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(54) **Insulator mount.**

(57) An insulator (22) is fixed on a base (21) by means of a mounting plate (31). A glazing layer (25) is formed all over the outer periphery of the insulator (22). A curved portion (27) is formed between a body (23) of the insulator (22) and a flange (26) formed at an end of the insulator A non-glazed smooth contact surface (28) which is formed in a ring shape having a center thereof at an axis of the insulator (22) is defined at the flange (26). A pressing surface (32) engaging with the contact surface (28) is formed on the mounting plate (31), the inner and outer peripheries extend outward beyond the contact surface (28). With this arrangement, the pressing surface (32) and the contact surface (28) are brought into a plane contact, so that the mechanical strength of the insulator (22) is maintained at a high level. Scratches or the like on the curved portion (27) are covered with the glaze.

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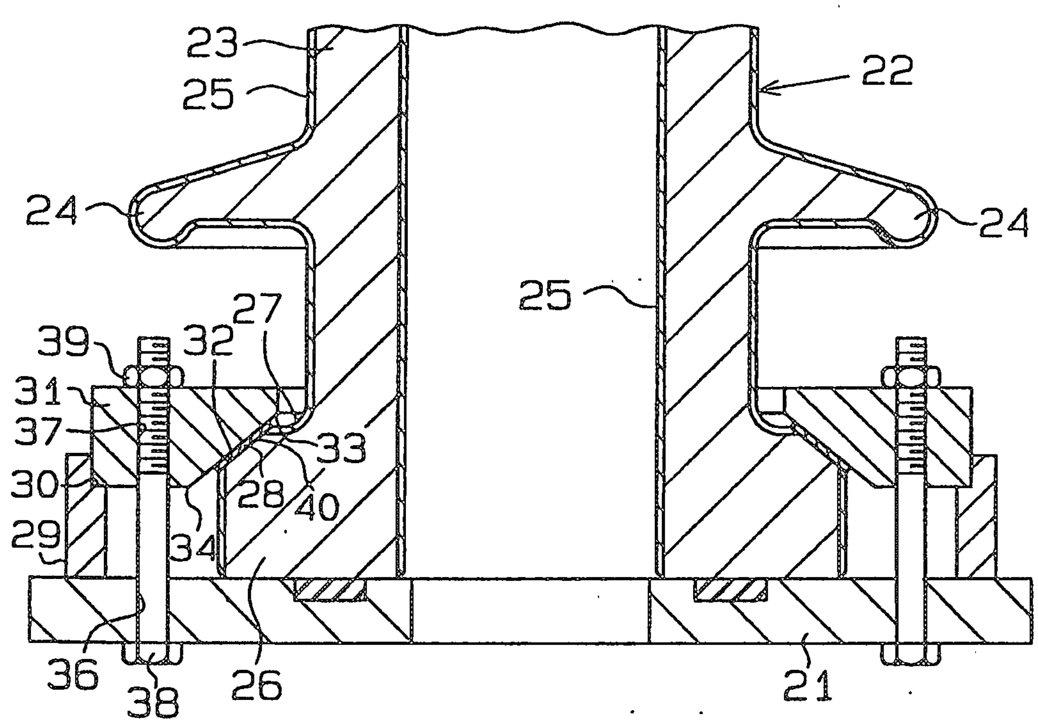
Fig. 1



INSULATOR MOUNT

The present invention relates to a structure for mounting an insulator that supports electric cables or the like. More specifically, it may provide a structure for mounting a porcelain insulator to a base such as an electric transformer housing or the like.

Figure 9 shows a conventional insulator and a mechanism for mounting the insulator. As seen therein, a substantially cylindrical insulator 1 has a flange 2 formed at one end thereof. A tapered contact surface 3 is defined on the flange 2. Internal and external surfaces of the insulator 1 are covered with a glazing layer 4. To mount the insulator 1 on a base 5, bolts 8 are inserted through holes 6 in the base 5 and aligned holes 17 in a mounting plate 7. Nuts 9 are then used to fasten the mounting plate 7 to the base 5. As a result the contact surface 3 of the flange 2 is pressed against an oblique surface 10 of the mounting plate 7, so that the insulator 7 is fixed on the base 5.

In this case, when the contact surface 3 is pressed in the direction "a" (downwards in the drawing) by means of the oblique surface 10, both the surfaces 3 and 10 generate therebetween a component force (reaction force) in the direction "c" which is parallel to the oblique surface 10. The oblique surface 10 also receives a component force (reaction force) in the direction "b" perpendicular to the component force "c". With this arrangement, there is a tendency for the mounting plate 7 to slide off the contact surface 3 because of the component force "c". Therefore, a supporting wall 11 is provided on the base 5, surrounding the periphery of the insulator 1 in a spaced relationship to receive the mounting plate 7 therein. With this arrangement, the mounting plate 7 is prevented from moving and sliding over the contact surface 3.

Further, when the insulator 1 is backed, the insulator 1 partially contracts, and the glaze applied to the surface of the insulator 1 often melts and runs down in steams. Slight unevenness often appears on the contact surface 3 due to the contraction of the insulator 1 and the streams of the melted glaze. When the oblique surface 10 is pressed against such uneven contact surface 3, there causes a point contact or a linear contact between the oblique surface 10 and the contact surface 3 due to the unevenness. Therefore, a large stress concentration occurs in the insulator 1 at the contact points, which lowers the mechanical strength of the insulator 1 against internal pressures, bending loads or the like. If the cylindrical insulator 1 is applied to electric transforming devices such as a breaker, when high pressure gas is generated during the occurence of a short-circuit, the internal pressure of the insulator 1 is liable to increase. In addition, an external force might be applied to the insulator 1 for a variety of reasons. The decrease of the mechanical strength of the insulator 1 often causes the breakage of the insulator 1 in the foregoing cases.

