(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 882 822 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.12.1998 Bulletin 1998/50

(51) Int. Cl.[6]: **D03C 9/06**

(21) Application number: **97122305.2**

(22) Date of filing: **17.12.1997**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **18.12.1996 IT MI962646**

(71) Applicant:
Nuova O.M.V. Officine Meccaniche Vilminore S.r.l.
24100 Bergamo (IT)

(72) Inventor: **Nani, Roberto**
I-24020 Ranica Bergamo (IT)

(74) Representative:
Faggioni, Marco, Dr. Ing. et al
c/o Fumero Studio Consulenza Brevetti
Franz-Joseph-Strasse 38
80801 München (DE)

(54) Removable force-fitting joint for the components of a heald frame for weaving looms

(57) In a removable force-fitting joint for fixing together the side-pieces (1) and the cross-beams (4) of a heald frame, each end of the side-piece (1) has a plate element (2) projecting towards the cross-beam (4) and housed in a cavity (3) of the latter. A first edge of said plate element (2) of the side-piece has a curved profile with a variable radius and co-operates with a locating surface formed in the cross-beam (4) having a similar profile, screw means (7,8) being arranged between the cross-beam (4) and an opposite edge of the element so as to cause locking of the plate element (2) on the cross-beam (4) against said locating surface.

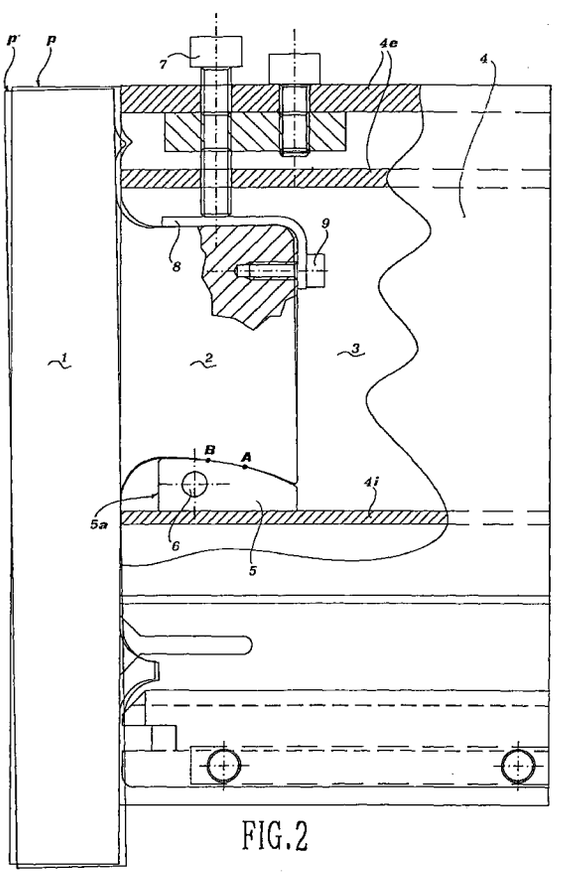


FIG.2

EP 0 882 822 A1

Description

The present invention relates to a removable force-fitting joint for fixing together in a fast, stable and precise manner the components of a heald frame. In particular, the invention relates to a corner joint for fixing together the side-pieces and the cross-beams of a heald frame.

The heald frame is a device used in weaving looms for obtaining the movement of groups of warp yarns by means of its alternating movement in a vertical plane perpendicular to the weaving plane. A certain number of heald frames are arranged in the loom, this number increasing with the greater complexity of the design to be formed in the fabric, and the individual frames are operated by a weave machine for obtaining a predetermined design in the fabric.

Each heald frame comprises a rectangular border formed by two lateral elements, called side-pieces, which form the guides for alternate sliding of the frame, and by two horizontal elements, called cross-beams, onto the inner sides of which, a plurality of thin steel rods are fastened, said rods being provided with an intermediate eyelet allowing a warp yarn to pass through. These rods are in fact referred to as healds.

The two side-pieces and the two cross-beams must obviously be fixed together at right angles, in the corner positions of the frame, so as to provide a rigid and stable structure which is able to withstand the high stresses to which the frame is subjected during its fast - in some cases extremely fast - alternating movement within the loom. At the same time the joints connecting the side-pieces and cross-beams must be able to be disassembled easily and rapidly, even by personnel without any particular knowledge of mechanics, since frequently the weaver must vary the number or the type of healds inside a frame, so as to adapt the frame itself for the processing of a different fabric.

