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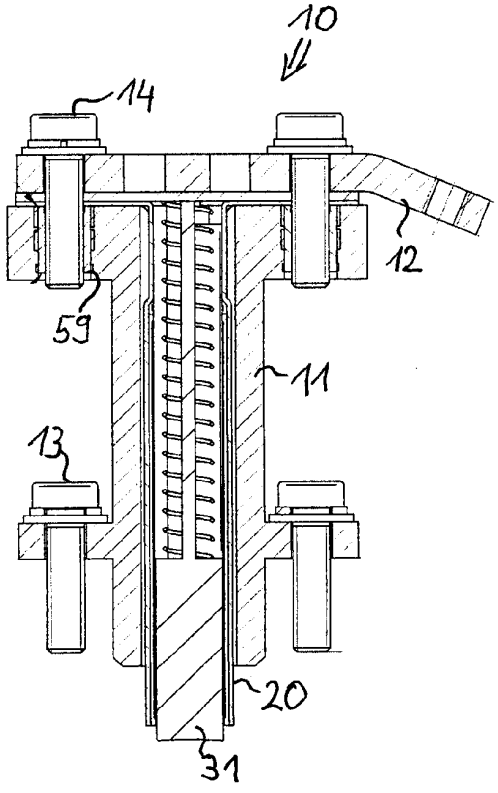
(54) Modular brush holder

(57) A brush holder for holding a contact brush to contact a slipring is disclosed. It has a housing made of an insulating material and enclosed therein at least one metal insert for holding the contact brush. The metal insert has a rectangular cross-section and is made of one piece of metal sheet defining three sidewalls to hold the contact brush at three sides. Furthermore the insert has a spring element at the fourth side to assert side pressure to the brush. The length of the spring element is larger than the partial length of the contact brush within the metal insert.

Fig. 1



EP 2 571 115 A1

Description

Field of the invention

[0001] The invention relates to a brush holder for holding brushes in an electrical power transfer device like a slipring or rotary joint. Sliprings are used to transfer electrical power between rotating parts of machines like wind power plants, CT scanners or electrical generators. There a brush, mainly comprising of electrically conductive material like carbon is sliding on a rotating cylindrical track of conductive material. Common materials for such tracks are steel or brass.

Description of the related art

[0002] Slipring brushes must have a low contact resistance to the track during a long lifetime. Furthermore they must have low contact noise. Specifically when used in CT scanners, the rotating speed of the track is comparatively high and may be in a range up to 20 m/s. To avoid contact interruptions the brush must quickly follow dynamic changes of the track height.

[0003] US patent 5,220,588 discloses a low inertia brush block assembly with comparatively light weight brush holders made of molded plastic material.

[0004] The European patent application EP 0 358 812 discloses a metal brush holder having an inner isolated sidewalls.

[0005] German patent application DE 10 2009 034 884 A1 discloses a brush holder having a spring asserting a force lateral to the longitudinal axis of a brush.

Summary of the invention

[0006] The problem to be solved by the invention is to provide a brush holder with improved dynamic characteristics and lifetime. A further object of the invention is to provide a brush holder with reduced manufacturing costs.

[0007] Solutions of the problem are described in the independent claims. The dependent claims relate to further improvements of the invention.

[0008] The brush holder comprises of two basic components. The first basic component is the insert which comprises of electrically and thermally conductive metal. Preferably the insert is punched from a metal sheet and bent to its final form. Due to its simplicity this can be done within a few manufacturing process steps. The second basic component is an isolated housing which preferably comprises of some resin or plastic material. The housing provides mechanical stability and electrical isolation to the insert. It is preferably manufactured by injection molding. The isolated housing provides at least one hole, preferably a plurality of holes for holding inserts. According to the required number of brushes, inserts may be inserted into the holes of the housing. This allows for a modular brush block concept. For example for achieving a high isolation for high voltage between neighbored brushes, one or a plurality of holes between these neighbored brushes may be left empty.

[0009] Measurements have shown that the brushes temperature increases under high electrical loads and/or at high rotational speeds due to mechanical friction. Therefore the brush holder is improved to offer better heat transfer and cool the brush which helps to reduce wear. This is done by removing the heat over the surface of the brush by the contacting surfaces of the metal brush holder insert. In addition the electrical resistance and/or the current load over the length of the brush is reduced by electric contact to the sides of the surfaces of the metal brush holder insert.