One attempt to overcome this problem contemplated interposing a cushion between the oblique surface 10 and the contact surface 3 to decrease the stress concentration.

However, there are a variety of angles on the contact surface 3 because of the bending of contraction of the insulator 1 due to the baking of the insulator 1. Therefore, the oblique surface 10 may not completely fit the contact surface 3. When the oblique surface 10 is pressed against the contact surface 3 in this condition, an edge of the oblique surface 10 comes in contact with the contact surface 3, generating a point or linear contact therebetween. In this condition, even when a cushion 12 is interposed between the oblique surface 10 and the contact surface 3, the stress concentration on the insulator 1 can not be avoided at the portion in contact with an edge of the mounting plate 7 as shown as dotted lines in Figure 10. Consequently, the mechanical strength of the insulator 1 is lowered in this case as well as in the foregoing case.

Thus, it has been proposed that an upper surface of the flange 2 be ground in a certain depth 1 to form the contact surface 3 as shown in Figure 12. Because of the grinding, an even contact surface 3 is formed, which can bring the oblique surface 10 into uniform contact with the contact surface 3. However, because a curved portion 14 leading the flange 2 to a body 13 of the insulator 1 is formed by the grinding, subtle scratches and grinding lines are formed at the curved portion. Accordingly, when the insulator 1 receives mechanical loads due to the bending or the internal pressure, the scratches and grinding lines tend to serve as starting points for breakage, so that the insulator 1 is liable to break with a relatively low mechanical load.

In addition, as shown in Figure 11, even when the oblique surface 10 completely fits the contact surface 3, both edges of the oblique surface 10 are brought into contact with the contact portion 3. Accordingly, as shown as dotted lines 16, stress concentrations occur in the insulator 1 about both the edges, which lowers the mechanical strength of the insulator 1 as well as in the foregoing cases.

The problem addressed herein is to provide new techniques for mounting insulators, and preferably to propose a mechanism for fixing insulators with an improved mechanical strength. In another aspect, we provide an insulator specially adapted for such techniques.

According to the invention, an insulator mounting arrangement is provided for attaching an insulator for supporting electric cables or the like to a base. The insulator mounting arrangement includes pressing means operating between the base and the insulator for fixing the insulator on the base. The insulator includes a body and a flange integrally formed at an end of the body. A curved portion is defined at an outer periphery of the insulator between the body and the flange. A ring shape non-glazed smooth surface is formed on the flange such that its center is positioned on the axis of the insulator. The remainder of the external periphery of the insulator is covered by a glazing layer.

The pressing means has a ring shape pressing surface for engaging the smooth surface. Both the inner and outer edges of the pressing surface are arranged such that they are spaced apart from the contact surface in a manner such that they are positioned beyond the contact surface and they do not contact the insulator.

In a preferred embodiment of the invention, a cushion material is interposed between the smooth surface and the pressing surface.

Brief Explanation of the Drawings

Figure 1 is a partially sectional view of an insulator fixed on a base by being tightened by means of the mounting plates of the first embodiment of the present invention.

Figure 2 is a partially enlarged sectional view showing a contact surface and a pressing surface of the first embodiment.

Figure 3 is a graph showing results of mechanical strength tests on the first embodiment.

Figure 4 is a partially sectional view showing the second embodiment of the present invention.

Figure 5 is a partially sectional view showing the third embodiment of the present invention.

Figure 6 is a partially sectional view showing a modification.

Figure 7 is a partially sectional view showing another modification.

Figure 8 is a partially sectional view showing another modification.

Figure 9 is a partially sectional view showing a conventional design.

Figure 10 is a sectional view showing the conventional insulator having stress concentration due to a point contact.

Figure 11 is a sectional view showing the insulator having the stress concentration because of the edges of the mounting plate of the conventional design.

Figure 12 is a sectional view of a flange of the conventional design after the flange is ground.

Explanation of the Working Examples

One embodiment of the present invention is described hereinafter referring to Figures 1 to 3. A base 21 serves as a housing for electric transformation devices. A cylindrical shaped insulator 22 is provided to stand upright on an upper surface of the base 21. A plurality of protrusions 24 are integrally formed at a body 23 of the insulator 22. A glazing layer 25 covers the entire periphery of the insulator 22 except for a contact surface 28 which will be described later. A flange 26 is also formed at an end of the body 23. An arc shape curved portion 27 is defined at a region between an outer side surface of the flange 26 and an outer peripheral surface of the body 23. A smooth contact surface 28 is formed on a surface of the flange 26 adjacent to the body 23 to be slanted (45 degrees) relative to an axis of the insulator 22. The contact surface 28 is located on a conical plane having a center thereof on the axis of the insulator 22 and having an apex thereof at a side closer to the middle of the insulator 22 than the flange 26. The contact surface 28 is formed by grinding a corner of the flange 26 to make an even surface. Accordingly, the glazing layer 25 is removed from the contact surface 28 as a result of the grinding.

In addition, a ring shape supporting wall 29 is provided on the upper surface of the base 21. The supporting wall 29 surrounds the insulator 22 and has a step 30 defined thereon.

