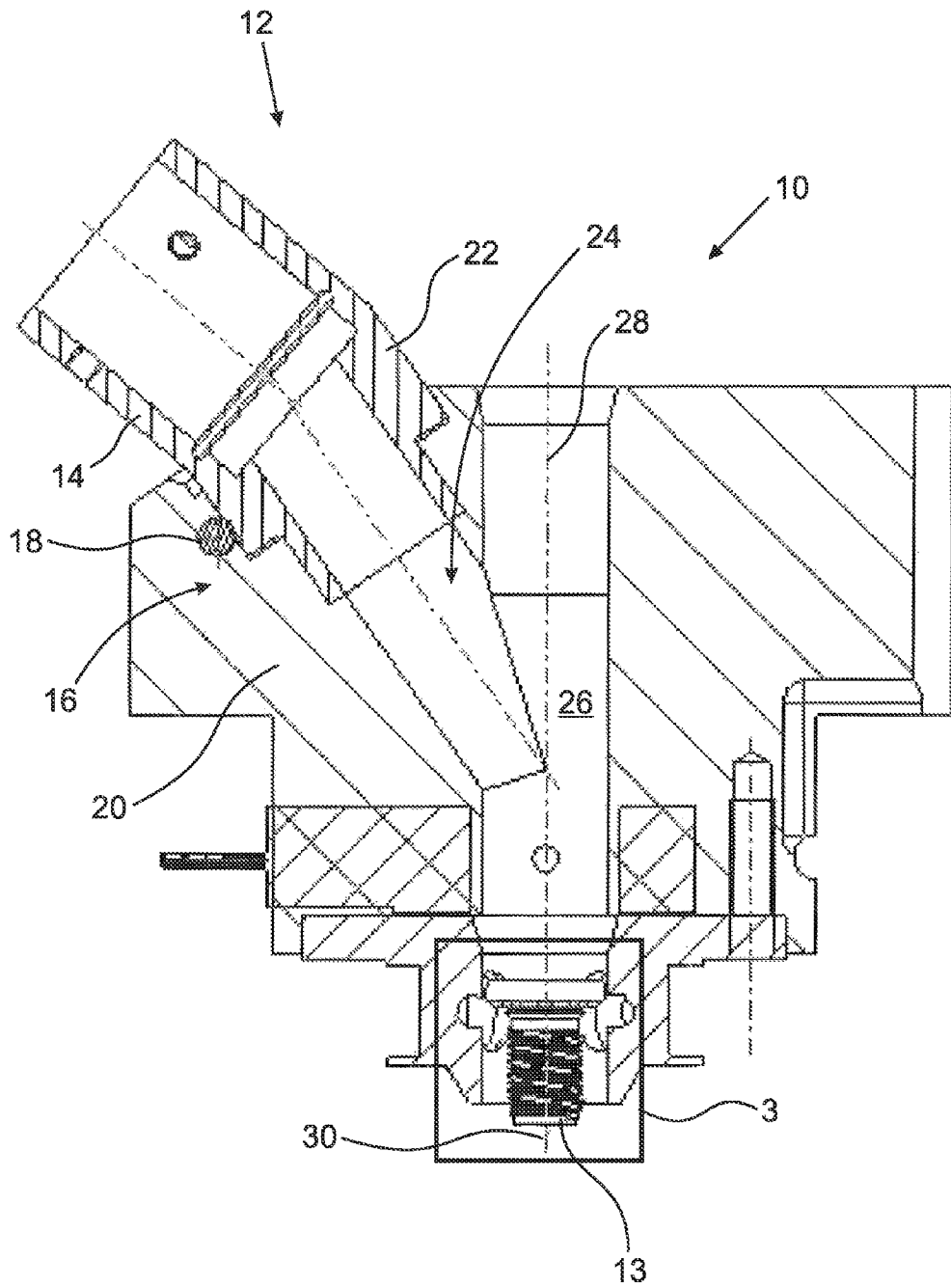


Fig. 2

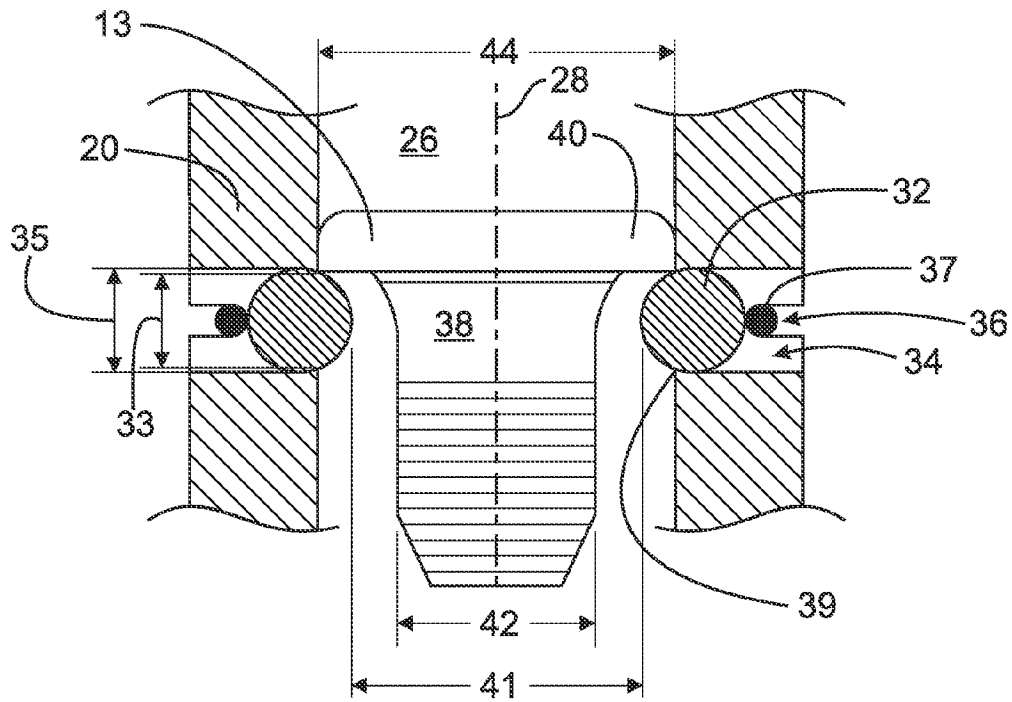


Fig. 3

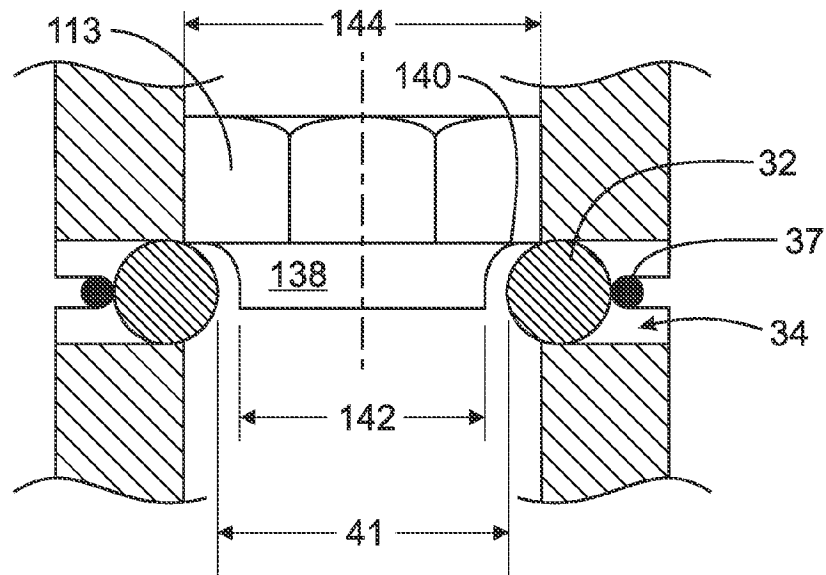


Fig. 4

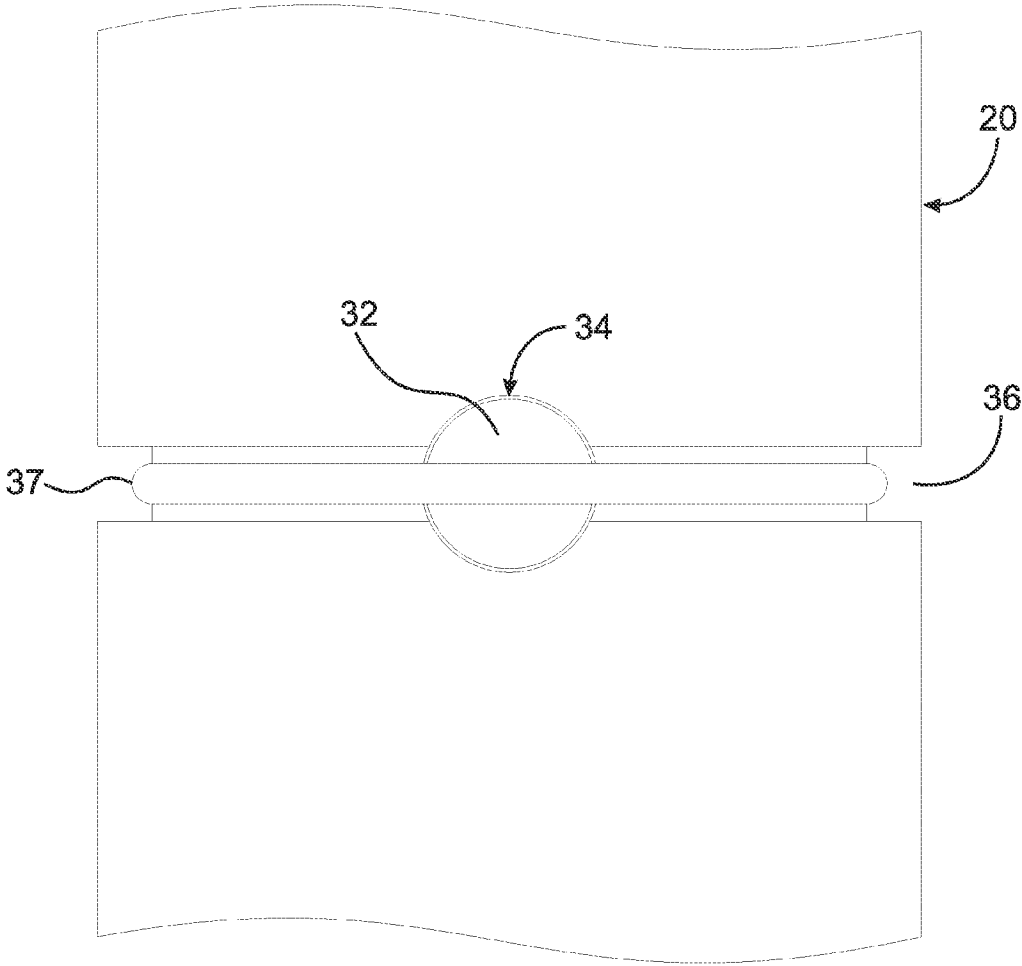


Fig. 3A

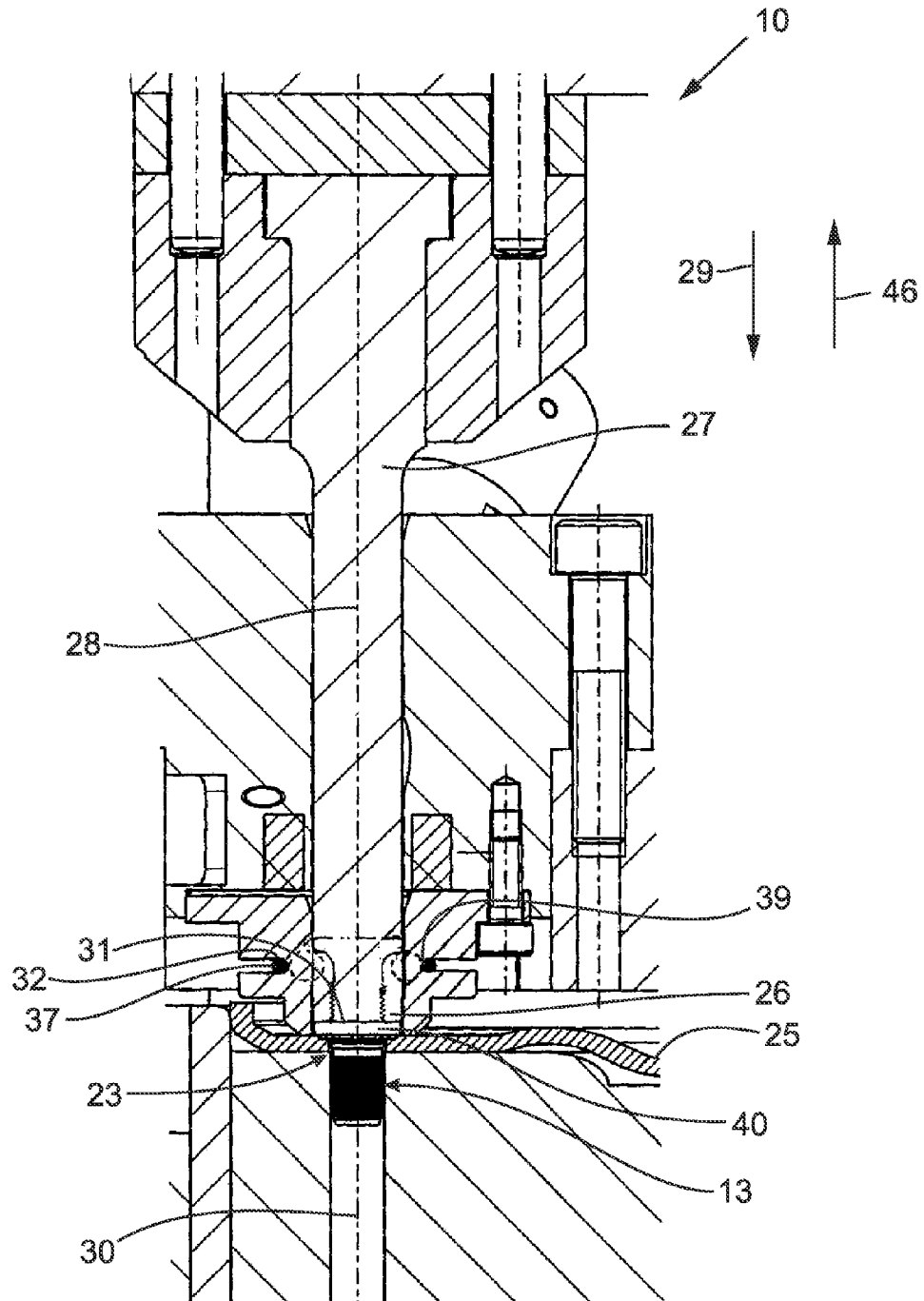


Fig. 5

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FASTENER POSITIONING DEVICECROSS-REFERENCE TO RELATED
APPLICATIONS

This application claims the benefit under 35 U.S.C. §119 (e) of U.S. Provisional Application No. 61/288,532, filed Dec. 21, 2009.

FIELD OF THE INVENTION

