



(11) **EP 1 755 801 B2**

(12) **NEW EUROPEAN PATENT SPECIFICATION**
After opposition procedure

(45) Date of publication and mention
of the opposition decision:
20.08.2014 Bulletin 2014/34

(51) Int Cl.:
B21C 37/15 ^(2006.01) **B21D 7/028** ^(2006.01)
C21D 1/673 ^(2006.01) **C21D 9/08** ^(2006.01)

(45) Mention of the grant of the patent:
27.04.2011 Bulletin 2011/17

(86) International application number:
PCT/SE2005/000687

(21) Application number: **05740415.4**

(87) International publication number:
WO 2005/110638 (24.11.2005 Gazette 2005/47)

(22) Date of filing: **13.05.2005**

(54) **A DEVICE AND A METHOD FOR SHAPING AND QUENCHING A BEAM**

VORRICHTUNG UND VERFAHREN ZUM FORMEN UND ABSCHRECKEN EINES TRÄGERS
DISPOSITIF ET PROCEDE DESTINES A FORMER ET TREMPER UNE POUTRE

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**

(30) Priority: **13.05.2004 SE 0401248**
13.05.2004 SE 0401249

(43) Date of publication of application:
28.02.2007 Bulletin 2007/09

(73) Proprietor: **Accra Teknik AB**
943 31 Öjebyn (SE)

(72) Inventors:
• **NILSSON, Lars**
973 41 Luleå (SE)
• **WIKSTRÖM, Peter**
944 73 Piteå (SE)

(74) Representative: **Müller, Eckhard**
Mühlstrasse 9a
65597 Hünfelden-Dauborn (DE)

(56) References cited:
WO-A1-97/35039 DE-C1- 10 012 974
GB-A- 770 935 JP-A- S56 134 022
SE-C2- 508 902 SE-C2- 516 762

EP 1 755 801 B2

Description

1.1 Technical field

[0001] According to an aspect of the present invention the invention relates to a method and a device for manufacturing a quenched beam.

1.2 Prior art

[0002] Increasing demands for traffic security have as one result an amended basic design of bumper beams for vehicles. Today it is common that the beam is formed of sheet metal and has a closed cross-section. This beam shape has as a result that the bumper takes up and distributes collision forces, torsional loads, strains and other forms of loads in an optimal way. The closed section, however, makes the beam voluminous and space consuming and often difficult to apply in the given space in a vehicle body.

[0003] There is a design for a bumper beam which solves these problems. It is a bumper beam for vehicles where the beam is elongated, has two ends and a closed cross-section. The beam sides are divided in a front flange directed forward in the normal direction of movement of the vehicle, a rear flange directed towards the vehicle, an upper web and a lower web. At least one portion of the rear flange, running along the beam, is impressed/intended towards at least one portion of the front flange running along the beam. The resulting indentation is complete a certain and limited distance from the beam ends and inwardly towards the beam centre portion. The inner sides of the portions are in contact with each other and hereby the beam has its greatest volume at its centre part and its smallest volume at the ends along the certain and limited distance.

[0004] A vehicle front is often curved backwards out towards the vehicle sides in order to decrease the air resistance, improve the collision force absorbing properties and make the design appealing. This prior art bumper beam has the corresponding curvature in order to optimize the use of space. The beam centre portion has a big volume and a big amount of material to be able to provide the best energy absorption possible at a collision. At its ends the beam is changed as far as shape is concerned in order to simplify the mounting of the beam to the vehicle.

[0005] Further, one has since long also desired to be able to simplify and cost-reduce the manufacture of curved and quenched beams, whereby an excellent accuracy regarding shape may be obtained if both the shaping and the quenching is performed in one and the same tool. However, it has proved difficult to design the combined shaping and quenching tools suitable for obtaining a sufficiently high cooling speed, which, especially when it comes to quenching low-alloy steels, is important for an acceptable quenching result.

[0006] It is previously known to rapidly cool a profile

element substantially shaped to a curved beam by heat transfer and heat removal by means of a cooling medium, which is passed on the outside of the beam present in the shaping tool, whereby the cooling medium is brought to pass between finger-like support means.

[0007] Previously known are thus a method and a combined shaping and quenching device in which finger-like support means are provided for supporting the beam to be shaped. A cooling medium is introduced between the finger-like support means for quenching. Although working quite satisfactory, the method and device are associated with the problem that efficient cooling and thereby quenching is prevented by the contact surfaces between the support means and the beam outer surface, the support means being quite many.

[0008] Special cooling problems are also associated with beams having grooves, channels or the like in the outer surface for improved bending and torsional rigidity properties. Such grooves etc are difficult to cool and therefore different material properties after quenching may occur in these areas.

[0009] For a better understanding it may be mentioned that by the expression profile element as it is used in the following, is meant a beam blank in the form of the tube-shaped blank with constant cross-section profile, which is collected from a roll-former plant or a similar sheet metal forming machine, and by the expression beam is meant a beam blank as well as a profile element or beam blank after that shaping and quenching of the same in a shaping tool has been performed.

[0010] In the embodiments shown and described here the profile element or beam blank is straight when it is heated and fed to the tool arrangement for shaping. However, embodiments may be imagined according to which the profile element or beam blank may be pre-formed cold or hot before it is heated and fed to the tool arrangement for shaping and quenching to a finished beam. In such cases, thus, the blank does not have to be straight and/or does not have to have a constant cross-section along the blank or profile element. Of course the tool arrangement has to be adapted accordingly.

[0011] Regarding the term curvature, as used here it should be realized that it can be a question of, starting from tube-shaped profile elements, manufacturing hollow beams, which can have both uni- and duo-curved surfaces, ie surfaces which can be curved or shaped in a number of axis directions.

[0012] Since long one has desired to be able to make the manufacture of curved and hollow beams for eg vehicle bodies more efficient and the object of the method and the device, described below, according to this aspect of the present invention is to provide a method which fulfils this desire and which, more specifically, provides an efficient cooling speed for the quenching independent of the given shape of the beam created. Another object of the invention is to provide a device for carrying out the method.

2. Brief summary of the invention

[0013] The object according to the aspect of the invention is obtained by a method and a device according to the attached claims 1 and 13 respectively. Further objects and advantages are obtained by what is specified in the respective dependent claims.

