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(71) Applicant (for all designated States except US): HANS OETIKER AG MASCHINEN- UND APPARATE-FABRIK [CH/CH]; Oberdorfstrasse 21, CH-8812 Horgen (CH).

(72) Inventor; and  
(75) Inventor/Applicant (for US only): KENWRIGHT, Eric [CA/CA]; 30 Mapleton Ave., Barrie, Ontario L4N 7M2 (CA).

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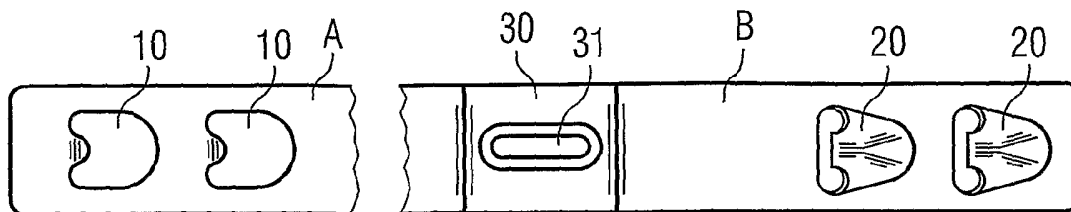
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(54) Title: AN ARRANGEMENT FOR CONNECTING THE ENDS OF AN OPEN CLAMP



(57) Abstract: For connecting the mutually overlapping band end portions A, B of an open clamp, a window (10) is provided in a first end portion (A) for engagement by a hook (20) provided on the second end portion (B). The hook (20) is pressed from the band material, starting at an opening (21) punched from the band material of the clamp. The opening (21) is formed by two substantially circular holes (22) and a parallelsided cut-out (23) connecting the hole (22), the width of the cut-out (23) as measured in the longitudinal band direction being smaller than the diameter of the holes (22).

WO 2006/111181 A1

## **An Arrangement for Connecting the Ends of an Open Clamp**

### **Description**

#### **Prior Art**

US 4,622,720 discloses an open hose clamp made of band material in which the outer one of the two mutually overlapping end portions is provided with windows for engagement by hooks provided on the inner band end portion. This  
5 clamp has the features included in the first part of claim 1. The hooks are produced by forming in the band material a cut extending transversely of the longitudinal direction of the band, and pressing the adjacent band material out of the band by cold deformation. In addition to these pressed hooks, the known band  
10 clamp has a guide hook which consists of a tab bent out of the material of the inner band end portion for engagement with a longitudinal cut provided in the outer band end portion. The edge of the tab remote from the inner band end is undercut to prevent inadvertent opening of the clamp.

EP 0 672 858 A1 shows a further open clamp made of band material  
15 wherein a window is formed in the outer band end portion to receive an embossment formed at the inner band end portion. The edge of the window remote from the outer band end has a lug projecting into the window, which lug, in the closed condition of the clamp, engages in a slot provided at the embossment to secure the clamp against inadvertent opening.

#### **20 Summary of the Invention**

It is an object of the invention to improve the connection of the end portions of an open clamp, and more specifically to form the connection so that it withstands high tensional force.

This object is met by the invention characterised in claim 1. The hook  
25 formed in accordance with claim 1 starts at an opening in the band material, the opening constituting an edge for engagement with the window with an undercut which causes the central part of the hook to extend above and beyond the corresponding edge of the window. The opening also avoids the considerable stress which in conventional pressing or deep drawing deformation occurs in this  
30 area of the hook and tends to result in cracks.

The features of claims 2 and 3 are advantageous in that they assist in reducing stress on the hook.

The embodiment recited in claim 4 is useful to ensure safe engagement between the hook and the edge of the window, at the same time avoiding unnecessary outward projecting parts of the clamp.

5 The development of the invention according to claims 5 and 6 further serves to increase the safety of the engagement between hook and window. The feature of claim 6 is advantageous for achieving easy tightening of the clamp because the lug, due to its oblique disposition, tends to move under the hook.

10 In the embodiment of claim 7, the outline of the window substantially follows the shape of the hook whereby any weakening of the material by an unnecessarily large window size and stress concentration are avoided.

The further embodiment of the invention according to claim 8 is of advantage in that it further makes the clamp easy to install.

15 Claims 9 to 11 relate to an advantageous process of manufacturing the connection arrangement according to the invention, wherein the hook is formed by means of a progressive die method in which the opening is formed in a first punching step for producing the engaging edge of the hook, and the hook shape proper is produced in a subsequent pressing or deep-drawing step.

