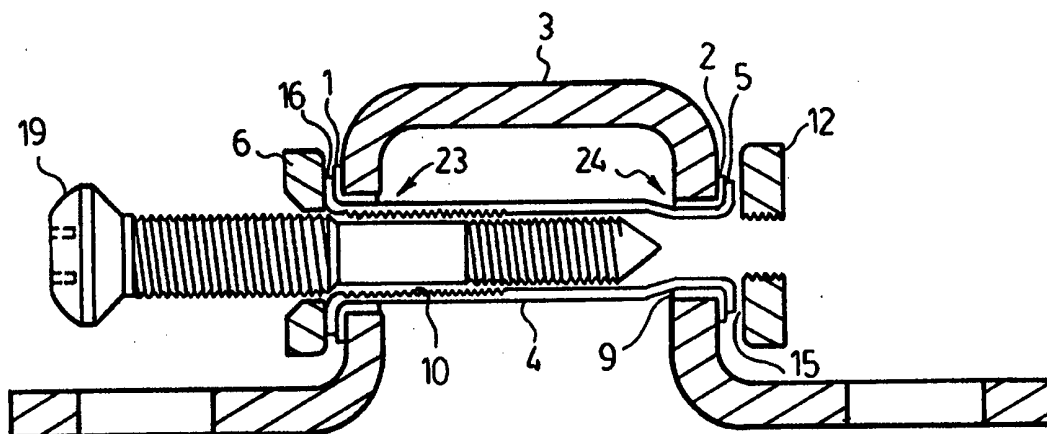




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                        |                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>(51) International Patent Classification <sup>6</sup> :</b><br><br><b>E05D 5/12</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>A1</b>                                                                                                                                                                                                                                              | <b>(11) International Publication Number:</b> <b>WO 99/40281</b><br><br><b>(43) International Publication Date:</b> 12 August 1999 (12.08.99) |
| <b>(21) International Application Number:</b> PCT/CA99/00082<br><br><b>(22) International Filing Date:</b> 29 January 1999 (29.01.99)<br><br><b>(30) Priority Data:</b><br>2,228,539                      3 February 1998 (03.02.98)                      CA<br><br><b>(71)(72) Applicant and Inventor:</b> GRUBER, Rudolf [CA/CA];<br>1760 Central Street, P.O. Box 1B7, Claremont, Ontario<br>L1V 1B1 (CA).<br><br><b>(74) Agent:</b> ZIMMERMANN, Gordon; Borden & Elliot, Scotia<br>Plaza, Suite 4100, 40 King Street West, Toronto, Ontario<br>M5H 3Y4 (CA). | <b>(81) Designated States:</b> AT, BR, CA, CN, DE, ES, GB, IN, JP,<br>KR, MX, SE, US, European patent (AT, BE, CH, CY, DE,<br>DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).<br><br><b>Published</b><br><i>With international search report.</i> |                                                                                                                                               |

(54) Title: IMPROVED HINGE WITH REMOVABLE PIN



## (57) Abstract

A low cost, double shear hinge (3) with a removable hinge pin (7) creates a zero-clearance joint in both axial and radial directions. Bushings (1, 2) are fitted into circular openings (23, 24) in the door side portion of the hinge (3). A partially internally threaded tube (4), flanged at the following end, is inserted through the bushings and swaged over the bushing at its leading end (5). After the body side portion of the hinge with corresponding circular openings (25, 27) is aligned with the door side portion, a hinge pin (7) with a wider threaded following section (8) and a narrower threaded leading section (9) of identical pitch is rotated through the openings to draw the structure together.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