[0010] Furthermore the brush holder prevents sticking of brushes due to debris particles between the brush and the brush holder. Even under normal operating conditions there is some wear of the brush. Smaller particles may break off the brush. Such particles or dust may come into the gap between the brush sidewalls and the brush holder. In most cases these particles are grinded by the movement of the brush against the brush holder. If the particles are big enough or dust has accumulated to some minimum size, the particles may prevent movement of the brush by generating frictional resistance which cannot be overcome by the spring. This results in sticking of the brush. Such as sticking brush can no more follow the tracks movement and therefore cannot conduct any current. It must be repaired manually. The brush holder insert has grooves of the surfaces contacting the sides of the brush, which allow debris and dust particles to be removed during movement of the brush against the brush holder insert.

[0011] The inventive brush holder allows easy checking of the brush wear. Through the slot in the brush holder insert the remaining length of the brush can easily be seen. There may also be a photo sensor to measure the remaining brush length or to identify a worn brush. Such a photo sensor may be integrated into the housing of the brush rock. Alternatively the housing may also have slot for viewing the brush from the outside.

[0012] Preferably, although not necessary, the insert provides a spring element having a length being larger than the partial length of the contact brush within the insert. Preferably this spring element asserts a force parallel to the longitudinal axis of the brush. The longitudinal axis is defined through the center and along the length of the brush. The spring element may guide the part of the brush within the insert. The spring element may assert a slight force to the carbon brush to provide for precise guiding within the insert. This prevents from unwanted movements of the brush within the brush holder during movement of the sliding track and therefore reduces contact noise. Furthermore the spring element ensures plane contact of one side of the brush with second sidewall. Due to this plane contact a significant part of the current guided through the contact brush can be diverted through the second sidewall to further reduce current load

through the brush material and therefore overall contact resistance of the brush. In addition with plane contact provides for a better heat transfer from the brush to the insert, further providing a better cooling of the brush, resulting in a significantly increased lifetime. This specific design of the spring element is based on the observation that it is impossible to build a brush holder which contacts the brush at all four sides. In practice the brush holder must have a larger inner size than the brush to prevent sticking of the brush. Accordingly the brush will tilt within the brush holder, having contact at two points or lines, but no plane contact, resulting in very small contact areas. These small contact areas cannot serve as an acceptable electrical or thermal contact. For this purpose the spring element was designed to press at least one side surface of the brush against one side wall of the brush holder. Preferably this sidewall is oriented at a right angle to the direction of movement between the brush and the sliding track, thus allowing the plane contact even when the brush tilts within the brush holder.

Description of Drawings

[0013] In the following the invention will be described by way of example, without limitation of the general inventive concept, on examples of embodiment with reference to the drawings.

Figure 1 shows a brush holder according to the invention in a sectional view.

Figure 2 shows the brush holder in a side view.

Figure 3 shows the insert.

Figure 4 shows a metal plate before bending it to an insert.

Figure 5 shows a side view of the insert.

Figure 6 shows a bottom view of the insert.

Figure 7 shows a brush.

Figure 8 shows a perspective view of a brush.

Figure 9 shows a sectional view of a dual brush holder.

Figure 10 shows a side view of the dual brush holder.

Figure 11 shows a perspective view of the brush holder.

Figure 12 shows a perspective view of a dual brush holder.

Figure 13 shows the inserts within the dual brush holder

[0014] In figure 1 a preferred embodiment according to the invention is shown in a sectional view. A brush holder 10 comprises of a housing 11 and an insert 20 therein. The housing is made of some insulating material, like plastic or resin. It isolates and stabilizes the insert. The insert is made of metal providing electrical and thermal conductivity. It holds a brush 31 which is preferably a carbon brush. Basically it may hold any other type of brush like brushes being based on combinations of metal particles with Teflon. During operation brush 31 extends slightly over the lower end of insert 20, preventing a mechanical contact between the insert 20 and slipring track 40, which may damage the slip ring track. Accordingly the small piece of brush 41 is outside of the insert 20, while the remaining partial length of brush 41 is inside of insert 20. In general this remaining partial length is significantly larger than the piece outside of brush 41. At least one screw 13, although not part of the brush holder, is provided for fixing the brush holder to any part of a machine. Preferably a plurality of brush holders is combined to a brush block. A brush holder contact 12 is preferably fixed by means of at least one screw 14 to the housing and to the insert. As shown, the housing provides a thread 59 for screw 14. Electrical contact between the brush holder contact 12 and the insert 20 is provided by mechanical pressure by screw 14. There may be protrusions (not shown) on the brush holder contact 12 and/or the insert 20 to improve contact.

