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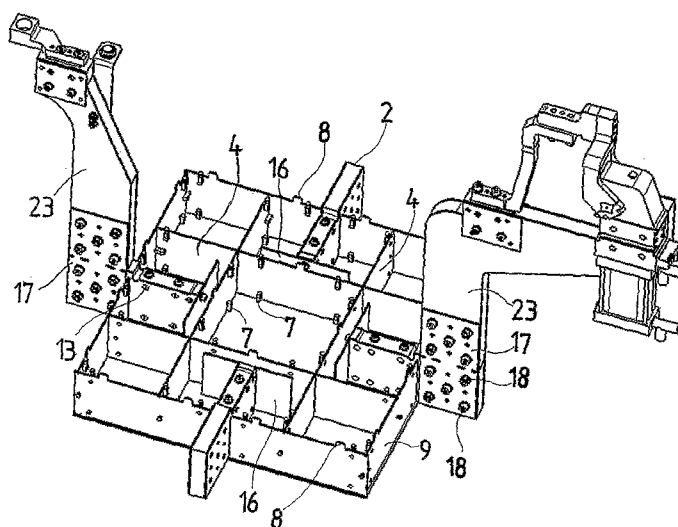
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(54) Title: HOLDER AND FIXING PLATE THEREFOR

Fig 2



(57) Abstract: A fixing plate (2) on a holder (1), which positions and positionally fixes a workpiece in relation to a fixed point or another workpiece, fixes the workpiece or equipment for controlling the workpiece. The holder (1) comprises a substantially closed volume (3) including a number of planar, lamellar material pieces (4, 9). The fixing plate (2) has a main plane of extension which is substantially transversal to the adjacent surfaces of the closed volume (3).

HOLDER AND FIXING PLATE THEREFOR

TECHNICAL FIELD

5 This invention concerns a fixing plate on a holder, which positions and positionally fixes a workpiece in relation to a fixed point or another workpiece, said fixing plate positionally fixing the workpiece or equipment for controlling the workpiece etc., wherein the holder comprises a substantially closed volume, including a number of planar, lamellar material pieces.

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The invention also concerns a holder.

BACKGROUND ART

15 In many fields, there is an urgent need for the exact positioning of a workpiece in order to perform an operation on the workpiece or to mutually join two different workpieces. One such field is the manufacturing industry, especially the car manufacturing industry. Examples of operations to be performed could be any kind of automatic machining, such as drilling, welding, etc.

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In order to position and hold workpieces in an exact position, numerous holders for use with industrial robots have been developed. An example of such a holder is disclosed in PCT-application SE2008/000721. In general, such a holder comprises a closed volume, comprising a number of mutually interconnected planar and lamellar material pieces. The holder has at least one fixing plate for mounting a fixing device for the workpiece, or other equipment in order to secure the holder and the workpiece and the holder on an industrial robot.

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In order to mount equipment which projects out of the general plane of extension of the holder, there is a need for using a separate bracket and/or connectors. This is not

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only a complex solution with several separate parts, but it also adds to the inertia factor and total weight of the construction. In some applications, this may be a disadvantage. Actually, the purpose of mounting certain components may be a wish to reduce the inertia factor, as the components may be placed closed to the axis of rotation.

Another potential problem of the known solution is that there is an increased need for precision in manufacture of the brackets and connectors, as each separate part will introduce a certain inexactness, due to its tolerance in measurement.

PROBLEM STRUCTURE

Thus the object of the invention is to provide a fixing plate and a holder which are less complex, have a lower weight and achieves a lower inertia factor of the construction, taken as a whole, while the ability of placing components outside of the general plane of extension of the holder. The need for precision in the construction is still high.

SOLUTION

The object of the invention is attained if the fixing plate intimated by way of introduction is characterized in that it has a main plane of extension which is substantially transversal to the adjacent surfaces of the closed volume.

Concerning the holder the object will be attained if it includes a fixing plate according to the above.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the accompanying drawings.
In the accompanying drawings:

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fig. 1 is a perspective view of a holder with fixing plates according to a preferred embodiment of the invention;

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fig. 2 is a perspective view of the holder according to fig. 1, where the top plate has been removed for clarity, and exemplary equipment has been mounted on two of the fixing plates;

fig. 3 is an exploded view of a fixing plate according to the invention;

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fig. 4 is a perspective view of the fixing plate of fig. 3 in its assembled condition;

fig. 5 is a partial view in perspective of the fixing plate with a connection plate for mounting equipment thereon;

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fig. 6 is a perspective view of an alternative embodiment of the invention;

fig. 7 is an exploded view of the embodiment according to fig. 6; and

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fig. 8 is a perspective view, seen from below, of the embodiment according to figures 6 and 7 in its mounted position.

DESCRIPTION OF PREFERRED EMBODIMENT

In the following, the invention will be described using such expressions for positions and directions as top, bottom, side etc. These expressions refer mainly to

the positions which are shown in the drawings, regardless of which position the invention will have during use thereof.

Figure 1 shows a holder 1 according to the invention, with four fixing plates 2. The holder 1 comprises a closed volume 3, which is constructed from a number of planar, lamellar material pieces, which are mutually interconnected with a high precision. As can be seen from figure 2, the closed volume 3 includes a number of interior, partitioning walls 4, which support the top and bottom plates 5, 6, and keep them at a substantially constant distance from each other throughout the volume 3. A number of fixing pins 7 and projections 8 extend through the bottom and top plates 5, 6, to keep the partitioning walls 4 and the top and bottom plates 5, 6 in their respective positions.