|    |                          |    |                                          |    |                                              |    |                          |
|----|--------------------------|----|------------------------------------------|----|----------------------------------------------|----|--------------------------|
| AL | Albania                  | ES | Spain                                    | LS | Lesotho                                      | SI | Slovenia                 |
| AM | Armenia                  | FI | Finland                                  | LT | Lithuania                                    | SK | Slovakia                 |
| AT | Austria                  | FR | France                                   | LU | Luxembourg                                   | SN | Senegal                  |
| AU | Australia                | GA | Gabon                                    | LV | Latvia                                       | SZ | Swaziland                |
| AZ | Azerbaijan               | GB | United Kingdom                           | MC | Monaco                                       | TD | Chad                     |
| BA | Bosnia and Herzegovina   | GE | Georgia                                  | MD | Republic of Moldova                          | TG | Togo                     |
| BB | Barbados                 | GH | Ghana                                    | MG | Madagascar                                   | TJ | Tajikistan               |
| BE | Belgium                  | GN | Guinea                                   | MK | The former Yugoslav<br>Republic of Macedonia | TM | Turkmenistan             |
| BF | Burkina Faso             | GR | Greece                                   |    |                                              | TR | Turkey                   |
| BG | Bulgaria                 | HU | Hungary                                  | ML | Mali                                         | TT | Trinidad and Tobago      |
| BJ | Benin                    | IE | Ireland                                  | MN | Mongolia                                     | UA | Ukraine                  |
| BR | Brazil                   | IL | Israel                                   | MR | Mauritania                                   | UG | Uganda                   |
| BY | Belarus                  | IS | Iceland                                  | MW | Malawi                                       | US | United States of America |
| CA | Canada                   | IT | Italy                                    | MX | Mexico                                       | UZ | Uzbekistan               |
| CF | Central African Republic | JP | Japan                                    | NE | Niger                                        | VN | Viet Nam                 |
| CG | Congo                    | KE | Kenya                                    | NL | Netherlands                                  | YU | Yugoslavia               |
| CH | Switzerland              | KG | Kyrgyzstan                               | NO | Norway                                       | ZW | Zimbabwe                 |
| CI | Côte d'Ivoire            | KP | Democratic People's<br>Republic of Korea | NZ | New Zealand                                  |    |                          |
| CM | Cameroon                 |    |                                          | PL | Poland                                       |    |                          |
| CN | China                    | KR | Republic of Korea                        | PT | Portugal                                     |    |                          |
| CU | Cuba                     | KZ | Kazakstan                                | RO | Romania                                      |    |                          |
| CZ | Czech Republic           | LC | Saint Lucia                              | RU | Russian Federation                           |    |                          |
| DE | Germany                  | LI | Liechtenstein                            | SD | Sudan                                        |    |                          |
| DK | Denmark                  | LK | Sri Lanka                                | SE | Sweden                                       |    |                          |
| EE | Estonia                  | LR | Liberia                                  | SG | Singapore                                    |    |                          |

## IMPROVED HINGE WITH REMOVABLE PIN

Background of the Invention

5 This invention relates generally to automobile door hinges and, more particularly, to low cost, zero-clearance hinges.

Door hinges are an important component of automotive closures. Hinges affect the door-margin accuracy, which in turn plays a large role in the quality perception of the total vehicle. It is therefore important that the pivoting joint  
10 of the hinge is manufactured in the most accurate way possible, while controlling the cost of material and manufacturing. In many cases, it is a further requirement that the door hinge be able to be dismantled in order to remove the door from the vehicle after it has been painted but before the body  
15 has been trimmed. The removal of the door allows large interior components of the automobile to be installed and eases the assembly of the door hardware.

United States Patent No. 5,033,163 teaches a mechanism for coupling body-side and door-side hinge members to facilitate for such door removal. The hinge  
20 disclosed is typical of stamped hinges with a removable hinge pin. The hinge of U.S. Patent No. 5,033,163, however, does not possess a zero-clearance pivot joint and is not perceived as a top-quality door hinge in the current marketplace.

25 U.S. Patent No. 4,542,588 discloses a hinge which does possess a zero-clearance disengageable joint. This hinge, however, is constructed of relatively costly

machined, hot-rolled profile parts and is designed as a single shear joint which is weaker than the double shear joint taught in U.S. Patent No. 5,033,163.

5 It would be advantageous to overcome the problems of the prior art by creating a low cost hinge with a removable hinge pin. In particular, a radially and axially zero-clearance, double shear hinge joint is desirable.

#### Summary of the Invention

10 It is therefore an important aspect of this invention to provide a double shear hinge with a removable hinge pin which creates a zero-clearance joint in both axial and radial directions, and which can be produced for a relatively low cost.

15 To this end, according to the present invention, there is provided a hinge assembly for mounting an automotive door to an automobile body comprising: a door side portion with first and second circular openings; a body side portion with third and fourth circular openings; said first, second, third and fourth openings adapted to be aligned about an axis; first and second bushings adapted to fit in said first and second circular openings respectively; a tube with a first  
20 end and a second end adapted to be inserted substantially through said first and second bushings and to fit snugly against said bushings; said first end of the tube comprising a flange adapted to abut said first bushing; said second end of the tube adapted to be swaged following said insertion to abut said second bushing; said tube comprising a threaded portion on its interior surface adjacent said first  
25 end; a hinge pin with head end and a leading end adapted to fasten the door side portion to the body side portion at said axis; the hinge pin comprising: (a) a

head at the head end adapted to be rotated by engagement with a tool, (b) a tapered section adjacent to the head adapted to contact said body side portion adjacent the third opening, (c) a first threaded section adjacent the tapered section adapted to engage the threaded portion of the tube, (d) a non-threaded section of smaller diameter than the first threaded section, (e) a second threaded section adjacent the leading end adapted to engage the tube adjacent the second end and the body side portion at the fourth opening.