3. Brief description of the drawings

[0014] The invention will now be described below based on examples and preferred embodiments in association with and with reference to the attached drawings. Further advantages will also be described. In the drawings

- Fig. 1 shows a perspective view of a curved and quenched hollow beam with open ends manufactured according to the principles of the invention,
- Fig. 2 shows schematically a longitudinal section of a device for manufacturing the beam according to Fig. 1 in a first stage of operation,
- Fig. 3 shows schematically a longitudinal section of a device for manufacturing a beam according to Fig. 1 in a second stage of operation,
- Fig. 4 shows a cross-section of a centre portion of a tube-shaped profile element seen along the line 4-4 in Fig. 2 for manufacturing the beam according to Fig. 1,
- Fig. 5 shows a cross-section of an end portion of the beam seen along the line 5-5 in Fig. 3,
- Fig. 6 shows schematically a longitudinal section of a device in a second alternative embodiment for manufacturing a beam, having substantially closed or semi-closed ends, in a first stage of operation,
- Fig. 7 shows schematically a longitudinal section of a device in a second alternative embodiment for manufacturing a beam, having substantially closed or semi-closed ends, in a second stage of operation,
- Fig. 8 shows a cross-section of a centre portion of a tube-shaped profile element seen along the line 8-8 in Fig. 6-,
- Fig. 9 shows a longitudinal section of an end portion of the beam having substantially closed ends seen along the line 9-9 in Fig. 7,
- Fig. 10 shows schematically a longitudinal section of a portion of a device for manufacturing the beam according to Fig. 1 in a second stage of operation and

- Fig. 11 shows a cross-section of an end portion of the beam seen along the line 11-11 in Fig. 10.

4. Detailed description of preferred embodiments

[0015] In Fig. 1 a curved and quenched hollow beam 21 is shown, which is manufactured starting from a beam-shaped profile element by profilation in a profile mill or roll-former plant. As a blank for the profile element a strip or sheet has been used, which has been given the shape of said beam with a closed cross-section and showing a first opening 22 in one end portion 23 and, a second opening 22' in the other end portion 23'. The closed cross-section has in a known way been obtained by fixing the strip edges, which after the rollforming meet and abut against each other, to each other by welding, eg by soft welding, seam welding or the like. The beam 21 has been given transverse local indentations 24 and may, even if it is not shown in the Fig., be provided with longitudinal grooves to further improve the beam 21 torsional and bending rigidity. The provision of said longitudinal grooves may be of special interest in case of manufacturing bumper beams or body details for vehicles, whereby the longitudinal grooves and the transverse local indentations contribute to the beam 21 chock-absorbing properties. It must be said that the expressions "shaping" and "bending" as used in the following refers to substantially all, to the person skilled in the art known, shaping methods for a hollow profile element to a beam of a desired shape.

[0016] The beam 21 has been bent along the longitudinal axis 25, so that it shows one convex 26 and one concave 27 main side respectively. Further the beam 21 has along the concave main side 27 been given an extensive longitudinal material indentation 28, which is so arranged that the beam shows the highest profile height in the centre portion 29 and the lowest profile height at the end portions 23, 23'. On the convex main side of the beam there is arranged a number of longitudinal relatively small profiling grooves 30, which contribute both to the beam rigidity and prevents buckling of the beam. Regarding said profiling grooves 30 reference also to Fig. 4, 5 and 8, 9 is made.

[0017] In Figs. 2 and 3 a longitudinal section of a combined shaping and quenching device 31 for the manufacture of the beam according to Fig. 1 is shown.

[0018] In Fig. 2 the combined shaping and quenching device 31 in a first state of operation is shown and in Fig. 3 it is shown in a second state of operation.

[0019] The shaping and quenching device 31 comprises support parts 32:1- 32:n, which are mutually movable and which are arranged to supportingly between them receive sections of the profile element and by manoeuvring relative to each other shape the profile element between them to a beam of desired shape. Since the shaping in this case substantially occurs in a vertical plane only, the support parts are in this case carried by a by 3 designated upper, first tool part and a by 4 designated

lower, second, tool part. Operated by set and manoeuvre means 35 in the form of hydraulic cylinders the two tool parts are movable to and from each other and intended to receive and between them shape a profile element, a beam blank, heated to austenitizing temperature to a finished beam 21.

[0020] As mentioned above the upper and the lower tool parts 3, 4 are provided with the above mentioned support parts 32:1 - 32:n having as a task to both shape the pipe-shaped profile element between them to a beam and hold the thus formed beam 21 in the shaping device for a subsequent quenching step.

[0021] In Fig. 4 the blank centre portion 29 is shown in cross-section in the starting position before the shaping and seen along the line 4-4 in Fig. 2 and in Fig. 5 the end portion 23 of the beam formed by the shaping is shown in cross-section along the line 5-5 in Fig. 3.

[0022] Since the design of the tool parts 3, 4 and the support parts 32:1 - 32:n comprised thereby, substantially is governed by the pre-determined shape of the beam 21 and said support parts as such do not constitute any substantive parts of this second aspect of the present invention, the design, the positioning or their mutual movability are not described in detail. A device 31 as described above is one embodiment of a device suitable for application of this second aspect of the present invention.

[0023] As can be understood from a closer examination of Figs. 2 and 3 the shaping and quenching device 31 comprises means 36 being in close connection with, in the Figs. not shown, source for output of a forced flow of cooling medium and means 37 for receiving and in a controlled way removing of such a cooling medium. Said cooling medium preferably consists of water, which is led into the hollow beam 21 via the output means 36 and after having passed through the beam is led out from the beam via the receiving means 37. Said output means and receiving means 36, 37 respectively, are located in the lower, second tool part 4 and thereby on the tool part against which the heated profile element 27 main side 26 is intended to be bent to a concave shape. The output means 36 comprises a flushing nozzle 38 and the receiving means 37 comprises a collection nozzle 39, which nozzles 38, 39 are so arranged in relation to the finished shaped beam 21 relative position between the tool parts that the beam openings 22, 22' in the end portions 23, 23' are present in a position adjacent or substantially ending against said nozzles 38, 39 (Fig. 3). During the shaping the profile element for the beam 21 is driven or bent so that the first opening 22 in the beam end portion 23 meets and is put into flow transferring connection with the output means 36 flushing nozzle 38. In the same way the other beam end portion 23' is bent so that the other beam opening 22' meets and is put into flow transferring connection with the collecting means 37, collecting nozzle 39. In connection with the establishment of said flow transferring connections cooling medium may be led in through the beam 21 via the first opening 22 and after

passage through the beam, out via the beam other opening 22'.

[0024] For start and activation of the equipment and, thus, for generating a forced flow of cooling medium through the beam when it is finished, the shaping and quenching device comprises a detection means 40, e.g. in the form of a photocell or switch, which may be arranged to detect the tool parts 3, 4 relative positions or, as in this case, be arranged to register the presence of the beam 21 first opening 22 adjacent to the collecting means 37 collecting nozzle 39. A fast cooling of the beam 21 is thus provided hereby by leading the cooling medium via the output means into the hollow beam via the opening 22 in one end portion 23 of the beam and by leading the cooling medium out in a controlled way via the collecting means 37 and the opening 22' in the beam 21 other end portion 23' after having passed through the beam 21.

[0025] In Figs. 6 and 7 a shaping and quenching device 31 is shown in a second embodiment, which primarily is intended for shaping or bending of the type of beams 21 having substantially closed or quite limited openings, semi-closed, in the end portions 23, 23', ie beams 21 with limited passage for leading cooling medium out through the respective ends of the beam 21.

[0026] In Fig. 8 the centre portion of the blank for a beam 21 is shown in cross-section in a starting position before the shaping and seen along the line 8-8 in Fig. 6, and in Fig. 9 the manufactured beam 21 end cross-section after the shaping is shown, seen along the line 9-9 in Fig. 7. Since the design of the upper and lower tool parts 3, 4, comprised by the shaping and quenching device 31, and the support means 32:1 - 32:n comprised therein, substantially totally is determined by the predetermined shape of the beam, these will, as such, not be described in detail for a beam in this design.

