(54) Title: PRESSURE PIERCE HEAD UNIT

(57) Abstract: A fastener installation assembly (10) having a base (12), a first support member (14) mounted to the base to slide upon the base and a second support member (16) mounted to the first support member to slide upon the first support member. The first and second support members have opposed engagement surfaces, one of the engagement surfaces has a stationary member (30) and a moveable member (32) mounted thereon and the other engagement surface has a die member (28) mounted thereon. The fastener installation assembly has first and second power cylinders (18, 20), the first power cylinder (18) is operatively coupled to the first support member and the second power cylinder (20) is operatively coupled to the second support member, the power cylinders move the engagement surfaces together to install a fastener into a panel. The moveable member is mounted proximate the stationary member and moveable relative to the stationary member.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
PRESSURE PIERCE HEAD UNIT

BACKGROUND OF THE INVENTION

This invention relates to head unit for a press that is used to install pierce nuts onto a panel. The head unit of the present invention provides an improved mechanism for ensuring precise relative movement between the stationary and movable members while providing an inexpensive and simple mechanism which facilitates replacing worn head unit components.

Prior art head units typically utilized a pair of guide pins, or shoulder screws to ensure that the movable and stationary members were properly aligned and to retain the movable member as the spring biased the movable member away from the stationary member. The guide pins were received in bores in the movable member and threaded into the stationary member. One such head unit is disclosed in U.S. Patent No. 4,505,416 issued on March 19, 1985 to the assignee of this application.

In the prior art, undesired play occurred as the guide pins and bores began to wear. Unfortunately, replacing the guide pins was not sufficient and the bores also required repair, resulting in costly repairs and lengthy downtime of the press. For example, the bores were typically repaired by welding them and then drilling the bores to the desired diameter so that the same size guide pins could be used. Alternatively, the bores were drilled to a larger diameter so that oversized guide pins could be used. Both of these repairs were undesirably time consuming and costly.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention can be understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a perspective view of a press used for installing pierce nuts onto a panel;

Figure 2 is an exploded perspective view of a head unit of the present invention;
Figure 3 is a rear perspective view of the head unit depicted in Figure 2 assembled;
Figure 4 is a front perspective view of the head unit depicted in Figure 2 assembled; and
Figure 5 is a cross-sectional view of the head unit taken along line 5–5 in Figure 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A press 10 for installing fasteners (not shown) onto a panel (not shown) is shown in Figure 1. Press 10 has a base 12 to which a first support member 14 is attached. The first support member 14 has an arm 15 extending from one portion of the first support member 14 and a second support member 16 slidably supported on an adjacent portion of the first support member 14. A first cylinder 18 is connected between the base 12 and the second support member 16 such that the second support member 16 will slide relative to the first member. A second cylinder 20 is supported on the second support member 16 opposite the arm 15, which together define a work area 22.

A head unit 26 is attached to the arm 15 opposite the second cylinder 20. The second cylinder 20 has a movable end 28 with a die for forming the panel during the pressing operation. During the pressing operation, a panel is loaded into the work area 22 between the movable die end 28 and the head unit 26 for installation of a fastener, such as a pierce nut, into the panel. The first cylinder 18 is actuated to the retracted position while the second cylinder 20 is initially in the retracted position, which is shown in Figure 1. This brings the arm 15 towards the end 28 which partially closes the area 22 and brings arm 15 to the panel. The second cylinder 20 is actuated and engages the panel with the die end 28 and forces the panel against the head unit 26. A pierce nut, which is located within the head unit 26, is forced into the panel by the action of the second cylinder 20. When the second cylinder 20 reaches a predetermined load, it overcomes the first cylinder 18 and forces the second support
member 16 to slide relative to the first support member 14. In the preferred embodiment, the cylinder 18 is about 886 lbs. And the cylinder 20 is about 15 tons.

The head unit 26 has a stationary member 30 that is secured to the arm 15 and a movable member 32 that is movable relative to the stationary member 30. A resilient member (not shown in Figure 1) is interposed between the movable member 32 and either the stationary member 30 or the arm 15 to bias the movable member 32 away from the stationary member 30 and toward the die end 28. A pierce nut is interposed between the stationary member and the panel. As the second cylinder 20 forces the panel against a face 33 of the movable member 32, the resilient member is compressed and the pierce nut is installed into the panel by the stationary member 30.

Referring to Figure 2, the head unit 26 is shown disassembled. The movable member 32 includes a body 40 that is fastened to a nut cap 42 to define an nut passage 44 for receiving the pierce nuts. The nut cap 42 has opposing outwardly extending tabs 46 and a flange 48. A nose plate 50 is fastened to the body 40 and nut cap 42 and has a groove 52 that receives the flange 48 to lock the body 40, nut cap 42, and nose plate 50 securely together. The body 40, nut cap 42, and nose plate 50 define a plunger passage 56 that runs transverse to the nut passage 44 through the nut cap 42 and body 40 to the face 33 forming an opening 57.