The difficulties of designing a joint which is able to guarantee the performance characteristics required and which, at the same time, has a sufficiently long working life, have increased considerably since the use of traditional materials, such as iron or steel, for the construction of the frame components has been abandoned in favour of increasingly lighter materials such as aluminium, light alloys and synthetic composite materials. These latter materials have in fact proved to be particularly advantageous for the construction of heald frames intended for high-speed looms on account of their low specific weight and their sound-absorption characteristics; however, they have a mechanical strength which is considerably lower than that of the known ferrous materials and therefore are unable to withstand satisfactorily high localised stresses.

The corner joints of the frames made with these latter materials must therefore be designed in a special way so as to ensure that the joints are sufficiently durable and stable over time. In an attempt to meet this requirement, different types of joints have been developed hitherto, all of which are essentially based on the common principle of providing side-pieces which are provided at their ends with plate elements which are rigidly fixed thereto and project towards the inside of the frame, said elements being housed and locked - using quick-blocking devices of different kinds - inside corresponding cavities formed in the thickness of the end part of the cross-beams. With this type of joint, in fact, it is possible to achieve the object of distributing the forces which are transmitted to the joint over wider areas and hence obtain unitary stresses which are sufficiently low that they may be withstood without problems also by the materials mentioned above. Examples of known systems of this type are the GROB joint, disclosed in IT-A-1173519, or the ACTEX joint, disclosed in IT-U-93000502.

All the known joints of the type described above have in common the characteristic feature that they are rigid joints of the hyperstatic type, which therefore have an excellent performance for as long as the stresses on the joint remain within the predetermined values, but are entirely unsuitable for allowing even minimum mutual displacements of the various components forming the joint, which are able to dampen the negative effects of excessive peak stresses, in particular of the flexural ones. The practical use of these joints has in fact clearly demonstrated that their useful life is practically never associated with failure of their component parts, but with the zone connecting together the side-piece and the plate element projecting from the same and used for fixing side-piece to the cross-beam. It is to this zone, in fact, that the excessive flexural stresses are transmitted, causing microscopic deformations in the slender structure of the side-piece and, over time, breakage due to fatigue of the side-piece.

The object of the present invention is therefore that of providing a corner joint for heald frames of the general type described above, which is nevertheless able to withstand excessive stressing forces of the flexural type, damping them internally by means of microscopic displacements of the joint connecting components, so as to prevent these excessive stresses from being transmitted instead onto the weaker elements of the frame, i.e. onto the side-pieces, with the consequences described above.

This object is achieved, according to the present model, by means of a removable force-fitting joint for fixing together the side-pieces and the cross-beams of a head frame, of the type in which each end of the side-piece has a plate element projecting towards the cross-beam and housed in a cavity of the latter, a first edge of said plate element of the side-piece co-operating with a locating surface formed in the cross-beam, screw means being arranged between the cross-beam and an opposite edge of the plate element so as to cause locking of the plate element on the cross-beam against said locating surface, characterized in that the profile of said first edge of the plate element which co-operates with

said locating surface and the profile of said locating surface are curved profiles with a variable radius.

In a first embodiment of the invention, said curved profiles are the same and have their concavity directed towards the inner part of the heald frame.

In a second embodiment of the invention, said curved profiles are different and in particular the profile of the edge of the plate element has radii greater than the profile of the locating surface of the cross-beam co-operating therewith.

The invention will now be described, however, in greater detail, with reference to the accompanying drawings, in which:

Fig. 1 is a front view, on a 2:1 scale, of the joint according to the present invention with parts removed and partially sectioned;

Fig. 2 is a view similar to that of Fig. 1, which illustrates in diagrammatic form the possibility of mutual microscopic displacements of the components of the joint and consequently of the side-piece and cross-beam;

Fig. 3 is a view, on a much larger scale, of the surfaces for engagement of the components of the joint in the two end positions of its possible microscopic displacements.