[0027] Contrary to what has been described above the output means 36 flushing nozzle 38 for discharging a forced flow of a cooling medium, the nozzle in this embodiment is located adjacent to the beam 21 centre portion 29. More specifically, a number of flushing nozzles 38 arranged at angles and at a distance in relation to each other are used, the nozzles are located so that they are present turned to or ending at the main side 27 of the beam the side being concave after the shaping.

[0028] In order to make the cooling medium able to be led into the beam inner cavity via the flushing nozzles 38, the beam has at the main side 27, having been bent to a concave shape, been provided with holes 41, which serve as a first opening 22 in the beam and also for introduction of cooling medium into the beam. These holes 41 are located so that they during the shaping of the beam are driven to meet and establish flow connections with the, at a distance in relation to each other located, flushing nozzles in the lower tool part. Since the beam ends are substantially closed and allow only a limited discharge of cooling medium, not only one end of the beam is used for discharging of cooling medium but both beam end portions 23, 23'.

[0029] For collecting the cooling medium the cooling medium, which is led out from the beam 21 are, as collecting means 37, two collecting nozzles 39, 39' arranged, one of which is arranged in the area of the first opening 22 in one end portion of the beam and the other in the area of the second opening 22' in the other end portion 23' of the beam. As in the case described above the collecting means 37 collecting nozzles 39, 39' are arranged in relation to the beam relative position between the tool parts 3, 4, so that the collecting nozzles 39, 39' are present at a position just in front of or substantially running out against the first and the second opening 22, 22' respectively in the beam ends 23, 23' when the beam is finished. Consequently, flow connections are hereby also established for leading cooling medium out of the beam 21 via said collecting nozzles 39, 39' and the beam first and second 22, 22' openings, only in the finally shaped stage of the beam.

[0030] Start and activation of the equipment and generation of a forced flow of cooling medium through the beam when the beam is finished, is done via the detection means 40, which detects the tool parts 3, 4 relative positions or, as in this example, the presence of the finished beam 21 first opening 22, which in this case is formed by the two holes 41, in relation to the output means 36 flushing nozzles 38. In a similar way the detection means also detects the relative presence between the finished beam 21 second opening, in this case defined as the opening in the beam respective ends, and the collecting means 37 two collecting nozzles 39, 39'.

[0031] Fast cooling of the beam is thus provided by leading the cooling medium into the hollow beam 21 centre portion 29 via the holes 41 and, after passage through the beam cavity, leading the cooling medium out from the beam via the openings 22, 22' in the beam end portions 23, 23'. For providing an especially efficient cooling it should be realized that the holes 41 and consequently also the output means 36 flushing nozzles 38 should be located as near the beam 21 centre portion 29 as possible in case of a symmetric beam. Alternatively, the flushing nozzles 38 as well as the corresponding holes arranged in the beam 21 may be distributed in a suitable way along the beam. In case of a non-symmetrical beam, seen from the centre portion, the holes 41 are preferably located in such a way that the cooling medium flow is about the same towards the respective end portions 23, 23' of the beam.

[0032] A profile element heated to a preferred, suitable, quenching temperature or to the austenitizing temperature, for eg a boron steel about 850-900°C, is placed between the two tool parts 3, 4 and bent or in another way shaped to a beam having the shape determined by the tool shape. After shaping the profile element to a beam, it is cooled rapidly by heat removal by a cooling medium which, while the beam is still locked in the shaping tool 31, is led through the beam cavity.

[0033] With reference to Fig. 10 and 11 which are not covered by the claims an embodiment of the device is

shown, which differs from the above exemplified devices in that the cooling medium exclusively is brought to pass through the beam via one end 23, ie the opening in one beam end portion 23 is used as both a first opening 22 for leading cooling medium into the beam cavity and a second opening 22' for leading the cooling medium out of the beam. The opening, in this case, double functions are illustrated by the two arrows 45, 46 in Fig. 10 and Fig. 11.

[0034] It should be realized that when one end portion 23 of the beam 21 is used for both input and output of cooling medium in this way, the other beam end is normally closed or so restrictedly open that it does not admit the necessary passage of cooling medium. For leading cooling medium into the beam there is adjacent to the opening 22 arranged a flushing nozzle 38 for discharging a forced flow of a cooling medium, as well as a collecting nozzle 39.

[0035] Said flushing nozzle 38 and collecting nozzle 39 respectively are so arranged in relation to the beam position between the tool parts 3, 4 that they are present in a position just in front of or substantially running out against the single opening 22 in the beam end portion 23 when the beam is finished.

[0036] Above the invention has been described with reference of exemplifying and preferred embodiments. Of course further embodiments as well as minor amendments and additions may be imagined without departing from the basic inventive idea as defined in the claims.

[0037] Thus, within the inventive idea it is fully possible to have other solutions and detailed designs for parts of the device. The description given above is not to be considered as a restriction for the invention but as a guidance for full understanding of the invention in all parts and aspects. The description is focused on bumper beams but the devices and the methods may of course be used for similar shaping and manufacturing of other types of beams, ie beams for other purposes.

[0038] Further, as mentioned earlier, the profile element or beam blank does not have to be straight and/or have to have a constant cross-section but may be pre-formed cold or hot to a different shape before being heated, at least after cold pre-forming, and shaped to a finished beam shape and quenched.

Claims

1. A method for shaping and quenching hollow beams, wherein a pipe-shaped profile element, heated to a quenching temperature and preferably manufactured by rollforming, is placed in a shaping device provided by support parts, which are mutually movable and intended to supportingly receive portions of the profile element between them and by manoeuvring in relation to one another shape the profile element to a beam of desired shape, and wherein the beam thus formed is quenched by being brought into

contact with a heat removing cooling medium for heat removal, **characterized in that** cooling medium is brought to pass the beam cavity while the beam is still positioned in the shaping device.

2. A method according to claim 1, wherein the cooling medium is brought to pass the beam cavity via a first (22) and second (22') beam opening.
3. A method according to claim 1 or 2, wherein a flushing nozzle (38), being in closed connection with a source for discharging a pressurized cooling medium, is used for feeding cooling medium into the beam via a first beam opening (22).
4. A method according to claim 2 or 3, wherein a collecting nozzle (39) for receiving and leading away cooling medium is used for leading cooling medium in a controlled way out of the beam via the second opening (22').
5. A method according to claims 3 or 4 wherein the beam first opening (22) is driven to meet and thereby establish a flow connection with the flushing nozzle (38) during a finishing step of the shaping.
6. A method according to claim 4, wherein the beam second opening (22') is driven to meet and thereby establish a flow connection with the collecting nozzle (39) during a finishing step of the shaping.
7. A method according to claim 3, wherein the beam first opening (22) is driven to meet and thereby establish a flow connection with the flushing nozzle (38) by bending one main side (27, 1.2) of the beam to a concave shape in a direction towards said flushing nozzle.
8. A method according to claim 4,5,6 or 7, wherein the beam second opening (22') is driven to meet and thereby establish a flow connection with the collecting nozzle (39) by bending one main side (27, 1.2) of the beam to a concave shape in a direction towards said collecting nozzle.
9. A method according to anyone of claims 2-8, wherein one end (23) of the beam serves as a first opening for feeding a cooling medium into the beam cavity and the other beam end (23') serves as a second opening (22') for leading cooling medium out of the beam.
10. A method according to anyone of claims 2-9, wherein the beam is provided with at least one hole (41) serving as a first opening (22) in the centre portion (29), through which hole cooling medium is fed into the beam and is fed out of the beam via the second opening (22') in the beam respective ends (23, 23').