The nose plate 50 has an opening 58 intersecting the plunger passage 56 and a contoured surface adapted to receive a proximiter probe 60. The proximiter probe 60 is secured to the nose plate 50 adjacent to the plunger passage 56 by a proximiter plate 62 to determine when a nut is present in the plunger passage 56.

The stationary member 30 includes a housing 64 that is secured to the arm 15. The housing 64 has a square portion 64 and a cylindrical portion 66 extending therefrom with a bore 68 extending therethrough. A T-shaped plunger 70 is fastened to the square portion 64 of the housing 64 parallel to the bore 68. The plunger 70 has a leg 72 with an engagement surface 76 for engaging the nuts during the pressing operation. The leg 72 is slidably disposed within the plunger passage 56 so that when the movable member 32 moves relative to the stationary member 30, the
plunger 70 will force the pierce nut out of the plunger passage 56, through the opening 57, and into the panel.

A shank 78 is secured to the movable member 32 and disposed within the bore 68. A standard sized bushing 80 is interposed between the shank 78 and movable member 32 to provide a bearing surface between the movable member 32 and the stationary member 30 during relative movement between the members 30,32. A resilient member, or spring 82, is received within an opening 84 in the shank 78. The spring 82 is arranged between the movable member 32 and the arm 15. Prior art devices positioned the spring between the movable member and a back-up plate that was secured to the stationary member on the side opposite the movable member.

A pair of keepers 88 is fastened to the arm 15 on opposing sides of the movable member 32. Each keeper 88 has a rectangular pocket 90 that receives a tab 46. The spring 82 biases the tabs 46 of the movable member 32 against a forward surface 92 of the pockets 90. The pockets 90 are large enough to permit the movable member 32 to travel a sufficient distance relative to the stationary member 30 so that the plunger 70 may install the nut into the panel. The tabs 46 and keepers 88 function together limit the travel of the movable member 32 relative to the stationary member 30, thereby replacing the travel limiting function of the guide pins in the prior art.

The shank 78, bushing 80, and housing 64 coact with one another to ensure that the plunger 70 is positioned properly relative to the pierce nut during the pressing operation. Together they operate to replace the guide pins of the prior art. With the present invention, the bushing 80 wears over time as the movable member 32 moves relative to the stationary member 30. To replace the bushing 80, the keepers 88 are simply removed from the arm 15, which permits removal of the rest of the head unit 26 and access to the bushing 80, as best shown in Figure 3.

The invention has been described in an illustrative manner, and it is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation. Obviously, many modifications and
variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.
CLAIMS

What is claimed is:

1. A fastener installation assembly for use with a press comprising:
   a stationary member for attachment to the press; said stationary member
   having a plunger attached.
   a moveable member proximate said stationary member and moveable relative
   to said stationary member, said moveable member including a shank extending into
   said stationary member to guide said moveable member with respect to said
   stationary member;
   a fastener passage formed in said moveable member to receive and guide
   fasteners to a plunger passage; said plunger extending into said plunger passage
   when said moveable member moves with respect to said stationary member, said
   plunger moving transverse to said fastener passage;
   keepers mounted relative to said moveable member to retain said moveable
   member with respect to said stationary member and allow said moveable member to
   move with respect to said stationary member and to cooperate with said shank to
   guide said moveable member with respect to said stationary member.

2. The fastener installation assembly of claim 1, further including a
   spring engaging said shank to normally bias said moveable member away from said
   stationary member.

3. The fastener installation assembly of claim 1, wherein said moveable
   member includes tabs extending outwardly from opposed sides of said moveable
   member and said keepers include pockets for receipt of said tabs, said keeper and
   tabs cooperating to limit the travel of said moveable member and allow said
   moveable member to move a sufficient predetermined distance.
4. The fastener installation assembly of claim 1, wherein said plunger is generally t-shaped having a leg with an engagement surface for engaging fasteners in said plunger passage.

5. The fastener installation assembly of claim 1, wherein said stationary member includes a block having a bore extending through it for receipt of said shank for reciprocation with said bore.

6. The fastener installation assembly of claim 5, wherein said stationary member includes a bushing inserted into said bore with said shank received within said bushing for reciprocation within said bushing.

7. The fastener installation assembly of claim 6, wherein said bushing is made of brass.

8. The fastener installation assembly of claim 6, wherein said bushing is a standard size.

9. The fastener installation assembly of claim 1, wherein said moveable member includes a nose plate fastened to a nose body defining said fastener passage.