As illustrated in Fig. 1, the joint according to the present invention comprises a side-piece 1, from the ends of which two plate elements 2 project laterally (only one is shown in the drawings), said plate elements being rigidly fixed to, or formed integrally, with the side-piece 1. Preferably the side-piece 1 and the plate elements 2 are obtained by means of mechanical machining from an extruded metal part consisting of aluminium. Each plate element 2 is housed in a corresponding cavity 3 formed in the end part of the cross-beams 4, which are for example formed by extruded aluminium parts provided with ample longitudinal cavities separated by external ribs 4e and internal ribs 4i.

As already mentioned in the introductory part of the present description, joint structures which have the general configuration described above have been known for some time, closing of the joint being performed by causing an edge of the plate element 2 projecting from the side-piece 1 to co-operate with a locating surface of the cross-beam or an element rigid therewith, by means of a locking screw which is operated from outside the cross-beam and presses the plate element 2 of the side-piece against said locating surface. This locating surface may be formed by the same ribs 4i of the metal structure of the cross-beam, as in the case of IT-u-93000502, and in this case it consists of a substantially horizontal surface; or else this locating surface may consist of a block rigidly fixed to said internal rib 4i and having a flat locating surface inclined towards the inside of the frame, as occurs instead in the patent IT-A-1173519, and in this case a force-fitting joint is formed. In both cases the joint has those rigidity characteristics and those consequent drawbacks which have been already mentioned in the discussion of the documents relating to the prior art.

The joint according to the present invention belongs to the second category of joints described above, namely force-fitting joints, whose high level of locking efficiency it aims to maintain, while avoiding at the same time the drawbacks, i.e. essentially the inability to dampen the excessive flexural stresses which are transmitted onto the joint. In order to achieve these results, the Applicants are proposing to construct the locating surfaces of the plate element 2 and of a block 5 co-operating therewith - the latter being rigidly fixed to the cross-beam by means of a rivet seated in the hole 6 - no longer with a straight profile as taught by the prior art, but with a curved variable-radius profile having its concavity directed towards the inside of the frame.

According to a characteristic feature of the invention, the curved profile of the block 5 is such that the height of the block itself increases towards the end of the cross-beam, such that the joint which is formed by the coupling arrangement between block 5 and plate element 2 is a force-fitting joint.

According to another characteristic feature of the invention, the curved profiles of the element 2 and the block 5 are formed by identical circle involutes characterized by radii which are variable within the range of between 40 mm and 80 mm.

According to another characteristic feature of the invention, the screw 7 for locking the joint acts with its end part against a plate 8 which covers the corresponding edge of the element 2 and is made of a metallic material which is sufficiently resilient to allow microscopic oscillations of the plate 8 and hence of the element 2 with respect to the tip of the screw 7. Preferably said tip is rounded and a similar rounded receiving area is formed in the corresponding point of engagement of the screw 7 on the plate 8. For the sake of ease of positioning and fixing, the plate 8 also extends at 90°, such that it can be stably fixed to the element 2 by means of screw means 9 which engage on the front edge of the element 2.

With this type of construction, a joint for heald frames with very special characteristics is obtained. As is in fact illustrated in diagrammatic form in Fig. 2, the particular configuration of the locating surfaces of its component parts enables the joint, in the event of excessive flexural stresses exerted on it, to perform mutual microscopic rotations of the surface of the element 2, which has a variable-radius profile, and the corresponding surface of the block 5, passing from the ordinary position P to the microscopically rotated position P', owing also to the resilience of engagement of the screw 7 on the plate 8. These microscopic rotations are so small that they do not create any macroscopically significant misalignment of the frame, but are sufficient to dampen significantly said excessive stresses, thus

preventing them from being fully transmitted so as to cause deformation of the side-piece.

This possibility of microscopic rotation may be further facilitated by reducing the friction between the co-operating locating surfaces. This result, in addition to the normal measures of the known type for reducing the friction between two co-operating surfaces, may be obtained by constructing the two profiles with different curvatures and in particular with the curved profile of the plate element 2 which has wider radii than the corresponding locating surface of the block 5. In this way, in fact, the area of contact between the co-operating surfaces of the element 2 and the block 5 is reduced to a segment with a length equal to the thickness of the element 2 or, in more realistic terms, to a small area in the region of this segment. A slight difference between the two series of radii, for example comprised within 10 mm, is already sufficient to achieve the desired object, while maintaining at the same time an area of contact between the components of the joint which is fairly high so as to prevent the occurrence of excessively high localised stresses. This preferred solution is illustrated in greater detail in Fig. 3, where the lines P' and P" illustrate the end positions A and B which the zone of contact between the plate element 2 and the block 5 is able to assume during mutual microscopic rotation of these two elements.