11. A method according to claim 10, wherein the hole (41) in the centre -portion (29) is provided in a step prior to the shaping and quenching steps.

- 5 12. A method according to anyone of claims 3-11, wherein an established, flow connection between the beam first opening (22) and the flushing nozzle (39) is detected by detection means (40) before the cooling medium is fed into and driven through the beam cavity.

- 10 13. A device (31) for shaping and quenching hollow beams, comprising a shaping device in which a pipe-shaped closed cross-section profile element heated to a quenching temperature and preferably manufactured by rollforming, is intended to be positioned, a number of support parts comprised by the shaping device, which support parts are mutually movable and intended to supportingly receive portions of the profile element, means for manoeuvring the support parts relative to each other and thereby shaping the profile element to a beam with a desired shape and means for quenching the beam arranged between the support parts by the provision of a cooling medium for heat removal, **characterized in that** the means for quenching of the beam comprises an output means (36), which for discharging cooling medium comprises a flushing nozzle (38) in connection with a source for discharging cooling medium, and wherein the flushing nozzle (38) has been positioned in relation to the beam finished in the shaping device, so that a flow connection is established between said flushing nozzle and a first opening (22) in the beam, whereby the cooling medium is led out via a second opening (22') in the beam. and wherein the collecting means (37) for receiving and collecting and, in a controlled way, leading cooling medium out of the beam (21) via the second opening comprises a collecting nozzle (39).

14. A device according to claim 13, wherein the shaping device support parts are carried by a first and a second, to and from each other movable tool part (3, 4) arranged for receiving the profile element and shaping the same by displacing the halves towards each other.

15. A device according to claim 14, wherein the profile element positioned between the first and the second tool part (3, 4) for shaping to a beam has a main side (27, 1.2), which is intended to be bent to a substantially concave shape against the second tool part (34).

16. A device according to anyone of claim 14 or 15, wherein the means (36) for discharging cooling medium into the beam and the means (37) for receiving and collecting and leading away in a controlled way

cooling medium from the beam, are carried by the second tool part (34).

17. A device according to anyone of claims 13-16, wherein the output means (36) for discharging cooling medium is so arranged on the second tool part (34) that the output means, when the beam is finished, is arranged in flow connection with the beam first opening present in one beam end (23).
18. A device according to anyone of claims 13-17, wherein the collection means (36) for collecting and leading away in a controlled way cooling medium is so positioned on the second tool part (34) that the collecting means, when the beam is finished, is present in flow connection with the beam second opening (22') present in the beam second end (23').
19. A device according to anyone of claims 13-16, wherein the output means (36) for discharging cooling medium is so arranged on the second tool part (34) that the output means, when the beam is finished, is present in flow connection with the beam first opening arranged as holes (41) in the beam centre mid-portion (29).

Patentansprüche

1. Verfahren zum Formen und Abschrecken von hohlen Trägern, wobei ein rohrförmiges Profilelement, auf eine Abschrecktemperatur erhitzt und bevorzugt durch Rollformen hergestellt, in einer Formgebungseinrichtung platziert wird, die durch Stützteile bereitgestellt wird, die gegenseitig bewegbar sind und Abschnitte des Profilelements zwischen sich stützend aufnehmen und durch Manövrieren relativ zueinander das Profilelement zu einem Träger gewünschter Form formen, und wobei der so geformte Träger dadurch abgeschreckt wird, dass er mit einem wärmeableitenden Kühlmedium zur Wärmeableitung in Kontakt gebracht wird, **dadurch gekennzeichnet, dass** das Kühlmedium dazu veranlasst wird, den Trägerhohlraum zu passieren, während der Träger immer noch in der Formgebungseinrichtung positioniert ist.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das Kühlmedium dazu veranlasst wird, den Trägerhohlraum über eine erste (22) und zweite (22') Trägeröffnung zu passieren.
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** eine Spüldüse (38), die mit einer Quelle zum Austragen eines unter Druck stehenden Kühlmediums in geschlossener Verbindung steht, dazu verwendet wird, Kühlmedium über eine erste Trägeröffnung (22) in den Träger einzuspei-

sen.

4. Verfahren nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** eine Sammeldüse (39) zum Aufnehmen und Wegführen von Kühlmedium verwendet wird, um Kühlmedium auf gesteuerte Weise über die zweite Öffnung (22') aus dem Träger herauszuführen.
5. Verfahren nach Ansprüchen 3 oder 4, **dadurch gekennzeichnet, dass** die erste Öffnung (22) des Trägers so angetrieben wird, dass sie während eines Fertigstellungsschritts der Formgebung die Spüldüse (38) trifft und dadurch mit ihr eine Strömungsverbindung herstellt.
6. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die zweite Öffnung (22') des Trägers so angetrieben wird, dass sie während eines Fertigstellungsschritts der Formgebung die Sammeldüse (39) trifft und dadurch mit ihr eine Strömungsverbindung herstellt.
7. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** die erste Öffnung (22) des Trägers so angetrieben wird, dass sie die Spüldüse (38) trifft und dadurch mit ihr eine Strömungsverbindung herstellt, indem eine Hauptseite (27, 1.2) des Trägers in eine Richtung zu der Spüldüse zu einer konkaven Form gebogen wird.
8. Verfahren nach Anspruch 4, 5, 6 oder 7, **dadurch gekennzeichnet, dass** die zweite Öffnung (22') des Trägers so angetrieben wird, dass sie die Sammeldüse (39) trifft und dadurch mit ihr eine Strömungsverbindung herstellt, indem eine Hauptseite (27, 1.2) des Trägers in eine Richtung zu der Sammeldüse zu einer konkaven Form gebogen wird.
9. Verfahren nach einem der Ansprüche 2-8, **dadurch gekennzeichnet, dass** ein Ende (23) des Trägers als eine erste Öffnung dient zum Speisen eines Kühlmediums in den Trägerhohlraum und das andere Trägerende (23') als eine zweite Öffnung (22') dient zum Herausführen von Kühlmedium aus dem Träger.
10. Verfahren nach einem der Ansprüche 2-9, **dadurch gekennzeichnet, dass** der Träger mit mindestens einem Loch (41) versehen ist, das als eine erste Öffnung (22) in dem Mittelabschnitt (29) dient, durch welche Öffnung Kühlmedium in den Träger eingespeist und aus dem Träger über die zweite Öffnung (22') in den jeweiligen Enden (23, 23') herausgeleitet wird.
11. Verfahren nach Anspruch 10, **dadurch gekennzeichnet, dass** das Loch (41) in dem Mittelabschnitt

(29) in einem Schritt vor den Schritten der Formgebung und des Abschreckens bereitgestellt wird.