[0015] Figure 2 shows a brush holder 10 in side view. Furthermore a slip ring track 40 or sliding track is shown, on which the contact brush 41 is sliding, providing electric contact. The slipring track 40 may be of any conductive material like steel or brass.

[0016] Figure 3 shows the insert 20. The insert is made of one piece of metal and has a first sidewall 21, a second sidewall 22 and a third sidewall 23, all sidewalls being in the 90° angle with respect to their neighbor side walls. A spring element 24 is next to third sidewall 23. It is obvious that the spring element 24 may also be next to first sidewall 21. The spring element 24 preferably has an angle of 90° with respect to third sidewall 23, although there may be slightly different angles.

[0017] As the spring element can be bent due to its elasticity, it may change its angle with respect to third sidewall 23. The spring element 24 may assert a slight force to the carbon brush to provide for precise guiding within the insert. The insert furthermore has a first contact surface 25 and a second contact surface 26. One of these contact surfaces may also be sufficient to provide for electrical contact between the insert and brush holder contact 12. Furthermore a first screw hole 27 and the second screw hole 28 are provided. Preferably these screw holes may have a thread or at least a slightly smaller diameter than the outer diameter of the screw to be inserted through the holes, causing electrical contact between the contact surfaces and the screw.

[0018] In figure 4 a metal plate before bending to an insert is shown. This figure further shows a first recess 51, second recess 52 and third recess 53. These the recesses provide for some space between the side walls and the brush which may aid in removing debris which otherwise could lead to sticking of the brush. Specifically at the second sidewall 22 which is opposed to spring element 24, recess 52 may be omitted, as the flexibility of spring element 24 allows for some movement of the brush, even when debris is present between the brush and the sidewall. Furthermore first bending edge 54, second bending edge 55, third bending edge 56, first contact surface bending edge 57 and second contact surface bending edge 58 are shown.

[0019] Figure 5 shows a side view of the insert.

[0020] Figure 6 shows a bottom view of the insert.

[0021] In figure 7 a brush 31 is shown. It is connected via braid 32 to contact plate 33. Furthermore spring 35 between contact plate 33 and brush 31 causes pressure of the brush against slipring track 40.

[0022] In figure 8 a perspective view of the brush is shown. Here contact plate 33 has at least one fixation hole 34.

[0023] In figure 9 a sectional view of a dual brush holder 50 is shown. Basically the elements are comparable to the previous brush holder. Due to the higher current a high carbon brush holder contact 15 is provided.

[0024] Figure 10 shows a side view of the dual brush holder 50. Here two brushes 31a and 31b are shown.

[0025] In figure 11 a perspective view of a brush holder 10 is shown, while in figure 12 a perspective view of dual brush holder 50 is shown.

[0026] Figure 13 shows the arrangement of two inserts 20a, 20b from a bottom view with in the dual brush holder. They are rotated against each other at 180° so that the spring elements 24 can interleave. This arrangement requires less space compared to an arrangement without rotation.

List of reference numerals

[0027]

10 brush holder

11 housing

12 brush holder contact

13 housing fixation screw

14 brush fixation screw

15 high current brush holder contact

20 insert

21 first sidewall

22 second sidewall

23 third sidewall

24 spring element

25 first contact surface

26 second contact surface

27 first screw hole

28 second screw hole

31 contact brush

32 braid

33 contact plate

34 fixation hole

35 spring

40 slipring track

51 first recess

52 second recess

53 third recess

54 first bending edge

55 second bending edge

56 third bending edge

57 first contact surface bending edge

58 second contact surface bending edge

60 dual brush holder assembly

Claims

1. Brush holder (10) for holding a contact brush (31) comprising of a housing (11) made of an insulating material and enclosing at least one metal insert (20) for enclosing the contact brush, wherein the metal insert has an approximately rectangular cross-section and is made of one piece of metal sheet defining three sidewalls (21, 22, 23) adapted to hold the contact brush at three sides and a spring element (24) adapted to hold the contact brush at the fourth side, the length of the spring element being larger than the partial length of the contact brush within the metal

insert.

2. Brush holder (10) according to claim 1,
characterized in, that
the width of the spring element (24) is less than half the width of the fourth side of the contact brush.

