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(54) **ANCHOR**

(57) An anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein a formation is provided to increase strength of the anchor when shear loaded, wherein the formation provides an I-Beam section taken diagonally across a shoulder of the anchor, at an angle substantially mid-angle between a transverse axis of the anchor and a longitudinal axis of the anchor.

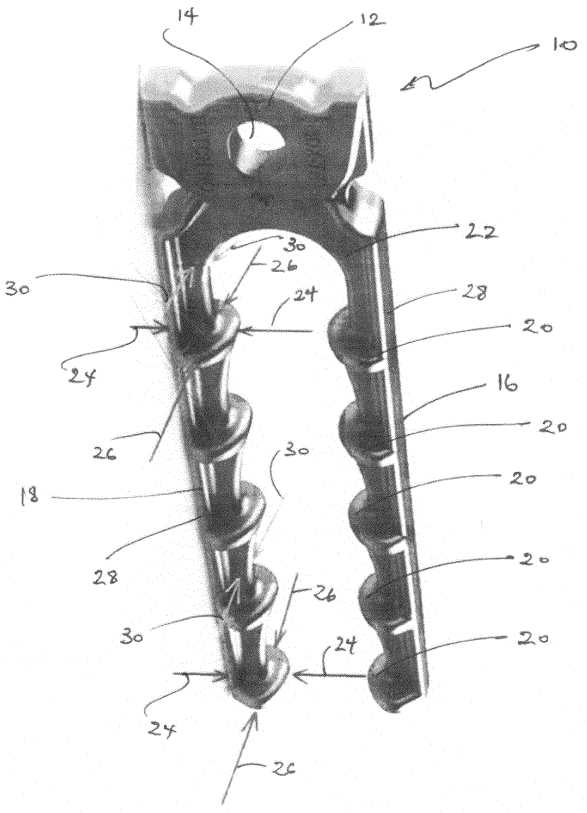

Figure 1

EP 3 988 738 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an anchor for concrete.

BACKGROUND OF THE INVENTION

[0002] It is known to provide an anchor for embedment in concrete for lifting of concrete parts. However, the applicant has identified that it would be advantageous to have an improved anchor with optimised performance.

[0003] In particular, the applicant has identified that it would be beneficial to provide an anchor with improved strength and performance by way of varying anchorage teeth profiles along the anchor and/or by varying an I-beam centre web thickness.

[0004] Examples of the present invention seek to provide an improved anchor for concrete which obviates or at least ameliorates one or more disadvantages of existing anchors.

SUMMARY OF THE INVENTION

[0005] In accordance with one aspect of the present invention, there is provided an anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein a flange is provided between the legs to increase strength of the anchor when shear loaded.

[0006] Preferably, the flange extends at least partially around a throat of the anchor.

[0007] Preferably, the flange extends along an inner periphery of the throat.

[0008] More preferably, the throat is round. In one form, the throat is substantially horseshoe shaped.

[0009] Preferably, the flange extends around an aperture for incorporating a tension bar.

[0010] It is preferred that the flange provides the anchor with a cross-section substantially in the manner of an I-Beam. More preferably, the flange provides the anchor with a cross-section substantially in the manner of an I-beam along a cross-section between the throat and an outside edge of each leg.

[0011] Preferably, the flange runs only along a head side of the throat or the tension bar aperture.

[0012] In a preferred form, the flange provides formation of an I-Beam section taken diagonally across a shoulder of the anchor, at an angle substantially mid-angle between a transverse axis of the anchor and a longitudinal axis of the anchor.

[0013] In one form, each leg has a plurality of anchorage formations along its length, and wherein a transverse dimension of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg, is varied between the formations.

[0014] In accordance with another aspect of the present invention, there is provided an anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein a formation is provided to increase strength of the anchor when shear loaded, wherein the formation provides an I-Beam section taken diagonally across a shoulder of the anchor, at an angle substantially mid-angle between a transverse axis of the anchor and a longitudinal axis of the anchor.

[0015] Preferably, the formation is in the form of a flange or rib.

[0016] In accordance with another aspect of the present invention, there is provided an anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein each leg has a plurality of anchorage formations along its length, and wherein a transverse dimension of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg, is varied between the formations.

[0017] Preferably, the anchorage formations are varied such that an anchorage formation closest to the head of the anchor has the greatest transverse dimension. More preferably, the anchorage formations are varied such that the transverse dimensions progressively reduce toward a distal end of the leg.

