Fig. 1

(57) Abstract: The present invention relates to a mechanical joint for connecting together, reversibly and robustly, elements (4) with any angle of approach; each of said elements (4) has, on the faying surface, at least one hole (9); said joint comprises at least two clamping pins (2) and at least one connecting pin (1); said connecting pin (1) has two ends that are adapted to be inserted respectively into said holes (9) of said two elements (4); said clamping pins (2) are adapted to couple to said connecting pin (1) respectively at said two ends and to said two elements (4); said connecting pin (1) has an articulation (6) at an intermediate point so as to allow it to bend at any angle.
MECHANICAL JOINT FOR REVERSIBLY CONNECTING ELEMENTS WITH ANY ANGLE OF APPROACH

Field of the invention

The present invention relates to a mechanical joint for joining elements together reversibly and robustly with any angle of approach.

Prior art

A problem that is common to mechanical joints commonly used in the field of joinery is the impossibility of joining elements that have any arbitrary angle of incidence, reversibly and robustly, avoiding the use of adhesives, of threads made directly in the pieces to be joined or with complicated and expensive recessed shapes. Consider, purely as an example, the joining of elements of the frame of fittings that have an assembly angle of 45°, or, still in the area of fittings, the joining of elements that constitute the upper part of arch frames or V frames, which can have any angle of incidence whatsoever.

From the prior art, some examples are known of mechanical joints for reversible coupling of elements, even allowing mutual rotation, but which have, on the assembly surface, coaxial holes for receiving a metal connecting element.

An example of such a solution is described in Italian utility model No. 252348, also of the applicant of the present application; that utility model describes a mechanical joint that makes it possible to join two or more elements that have coaxial holes on the faying surface, into which a cylindrical element called "connecting pin" is to be inserted. Each element to be joined must moreover have a second hole, of larger diameter, with its axis perpendicular to the first, into which a metal element, called "clamping pin", is inserted. The two metal elements (connecting pin and clamping pin) are fixed, once positioned, with grub screws.

It is clear that the mechanical joint described in this utility model only applies to the joining of elements in which it is possible and (economically) expedient to make a pair of coaxial holes and, for each element, a second hole perpendicular to the first.

However, it is not always possible or expedient to make coaxial holes at the interface between two elements to be joined.
Summary of the invention

The general aim of the present invention is to provide a mechanical joint that overcomes the drawbacks of the prior art and, more especially, to provide a mechanical joint able to join, reversibly and robustly, elements with any angle of approach.

These and other aims are achieved by the mechanical joint having the technical features set out in the claims appended hereto, which form an integral part of the present description.

The idea on which the present invention is based is to use, for joining, a pin that has an articulation at an intermediate point.

Description of the drawings

The technical features of the present invention as well as its advantages will become apparent from the following description, which should be examined together with the annexed drawings, in which:

Fig. 1 shows a three-dimensional view of the assembly of two elements by means of a joint according to the present invention;

Fig. 2 shows a three-dimensional view of a connecting pin according to the present invention in the bent condition;

Fig. 3 shows a three-dimensional view of a connecting pin according to the present invention in the straight condition;

Fig. 4 shows a plane sectional view of a connecting pin according to the present invention in the straight condition;

Figs. 5 and 6 show some possible applications of the joint according to the present invention;

Fig. 7 shows a peg that can be used in combination with a joint according to the present invention; and

Fig. 8 shows a three-dimensional view of the assembly of two parts of the frame of a fitting by the application of a joint according to the present invention (in particular the joint in Fig. 1) and application of the peg of Fig. 7.

Both the description and the drawings are provided only by way of non-limiting example; therefore the present invention can be implemented according to other various embodiments.
Detailed description of the invention
The mechanical joint described here is an improvement of the joint described and claimed in Italian utility model No. 252348.
The joint depicted in Fig. 1 joins together two elements (4) by means of two connecting pins (1) and two clamping pins (2) that have holes (12) with shape and dimensions such that the connecting pins (1) can be inserted therein. The shape of the connecting pin (1) that makes it possible to assemble elements (which do not have coaxial holes) is shown according to one embodiment in Figs. 2, 3 and 4. As can be seen, the connecting pin (1) consists of at least two elements (7), cylindrical or of some other section, that will form an angle equal to that formed by the holes present at the interface of the elements (4) to be joined, when the latter are in the assembly position. For assembly of the elements (4) it is sufficient to insert the clamping pins (2) in the two seatings (3) provided for them respectively in the two elements (4) to be joined, which are perpendicular to the seatings (9) respectively made in the same elements (4) for the connecting pins (1). Thus, the two connecting pins (1), as shown in Fig. 1, are inserted in one of the two elements (4) to be joined and the second element (4) is brought close to the first element (4) taking care to insert the projecting part of each connecting pin (1) into the hole (11) arranged if necessary on the second element (4) to be joined.

Typically and advantageously, the faying surfaces of the two elements to be joined (4) will be shaped so as to fit perfectly when brought together; preferably, the aforesaid faying surfaces are straight. It should be noted that simpler embodiments of the present invention can also envisage a single connecting pin; alternatively and theoretically, the connecting pins could also be more than two in number. The presence, on the connecting pin (1), of the two countersunk holes (5) that can be seen in Figs. 2, 3 and 4 makes it possible to fix the connecting pin (1) to the clamping pins (2) by means of grub screws (shown only in Fig. 8). The countersinking (5), in particular of oval shape, is provided to allow small relative movements between the two parts and carry out tightening only when they are positioned perfectly.