The fixing plates 2 extend, in the preferred embodiment, outwards at right angles to the side plates 9 of the closed volume 3 of the holder 1. In order to attain a construction with a high degree of stiffness, each fixing plate 2 extends inwards into the closed volume 3, in the direction of its general plane of extension. As can be seen in figure 1, there are screws 10 through the top plate 5 into the inner part of the fixing plate 2, as well as recesses 11, through which a projection 12 on the inner part of the main body 28 of each fixing plate 2 extends.

In the preferred embodiment, each main body 28 of the fixing plate 2 comprises a board material with a honey comb structure, preferably of aluminum, between two planar, lamellar material pieces. The board material will thereby be stable, yet lightweight, and particularly suitable for including into a holder 1 where high precision in positioning is required.

As the honey comb structure in the board material includes only thin, almost foil-like, sheets of aluminum in a folded structure, the possibility of engagement with threads on screws is low, regardless of the direction of the screws. In order to

provide a secure bond, e. g. for securing another plate transversely to or parallel with the board material, special means for providing threads have to be employed.

In the case of fastening another plate 5, 6, 16 transversely to the main body 28,
5 holes 13 are provided therein for insertion of thread elements 14, which are provided with a transverse, threaded bore 15. The axis of each threaded bore 15 is aligned with the axis of the respective screw 10, and a secure engagement of the screw 10 is enabled.

10 If another plate 17 is to be fastened in parallel with the fixing plate 2, through-going screws 18 with corresponding nuts, on the other side of the fixing plate 2, are used to provide a secure bond.

In figure 2 is also shown equipment that has been fixed on the fixing plates 2 with
15 high precision in the positioning in relation to the holder 1, as well as to other equipment.

Further, the structure of the fixing plates 2, inside the closed volume 3 of the holder 1, is shown in figure 2. In order to provide a stable construction of the fixing plates
20 2 and the holder 1, into which they are secured, each fixing plate 2 has a transverse end plate 16 at the inner end of the main body 28. The end plate 16 has substantially the same height as the main body 28 and as the partitioning walls 4. Hence it is enclosed in the closed volume 3, when the top plate 5 is arranged on the holder 1, and it is able to abut the inside of the top and bottom plates 5, 6, thereby stabilizing
25 the construction of the holder.

The transverse end plate 16 is arranged on the inner end of the main body 28 in the shape of a T. This arrangement especially stabilizes the construction against rotation around the longitudinal axis of the fixing plate 2 per se. Actually, the arrangement
30 will counteract any tendency to rotation around an axis substantially parallel with

the top or bottom plates 5, 6 of the holder 1, due to the contact between the transverse end plate 16 and the top and bottom plates 5, 6, respectively.

Any tendency to rotation of the fixing plate 2 around an axis transversal to the top
5 and bottom plates 5, 6 is counteracted by the screws 10 and the projection 12 on the main body 28 extending into the recess 10 in the top plate 5.

Hence the resulting construction of a holder 1 with fixing plates 2 according to the present invention is rigid and provides a high accuracy in positioning the equipment
10 fixed thereon or any workpiece held thereby.

As the weight of the holder 1 and the fixing plates 2 is kept to a minimum, while the strength and rigidity is still high, the capacity of the industrial robot, concerning the maximum load, can be utilized to its maximum, i. e. heavier workpieces may be
15 handled, than what was possible with heavier holders and fixing plates.

The compactness of the holder 1 and its fixing plates 2, where parts of the fixing plates 2 are arranged inside the closed volume 3, will save space in the industrial environment where it will be used. Also, the inertia factor will be reduced, which
20 enables quick starts, stops and rotations with a minimum force applied, and the wear on essential parts of the industrial robot will be lessened.

The compactness of the invention is also due to the low number of separate parts, which also results in lower costs.

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Figure 3, which is an exploded view of the fixing plate 2, shows the constructional characteristics in greater detail. The transverse end plate 16 is fixed onto the main body 28 by means of screws 19 and thread elements 15, as described above. The fixing plate 2 is joined in a similar manner to the top and bottom plates 5, 6 by

means of screws 10 and thread elements 15. In the preferred embodiment, washers 20 are provided to keep the screws 10, 19 securely tightened.

In the preferred embodiment, the outer part of each fixing plate 2, extending out of
5 the closed volume 3, has a greater height than the part inside the closed volume 3. As can be seen in figure 2, the outer, higher part of the fixing plate 2 extends a short distance into the closed volume 3, and recesses 21 are formed in the top plate 5 to allow for this. Hence the fixing plate 2 is stabilized and positioned in relation to the top plate 5 not only by the screws 10 and the projection 12 in the recess 11, but also
10 by the fixing plate 2 extending into the recess 21.

The transition 22 between the outer, higher part of the fixing plate 2 and its inner, lower part is rounded, with a semi-circular cross section. The transition 22 will thereby be less prone to cracks and ruptures.
15

In figure 4 the fixing plate 2 is shown in its assembled state, however the closed volume 3 is not shown for the sake of clarity.

Figure 5 shows a perspective view of the fixing plate 2, where an arm 23, generally
20 known as a riser, for carrying equipment has been secured to the fixing plate 2 by means of a connection plate 24. The connection plate 24 extends along substantially all of the outer part of the fixing plate 2, and has generally the same extension along the end of the arm 23. A similar (not shown) connection plate is arranged on the other side of the fixing plate 2 and the arm 23, facing away from the viewer of
25 figure 5. A number of screws 18 with nuts extend through the connection plates and the fixing plate 2 and the lower end of the arm 23, respectively, as described above.