The invention relates generally to a fastener positioning device, and more specifically to a fastener positioning device for a die block in a stamping press.

BACKGROUND OF THE INVENTION

U.S. Pat. No. 6,021,562, assigned to Haeger, Inc., describes a fastener insertion module for a progressive die that uses a special bisected bushing. The bushing securely holds and positions each fastener in place prior to and during insertion. U.S. Pat. No. 3,452,418, assigned to Penn Engineering, describes a gate for an automatic fastener press. The gate includes a pilot spring extending to a hole of a fastening element such as a nut, for example.

BRIEF SUMMARY OF THE INVENTION

Example aspects of the present invention broadly comprise a fastener positioning device for a die block including a punch tube arranged to receive the fastener, at least one aperture extending radially out from the tube, at least one displaceable retainer disposed in the at least one aperture, and a resilient ring urging the at least one retainer towards an axis of the punch tube. In an example embodiment of the invention, the aperture includes a first diameter proximate the punch tube and a second, larger diameter radially outside of the first diameter. The retainer may be a ball, the resilient ring may be an O-ring, and the fastener may be a stud or nut.

In some example embodiments of the invention, the fastener positioning device has a chute portion connected to the punch tube, and the chute portion is arranged to guide the fastener into the punch tube. The fastener may be gravity-fed through the chute portion into the punch tube. The device may also include a punch arranged to travel through the punch tube to install the fastener. In an example embodiment of the invention, the at least one retainer is arranged to be radially displaced by the fastener.