3. Brush holder (10) according to any one of the preceding claims,
characterized in, that
at least one recess (51, 52, 53, 54) is provided within at least one of the sidewalls (21, 22, 23).

4. Brush holder (10) according to any one of the preceding claims,
characterized in, that
the thickness of the metal sheet is adapted to bear the current through the brush.

5. Brush holder (10) according to any one of the preceding claims,
characterized in, that
the insert has at least one contact surface (25, 26) for providing electrical contact and/or thermal contact with the insert.

6. Brush holder (10) according to any one of the preceding claims,
characterized in, that
two inserts rotated an angle of 180° relative to each other, are provided within a housing.

Fig. 1

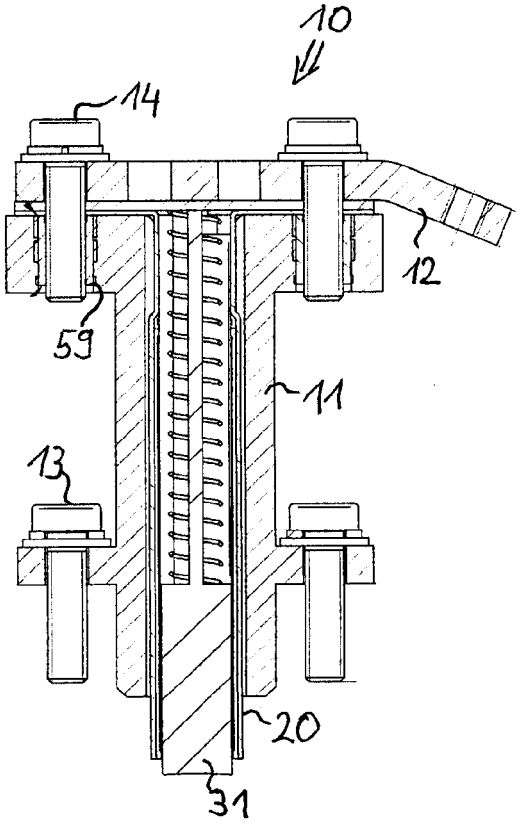


Fig. 2

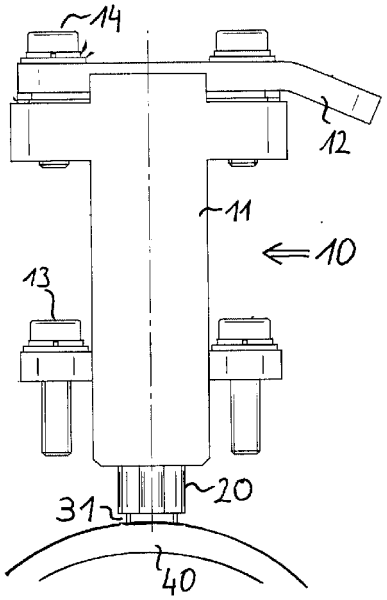


Fig. 3

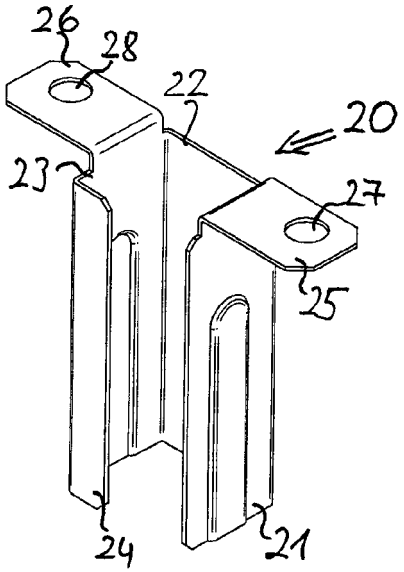


Fig. 4

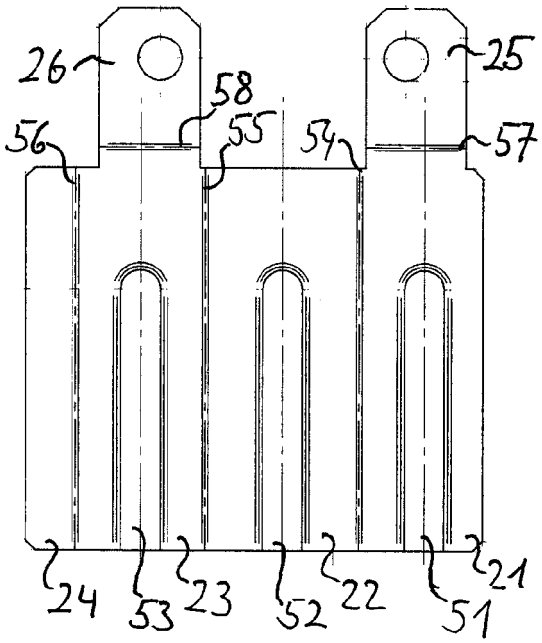


Fig. 5

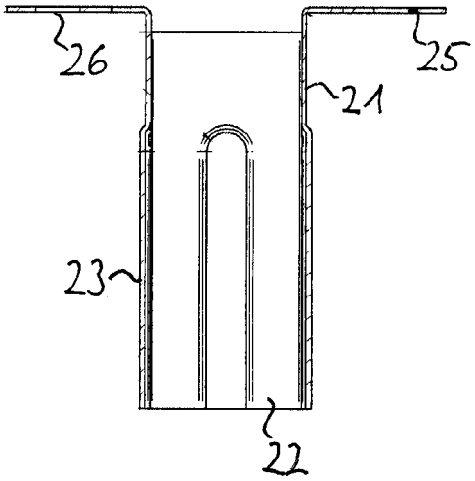


Fig. 6

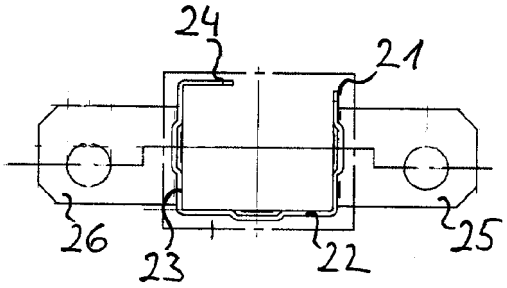


Fig. 7

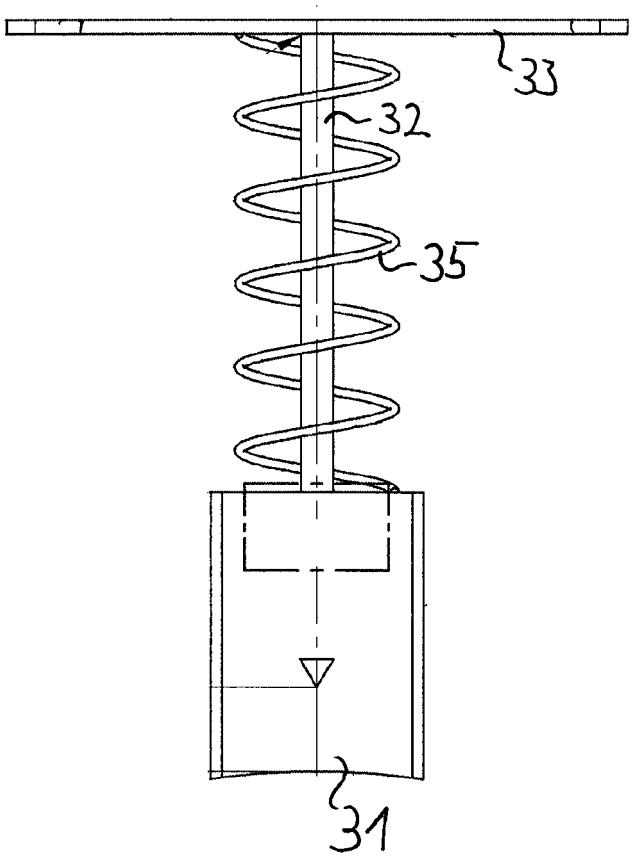


Fig. 8