The connection plates 24, the fixing plate 2, and the lower end of the arm 23 includes a number of small holes 25 which are not used for the screws 18. These
30 holes 25 are positioning holes 25, which are machined with great precision and are

used for the exact positioning of the arm 23 in relation to the fixing plate 2, and hence to the holder 1.

There is a small gap 26 between the upper lateral side of the fixing plate 2 and the lower end of the arm 23. Notches 27 in the connection plates 24 are arranged in register with the gap, so that in case of a collision between the arm 23, or equipment mounted thereon, with anything in its environment, this region will be the most likely point, or line, of breakage, thereby preventing greater damages to the holder 3 or to the industrial robot whereon the holder 3 is mounted.

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ALTERNATIVE EMBODIMENTS

Figure 6 shows an alternative embodiment of the fixing plate 2' according to the invention. As in the preferred embodiment, there is a transversal end plate 16, which is to be arranged inside the closed volume 3 of the holder 1. The transversal end plate 16 will, as described earlier, interact with the inner surfaces of the closed volume 3 to counteract forces which tend to rotate the fixing plate 2'.

A major difference in relation to the preferred embodiment is that the fixing plate 2' has two main bodies 28' positioned side by side, with their respective ends regions connected with the end plate 16 in a manner corresponding to what has been described earlier. With two or more main bodies 28', one or more mounting plates 29 may be securely and exactly positioned on the outer side edges of the main bodies 28'. Thereby the mounting plate 29 is positioned in a plane which is transversal, and more precisely perpendicular, to the planes of extension of the main bodies 28'. Depending on the shape of the outer regions of the main bodies 28', the extension plane of the mounting plate 29 may be just about any plane which is transversal to the extension planes of the main bodies 28'.

As can be seen in figures 6 and 7, the main bodies 28' are provided with lightening holes 30, which make the main bodies 28' lighter, without reducing their strength. For ease of manufacture, the main bodies 28' are not necessarily manufactured of the honey comb material described earlier, but may be molded in a suitable material, such as aluminum.

Figure 7, which is an exploded view of the alternative embodiment of the fixing plate 2', gives a good overview of the construction of the fixing plate 2', with its end plate 16, the mounting plate 29, and positioning pins 31.

Flat projections 32 are also visible in figures 6 and 7 at the lower ends of the main bodies 28'. The height of the projections 32 correspond to the thickness of the planar, lamellar material used in the bottom plate 6. The projections 32 fit into corresponding recesses 33, 34 in the bottom plate 6, which is clear from figure 8, where the alternative embodiment of the fixing plate 2' is shown in its mounted state in the closed volume 3.

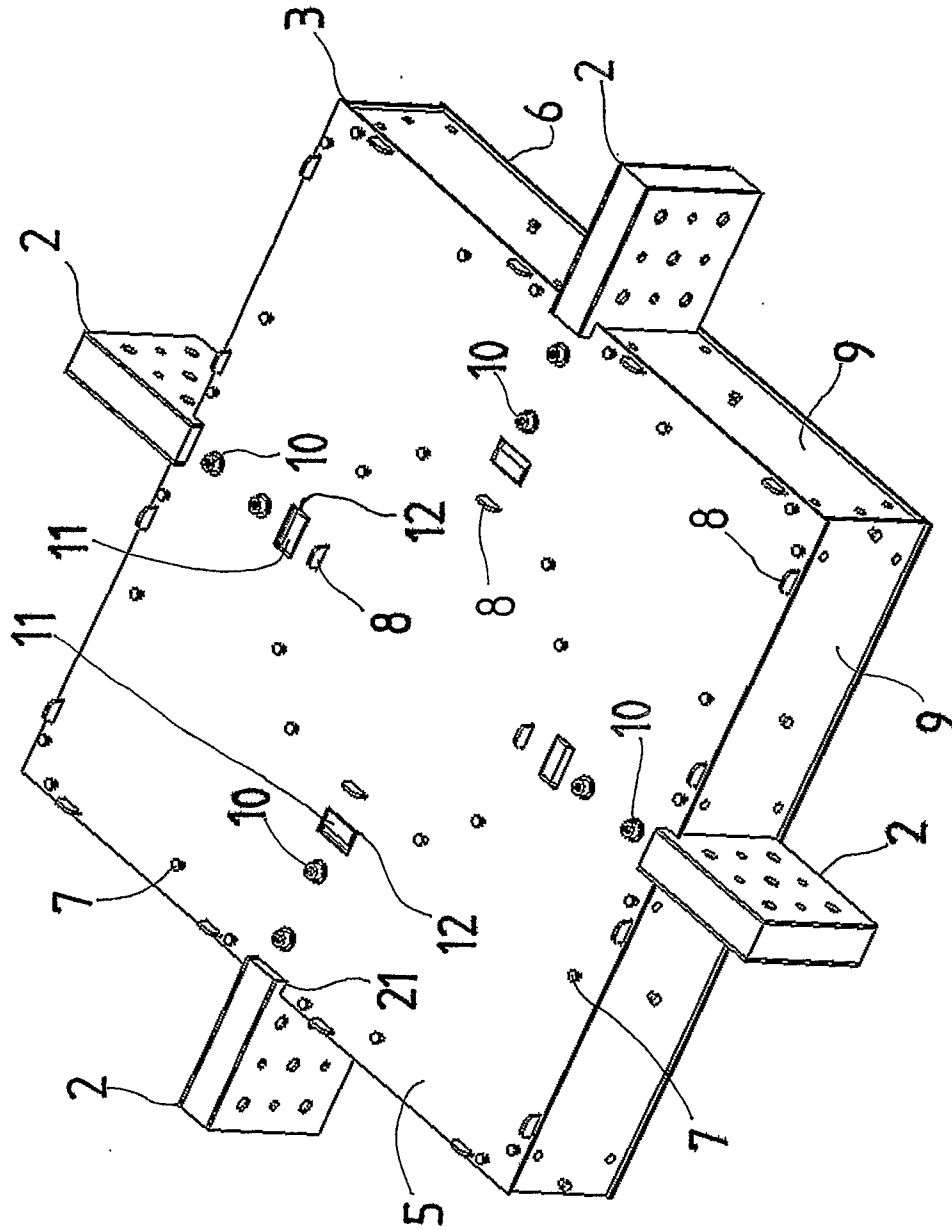
Although the alternative embodiment shown in figures 6 to 8 discloses, on the one hand, a fixing plate 2' with two main bodies 28', and, on the other hand, the presence of lightening holes 30 in a molded main body 28', these two characteristics need not be present at the same time. Further alternative embodiments, where only one of these characteristics is present could easily be envisaged by the skilled person.