### **Brief Description of the Drawing**

20 An embodiment of the invention will be explained in more detail below with reference to the drawing in which

Fig. 1 shows the two end portions of a clamp made of band material in a flat condition,

Fig. 2 is an enlarged representation of the band end portions with punched portions forming the window and the hook,

25 Fig. 3 shows the band end portions of Fig. 2 after deformation by pressing,

Fig. 4 is a side view of the band end portions, and

Fig. 5 is a section through the two band end portions in the hooked condition.

### **Detailed Description of an Embodiment**

30 The clamp shown in a flat condition in Fig. 1 has in its first, left-hand band end portion **A** two identically shaped windows **10**, and in its second, right-hand band end portion **B** two identically shaped hooks **20** and a tightening ear **30** the bridge portion of which has a reinforcing depression **31**. The tightening ear **30** is a so-called Oetiker ear of the type provided also in the hose clamp known from  
35 US 4,622,720 referred to above.

One of the two windows **10** is shown in the left-hand part of Fig. 2 on an enlarged scale. The window **10** has two edges **11** extending parallel to the longitudinal band edges **32**. The ends of the edges **11** remote from the first band end **12** are joined by a semicircular edge **13**. A lug **14** projecting into the window **10** is formed at the edge of the window **10** remote from the first band end **12**. The lug **14** has a width corresponding to 1/4 to 1/3 of the width of the window **10**. The lug **14** is confined by a semicircular convex edge which is connected to the lateral edges **11** of the window **10** by semicircular concave edges **15**.

The right-hand part of Fig. 2 shows an opening **21** punched out of the band material, the opening **21** being formed by two circular holes **22** and a parallel-sided cut-out **23** which interconnects the holes **22** and extends transversely of the longitudinal band direction. The width of the cut-out **23** as measured in the longitudinal direction of the band is about 1/3 to 1/2 the diameter of each hole **22**. The rectilinear edge **25** of the cut-out **23** remote from the second band end **24** merges tangentially into the inner edges of the holes **22**.

Fig. 2 shows the band end portions **A** and **B** subsequent to a punching step.

Fig. 3 shows the band end portions **A** and **B** after a subsequent pressing or deep drawing step. In this step, the lug **14** formed within the window **10** is bent down obliquely while the portion of the material adjoining the opening **21** in the direction toward the second band end **24** is pressed upward to form a roof-like structure which rises obliquely in a direction away from the second band end **24**, thereby constituting the hook **20**. During this pressing step, the central upper part **26** of the hook **20** is pressed parallel to the surface of the band material.

The right-hand part of Fig. 4 is a side view of the hook thus formed. As shown, the circular holes **22** form undercuts **27** in the finished hook **20**.

In the engaged condition shown in Fig. 5, the second band end portion **B** extends above and beyond the first band end portion **A**, with the hooks **20** engaging the windows **10**. In course of engagement, the bent-down lugs **14** projecting into the windows **10** move underneath the central parts **26** of the hooks **20** while the convex edges **15** of the windows **10** abut the undercuts **27** of the hooks **20**. An intimate connection between the hook **20** and the corresponding window **10** is thus achieved and inadvertent opening of the connection is prevented.

## Claims

- 1 1. An arrangement for connecting the mutually overlapping end portions (**A**,  
2 **B**) of an open clamp made of band material, including a window (**10**) provided in a  
3 first end portion (**A**) and a hook (**20**) formed in a second end portion (**B**) for  
4 engaging the window (**10**), the hook (**20**) being deep-drawn from the band  
5 material starting at a cut in the band material, **characterised** in that the cut  
6 defines a punched opening (**21**) which has a greater width in the longitudinal  
7 direction of the band at its end portions (**22**) adjacent the longitudinal band edges  
8 than in its central portion (**23**).
- 1 2. The arrangement of claim 1, wherein the opening (**21**) is formed by two  
2 substantially circular holes (**22**) and a parallel-sided cut-out (**23**) interconnecting  
3 the holes, the width of the cut-out (**23**) in the longitudinal direction of the band  
4 being smaller than the diameter of the holes (**22**).
- 1 3. The arrangement of claim 2, wherein the edge (**25**) of the opening (**21**)  
2 remote from the second band end (**24**) extends tangentially with respect to the  
3 edges of the holes (**22**).
- 1 4. The arrangement of any preceding claim, wherein the free end of the hook  
2 (**20**) has a flat central part (**26**) as viewed transversely of the longitudinal band  
3 direction such that the central part (**26**) is inclined with respect to the surface of  
4 the band at a smaller angle than the rising part of the hook (**20**).
- 1 5. The arrangement of any preceding claim, wherein a lug (**14**) projecting into  
2 the window (**10**) is formed at the edge of the window (**10**) adjacent the first band  
3 end (**12**).
- 1 6. The arrangement of claim 5, wherein the lug (**14**) is bent out of the band  
2 material in a direction opposite to the deep-drawing direction of the hook (**20**).
- 1 7. The arrangement of claim 5 or 6, wherein the edge (**13**) of the window (**10**)  
2 remote from the first band end (**12**) has a substantially semicircular shape.