In some example embodiments of the invention, in response to an axial force upon the fastener in an axial direction, the fastener is axially displaceable in the axial direction to radially outwardly displace the at least one retainer. The at least one retainer may be radially outwardly displaceable such that the fastener is displaceable past the at least one retainer in the axial direction.

Other example aspects of the present invention broadly comprise a method of installing a fastener in a plate by radially contracting a plurality of retainers with a resilient ring, introducing the fastener through a chute portion, and axially positioning a radial surface of the fastener on the plurality of retainers. The method may include axially displacing the fastener with a punch, radially displacing the retainers with the fastener, and inserting the fastener into a hole in the plate.

Other example aspects of the present invention broadly comprise a fastener positioning device for a die block including a punch tube arranged to receive a stud or nut, and a plurality of apertures extending radially out from the tube.

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The tube has an axis and each aperture has a first diameter, a second diameter less than the first diameter, and a respective lip proximate the tube. The fastener positioning device includes a plurality of balls disposed in the plurality of apertures and an O-ring urging the plurality of balls towards the axis. The plurality of balls is radially displaceable by axial displacement of the stud or nut.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature and mode of operation of the present invention will now be more fully described in the following detailed description of the invention taken with the accompanying drawing figures, in which:

FIG. 1A is a perspective view of a cylindrical coordinate system demonstrating spatial terminology used in the present application;

FIG. 1B is a perspective view of an object in the cylindrical coordinate system of FIG. 1A demonstrating spatial terminology used in the present application;

FIG. 2 is a cross-section view of a fastener positioning device for a die block, according to an example aspect of the invention;

FIG. 3 is a detail view of encircled region 3 in FIG. 2;

FIG. 3A is a side view of encircled region 3, FIG. 3;

FIG. 4 is a detail view of encircled region 3 in FIG. 2 showing an alternative embodiment of the invention; and,

FIG. 5 is a partial cross section view of a die block with a fastener positioning device, according to an example aspect of the invention.

DETAILED DESCRIPTION OF THE INVENTION

At the outset, it should be appreciated that like drawing numbers appearing in different drawing views identify identical, or functionally similar, structural elements. Furthermore, it is understood that this invention is not limited only to the particular embodiments, methodology, materials and modifications described herein, and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only, and is not intended to limit the scope of the present invention, which is limited only by the appended claims.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this invention belongs. Although any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of the invention, the following example methods, devices, and materials are now described.

FIG. 1A is a perspective view of cylindrical coordinate system 80 demonstrating spatial terminology used in the present application. The present invention is at least partially described within the context of a cylindrical coordinate system. System 80 has a longitudinal axis 81, used as the reference for the directional and spatial terms that follow. The adjectives "axial," "radial," and "circumferential" are with respect to an orientation parallel to axis 81, radius 82 (which is orthogonal to axis 81), and circumference 83, respectively. The adjectives "axial," "radial" and "circumferential" also are regarding orientation parallel to respective planes. To clarify the disposition of the various planes, objects 84, 85, and 86 are used. Surface 87 of object 84 forms an axial plane. That is, axis 81 forms a line along the surface. Surface 88 of object 85 forms a radial plane. That is, radius 82 forms a line along the surface. Surface 89 of object 86 forms a circumferential plane. That is, circumference 83 forms a line along the

surface. As a further example, axial movement or disposition is parallel to axis **81**, radial movement or disposition is parallel to radius **82**, and circumferential movement or disposition is parallel to circumference **83**. Rotation is with respect to axis **81**.

The adverbs “axially,” “radially,” and “circumferentially” are with respect to an orientation parallel to axis **81**, radius **82**, or circumference **83**, respectively. The adverbs “axially,” “radially,” and “circumferentially” refer to an orientation parallel to respective planes.

FIG. 1B is a perspective view of object **90** in cylindrical coordinate system **80** of FIG. 1A demonstrating spatial terminology used in the present application. Cylindrical object **90** is representative of a cylindrical object in a cylindrical coordinate system and is not intended to limit the present invention in any manner. Object **90** includes axial surface **91**, radial surface **92**, and circumferential surface **93**. Surface **91** is part of an axial plane, surface **92** is part of a radial plane, and surface **93** is part of a circumferential plane.