10. The fastener installation assembly of claim 9, wherein said moveable member includes a cover plate for securing said nose plate to said body plate, said cover plate and said nose plate having apertures for receipt of connectors to secure said cover plate to said nose plate, and said nose body has a flange and said cover plate has a groove for receipt of said flange so that when said cover plate is secured to said nose plate said nose body is secured to said nose plate.
11. The fastener installation assembly of claim 1, further including a proximity switch mounted to said cover plate, said proximity switch adapted to determine the location of a fastener in said plunger passage.

12. The fastener installation assembly of claim 1, wherein said shank is connected to said moveable member by a bolt.

13. The fastener installation assembly of claim 1, further including a press with said fastener installation assembly being mounted to said press.

14. The fastener installation assembly of claim 13, wherein said press has a base, a first support member mounted to said base to slide upon said base and a second support member mounted to said first support member to said slide upon said first support member, said first and second support members have opposed engagement surfaces, one of said engagement surfaces having said stationary and moveable member mounted thereon and said other engagement surface having a die member mounted thereon.

15. The fastener installation assembly of claim 14, further including power cylinders, one of said power cylinders is operatively coupled to said first support member and the other power cylinder is operatively connected to said second power cylinder, said power cylinders moving said engagement surfaces together to install a fastener into a panel.

16. A fastener installation assembly comprising:

a base, a first support member mounted to said base to slide upon said base and a second support member mounted to said first support member to slide upon said first support member, said first and second support members have opposed engagement surfaces, one of said engagement surfaces having a stationary and a
moveable member mounted thereon and said other engagement surface having a die
member mounted thereon;

first and second power cylinders, said first power cylinder is operatively
coupled to said first support member said second power cylinder is operatively
connected to said second power cylinder, said power cylinders moving said
engagement surfaces together to install a fastener into a panel;

said first power cylinder having a final pressure that is less than the final
pressure of said second power cylinder such that when the final pressure of the
second cylinder exceeds the final pressure of the first cylinder the first cylinder is
forced to retract and causes the second support member to slide relative to the first
support member permitting removal of said panel to maintained a predetermined
pressing force.

17. The fastener installation assembly of claim 16, wherein said
stationary member includes a plunger;

said moveable member is mounted proximate said stationary member and
moveable relative to said stationary member, said moveable member including a
shank extending into said stationary member to guide said moveable member with
respect to said stationary member;

a fastener passage formed in said moveable member to receive and guide
fasteners to a plunger passage; said plunger extending into said plunger passage
when said moveable member moves with respect to said stationary member, said
plunger moving transverse to said fastener passage;

keepers mounted relative to said moveable member to retain said moveable
member with respect to said stationary member and allow said moveable member to
move with respect to said stationary member and to cooperate with said shank to
guide said moveable member with respect to said stationary member.

18. The fastener installation assembly of claim 17, wherein said
moveable member includes tabs extending outwardly from opposed sides of said
moveable member and said keepers include pockets for receipt of said tabs, said keeper and tabs cooperating to limit the travel of said moveable member and allow said moveable member to move a sufficient predetermined distance.

19. The fastener installation assembly of claim 18, wherein said plunger is generally t-shaped having a leg with an engagement surface for engaging fasteners in said plunger passage.

20. The fastener installation assembly of claim 18, wherein said stationary member includes a bushing inserted into said bore with said shank received within said bushing for reciprocation within said bushing.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

- IPC(7) : Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)


Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>US 5,146,672 A (MULLER) 15 SEPTEMBER 1992, col. 5 and 6, and Figure 1.</td>
<td>1, 2, 4, 5, 9, 11-13</td>
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<td>US 5,072,518 A (SCOTT) 17 DECEMBER 1991, col. 5 and 6, and Figure 1.</td>
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[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier document published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

**Date of the actual completion of the international search**

25 JANUARY 2001

**Date of mailing of the international search report**

26 FEB 2001

**Name and mailing address of the ISA/US Commissioner of Patents and Trademarks**

Box PCT

Washington, D.C. 20231

Facsimile No. (703) 305-3230

**Authorized officer**

TOM HUGHES

Telefon No. (703) 308-1804

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<td>A</td>
<td>US 4,384,667 A (SMALLEGAN ET AL.) 24 MAY 1983, col. 3 and 4, and Figure 1.</td>
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### INTERNATIONAL SEARCH REPORT

**International application No.**  
PCT/US00/28562

### A. CLASSIFICATION OF SUBJECT MATTER:

**IPC (7):**

- B21J 15/10; B23P 11/00, 19/00, 21/00; B23Q 3/00, 15/00; B25C 5/02, 5/06; B27P 7/00

**US CL :**