A ring shaped mounting plate 31 which acts as a pressing means is divided in the radial direction into a plurality of segments. A ring shape pressing surface 32 having a center thereof on the axis of the insulator 22 is formed at a lower inner periphery of the mounting plate 31 and has the same curvature and slanting angle as the contact surface 28. The mounting plate 31 is supported at the outer periphery thereof on the step 30 and its pressing surface 32 engages with the contact surface 28. The size of the pressing surface 32 in the axial direction is defined larger than that of the contact surface 28, an upper corner 33 of the pressing surface 32 protrudes above the curved portion 27 and does not interfere with the insulator 22. A lower corner 34 of the pressing surface 32 protrudes downwards from an edges of the contact surface 28.

A cushion sheet 40 made of hard rubber or soft aluminum is interposed between the contact surface 28 and pressing surface 32.

A plurality of holes 36 are defined in the base 21 around the flange 26. A plurality of holes 37 are formed in the mounting plate 31, corresponding to the holes 36. A plurality of bolts 38 are inserted into the holes 36 and 37, and nuts 39 are screwed to the tips of the bolts 38. The mounting plate 31 is tightened by means of the nuts 39 and is thus pressed towards the flange 26. Accordingly, the outer periphery of the mounting plate 31 is unmovably fixed on the step 30, the pressing surface 32 presses the contact surface 28, so that the insulator 22 is fixed on the base 21.

In the above design, when the nuts 39 are thightened as described above, the pressing surface

32 of the mounting plate 31 pressed the contact surface 31 of the flange 26, so that the insulator 22 is fixed on the base 21. The mounting plate 31 tends to slide and move on the contact surface 28 because of tighrening the nuts 39, however the supporting wall prevents the movement of the mounting plate 31. Accordingly, the insulator 22 is firmly fixed on the base 21 by means of mounting plate 31.

The glazing layer 25 is removed from the contact surface 28 which is thus formed evenly. In addition, the contact surface 28 is ground to be formed, so that the angle and curvature of the contact surface 28 can be freely determined. Accordingly, the contact surface 28 and the pressing surface 32 can easily define the same angles and curvatures. Their precise conformation is not strictly prescribed, but they must be smooth and accurately complementary. Therefore, the contact surface 28 can completely fit the pressing surface 32, so that the contact surface 28 and the pressing surface 32 can be brought into planar contact. Consequently, the generation of stress concentrations due to a point contact or a linear contact between the contact surface 28 and the pressing surface 32 are avoided. This results in an improved mechanical strength of the insulator 22. In reality the contact surface 28 is not planar; it is frusto-conical. However, it is flat in longitudinally cross-section.

The corners 33 and 34 of the pressing surface 32 project beyond the contact surface 28 and do not come to contact with the pressing surface 28. Accordingly, the stress concentration due to the corners 33 and 34 pressed against the contact surface 28 will not occur. As a result the mechanical strength also improves.

In addition, when the bending load is applied to the insulator 22, bending stress will concentrate on the curved portion of the insulator 22. However, the glazing layer 25 is formed on the curved portion 27. Accordingly, the curved portion 27 is not ground and thus has not small scratches or grinding lines which serve as starting points for breakage. This results in improved strength of the insulator 22.

Even if the pressing surface 32 and the contact surface 28 do not fit completely because of errors in manufacturing accuracy or slight displacement during assembling, the stress concentration can decrease because the cushion sheet 42 is interposed between the pressing surface 32 and contact surface 28.

Figure 3 shows test results comparing the insulator and its mounting mechanism of the present embodiment with conventional mounting structures. As it is obvious from Figure 3, the present embodiment has the strength larger than the conventional design by 2.5 times against the bending breakage moment.

The second embodiment of the present invention will be described referring to Figure 4. In the second embodiment the mounting plate 41 has a smaller width in the radial direction than the mounting plate 31 of the first embodiment and does not have holes 39 for the bolts 38. The bolts 38 are inserted into holes 43 in a fixing ring 42 and support the fixing ring 42. The internal diameter of the fixing ring 42 is larger than the external diameter of the insulator 22. A stop 44 is formed at the lower inner periphery of the fixing ring 42 and engages with the right angle corner of the upper outer periphery of the mounting plate 41. The fixing ring 42 is tightened by means of the nuts 39, so that the mounting plate 41 is pressed against the contact surface 28.

Accordingly, in the second embodiment, the position of the fixing ring 42 can be freely adjusted along the axial direction of the insulator 22. Therefore, the position of the mounting plate 41 can also be adjusted along the axial direction of the insulator 22, to that if the thickness of the flange 26 changes, it can be compensated.

The third embodiment of the present invention is described referring to Figure 5. In the third embodiment, the cushion sheet 40 is not used. When the pressing surface 32 and the contact surface 28 are in a complete plane contact, this design can be utilized.

The present invention should not be limited to the foregoing embodiments. The following modifications can be also possible.

An example is shown in Figure 6, wherein the contact surface 28 is located on an imaginary ring plane vertically crossing the axis of the insulator 22. This contact surface 28 is truly flat in a radial plane.

Other examples are shown in Figures 7 and 8, wherein the slanting angle of the contact surface 28 is different from the above embodiment respectively, and the radius of the arc of the curved portion 27 is also modified.

As described in detail above, when the mounting plate tightens the flange of the insulator, or when the external force such as the bending load is applied to the insulator, the stress concentration upon the flange can decrease, resulting in that the mechanical strength of the insulator can improve significantly.