The invention may be varied within the scope of the appended claims.

CLAIMS

1. Fixing plate on a holder (1), which positions and positionally fixes a workpiece in relation to a fixed point or another workpiece, said fixing plate (2, 2') positionally fixing the workpiece or equipment for controlling the workpiece the workpiece etc. wherein the holder (1) comprises a substantially closed volume (3) including a number of planar, lamellar material pieces (4, 5, 6, 9), characterised in that the fixing plate (2, 2') has a main plane of extension which is substantially transversal to the adjacent surfaces of the closed volume.
2. Fixing plate according to claim 1, characterised in that the fixing plate (2, 2') extends a distance inwards in its main plane of extension into the closed volume (3), and comprises a transversal, inner end plate (16) for fixing the fixing plate (2, 2') in relation to the holder (1).
3. Fixing plate according to claim 2, characterised in that the sides of the fixing plate (2, 2') and its end plate (16), inside the closed volume (3), abut against the inside of the planar, lamellar material pieces (5, 6) comprised in the holder (1).
4. Fixing plate according to claim 2 or claim 3, characterised in that the end plate (16) is arranged at right angles with the main body (28, 28') of the fixing plate (2, 2').
5. Fixing plate according to any of claims 1-4, characterised in that the outer section of the fixing plate (2, 2') is provided with positioning means (25, 31) for a connection plate (24), which fixes equipment for positioning the workpiece etc.

6. Fixing plate according to claim 5, characterised in that the connection plate (24) is arranged to span a gap (26) between the fixing plate (2) and the equipment (23) fixed thereto.
- 5 7. Fixing plate according to claim 3, characterised in that positioning means (10, 12) are arranged on the sides of the fixing plate (2, 2') for co-operation with the planar, lamellar material pieces (5, 6) comprised in the holder (1).
8. Holder for positioning and positionally fixing a workpiece in relation to a
10 fixed point, including a fixing plate (2, 2') according to any of claims 1-7.