[0018] Preferably, the anchorage formations are in the form of a series of spaced anchorage formations.

[0019] In accordance with another aspect of the present invention, there is provided an anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein each leg has a plurality of anchorage formations along its length, and wherein a transverse dimension of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg and parallel to a plane of the anchor, is varied between the formations.

[0020] Preferably, the anchorage formations are varied such that an anchorage formation closest to the head of the anchor has the greatest transverse dimension. More preferably, the anchorage formations are varied such that the transverse dimensions progressively reduce toward a distal end of the leg.

[0021] Preferably, the anchorage formations are in the form of a series of spaced anchorage formations.

[0022] In accordance with another aspect of the present invention, there is provided an anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs

adapted for embedment within the concrete body, wherein each leg has a plurality of anchorage formations along its length, and wherein a transverse dimension of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg and transverse to a plane of the anchor, is varied between the formations.

[0023] Preferably, the anchorage formations are varied such that an anchorage formation closest to the head of the anchor has the greatest transverse dimension.

[0024] More preferably, the anchorage formations are varied such that the transverse dimensions progressively reduce toward a distal end of the leg.

[0025] Alternatively, the anchorage formations are varied such that an anchorage formation closest to a distal end of the leg has the greatest transverse dimension. Preferably, the anchorage formations are varied such that the transverse dimensions progressively increase toward a distal end of the leg.

[0026] In accordance with another aspect of the present invention, there is provided an anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein each leg has a central flange in a plane of the anchor, each leg has an outer rib extending along the leg and protruding in a direction transverse to the central flange, and wherein the central flange varies in thickness along its length.

[0027] Preferably, the central flange is thickest close to the head. More preferably, the central flange is gradually thickened from a distal end of each leg toward the head.

[0028] In a preferred form, each leg has a series of spaced anchorage formations along its length.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention is further described by way of non-limiting example only with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of an anchor in accordance with an example, depicting dimensions in which the anchorage teeth/formations and central web/flange may be varied along the legs;

Figure 2 shows a perspective view of the anchor;

Figure 3 shows a bottom perspective view of the anchor;

Figure 4 shows a side profile view of the anchor;

Figure 5 shows a front view of the anchor;

Figure 6 shows a cross-sectional view taken along line A-A shown in Figure 5;

Figure 7 shows a cross-sectional view taken along line B-B shown in Figure 5;

Figure 8 shows a top view of the anchor;

Figure 9 shows a bottom view of the anchor;

Figures 10 to 17 show an anchor according to another example, in which there is provided a flange along a periphery of a substantially horseshoe shaped throat of the anchor;

Figures 18 to 25 show an anchor in accordance with another example of the present invention, in which there is provided a flange in the form of an arch extending for a part along a periphery of a substantially horseshoe shaped throat of the anchor and being angled at either side toward an outer rib of the respective anchor leg;

Figures 26 to 33 show an anchor in accordance with an example of the present invention, in which there is provided an inner flange around a periphery of a tension bar aperture of the anchor;

Figure 34 shows a perspective view of a head end portion of an anchor similar to the one shown in Figures 10 to 17, showing in blue colour the flange extending around a periphery of the generally horseshoe shaped throat of the anchor;

Figure 35 shows a front view of the head end portion of the anchor shown in Figure 34, as well as a cross-sectional view taken across line A-A;

Figure 36 shows a perspective view of the anchor shown in Figures 10 to 17, 34 and 35.

DETAILED DESCRIPTION

[0030] As can be seen in Figures 1 to 9 of the drawings, there is shown an anchor 10 for embedment in a concrete body for lifting the concrete body. The anchor 10 includes a head 12 having an aperture 14 for engagement with a lifting device. The anchor 10 also includes a pair of legs 16, 18 adapted for embedment within the concrete body during casting of the concrete body. Each leg 16, 18 has a plurality of anchorage formations 20 along its length. A transverse dimension of the anchorage formations 20, in a direction transverse to a longitudinal direction of the respective leg, is varied between the formations 20.

[0031] Accordingly, the applicant has determined that strength and performance of the anchor 10 may be optimised by varying the anchorage formations/teeth 20 profiles along the anchor 10 and/or by varying an I-beam centre web/flange 22 thickness of the anchor 10.