Claims

1. An insulator mounting arrangement for attaching an insulator for supporting electric cables or the like to a base, the insulator mounting arrangement including pressing means provided between the base and the insulator for fixing the insulator on the base,

   wherein the insulator includes a body and a flange integrally formed at an end of the body, a curved portion defined at an outer periphery of the insulator between the body and the flange, a ring shape no-glaze smooth surface formed on the flange, the center of the ring of the smooth surface being an axis of the insulator, and a glazing layer covering the entire external periphery of the insulator except for the smooth surface, and

wherein the pressing means has a ring shape pressing surface or engaging the smooth surface, the pressing surface having inner and outer edges, the center of the ring of the pressing surface being on the axis of the insulator, the improvement being characterized in that:

the pressing means is arranged such that the inner and outer edges of the pressing surface are spaced apart from the contact surface in a manner such that they are positioned beyond the contact surface and they do not contact the insulator.

2. An insulator mounting arrangement as set forth in Claim 1 wherein a cushion material is interposed between the smooth surface and the pressing surface.

3. An insulator mounting arrangement as set forth in Claim 1 or 2 wherein the contact surface is located on an imaginary conical plane having the center thereof at the axis of the insulator and having the apex thereof at a middle portion of the insulator.

4. An insulator mounting arrangement as set forth in Claim 1 or 2 wherein the contact surface is located on a plane perpendicularly crossing the axis of the insulator.

5. An insulator mounting arrangement as set forth in any one of Claims 1 to 4 wherein the pressing means in formed in a ring shape as a whole and is divided in the radial direction into a plurality of segments.

6. An insulator mounting arrangement as set forth in any one of Claims 1 to 5 wherein the fixing means has a supporting wall located on the base for supporting the pressing means, bolts inserted into holes on the base and on the pressing means, and nuts fitted to the bolts for fastening the pressing means to the flange.

7. An insulator mounting arrangement as set forth in Claim 6 wherein the supporting wall has a step for receiving the pressing means.

8. an insulator mounting arrangement as set forth in any one of Claims 1 to 5 wherein the fixing means has a ring engaging with the upper periphery of the pressing means, bolts inserted into holes on the ring and on the base, and nuts fastening the pressing means to the flange.

9. An insulator mounting arrangement as set forth in Claim 8 wherein the ring has a step engaging with the upper peripheral corner of the pressing means.

10. An insulator for mounting to a base (5) by clamping it to the base using a clamping ring surface (32) directed towards the base and clamping against a complementary glaze-free smooth contact surface (28) formed on a base flange (26) of the insulator and facing away from the base thereof, characterized in that the base flange surface adjacent the contact surface (28) provides clearance whereby in use extremities of an oversize complementary smooth clamping ring surface (32) can extend beyond the contact surface (28) to a position out of contact with the insulator.