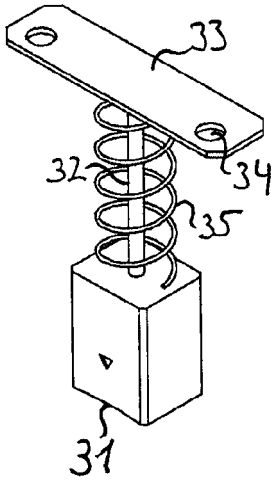


Fig. 9

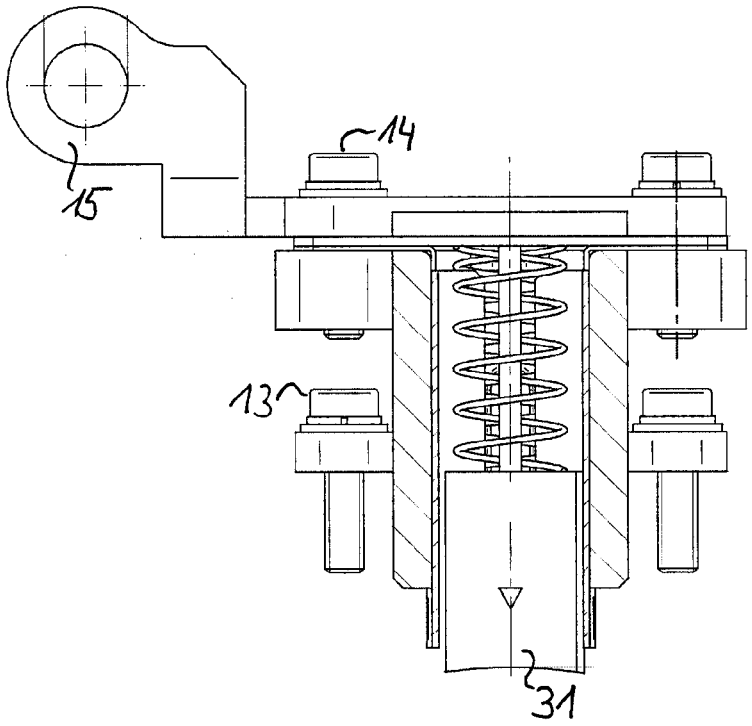


Fig. 10

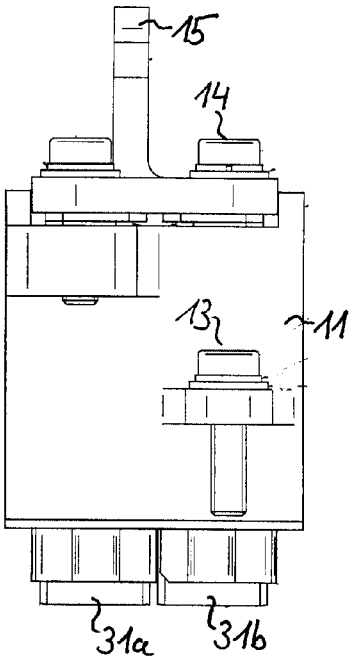


Fig. 11

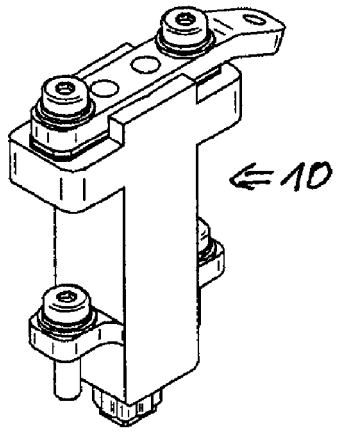


Fig. 12

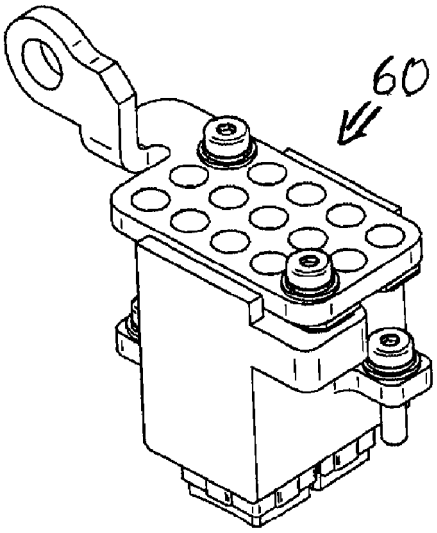
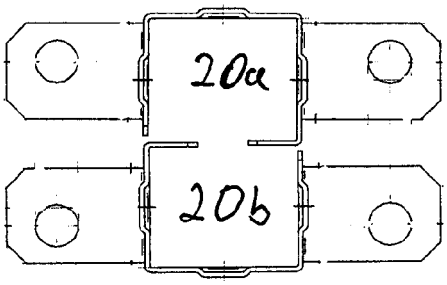


Fig. 13



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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 1549

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 January 2012	Jiménez, Jesús

CATEGORY OF CITED DOCUMENTS

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