In a further aspect of the invention, the body side and door side portions are stamped.

In a further aspect of the invention, the body side portion is chamfered around the third opening to contact the tapered section of the hinge pin.

In a further aspect, the second threaded section of the hinge pin is adapted to be self-tapping.

In a further aspect of the invention, the method of constructing the hinge using the structure set out above is disclosed.

#### Description of the Drawings

These and other features, objects, aspects and advantages of the invention will become apparent upon consideration of the specification and appended claims in which:

Figure 1 is a top elevational view of an automotive hinge;

Figure 2 is a cross-sectional view of said hinge through line A-A;

5 Figure 3a is a cross-sectional view of said hinge through line A-A illustrating the commencement of swaging of the tube with a swaging tool.

Figure 3b is a cross-sectional view of said hinge through line A-A illustrating the support of the hinge adjacent the flanged end of the tube as pressure is applied  
10 to the swaging tool.

Figure 4 is a cross-sectional view of said hinge through line A-A illustrating the fully swaged tube and the partially inserted hinge pin.

Description of the Preferred Embodiment

15

Referring now to the drawings, Figure 1 is a top view of a motor vehicle door hinge showing sectional lines A-A. Figures 2, 3 and 4 are sectional views along the line A-A of the hinge.

20 Steel-backed PTFE (Teflon <sup>™</sup>) bushings 1 and 2 are inserted into circular openings 23 and 24 in the door half of the hinge 3, and a flanged tube 4 is inserted through the bushings with an interference fit. An interference fit with PTFE bushings is commonly used to create a radial zero-clearance fit hinge assembly. The flanged end 16 of the tube 4 abuts the bushing 1. The leading  
25 end 5 of the tube is then spread open with an appropriate swage tool 18 and

formed over the bushing 2. This creates an axial zero-clearance fit between the tube 4 and the door half of the hinge 3.

5 This assembly is then inserted into the body half of the hinge at the ears 6 and 12. Circular holes 25 and 27 in the ears of the body half of the hinge correspond to circular holes 23 and 24 in the door half of the hinge now containing the bushings and the tube.

10 A hinge pin 7 is then inserted through the opening in body half ear 6 and tube 4 and finally past body half ear 12.

15 In a preferred embodiment, the hinge pin 7 is provided with a M8 x 1.25 thread 8 in the section of the pin adjacent the head 19. The leading end of the pin is provided with a narrower diameter thread 9. The threading 8 on the hinge pin adjacent the head corresponds with threading 10 in the tube adjacent the flanged end 16 of the tube 4. The threading 9 on the pin adjacent the leading end may correspond to threading (not illustrated) in the tube and the opening 27 in body half ear 12. Alternatively, the threading 9 at the leading end of the hinge pin may be adapted to be self-tapping to engage the tube 4 and ear 12 for a zero-clearance fit between the pin, tube and body half of the hinge. The self-threading section 9 may comprise an M6 x 1.25 thread with an M8 pitch. The self-tapping action of the leading end of the pin removes any free play between the body side, the pin and the swaged over tube. It is important that the pitch on both threaded portions of the pin be identical.

25

5 The thread 8 on the hinge pin engages the tube thread 10 first and acts as a lead screw to aid the threading of the leading end of the pin. Pin portion 9 may be self-threading into an unthreaded opposite end of the tube 11 and the body half ear 12, or the end of the tube 11 and body half ear may be correspondingly threaded.

10 The hinge pin is tapered in the area adjacent the head to contact body half ear 6 which may be correspondingly chamfered. When the conical or tapered portion 13 of the hinge pin contacts body half ear 6, the door half of the hinge 3 and the tube 4 assembly are pulled towards the body half ear 6 to create a zero-clearance radial and axial hinge joint.

15 It is often preferable to leave a gap 15 between bushing 2 and body half ear 12 for take up of body and door half tolerance.

In order to produce a low cost hinge, typically the body side and door side portions of the hinge are stamped rather than cast or hot-rolled.