These second embodiment of the joint according to the present invention also has another considerable advantage consisting in the fact that the straight line of action of the force exchanged in the restricted zone of contact between plate element 2 and block 5 (indicated by arrows in Fig. 1) is displaced towards the side-piece passing from the point A to the point B, when there is an increase in the load induced on the frame by the healds applied to the cross-beams 4 and by the associated microscopic rotation of the joint components. The displacement of the point of application of the force exchanged between the joint components causes, as a desired consequence, a marked reduction in the bending arm of this force with respect to the side-piece 1 - from the value bA to the value bB - with a consequent reduction in the stressing in the critical zone of the side-piece itself. This behaviour of the joint therefore ensures limitation of the maximum value of the flexural stress on the side-piece 1, when there is an increase in the load exerted by the healds on the frame.

According to a further characteristic feature of the invention, it is envisaged that the curved profile of the locating surface of the block 5 should terminate abruptly, on the side directed towards the side-piece, in a wall 5a which breaks away cleanly from the edge of the plate element 2, substantially at the maximum point of the profile of said element - a maximum point which is determined by the presence of a gentle connection of the element 2 with the wall of the side-piece - and hence at a significant distance d from the end face of the cross-beam. This particular configuration of the block 5 thus enables a first advantage to be obtained, owing to the fact that the free rotation of the two co-operating surfaces with a curved profile is significantly facilitated. It also enables a second advantage to be obtained owing to the fact that it prevents any possible accidental contact of the side-piece 1 against the block 5 (in the case where the latter, during assembly, should not be perfectly aligned with the end face of the cross-beam), during closing of the frame, contact which would result in entirely unacceptable localised stresses on the side-piece.

The joint according to the present invention, finally, also provides considerable advantages during the frequent operations involving opening and closing of the frame in order to replace the healds. The particular configuration of the profiles of the locating surfaces of the plate element 2 and the block 5 in fact makes it possible to achieve self-centring of the side-piece in perfect abutment against the cross-beam by simply tightening the screw 7, since the force exchanged between the two locating surfaces always has a component in the horizontal direction which, on the plate element 2, is directed towards the inside of the frame. Owing to this fact and the reduced friction between the two variable-radius profiles, the element 2 therefore slides on the block 5 with the gradual tightening of the screws 7, until the side-piece 1 comes into perfect abutment against the cross-beam 4, recovering at the same time all the play existing between the various parts of the joint.

Claims

1. Removable force-fitting joint for fixing together the side-pieces and the cross-beams of a heald frame, of the type in which each end of the side-piece has a plate element projecting towards the cross-beam and housed in a cavity of the latter, a first edge of said plate element of the side-piece co-operating with a locating surface formed in the cross-beam, screw means being arranged between the cross-beam and an opposite edge of the element so as to cause locking of the plate element on the cross-beam against said locating surface, characterized in that the profile of said first edge of the plate element which co-operates with said locating surface and the profile of said locating surface are curved profiles with a variable radius having their concavity directed towards the centre of the heald frame.

2. Joint as claimed in Claim 1, in which said locating surface formed on the cross-beam is formed on a block stably fixed to a longitudinal element of the cross-beam.

3. Joint as claimed in Claim 2, in which the height of said block increases towards the end of the cross-beam.

4. Joint as claimed in Claim 3, in which the front surface of said block directed towards the end of the cross-beam is set back with respect to said end.

5. Joint as claimed in Claim 4, in which said front surface of the block is located at a maximum point of the variable-radius profile of said plate element.

6. Joint as claimed in any one of the preceding claims, in which said variable-radius profiles are the same.

7. Joint as claimed in any one of the preceding claims, in which said variable-radius profiles are different and the profile of said plate element has radii greater than the profile of said locating surface of the cross-beam.

8. Joint as claimed in Claim 7, in which the differences between the radii of the profile of said plate element and the corresponding radii of the profile of said locating surface of the cross-beam are less than or equal to 10 millimetres.

9. Joint as claimed in any one of the preceding claims, in which said variable-radius profiles are circle-involute profiles.