15

Fig. 2

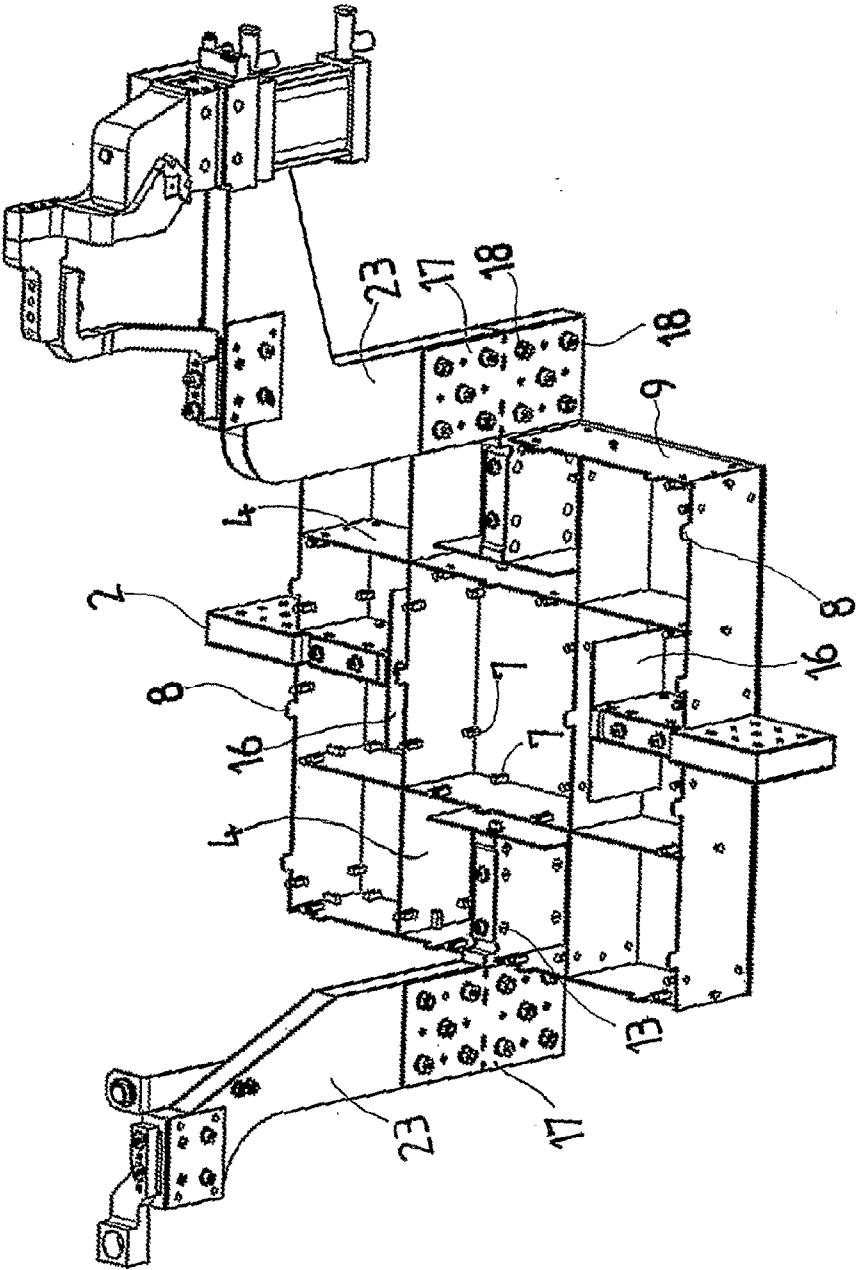
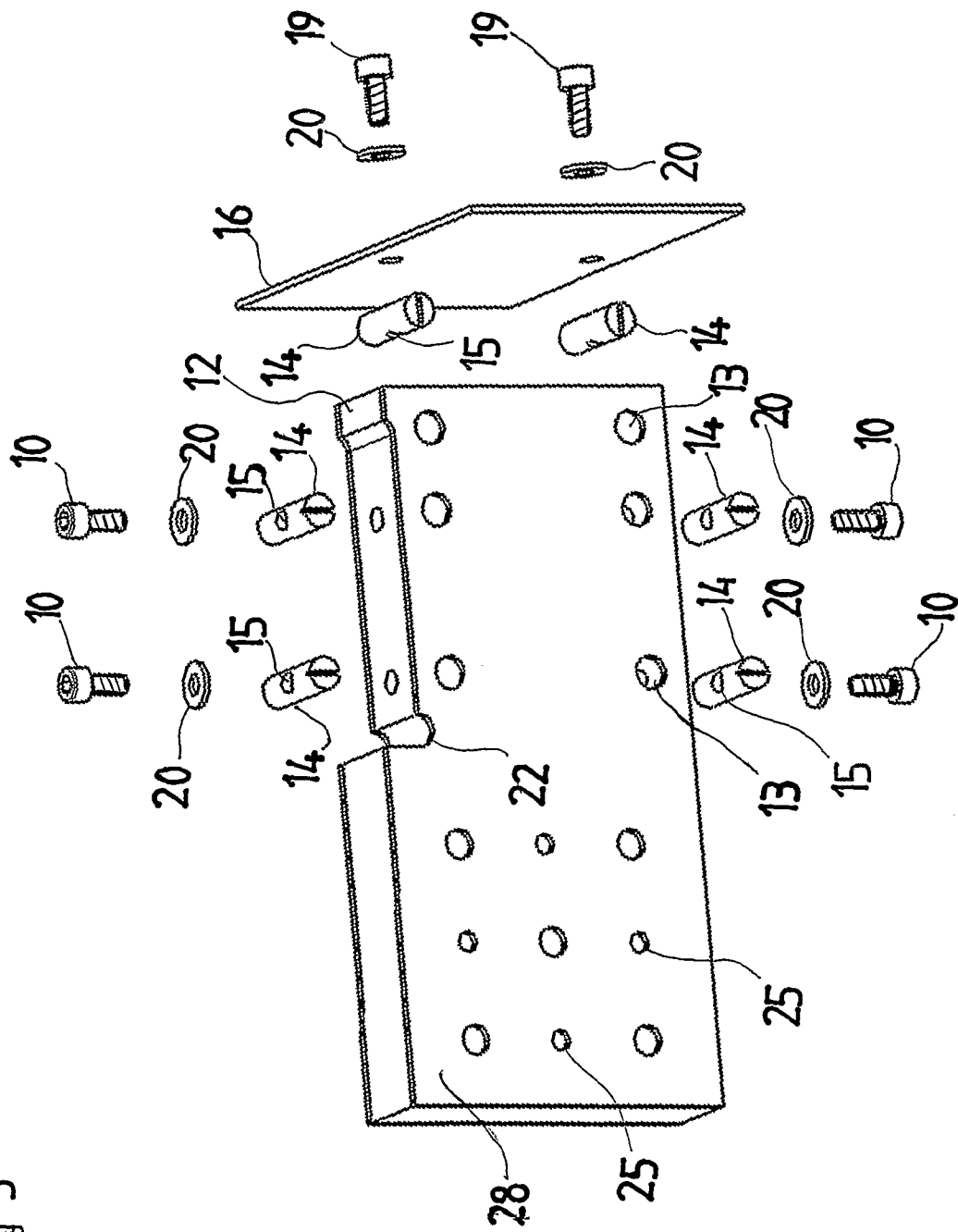