20 While a preferred embodiment of the invention has been illustrated and described, this is for the purpose of illustration and it is to be understood that various modifications in structure will occur to a person skilled in the art.

## I CLAIM:

1. A hinge assembly for mounting an automotive door to an automotive body comprising:
  - (i) a door side portion with first and second circular openings;
  - (ii) a body side portion with third and fourth circular openings;
  - (iii) said first, second, third and fourth openings adapted to be aligned about an axis;
  - (iv) first and second bushings adapted to fit in said first and second circular openings respectively;
  - (v) a tube with a first end and a second end adapted to be inserted substantially through said first and second bushings and to fit snugly against said bushings;
  - (vi) said first end of the tube comprising a flange adapted to abut said first bushing;
  - (vii) said second end of the tube adapted to be swaged following said insertion to abut said second bushing;
  - (viii) said tube comprising a threaded portion on its interior surface adjacent said first end;

- (ix) a hinge pin with a head end and a leading end adapted to fasten the door side portion to the body side portion at said axis;
  - (x) the hinge pin comprising:
    - (a) a head at the head end adapted to be rotated by engagement with a tool;
    - (b) a tapered section adjacent the head adapted to contact said body side portion adjacent the third opening;
    - (c) a first threaded section with a selected thread pitch adjacent the tapered section adapted to engage the threaded portion of the tube;
    - (d) a narrower diameter non-threaded section;
    - (e) a second threaded section with a thread pitch corresponding to the thread pitch of the first threaded section adjacent the leading end adapted to engage the tube adjacent the second end and the body side portion adjacent the fourth opening.
2. The hinge assembly of claim 1 wherein the body side and the door side portions of the hinge are stamped.

3. The hinge assembly of claim 1 wherein the body side portion is chamfered about the third opening.
4. The hinge assembly of claim 1 wherein the second threaded section of the pin is adapted to be self-tapping through the tube and the fourth opening of the body side portion.
5. The hinge assembly of claim 1 wherein the tube and the fourth opening of the body side portion are threaded to engage the second threaded section of the pin.
6. A method of assembling a hinge comprising:
  - (i) positioning a door side portion of a hinge with first and second circular openings for insertion of bushings and a tube;
  - (ii) snug fitting first and second bushings in said first and second circular openings;
  - (iii) interference fitting a tube comprising a flanged end and a non-flanged end through said bushings so that the flanged end abuts said first bushing;
  - (iv) using a swaging tool, opening and spreading said second end of the tube to abut said second bushing snugly;

- (v) positioning a body side portion of the hinge with third and fourth circular openings in line with said first and second circular openings in the door side portion of the hinge;
- (vi) rotating a hinge pin threaded adjacent both ends through said openings so that the threaded section of the hinge pin adjacent the head engages an interiorly threaded portion of the tube adjacent its flanged end, and a threaded portion of the pin adjacent its leading end engages the tube and body side portion of the hinge adjacent the fourth opening, thus removing any free play between the body side, the hinge pin and the swaged over tube.