1 8. A clamp having a connecting arrangement according to any preceding  
2 claim, the clamp being pre-bent such that the first band end portion (**A**) provided  
3 with the window (**10**), in the closed condition of the clamp, overlaps the outer side  
4 of the second band end portion (**B**) carrying the hook (**20**).

1 9. A method of producing an arrangement for connecting the mutually  
2 overlapping end portions (**A**, **B**) of an open clamp made of band material, wherein  
3 a window (**10**) is punched out of a first end portion (**A**) and a hook (**20**) for  
4 engagement in the window (**10**) is punched out of a second end portion (**B**),  
5 **characterised** in that the hook (**20**) is formed by punching an opening (**21**) out of  
6 the band material in a first step, the opening (**21**) having a greater width in the  
7 longitudinal direction of the band at its end portions adjacent the longitudinal band  
8 edges than in its central portion, and pressing a portion contiguous with the  
9 opening (**21**) out of the band material in a second step.

1 10. The method of claim 9, wherein the window (**10**) is punched out of the band  
2 material simultaneously with the opening (**21**).

1 11. The method of claim 10, wherein a lug (**14**) projecting into the window (**10**)  
2 is formed at the edge of the window (**10**) adjacent the first band end (**12**), the lug  
3 (**14**) being bent out of the band material in said second step in a direction  
4 opposite to the pressing direction of the hook (**20**).