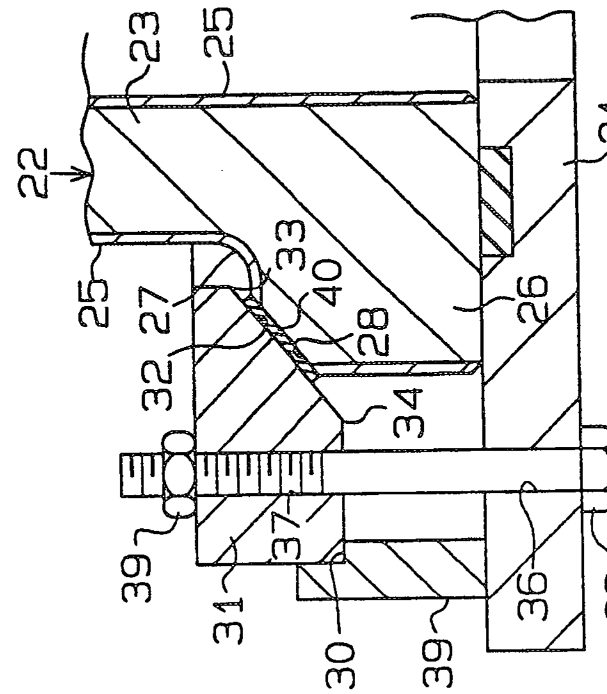

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Fig.2

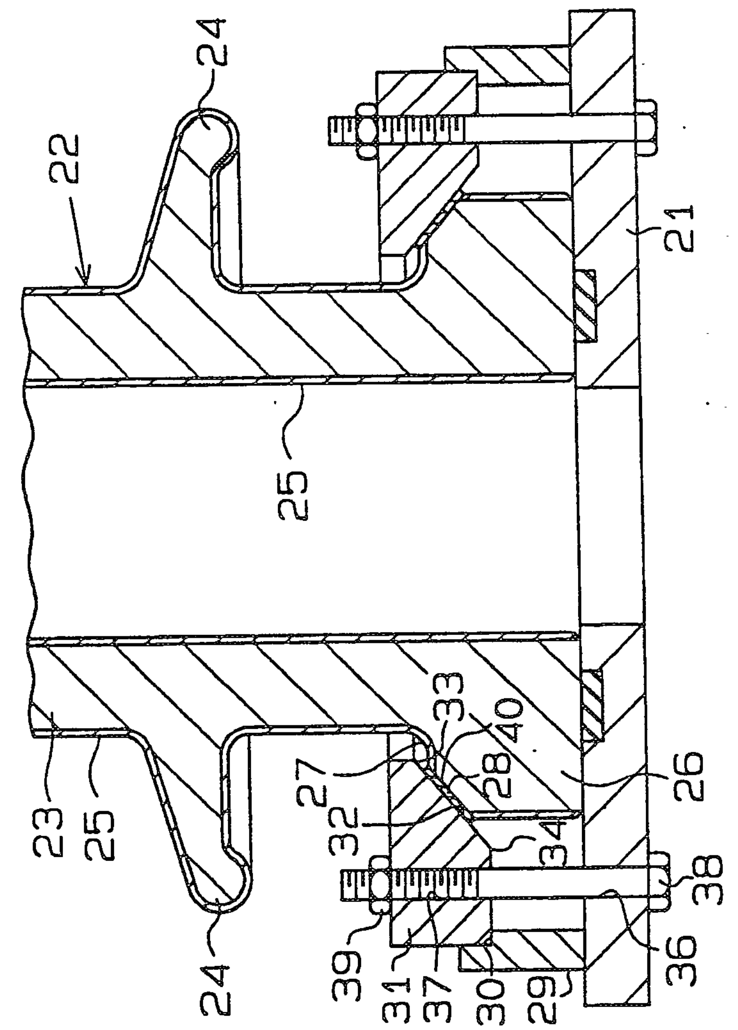
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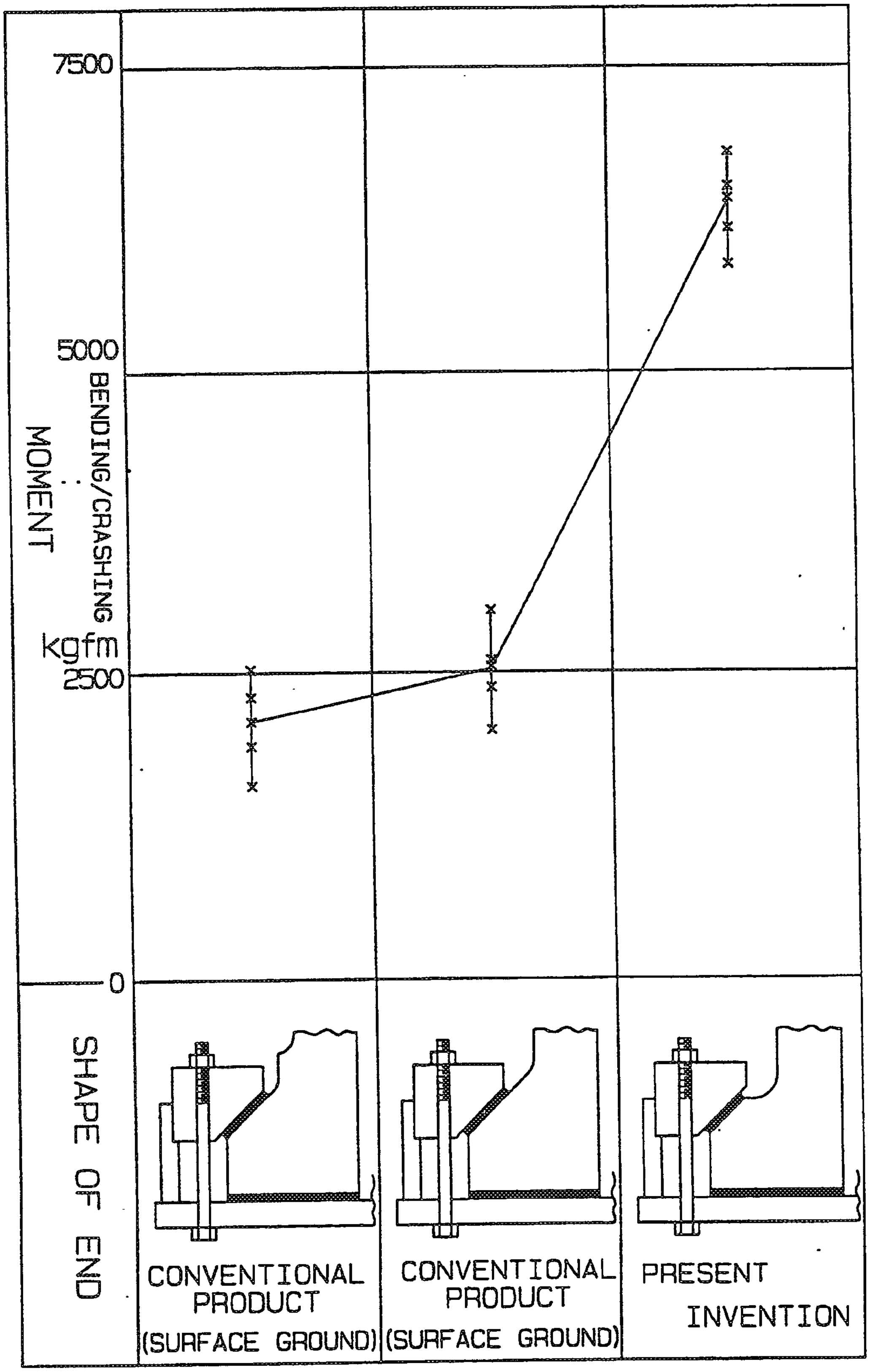
Fig.1