12. Verfahren nach einem der Ansprüche 3-11, **dadurch gekennzeichnet, dass** eine hergestellte Strömungsverbindung zwischen der ersten Öffnung (22) des Trägers und der Spüldüse (38) durch Detektionsmittel (40) detektiert wird, bevor das Kühlmedium in den Trägerhohlraum eingespeist und dort hindurch geführt wird. 5
13. Einrichtung (31) zum Formgeben und Abschrecken von hohlen Trägern, umfassend eine Formgebungseinrichtung, in der ein rohrförmiges Profilelement mit geschlossenem Querschnitt auf eine Abschrecktemperatur erhitzt und bevorzugt durch Rollformen hergestellt, positioniert werden soll, eine Anzahl von Stützteilen, die von der Formgebungseinrichtung umfasst sind, wobei die Stützteile gegenseitig bewegbar sind und Abschnitte des Profilelements stützend aufnehmen sollen, Mittel zum Manövrieren der Stützteile relativ zueinander und dadurch Formen des Profilelements zu einem Träger mit einer gewünschten Form und zwischen den Stützteilen angeordneten Mittel zum Abschrecken des Trägers durch die Bereitstellung eines Kühlmediums zur Wärmeableitung, **dadurch gekennzeichnet, dass** das Mittel zum Abschrecken des Trägers ein Ausgabemittel (36) umfasst, das zum Austragen von Kühlmedium eine Spüldüse (38) aufweist, die in Verbindung mit einer Quelle für das Austragen von Kühlmedium steht, und wobei die Spüldüse (38) relativ zu dem in der Formgebungseinrichtung fertiggestellten Träger positioniert worden ist, so dass eine Strömungsverbindung zwischen der Spüldüse und einer ersten Öffnung (22) in dem Träger hergestellt wird, wodurch das Kühlmedium über eine zweite Öffnung (22') in dem Träger herausgeführt wird und dass Sammelmittel (37) zum Aufnehmen und Sammeln und Herausführen von Kühlmedium aus dem Träger (21) auf gesteuerte Weise über die zweite Öffnung eine Sammeldüse (39) umfassen. 10
14. Einrichtung nach Anspruch 13, **dadurch gekennzeichnet, dass** die Stützteile der Formgebungseinrichtung von einem ersten und einem zweiten, aufeinander zu und voneinander weg beweglichen Werkzeugteil (3, 4) getragen werden, die zum Aufnehmen des Profilelements und Formen desselben durch Platzieren der Hälften zueinander ausgebildet sind. 15
15. Einrichtung nach Anspruch 14, **dadurch gekennzeichnet, dass** das zwischen dem ersten und dem zweiten Werkzeugteil (3, 4) positionierte Profilelement zum Formen zu einem Träger eine Hauptseite (27, 1.2) aufweist, die dazu bestimmt ist, gegen das zweite Werkzeugteil (34) zu einer im Wesentlichen 20

konkaven Form gebogen zu werden.

16. Einrichtung nach einem der Ansprüche 14 oder 15, **dadurch gekennzeichnet, dass** das Mittel (36) zum Austragen von Kühlmedium in den Träger und das Mittel (37) zum Aufnehmen und Sammeln und Wegführen von Kühlmedium von dem Träger auf gesteuerte Weise von dem zweiten Werkzeugteil (34) getragen werden. 25
17. Einrichtung nach einem der Ansprüche 13-16, **dadurch gekennzeichnet, dass** das Ausgabemittel (36) zum Austragen von Kühlmedium so auf dem zweiten Werkzeugteil (34) angeordnet ist, dass das Ausgabemittel, wenn der Träger fertiggestellt ist, in einer Strömungsverbindung mit der in einem Trägerende (23) vorliegenden ersten Öffnung des Trägers angeordnet ist. 30
18. Einrichtung nach einem der Ansprüche 13-17, **dadurch gekennzeichnet, dass** das Sammelmittel (37) zum Sammeln und Wegführen von Kühlmedium auf gesteuerte Weise so an dem zweiten Werkzeugteil (34) positioniert ist, dass das Sammelmittel, wenn der Träger fertiggestellt ist, in einer Strömungsverbindung mit der in dem zweiten Ende (23') des Trägers vorliegenden zweiten Öffnung (22') des Trägers vorliegt. 35
19. Einrichtung nach einem der Ansprüche 13-16, **dadurch gekennzeichnet, dass** das Ausgabemittel (36) zum Austragen von Kühlmedium so an dem zweiten Werkzeugteil (34) angeordnet ist, dass das Ausgabemittel, wenn der Träger fertiggestellt ist, in einer Strömungsverbindung mit der ersten Öffnung des Trägers vorliegt, die als Löcher (41) in dem Zentrum des Mittelabschnitts (29) des Trägers angeordnet ist. 40

Revendications

1. Procédé pour façonner et tremper des poutres creuses, dans lequel un élément profilé en forme de tuyau, chauffé à une température de trempe et de préférence fabriqué par profilage, est placé dans un dispositif de façonnage muni de pièces de support, qui sont mutuellement déplaçables et qui sont destinées à recevoir entre elles en les supportant des portions de l'élément profilé et qui, en manoeuvrant les unes par rapport aux autres, façonnent l'élément profilé en une poutre de forme souhaitée, et dans lequel la poutre ainsi formée est trempée du fait de sa mise en contact avec un fluide de refroidissement évacuant la chaleur pour l'évacuation de la chaleur, **caractérisé en ce que** le fluide de refroidissement est amené à passer dans la cavité de la poutre alors que la poutre est encore positionnée dans le dispo- 45

sitif de façonnage.