10. Joint as claimed in any one of the preceding claims, in which the radii of said variable-radius profiles vary in the range of between 40 and 80 millimetres.

11. Joint as claimed in any one of the preceding claims, in which said screw means for tightening the joint make contact against a plate of high-resilience metallic material, which is fixed onto the edge of said plate element intended to co-operate with the screw means.

12. Joint as claimed in Claim 11, in which said screw means consist of a screw with a rounded head and said plate has a corresponding rounded recess for engagement of said screw head.

13. Joint as claimed in any one of the preceding claims, in which said plate element is formed as one piece with said side-piece.

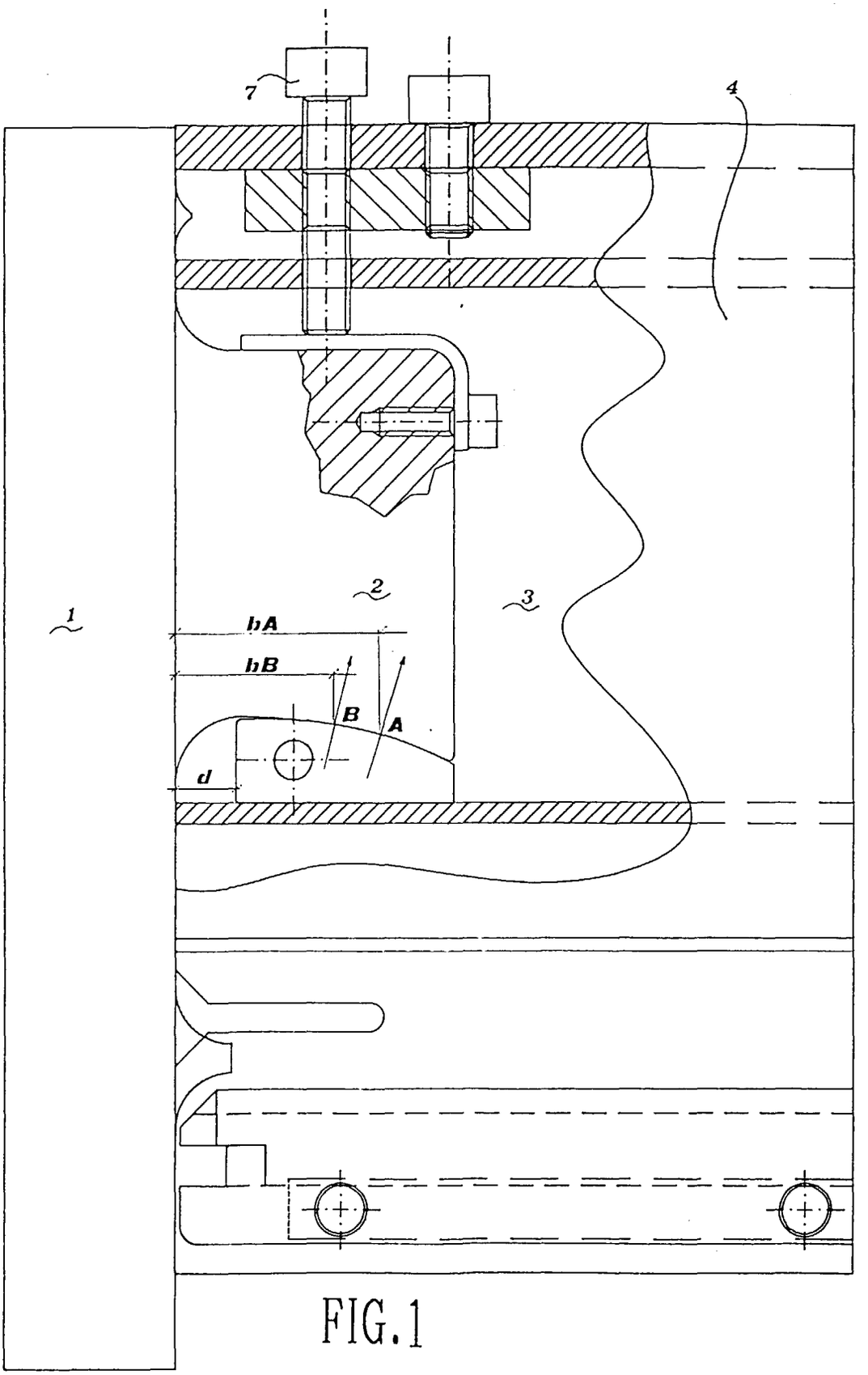


FIG.1

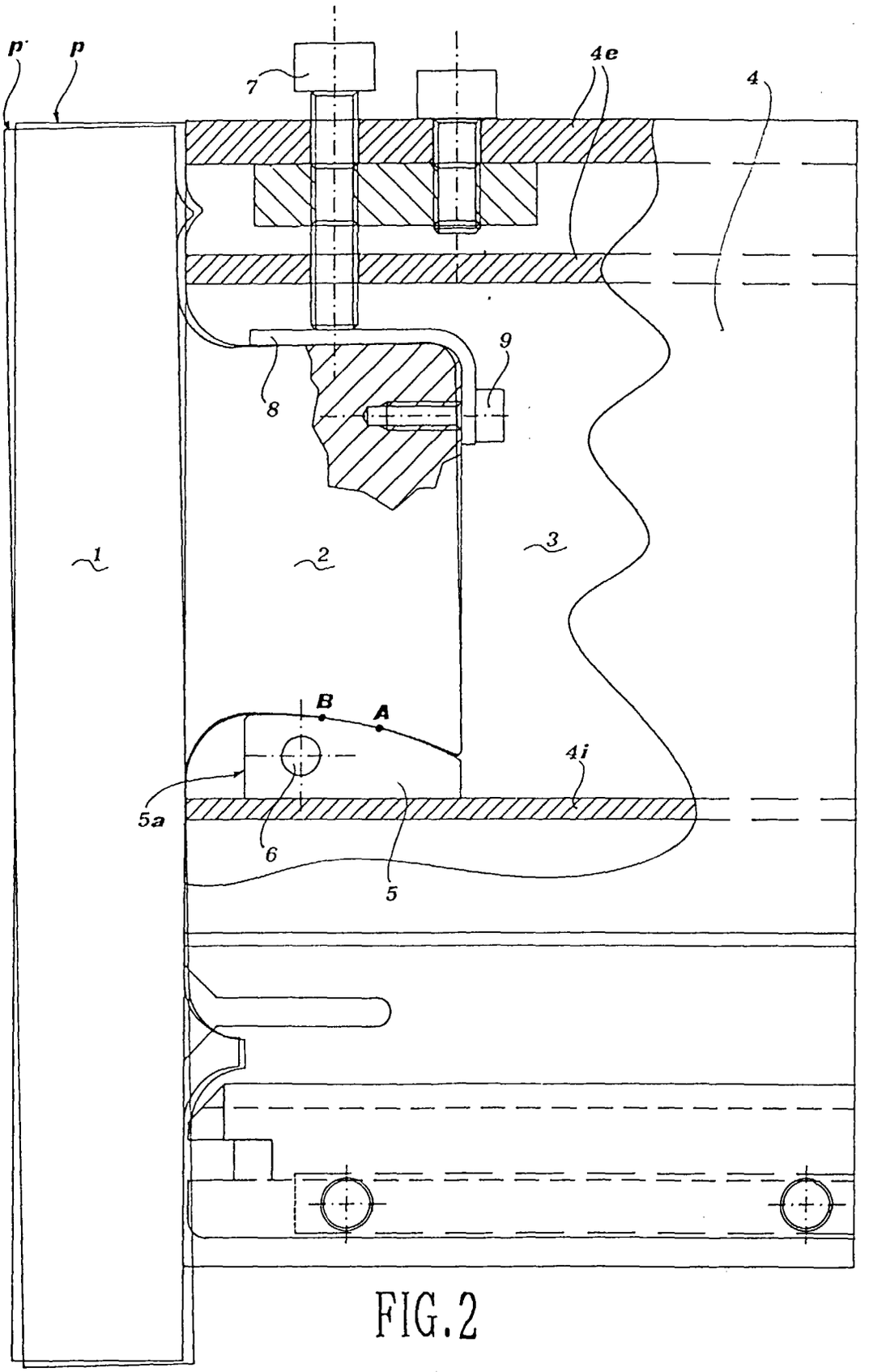


FIG.2

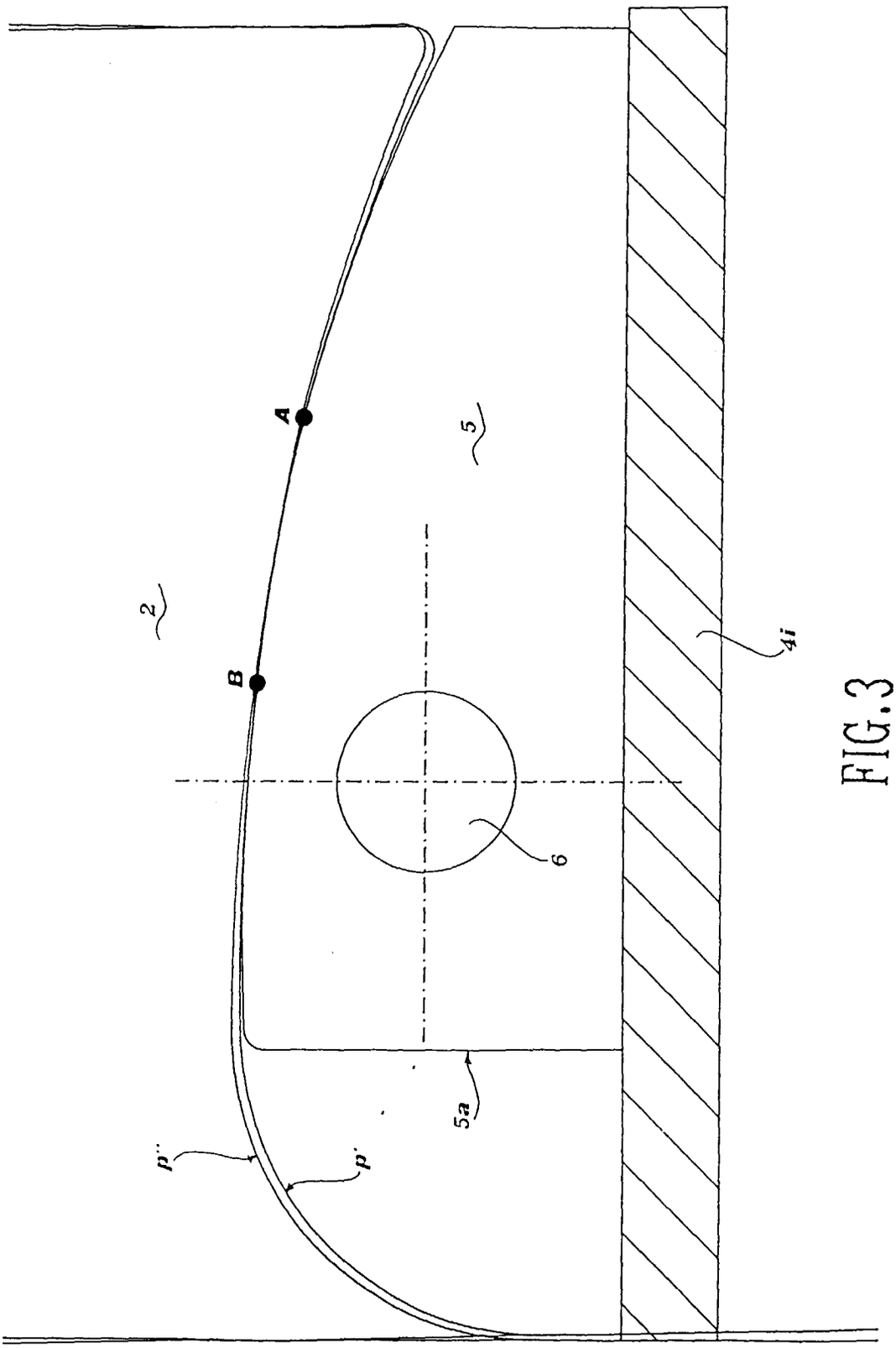


FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 12 2305

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.6)
A	DE 33 08 371 C (GROB) 30 May 1984 * the whole document * & IT 1 173 519 A (GROB)	1-3,12, 13	D03C9/06
A	WO 91 17291 A (GROB) 14 November 1991 * figures 4,5 *	1,2,4	
A	US 5 411 061 A (FAASE GENE E) 2 May 1995 * figures *	1	
A	US 5 005 607 A (SHIMIZU YOICHI) 9 April 1991		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D03C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 June 1998	Rebiere, J-L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)