[0032] As can be seen in Figure 1, the anchorage formations 20 may be varied by varying the height of the

anchorages as per the blue arrows. In one example, the anchorage formations may be taller close to the head 12 of the anchor 10. The applicant has also identified that the anchorage formations 20 may be varied by varying the width of the anchorages as per the red arrows. In one example, the anchorage formations 20 may be wider toward the head 12 or, alternatively, they may be wider toward distal ends of the legs 16, 18. The applicant has also identified that the thickness of the central web/flange 22 may be varied as per the orange arrows. In one example, the central web/flange 22 may be progressively thickened so as to be thickest close to the head 12.

[0033] With reference to the blue arrows in Figure 1, a transverse dimension 24 of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg 16, 18 and parallel to a plane of the anchor 10, is varied between the formations 20.

[0034] In one form, the anchorage formations 20 are varied such that an anchorage formation 20 closest to the head 12 of the anchor 10 has the greatest transverse dimension. The anchorage formations 20 may be varied such that the transverse dimensions 24 progressively reduce toward a distal end of the respective leg 16, 18.

[0035] The anchorage formations 20 may be in the form of a series of spaced anchorage formations 20. In one form, the anchorage formations 20 may be in the form of a series of repeated spaced anchorage formations 20, spaced at regular intervals along the lengths of the legs 16, 18.

[0036] With reference to the red arrows in Figure 1, a transverse dimension 26 of the anchorage formations 20, in a direction transverse to a longitudinal direction of the respective leg 16, 18 and transverse to a plane of the anchor 10, is varied between the formations 20.

[0037] Preferably, the anchorage formations 20 are varied such that an anchorage formation 20 closest to the head 12 of the anchor 10 has the greatest transverse dimension 26. More preferably, the anchorage formations 20 are varied such that the transverse dimensions 26 progressively reduce toward a distal end of the respective leg 16, 18.

[0038] Alternatively, the anchorage formations 20 are varied such that an anchorage formation 20 closest to a distal end of the respective leg 16, 18 has the greatest transverse dimension 26. Preferably, the anchorage formations 20 are varied such that the transverse dimensions 26 progressively increase toward a distal end of the respective leg 16, 18.

[0039] In another form of the invention, the anchor 10 has a generally I-beam form in which the anchor 10 has a central web/flange 22, as well as ribs 28 extending along outside edges of the legs 16, 18. Each leg 16 ,18 has the central flange 22 in a plane of the anchor 10, each leg 16, 18 having an outer peripheral rib 28 extending along the leg 16, 18 and protruding in a direction transverse to the central web/flange 22. The central web/flange 22 may vary in thickness along the length of the legs 16, 18 as depicted by the orange arrows 30.

[0040] Preferably, the central flange 22 is thickest close to the head 12 of the anchor 10. More preferably, the central flange 22 is gradually/progressively thickened from a distal end of each leg 16, 18 toward the head 12. With reference to Figures 5 to 7, it can be seen that the central flange 22 is thickest close to the head 12 (as shown in figure 6) when compared to the thickness of the central flange 22 close to the distal end of the leg 16, 18 (as shown in Figure 7).

[0041] In a preferred form, each leg 16, 18 has a series of spaced anchorage formations 20 along its length.

[0042] With reference to Figures 10 to 36, there are shown anchors 10 in accordance with other examples, similar to the example shown in Figures 1 to 9, and like features are depicted with like reference numerals. The main difference between the anchors 10 shown in Figures 10 to 36 when compared with the anchor 10 shown in Figures 1 to 9 is that the anchors shown in Figures 10 to 36 include a flange 32 provided between the legs 16, 18 to increase strength of the anchor 10 when shear loaded.

[0043] Also, the anchors 10 shown in Figures 10 to 36 have anchorage formations 20 having a different profile wherein the anchorage formations 20 are more square in that a central anchorage edge 34 is flatter (rather than rounded), the central anchorage edge 34 terminating at either end in a more pronounced anchorage corner 36 which flares outwardly into a larger rounded anchorage edge 38.

[0044] More specifically, with reference to Figures 10 to 36, there are shown several examples of an anchor 10 for embedment in a concrete body for lifting the concrete body, wherein the anchor 10 includes a head 12 having an aperture 14 for engagement with a lifting device, and a pair of legs 16, 18 adapted for embedment within the concrete body. The flange 32 is provided between the legs 16, 18 to increase strength of the anchor 10 when shear loaded.

[0045] In the example shown in Figures 10 to 17, the flange 32 extends at least partially around a throat 40 of the anchor. More specifically, as can be seen in Figure 12, the flange 32 extends along an inner periphery of the throat 40. It can also be seen in Figure 12 that the throat 40 is round and is substantially horseshoe shaped.