2. Procédé selon la revendication 1, dans lequel le fluide de refroidissement est amené à passer dans la cavité de la poutre via une première (22) et une deuxième (22') ouverture de poutre. 5
3. Procédé selon la revendication 1 ou 2, dans lequel une buse de rinçage (38), en connexion fermée avec une source pour décharger un fluide de refroidissement sous pression, est utilisée pour alimenter la poutre en fluide de refroidissement via une première ouverture de poutre (22). 10
4. Procédé selon la revendication 2 ou 3, dans lequel une buse collectrice (39) pour recevoir et évacuer le fluide de refroidissement est utilisée pour évacuer le fluide de refroidissement hors de la poutre d'une manière contrôlée via la deuxième ouverture (22'). 15
5. Procédé selon la revendication 3 ou 4, dans lequel la première ouverture de poutre (22) est mue de façon à venir au contact de, et établir ainsi une connexion d'écoulement avec, la buse de rinçage (38) au cours d'une étape de finition du façonnage. 20
6. Procédé selon la revendication 4, dans lequel la deuxième ouverture de poutre (22') est mue de façon à venir au contact de, et établir ainsi une connexion d'écoulement avec, la buse collectrice (39) au cours d'une étape de finition du façonnage. 25
7. Procédé selon la revendication 3, dans lequel la première ouverture de poutre (22) est mue de façon à venir au contact de, et établir ainsi une connexion d'écoulement avec, la buse de rinçage (38) en courbant un côté principal (27, 1.2) de la poutre en une forme concave en direction de ladite buse de rinçage. 30
8. Procédé selon la revendication 4, 5, 6, ou 7, dans lequel la deuxième ouverture de poutre (22') est mue de façon à venir au contact de, et établir ainsi une connexion d'écoulement avec, la buse collectrice (39) en courbant un côté principal (27, 1.2) de la poutre en une forme concave en direction de ladite buse collectrice. 35
9. Procédé selon l'une quelconque des revendications 2 à 8, dans lequel une extrémité (23) de la poutre sert de première ouverture pour alimenter la cavité de la poutre en fluide de refroidissement et l'autre extrémité (23') de la poutre sert de deuxième ouverture (22') pour évacuer le fluide de refroidissement hors de la poutre. 40
10. Procédé selon l'une quelconque des revendications 2 à 9, dans lequel la poutre est munie d'au moins un 45

trou (41) servant de première ouverture (22) dans la portion centrale (29), à travers lequel trou le fluide de refroidissement est introduit dans la poutre et est évacué hors de la poutre via la deuxième ouverture (22') aux extrémités respectives (23, 23') de la poutre.

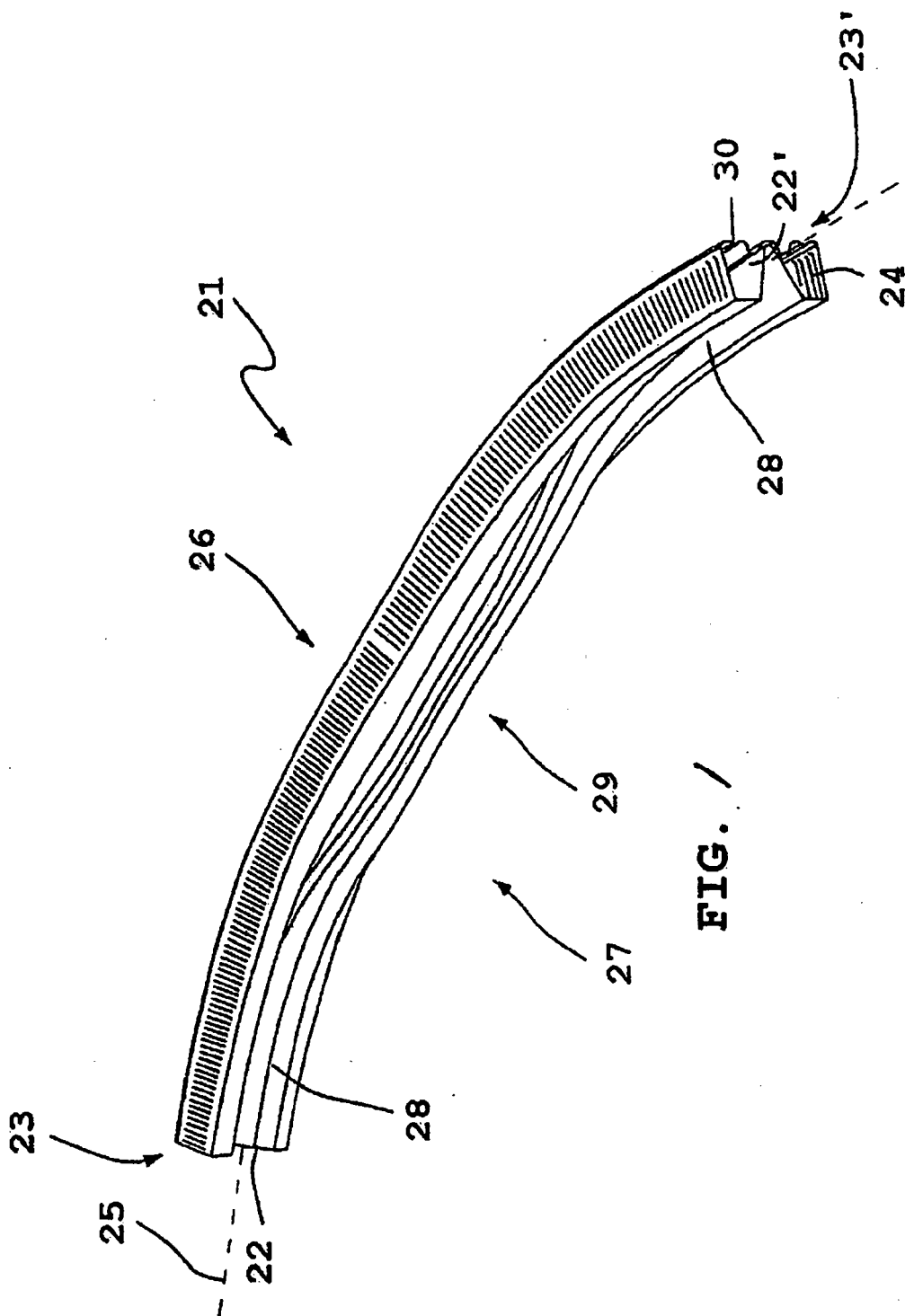
11. Procédé selon la revendication 10, dans lequel le trou (41) dans la portion centrale (29) est pratiqué lors d'une étape antérieure aux étapes de façonnage et de trempe. 50
12. Procédé selon l'une quelconque des revendications 3 à 11, dans lequel une connexion d'écoulement établie entre la première ouverture de poutre (22) et la buse de rinçage (38) est détectée grâce à un moyen de détection (40) avant que le fluide de refroidissement ne soit introduit dans, et mû à travers, la cavité de la poutre. 55
13. Dispositif (31) pour façonner et tremper des poutres creuses, comprenant un dispositif de façonnage dans lequel doit être positionné un élément profilé à section transversale fermée et en forme de tuyau chauffé à une température de trempe et de préférence fabriqué par profilage, un certain nombre de pièces de support contenues dans le dispositif de façonnage, lesquelles pièces de support sont mutuellement déplaçables et destinées à recevoir en les supportant des portions de l'élément profilé, un moyen pour manoeuvrer les pièces de support les unes par rapport aux autres et façonner ainsi l'élément profilé en une poutre de forme souhaitée, et un moyen pour tremper la poutre disposée entre les pièces de support du fait de l'apport d'un fluide de refroidissement pour l'évacuation de la chaleur, **caractérisé en ce que** le moyen pour tremper la poutre comprend un moyen de sortie (36), qui, pour décharger le fluide de refroidissement, comprend une buse de rinçage (38) en connexion avec une source pour décharger le fluide de refroidissement, et la buse de rinçage (38) ayant été positionnée par rapport à la poutre finie dans le dispositif de façonnage, de sorte qu'une connexion d'écoulement soit établie entre ladite buse de rinçage et une première ouverture (22) dans la poutre, le fluide de refroidissement pouvant ainsi être évacué via une deuxième ouverture (22') dans la poutre et dans lequel un moyen de collecte (37) pour recevoir et collecter et, d'une façon contrôlée, évacuer le fluide de refroidissement hors de la poutre (21) via la deuxième ouverture comprend une buse collectrice (39). 60
14. Dispositif selon la revendication 13, dans lequel les pièces de support du dispositif de façonnage sont portées par une première et une deuxième partie d'outil (3,4), déplaçables l'une vers l'autre ou l'une à l'écart de l'autre, disposées de manière à recevoir 65