Fig.3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CONVENTIONAL PRODUCT (SURFACE GROUND)
PRESENT INVENTION

Fig. 5

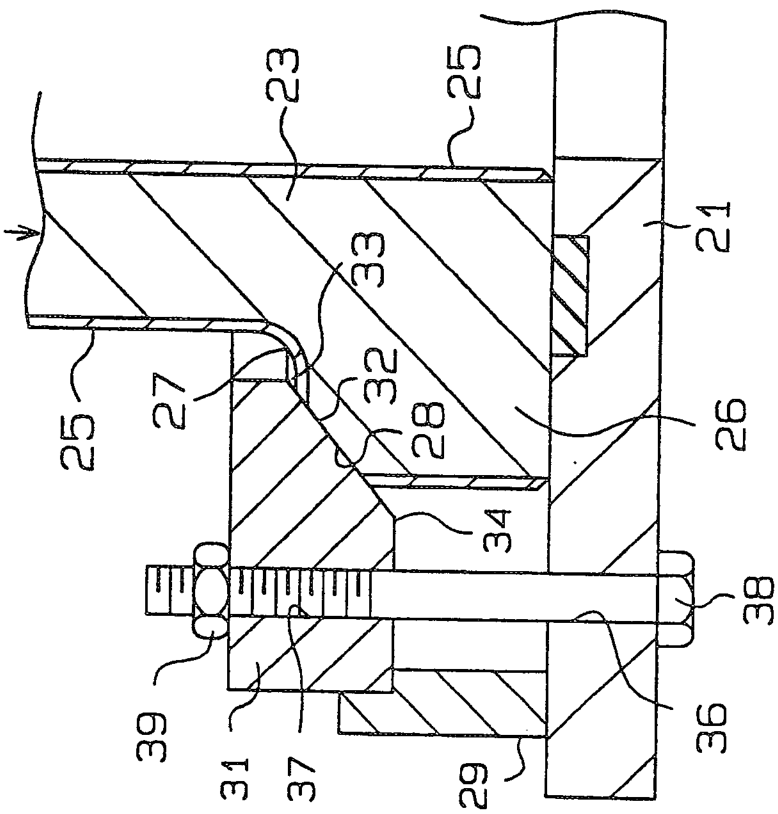
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Fig. 4

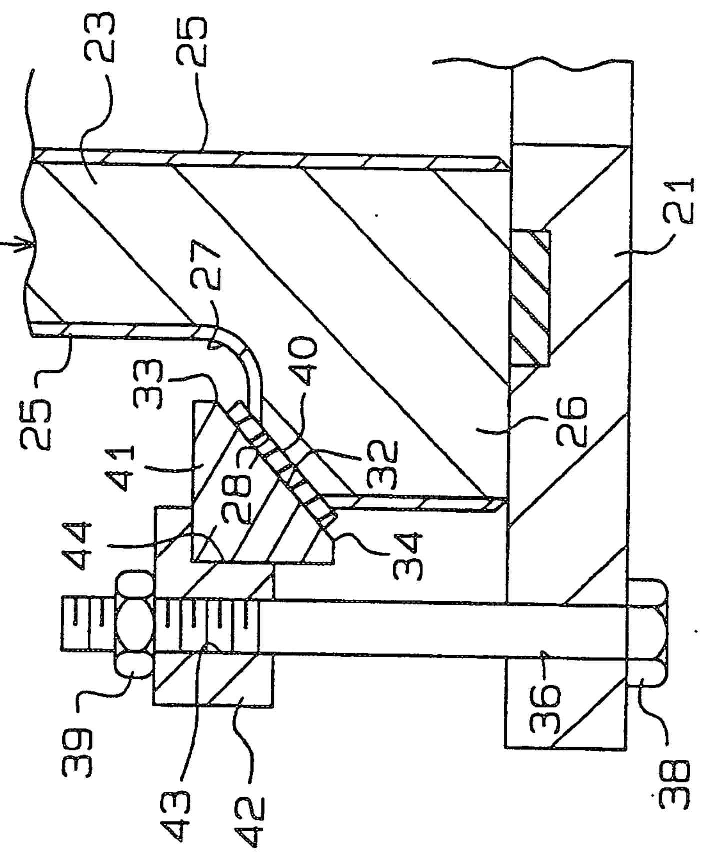
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Fig.7