The following description is made with reference to FIG. 2. FIG. 2 is a cross-section view of a fastener positioning device for a die block, according to an example aspect of the invention. Fastener positioning device **10** may be assembled in a die block (not shown) for a stamping press (not shown). Fastener positioning device **10** includes chute portion **12** attached to a fastener tube (not shown). The fastener tube works with a synchronizing mechanism that transmits individual fasteners through the tube as the press operates. In some example embodiments of the invention, the fastener tube transmits studs **13** or nuts (not shown). The synchronizing mechanism controls timing such that a single stud **13** is correctly oriented and introduced to the positioning device **10** between strokes of the stamping press.

Stud **13** is positioned as described supra before being installed into a plate (not shown) by a die punch (not shown). Chute portion **12** includes stud tube connection portion **14**, retaining portion **16** held by pin **18** in block **20**, and angled section **22**. Angled section **22** is aligned with angled hole **24** in block **20**. Angled hole **24** connects angled section **22** to punch tube **26**, thereby guiding stud **13** into punch tube **26**. Punch tube **26** includes axis **28**. In an example embodiment of the invention, the fastener is gravity-fed through chute portion **12** into punch tube **26**.

The following description is made with reference to FIG. 3. FIG. 3 is a detail view of encircled region **3** in FIG. 2. Stud **13** is axially positioned in punch tube **26** by retainers **32** disposed in apertures **34**. In the embodiment shown, retainers **32** are balls, but other configurations of retainers **32** are possible. For example, retainers **32** may include a block with a tapered end. Apertures **34** extend radially out from tube **26**. FIG. 3A is a side view of encircled region **3**, FIG. 3.

Retainers **32** are located radially inward of groove **36**. In an example embodiment of the invention, diameter **35** of recesses **34** is not constant through block **20** and prevents balls **32** from falling into punch tube **26**. Aperture **34** comprises diameter **33** proximate punch tube **26** and diameter **35** radially outside of diameter **33**. Diameter **35** is larger than diameter **33**. In an example embodiment of the invention, aperture **34** tapers radially inward. In one embodiment, diameter **35** is constant up to edge **39** which has diameter **33**.

Resilient ring **37** is positioned in groove **36**. Ring **37** may be an O-ring made of rubber or another elastic material, or a circularly-formed coil spring, for example. Ring **37** radially contracts balls **32** against edge **39** of recess **34** proximate stud shaft **38**. That is, ring **37** urges retainer **32** towards axis **28**. Edge **39** may be a rim or ledge for restricting motion of balls **32** towards axis **28**. Balls **32** are radially positioned on diam-

eter **41** slightly larger than diameter **42** of stud shaft **38** so that stud **13** easily slides into position between balls **32**. Stud head **40** axially positions stud **13** in relation to balls **32** in punch tube **26**. That is, diameter **44** of stud head **40** is larger than diameter **41**, and contact between balls **32** and stud head **40** controls axial position of stud **13** in punch tube **26**. That is, a radial surface of stud head **40** rests on retainers **32**.

The following description is made with reference to FIG. 4. FIG. 4 is a detail view of encircled region **3** in FIG. 2 showing an alternative embodiment of the invention. Nut **113** is axially positioned in punch tube **26** by retainers **32** disposed in apertures **34**. The configuration of retainers **32**, apertures **34** and ring **37** described supra applies to this embodiment as well.

Balls **32** are radially positioned on diameter **41** slightly larger than diameter **142** of nut installation ring **138** so that nut **113** easily slides into position between balls **32**. Nut base **140** axially positions nut **113** in relation to balls **32** in punch tube **26**. That is, diameter **144** of nut base **140** is larger than diameter **41**, and contact between balls **32** and nut base **140** controls axial position of nut **113** in punch tube **26**. That is, nut base **140** rests on retainers **32**.

The following description is made with reference to FIG. 5. FIG. 5 is a partial cross section view of a die block with a fastener positioning device, according to an example aspect of the invention. Fastener positioning device **10** may include stud insertion punch **27**. Punch tube **26** is disposed perpendicular to plate **25** so that stud insertion punch **27** moves along punch tube axis **28**, parallel to stud axis **30**, when displaced in direction **29** by the stroke of the stamping press (not shown). Stud **13** is inserted into plate **25** by punch **27** traveling along punch tube axis **30**. When head **31** of punch **27** contacts head **40** of stud **13**, head **40** is pushed in direction **29** displacing retainers **32**. That is, axial force on head **40** radially displaces the retainers and resilient ring **37** so that stud **13** travels through tube **26** towards plate **25**. The tube aligns the stud with hole **23** in plate **25** so that additional force acting on punch **27** installs stud **13** into plate hole **23**.