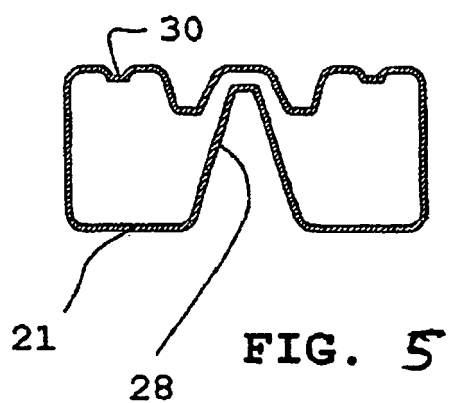
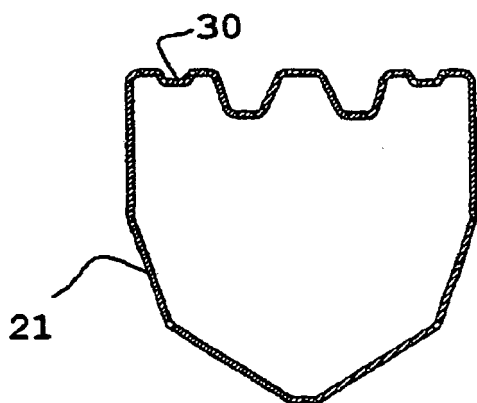
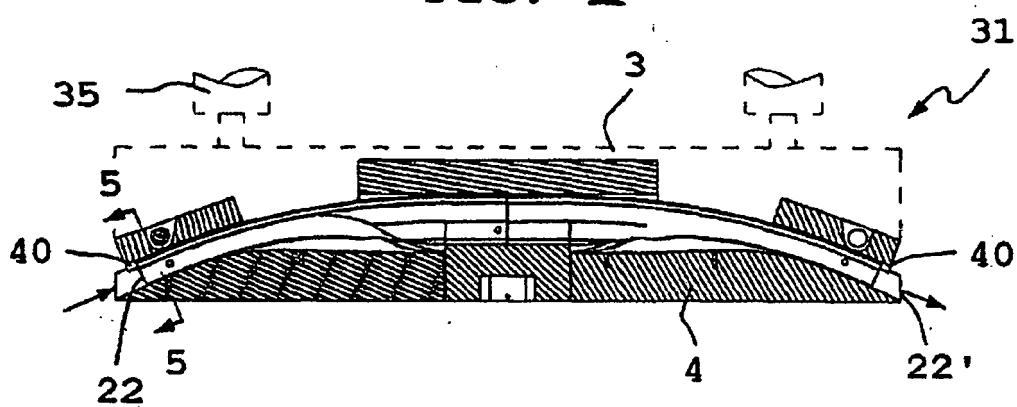
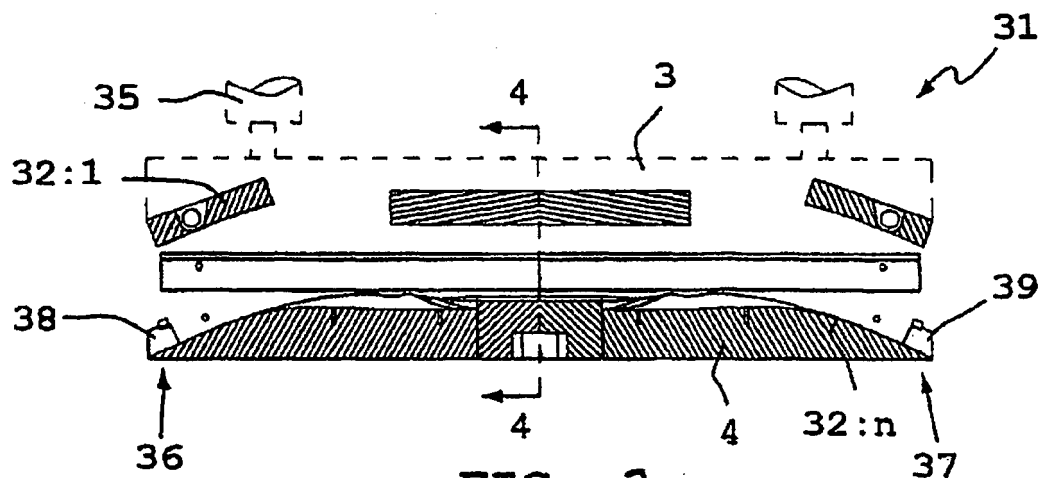
l'élément profilé et à façonner ce dernier en déplaçant les moitiés l'une vers l'autre.

15. Dispositif selon la revendication 14, dans lequel l'élément profilé positionné entre la première et la deuxième partie d'outil (3, 4) pour façonner une poutre possède un côté principal (27, 1.2), qui est destiné à être courbé en une forme substantiellement concave contre la deuxième partie d'outil (34). 5
- 10
16. Dispositif selon l'une quelconque des revendications 14 et 15, dans lequel le moyen (36) pour décharger le fluide de refroidissement dans la poutre et le moyen (37) pour recevoir, collecter et évacuer d'une façon contrôlée hors de la poutre le fluide de refroidissement sont portés par la deuxième partie d'outil (34). 15
17. Dispositif selon l'une quelconque des revendications 13 à 16, dans lequel le moyen de sortie (36) pour décharger le fluide de refroidissement est disposé sur la deuxième partie d'outil (34) de telle sorte que le moyen de sortie, lorsque la poutre est finie, soit disposé en connexion d'écoulement avec la première ouverture de poutre qui se trouve à une extrémité de la poutre (23). 20 25
18. Dispositif selon l'une quelconque des revendications 13 à 17, dans lequel le moyen collecteur (37) pour collecter et évacuer, d'une façon contrôlée, le fluide de refroidissement est positionné sur la deuxième partie d'outil (34) de telle sorte que le moyen collecteur, lorsque la poutre est finie, se trouve en connexion d'écoulement avec la deuxième ouverture de poutre (22') qui se trouve à la deuxième extrémité de la poutre (23'). 30 35
19. Dispositif selon l'une quelconque des revendications 13 à 16, dans lequel le moyen de sortie (36) pour décharger le fluide de refroidissement est disposé sur la deuxième partie d'outil (34) de telle sorte que le moyen de sortie, lorsque la poutre est finie, se trouve en connexion d'écoulement avec la première ouverture de poutre agencée sous forme de trous (41) dans la partie centrale médiane de la poutre (29). 40 45