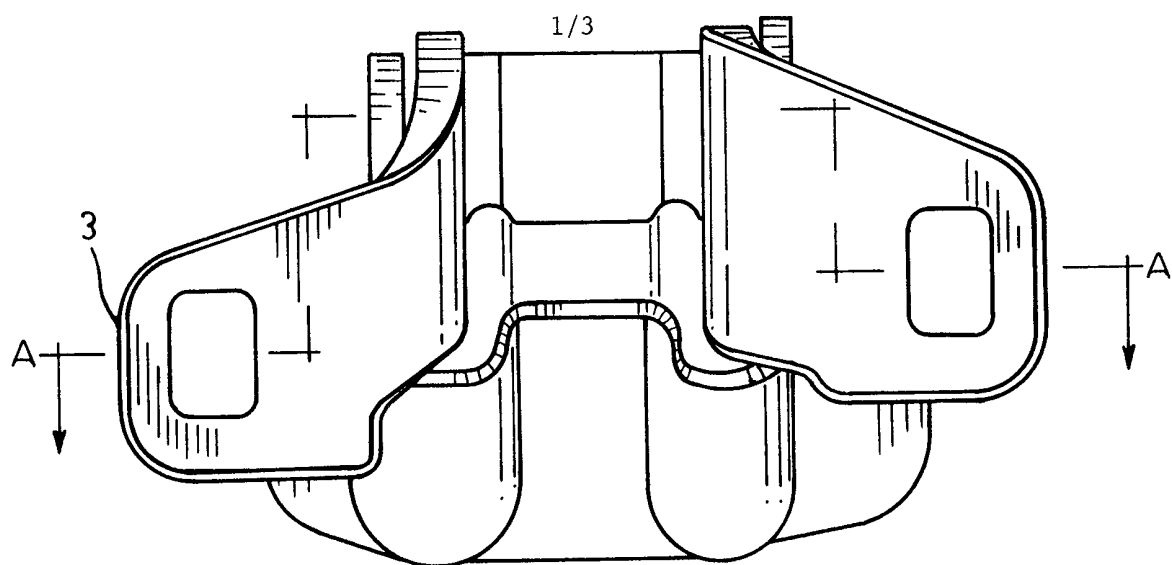


FIG.1

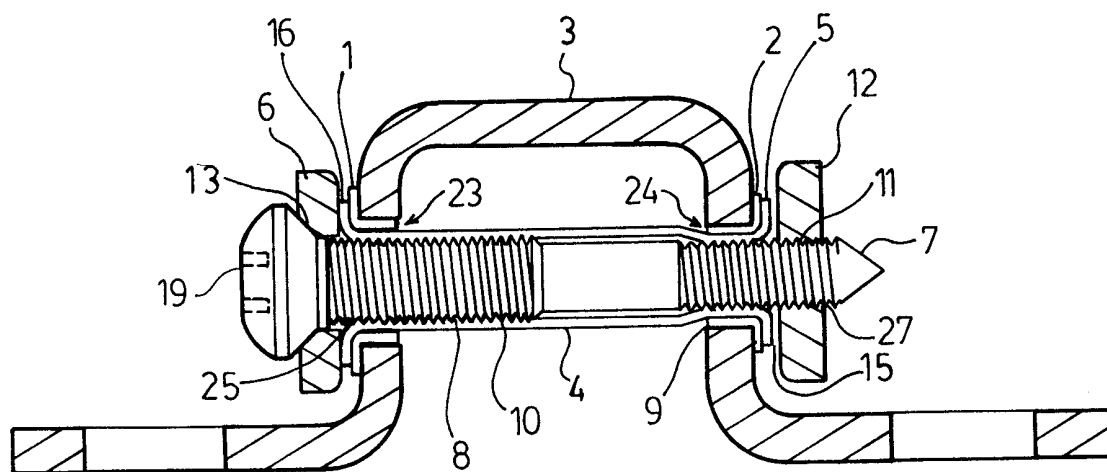


FIG.2

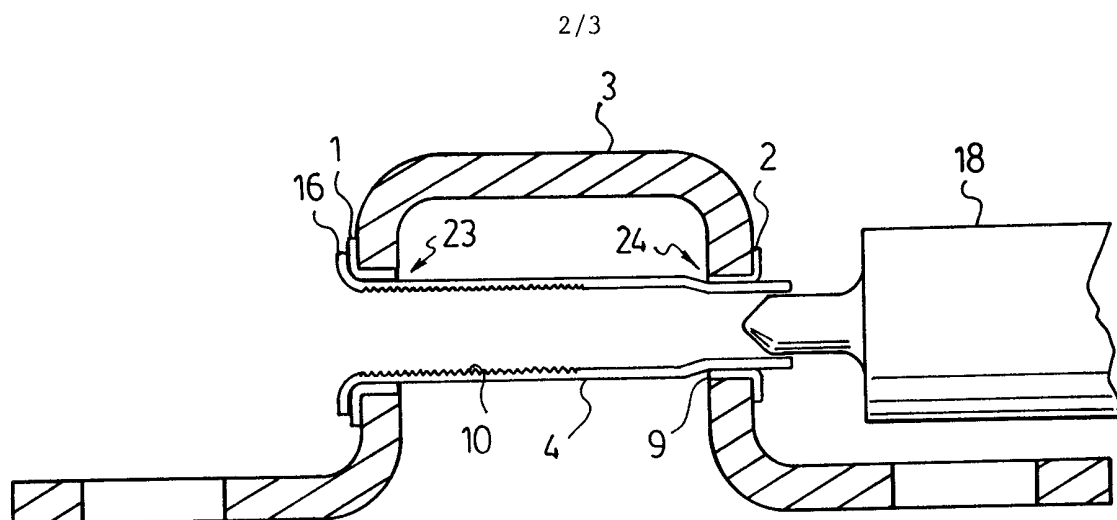


FIG.3a

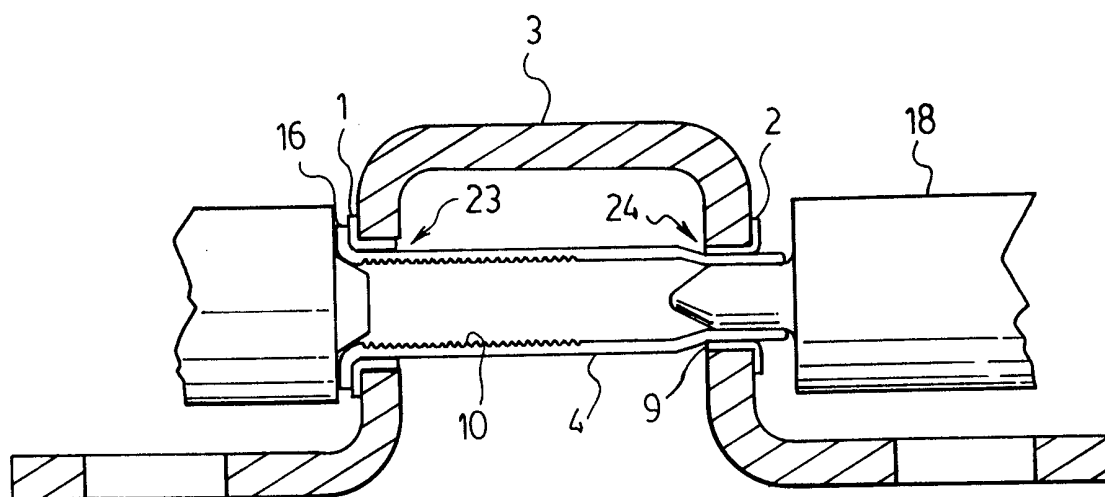
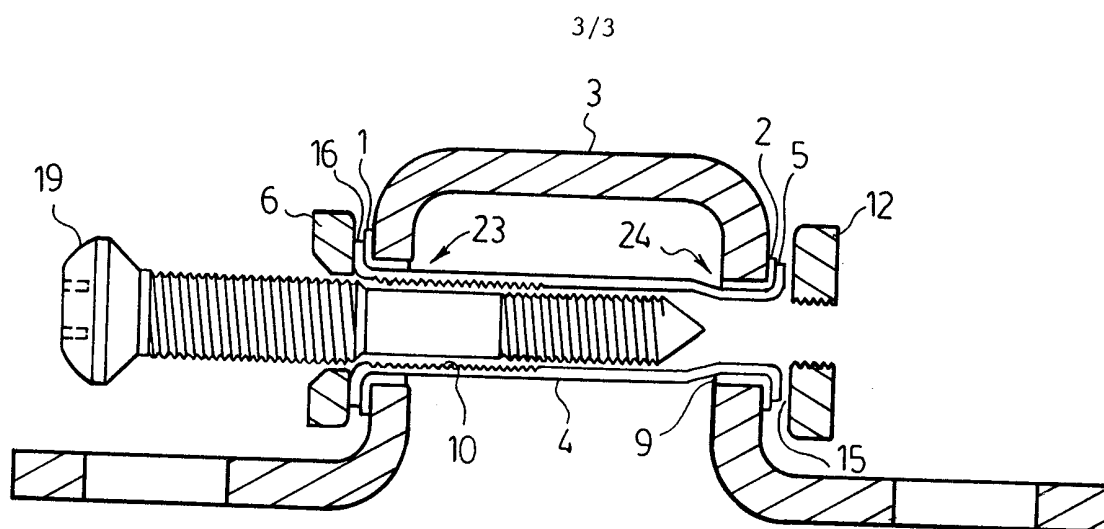


FIG.3b



# INTERNATIONAL SEARCH REPORT

Inte. onal Application No

PCT/CA 99/00082

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 E05D5/12

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)

IPC 6 E05D

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

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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages     | Relevant to claim No. |
|------------|----------------------------------------------------------------------------------------|-----------------------|
| A          | FR 2 606 822 A (COMACI SA) 20 May 1988<br>see page 2, line 28 - page 4; figures<br>--- | 1,6                   |
| A          | US 1 516 086 A (DAVIDSON) 18 November 1924<br>see the whole document<br>-----          | 1,6                   |



Further documents are listed in the continuation of box C.



Patent family members are listed in 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 but 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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

6 May 1999

Date of mailing of the international search report

19/05/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Van Kessel, J

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/CA 99/00082

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| FR 2606822    A                           | 20-05-1988          | NONE                       |                     |
| US 1516086    A                           | 18-11-1924          | NONE                       |                     |