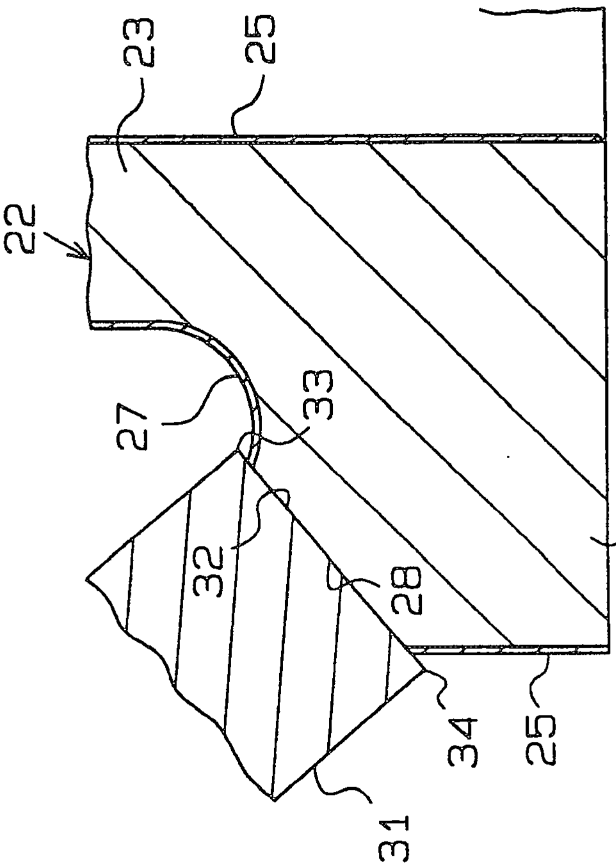

Fig.6

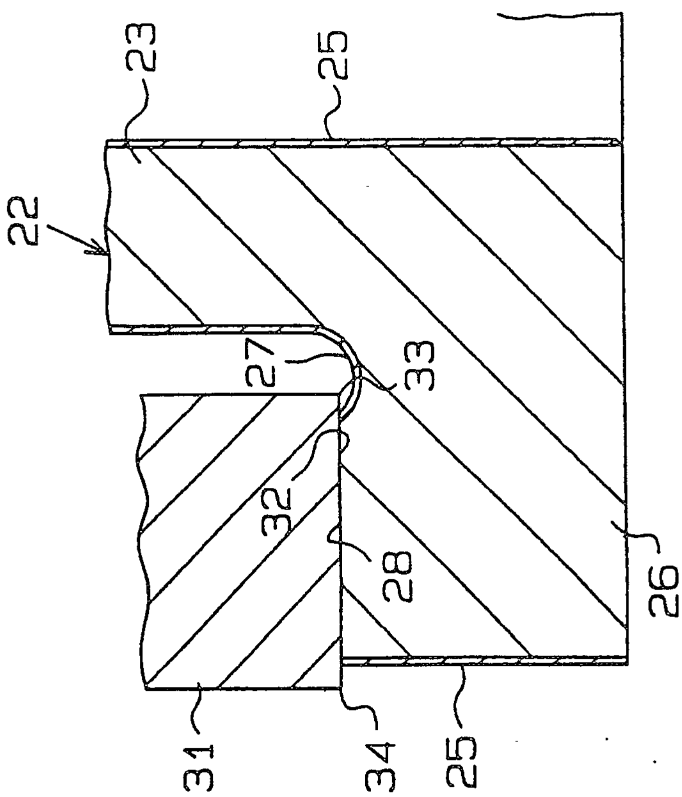

Fig. 9

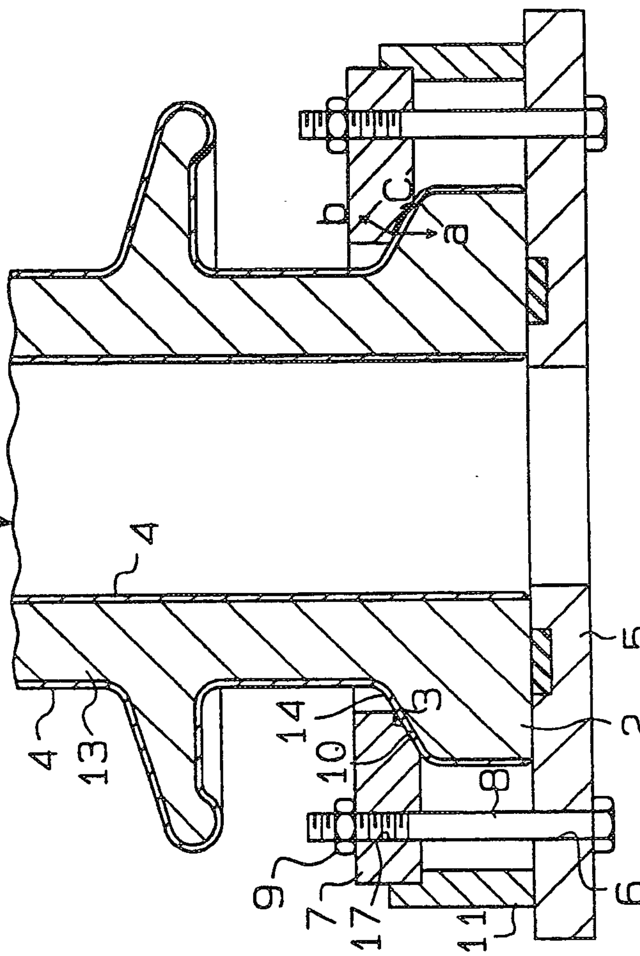

Fig. 8

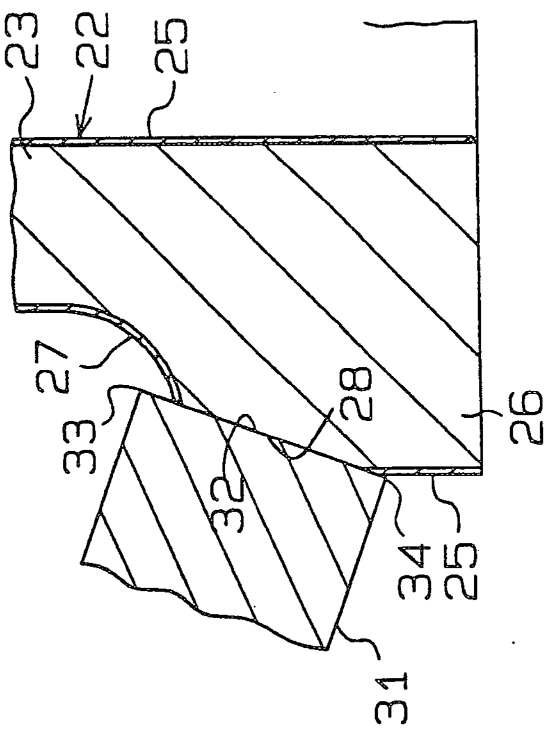

Fig.11

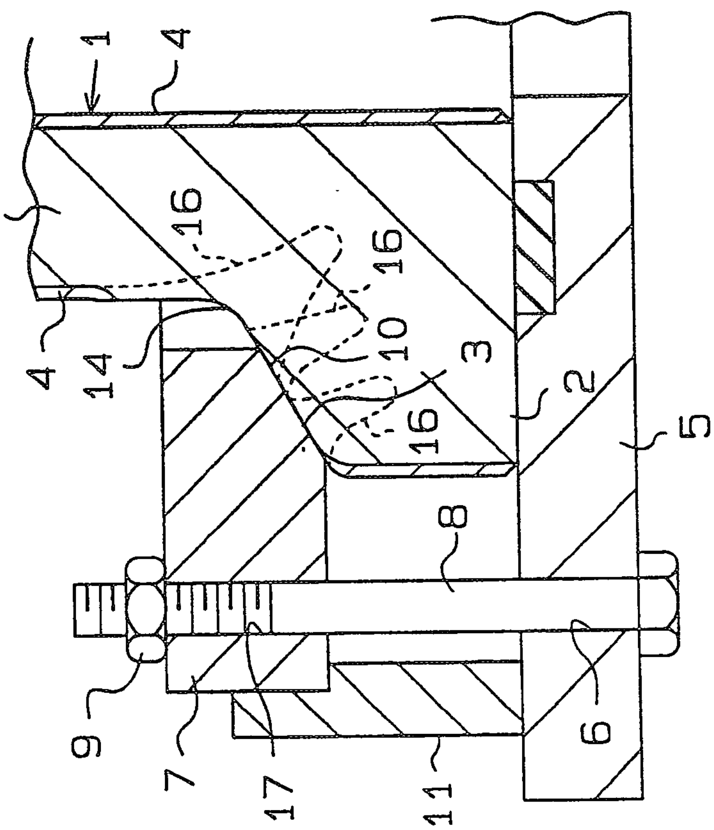
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Fig.10

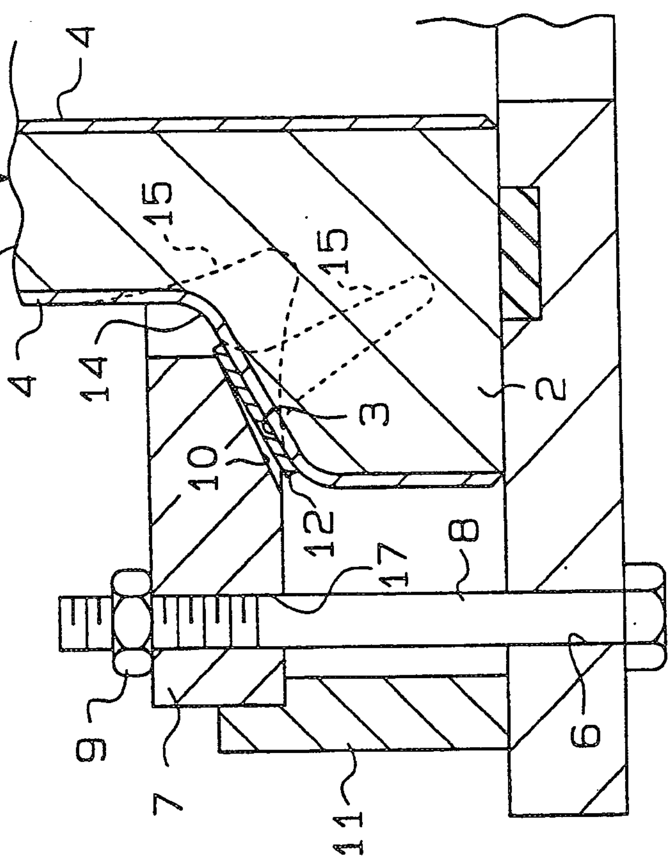
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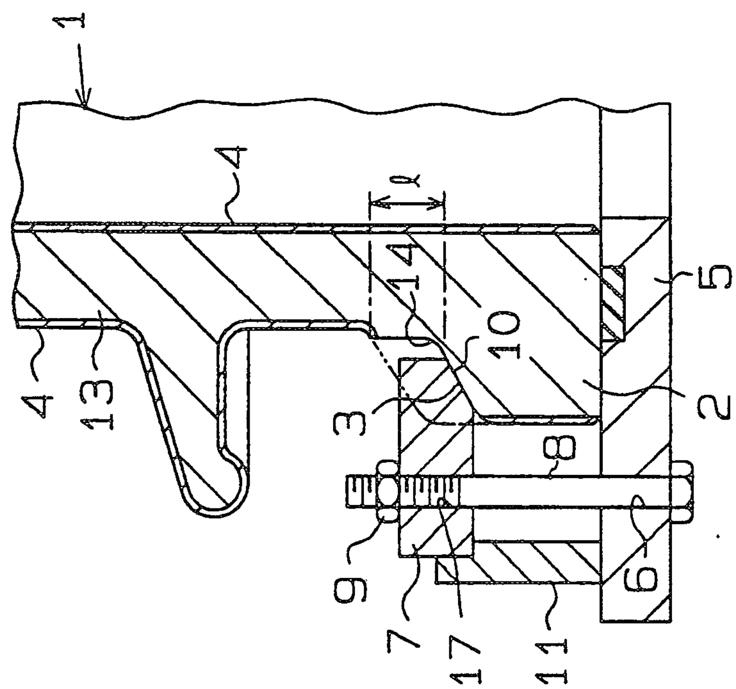
Fig. 12



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 2549

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	BE-A-508769 (COMP. GEN. D'ELECTR.) * page 2, line 7 - page 3, line 40; figures 1-7 *	1, 5, 6	H01B17/26
A	FR-A-588814 (TREVE) * figure 2 *	1, 4, 5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 JUNE 1991	DEMOLDER J.

CATEGORY OF CITED DOCUMENTS

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