50

55





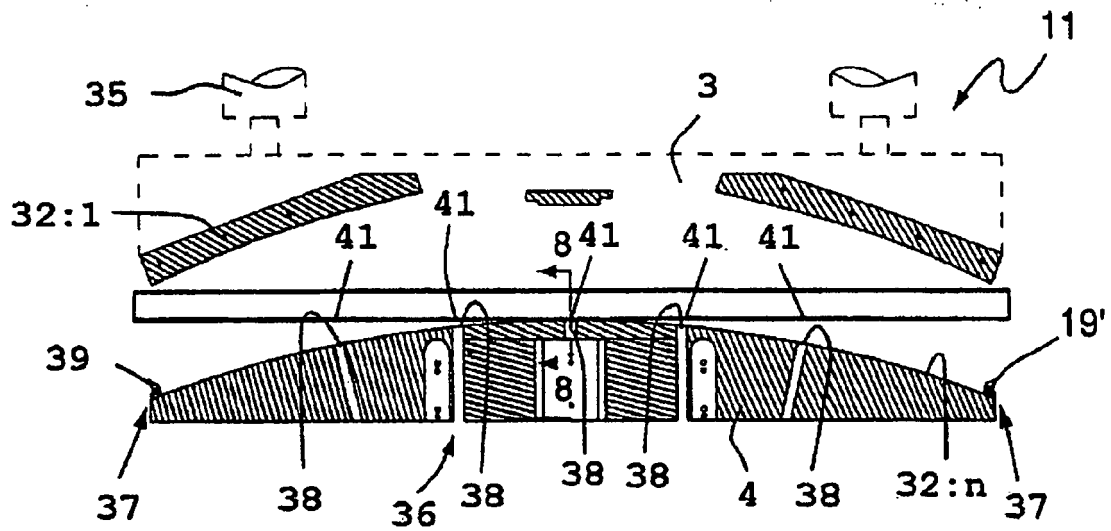


FIG. 6

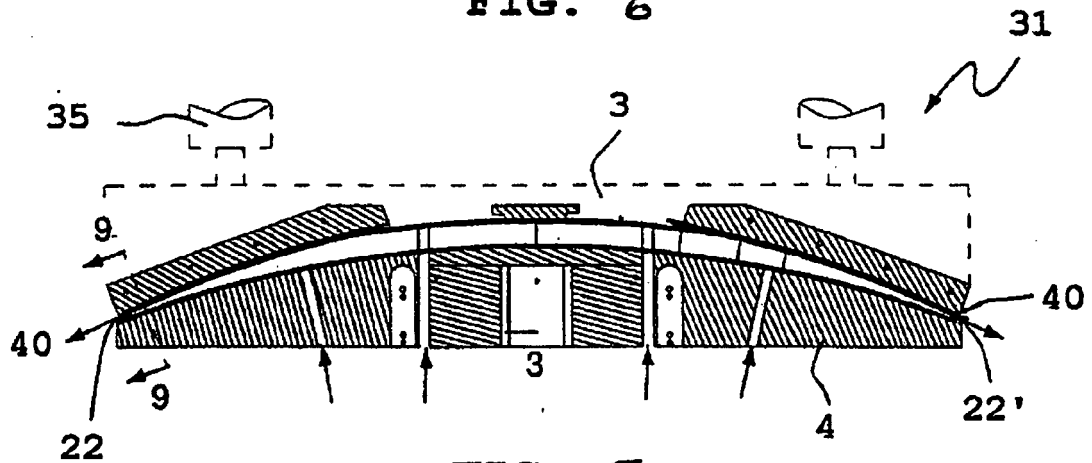


FIG. 7

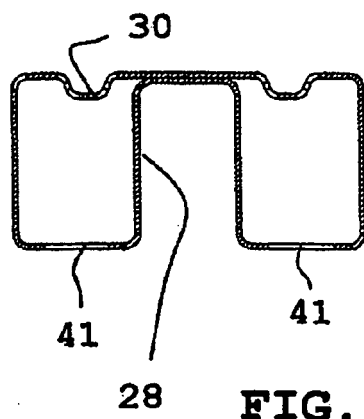


FIG. 8

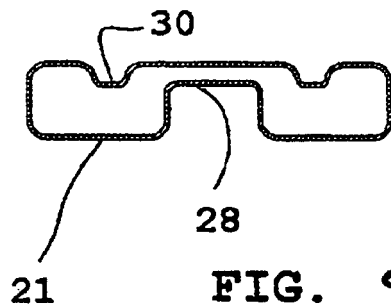


FIG. 9

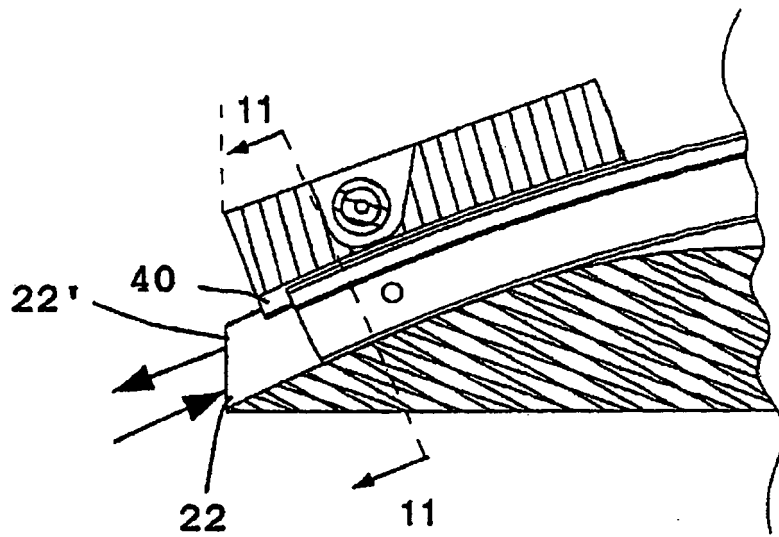


FIG. 10

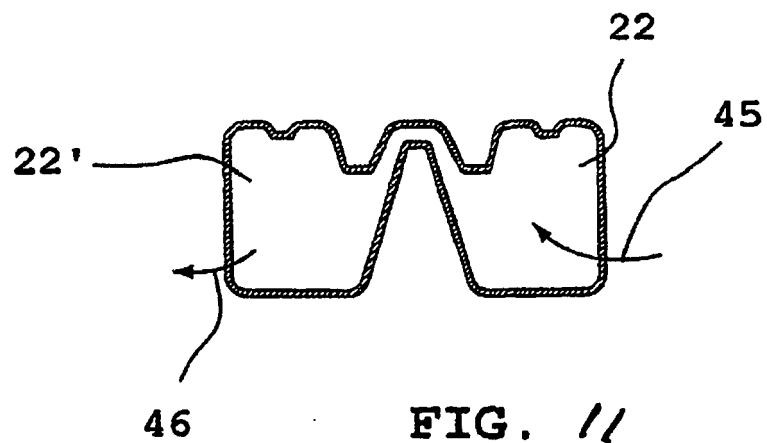


FIG. 11