After installation of stud **13** into plate hole **23**, punch **27** is retracted in direction **46**, opposite direction **29**. Once punch **27** is retracted past retainers **32**, ring **37** urges retainers into contact with edge **39** as described supra. Once punch **27** is retracted past angled hole **24**, another stud **13** is introduced through chute portion **12** into positioning device **10**. Punch **27** is then moved in direction **29** to install new stud **13** into new plate **25**.

Although fastener positioning device **10** is shown with a particular number of retainers **32**, device **10** may include other numbers of balls or retainers. Generally, at least three retainers are preferred to properly position stud **13** in the tube.

Of course, changes and modifications to the above examples of the invention should be readily apparent to those having ordinary skill in the art, without departing from the spirit or scope of the invention as claimed. Although the invention is described by reference to specific preferred and/or example embodiments, it is clear that variations can be made without departing from the scope or spirit of the invention as claimed.

What we claim is:

1. A fastener positioning device for a die block, comprising:
 - a punch tube arranged to receive a fastener, the tube comprising an axis;
 - first and second apertures extending radially out from the tube;
 - a groove circumferentially disposed about the punch tube and connecting with the first and second apertures;

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- first and second displaceable retainers disposed in the at least one first and second apertures, respectively; and, a resilient ring in contact with the first and second retainers and urging the at least one first and second retainers towards the axis, wherein the resilient ring is positioned within the groove.
2. The fastener positioning device of claim 1, wherein the first and second apertures comprise first respective diameters proximate the punch tube and second respective, larger diameters radially outside of the first diameter.
3. The fastener positioning device of claim 2, wherein the first and second retainers comprise respective balls.
4. The fastener positioning device of claim 1, wherein the resilient ring comprises an O-ring.
5. The fastener positioning device of claim 1, further comprising a chute portion connected to the punch tube, wherein the chute portion is arranged to guide the fastener into the punch tube.
6. The fastener positioning device of claim 5, wherein the fastener is gravity-fed through the chute portion into the punch tube.
7. The fastener positioning device of claim 1, further comprising a punch arranged to travel through the punch tube to install the fastener.
8. The fastener positioning device of claim 1, wherein the at least one retainer is radially displaceable by the fastener.
9. The fastener positioning device of claim 1, wherein in response to an axial force upon the fastener in an axial direction, the fastener is axially displaceable in the axial direction to radially outwardly displace the at least one retainer.
10. The fastener positioning device of claim 9, wherein the first and second retainers are radially outwardly displaceable such that the fastener is displaceable past the first and second retainers in the axial direction.
11. The fastener positioning device of claim 1, wherein the fastener is a stud or a nut.
12. A fastener positioning device for a die block, comprising:

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- a punch tube arranged to receive a stud or nut, the tube comprising an axis;
- a plurality of apertures extending radially out from the tube, each aperture having:
- a first respective diameter;
- a groove circumferentially disposed about the punch tube and connecting with the first and second apertures; and, a respective edge proximate the tube and with a second respective diameter less than the first respective diameter;
- a plurality of balls disposed in the plurality of apertures; and,
- an O-ring in contact with the plurality of balls and urging the plurality of balls towards the axis, wherein the resilient ring is positioned within the groove, and wherein the plurality of balls are radially displaceable by axial displacement of the stud or nut.
13. A fastener positioning device for a die block, comprising:
- a punch tube arranged to receive a stud or nut, the tube comprising an axis;
- a plurality of apertures extending radially out from the tube, each aperture including:
- a first respective diameter at a respective radially outermost end of said each aperture; and,
- a second respective diameter, less than the first respective diameter, at a respective radially innermost end of said each aperture;
- a plurality of balls disposed in the plurality of apertures; and,
- an O-ring in contact with the plurality of balls and urging the plurality of balls towards the axis, wherein: the plurality of balls are radially displaceable by axial displacement of the stud or nut; and, said each aperture tapers inward from the first respective diameter to the second respective diameter.

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