Two threaded caps (shown only in Fig. 8) that screw into the same hole into which the grub screws are screwed, allow the holes (3) to be closed on completion of
assembly.

Figs. 2, 3 and 4 show, in three-dimensional and sectional views, embodiments of the connecting pin (1) for a joint according to the present invention. According to these embodiments the connecting pin (1) consists of two or more elements (7) joined together by a peg (6) that allows the two elements to be constrained but with freedom to vary the angle of incidence. Because of this connecting pin it is possible to assemble, with the same joint, elements to be joined that have different angles between the holes present at the interface.

The embodiment in Fig. 3 differs from the embodiment in Fig. 2 with respect to the axis of the holes (5) present in the connecting pin (1). As can be seen, in Fig. 2 the axis of both holes (5) is parallel to the axis of the peg (6), while in Fig. 3 the axis of both holes (5) is perpendicular to the axis of the peg (6); a further variant corresponds to the case when the axis of a first hole (5) is parallel to the axis of the peg (6) and the axis of a second hole (5) is perpendicular to the axis of the peg (6). The usefulness of this variation of angle is evident in cases when there is no space for the operator, who has to tighten the grub screws in the upper part of the elements (4) to be joined.

Figs. 5 and 6 show, purely as examples, some possible applications of the joint described here. These apply to the joining of elements that form the frame of two fittings, the first (Fig. 5) having a V-shaped arch and the second (Fig. 6) with an arc-shaped arch.

It should be pointed out that in the drawings the connecting pins (1) are only shown schematically and therefore their peg (6) and therefore possibility of bending is not indicated, although it is present; moreover, in Fig. 1, the elements to be joined (4) are arranged at 90° to one another only as an example; but in Figs. 5 and 6 the angles are for example 90°, 135° and 180°.

By means of connecting pins (1) formed from three or more elements (7) converging in the same hinged joint, it is possible to assemble, by means of a single joint, three or more pieces that converge on the same point.

Fig. 7 shows a peg (8) that can be used, in conjunction with the joint described, for example for protecting, from possible ingress of water, the elements of the frame of a fitting joined together with the joint according to the present invention; said
peg (8) is rectilinear and has an "L-shaped" cross-section; as an alternative, it could for example be possible to use two pegs having an "I-shaped" cross-section and arranged perpendicularly to one another, or also a single peg having for example "I", "L", "U", or "V" cross-section, etc.

For using the peg (8), each section of the fitting envisages, as shown schematically in Fig. 8, as well as the hole (9) for receiving the connecting pin (1), a recess (10) with a shape corresponding to that of the cross-section of the peg, for receiving the latter; in this way the peg makes a seal. A recess of the same shape must of course be provided on the second element in order to allow the plate (8) to form a seal between the two elements to be joined.

The arrangement of the hole (9) and of the recess (10) on the faying surface of the elements to be joined (4) can be varied at will, according to the design requirements of the elements to be joined.
CLAIMS
1) Mechanical joint for reversible coupling of two or more elements (4) brought together at any angle, in which each of said elements (4) has, on the faying surface, at least one hole (9), comprising at least two clamping pins (2) and at least one connecting pin (1), in which said connecting pin (1) has two ends that are adapted to be inserted respectively into said holes (9) of said two elements (4), in which said clamping pins (2) are adapted to couple to said connecting pin (1) respectively at said two ends and to said two elements (4), characterized in that said connecting pin (1) has an articulation (6) at an intermediate point so as to allow it to bend at any angle.

2) Joint according to Claim 1, characterized in that said joint (6) is such as to permit rotations about a single axis of rotation.

3) Joint according to Claim 2, characterized in that said connecting pin (1) is formed from two or more elements (7) joined together by a hinge (6) that makes it possible to vary the angle formed by said elements (7), said elements (7) preferably being rectilinear.

4) Joint according to any one of the preceding claims, characterized in that at least one of and preferably each of said clamping pins (2) comprises a grub screw for fixing a clamping pin (2) at one end of said connecting pin (1).

5) Joint according to Claim 4, characterized in that said end of said connecting pin (1) has a seating or a hole (5) for receiving said grub screw.

6) Joint according to Claim 5, characterized in that said seating or said hole (5) of said connecting pin (1) has a countersunk mouth, preferably with oval countersinking.

7) Joint according to any one of the preceding claims, characterized in that at least one of and preferably each of said clamping pins (2) has a through-hole for receiving an end of said connecting pin (1).

8) Joint according to any one of the preceding claims, characterized in that at least one of said clamping pins (2) and at least one end of said connecting pin (1) have axes that are perpendicular to one another.

9) Joint according to any one of the preceding claims, characterized in that said two elements (4) are of such conformation that two corresponding flat
surfaces are brought together on an interface plane, and in that said interface plane bisects the angle of bending of said connecting pin (1).

10) Assembly of two faying elements, characterized in that it comprises a mechanical joint according to any one of the preceding claims.

11) Assembly according to Claim 10, further comprising a peg (8) inserted in both said elements (4) at the faying surface.

12) Assembly according to Claim 11, characterized in that said peg (8) is rectilinear and has an "L-shaped" cross-section.
### INTERNATIONAL SEARCH REPORT

**International application No:**
PCT/IB2011/053431

**A. CLASSIFICATION OF SUBJECT MATTER**

**INV.** F16B12/20 F16B19/02

ADD.

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)
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)
EPO-Internal, PAJ, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>CH 625 314 A5 (WELCO TECHNIK AG [CH]) 15 September 1981 (1981-09-15) page 2, right-hand column, line 13 - page 3, left-hand column, line 15; figures 1, 2</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

- "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
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