Fig 3



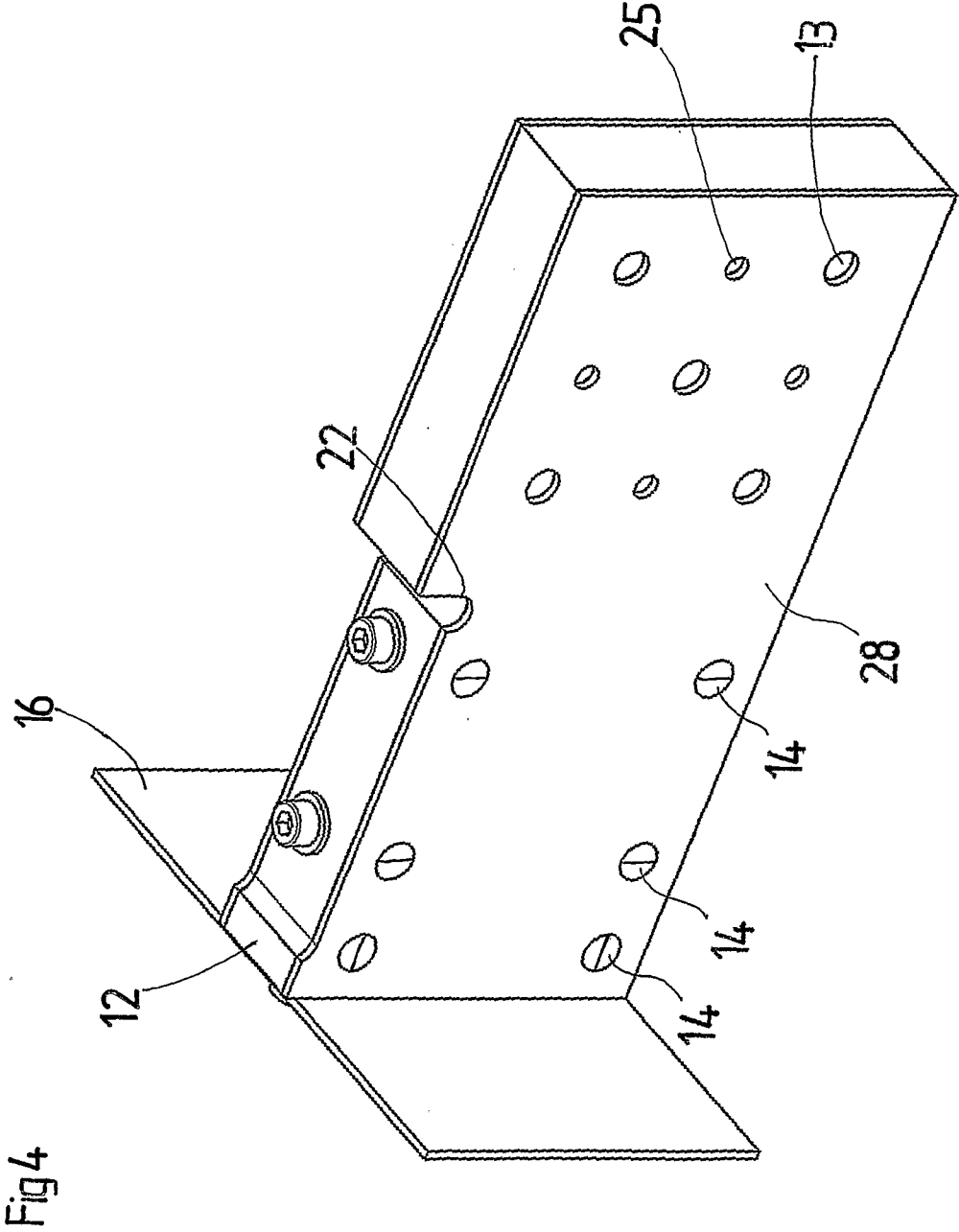


Fig 5

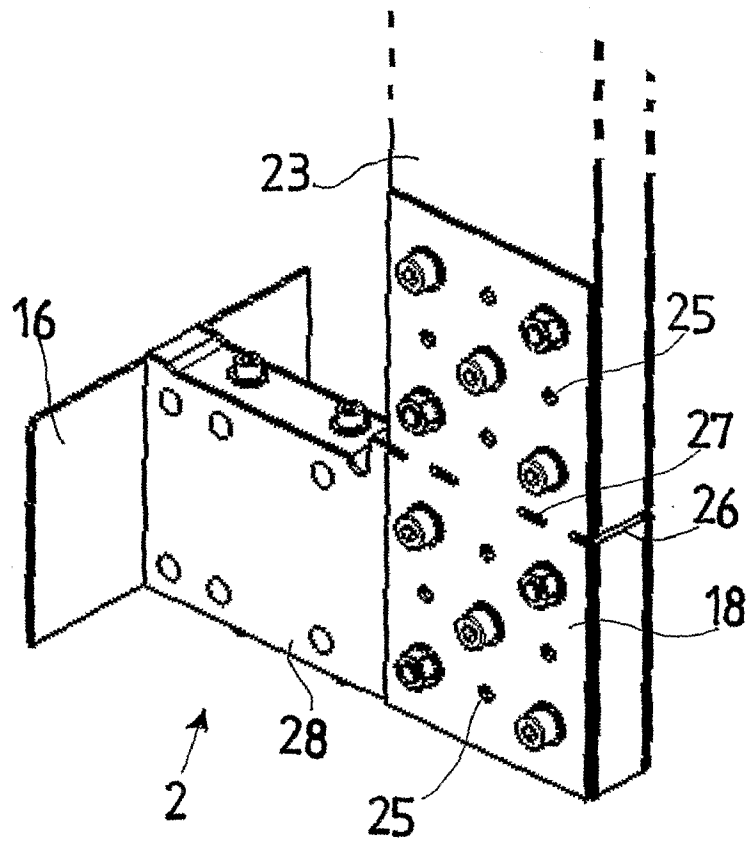


Fig 6

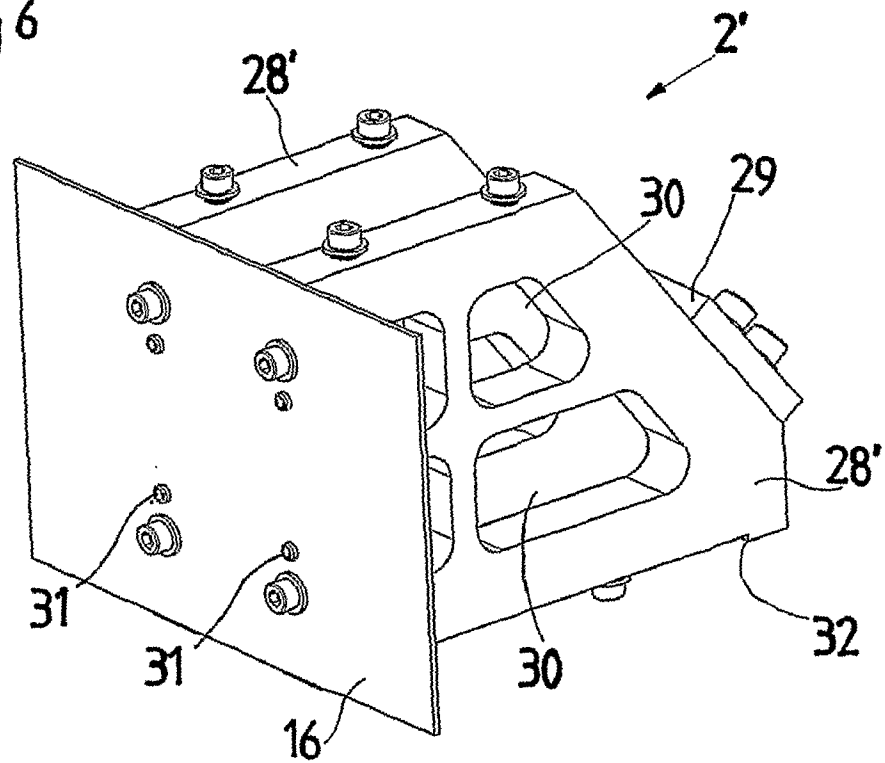
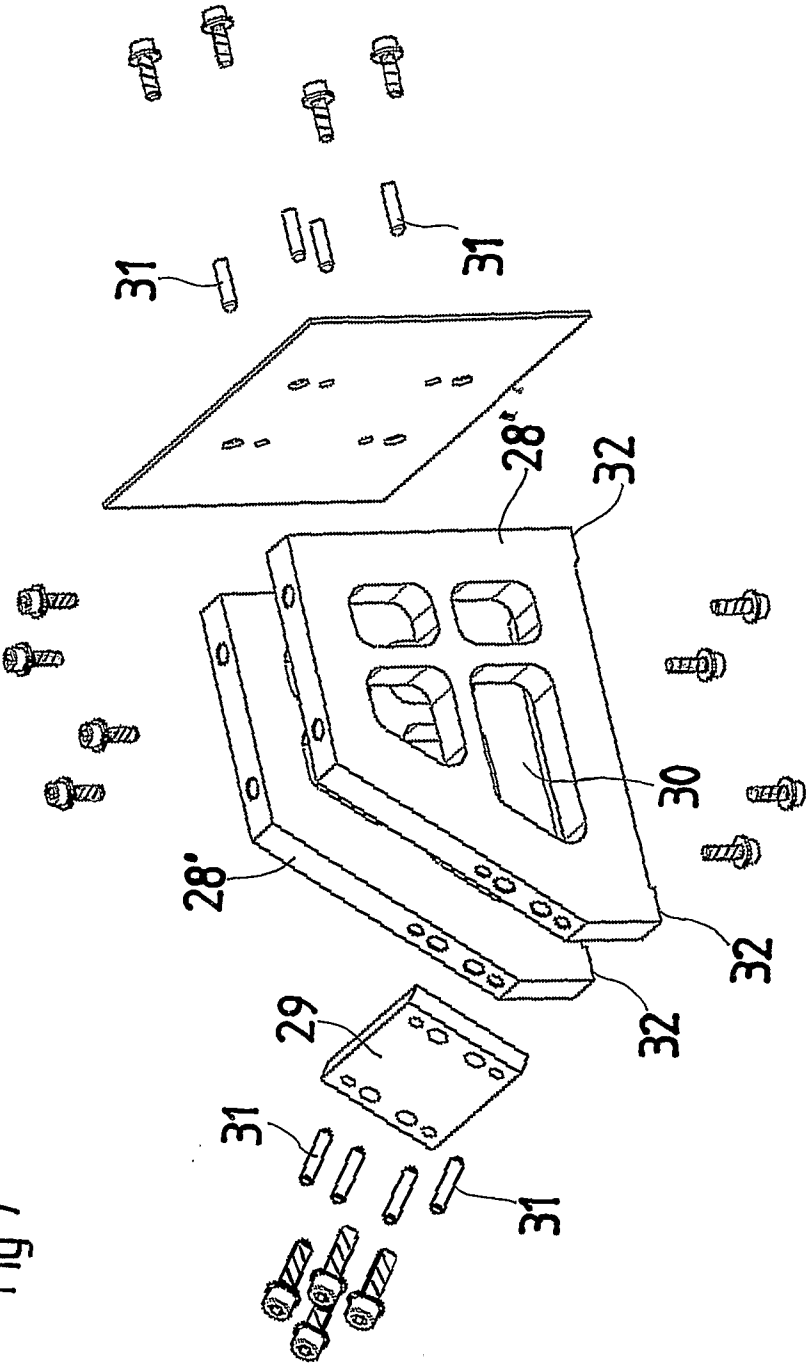
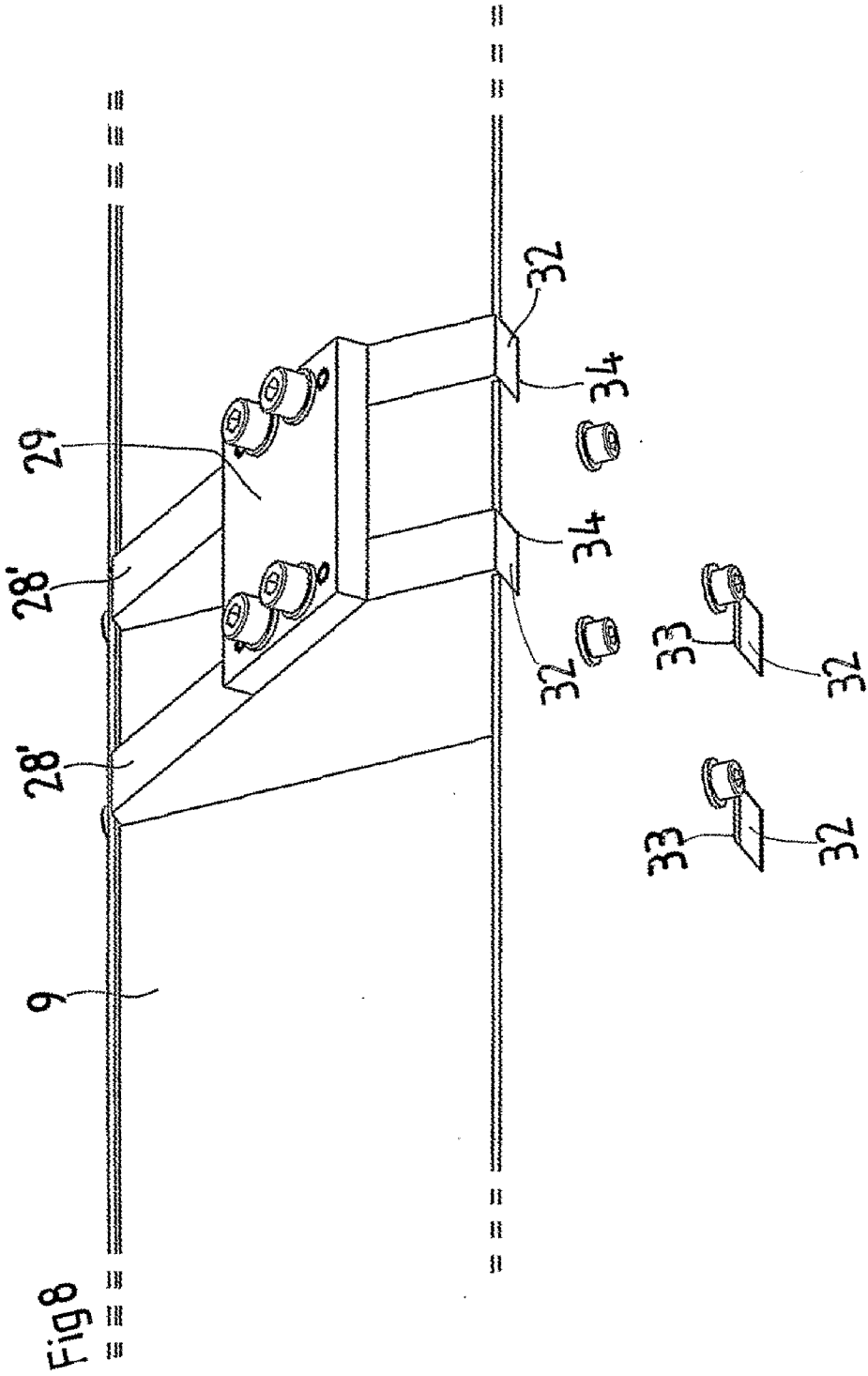


Fig 7





INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2009/000224

A. CLASSIFICATION OF SUBJECT MATTER

IPC: 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)

IPC: B23Q

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 4314629 A1 (EROWA AG), 10 November 1994 (10.11.1994), figures 1-4, abstract --	1-8
A	DE 102007044060 A1 (SCHUSTER, H.), 26 March 2009 (26.03.2009), figures 1-3, abstract --	1-8
A	EP 0209100 A2 (CINCINNATI MILACRON INC.), 21 January 1987 (21.01.1987), figures 1-9, abstract -- -----	1-8

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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