FIG 1

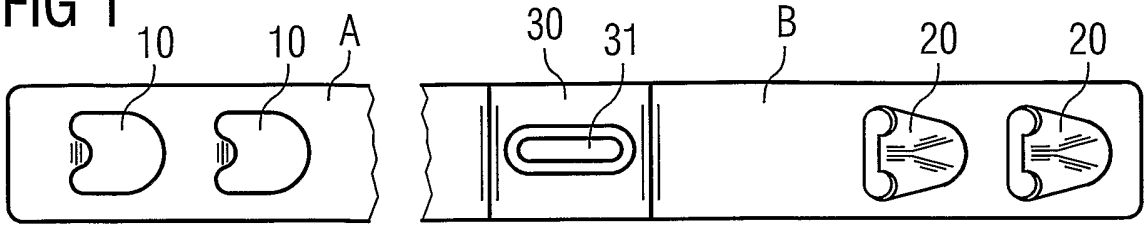


FIG 2

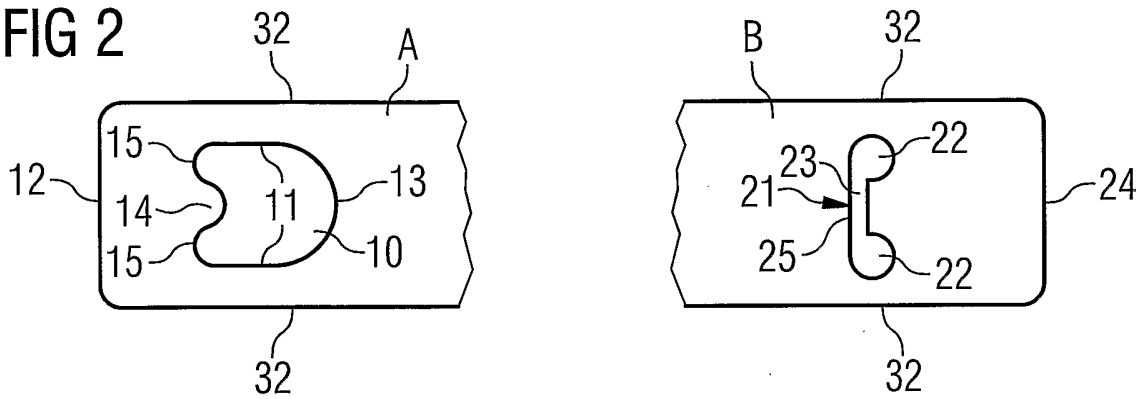


FIG 3

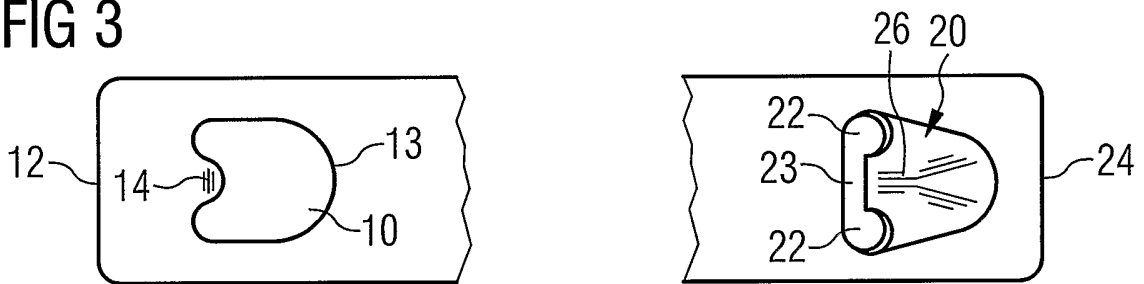


FIG 4

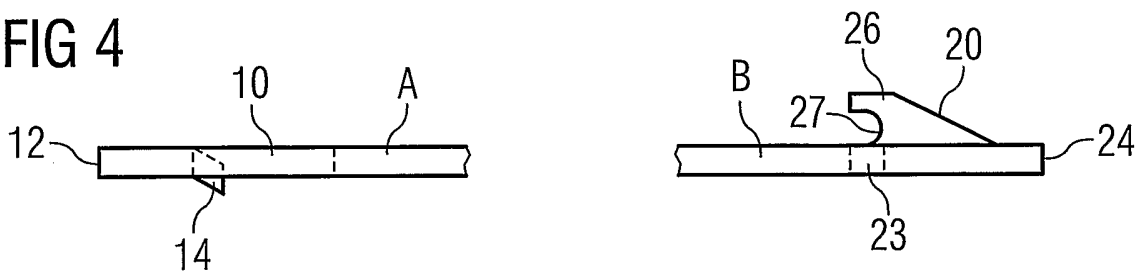
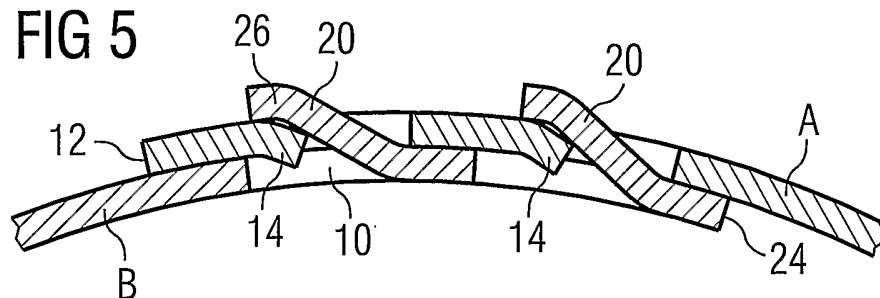


FIG 5



# INTERNATIONAL SEARCH REPORT

International Application No  
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|---|---|-----------------------|
| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>F16L33/035 B65D63/04 F16B2/08   |   |                       |
| According to International Patent Classification (IPC) or to both national classification and IPC   |   |                       |
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>F16L B65D F16B  |   |                       |
| 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)<br>EPO-Internal  |   |                       |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>   |   |                       |
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| <input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <span style="margin-left: 100px;"><input checked="" type="checkbox"/> Patent family members are listed in annex.</span>  |   |                       |
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| "A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier document but published on or after the international filing date<br>"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)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"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<br>"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<br>"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.<br>"&" document member of the same patent family |                       |
| Date of the actual completion of the international search   | Date of mailing of the international search report  |                       |
| 9 December 2005   | 23/12/2005  |                       |
| Name and mailing address of the ISA   | Authorized officer  |                       |
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016   | Untermann, N  |                       |

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International Application No  
PCT/EP2005/004253

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