[0046] In contrast, in the example shown in Figures 18 to 25, the flange 32 has a rounded central portion 42 terminating at either side in a linear portion 44 which extends diagonally at an angle to a longitudinal axis of the anchor 10.

[0047] In the example shown in Figures 26 to 31, the flange 32 extends around an aperture 46 for incorporating a tension bar.

[0048] In all cases, as can be seen in the cross-sectional views in the representations, the flange 32 provides the anchor 10 with a cross-section substantially in the manner of an I-Beam (see figures 16, 17, 24, 25, 32 and 33). The flange 32 may provide the anchor 10 with a cross-section substantially in the manner of an I-beam

along a cross-section between the throat 40 and an outside edge of each leg 16, 18.

[0049] In one form, the flange 32 may run only along a head side of the throat 40 or the tension bar aperture 46.

[0050] As can be seen with line B-B in Figure 12, the flange 32 provides formation of an I-Beam section taken diagonally across a shoulder of the anchor 10, at an angle substantially mid-angle between a transverse axis of the anchor 10 and a longitudinal axis of the anchor 10 (that is, it may be at an angle of approximately 45° to both the transverse axis and the longitudinal axis of the anchor 10). As can also be seen in Figure 12, the flange 32 may at either end run directly into an uppermost one of the anchorage formations 20. More specifically, the flange 32 may at either end run directly into an inside peak (tip) of the uppermost anchorage formation 20.

[0051] Each leg has a plurality of anchorage formations 20 along its length. A transverse dimension of the anchorage formations 20, in a direction transverse to a longitudinal direction of the respective leg 16, 18, may be varied between the formations 20.

[0052] The flange 32 is an example of a formation provided to increase strength of the anchor 10 when shear loaded. Accordingly, the formation provides an I-Beam section taken diagonally across a shoulder of the anchor 10, at an angle substantially mid-angle between the transverse axis of the anchor 10 and the longitudinal axis of the anchor 10.

[0053] The formation may, for example, be in the form of a flange 32 or rib.

[0054] As will be appreciated from the above, Figures 10 to 36 show additional examples in which there is provided an inner flange 32 around the throat 40 (or tension bar aperture 46) of the anchor 10 to increase its strength when shear loaded. More specifically, Figures 10 to 17 show an anchor 10, in accordance with an example, in which there is provided a flange 32 along a periphery of a substantially horseshoe shaped throat 40 of the anchor 10. Figures 18 to 25 show an anchor 10, in accordance with another example, in which there is provided a flange 32 in the form of an arch extending for a part 42 along a periphery of a substantially horseshoe shaped throat 40 of the anchor 10 and being angled in a linear portion 44 at either side toward an outer rib 28 of the respective anchor leg 16, 18. Figures 26 to 33 show an anchor 10, in accordance with an example, in which there is provided an inner flange 32 around a periphery of a tension bar aperture 46 of the anchor 10.

[0055] Figures 34 to 36 also show the same anchor 10 as is shown in Figures 10 to 17, having a flange 32 along a periphery of a substantially horseshoe shaped throat 40 of the anchor.

[0056] The concept works for anchors that do not utilise a tension bar (as in New Zealand and other parts of the world) and anchors like the applicant's own existing anchor used in Australia which features a slot or hole to incorporate a tension bar.

[0057] The function is to maximise the strength of the section (shown on the drawings by a sectional view on a diagonal), by making it like an I-Beam. This zone of the anchor 10 is critical in reducing deflection of the anchor 10 under shear loading and hence increasing the shear load at which first cracks appear in the concrete panel when lifting in shear from the casting bed at minimal concrete compressive strength.

[0058] The concept is shown in the ideal state in Figures 10 to 17 and Figures 26 to 33, however this concept also covers the arrangement where the flange 32 runs around only the head side of the throat 40 (or tension bar hole 46) or slot as shown by example in Figures 18 to 25. Advantageously, the flange or rib provides the formation of an I-Beam section through Section B-B shown in the drawings (which has the same I-beam cross section as the ideal states above.)

[0059] The inner flange 32 ideally would be narrower than the outer flange provided by ribs 28 but could be the same width as the other flange or be wider than the outer flange.

[0060] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.

[0061] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

Listing of reference numerals

[0062]

10	Anchor
12	Head
14	aperture
16	leg
18	leg
20	anchorage formations
22	I-beam centre web/flange
24	transverse dimension (in plane of anchor)
26	transverse dimension (perpendicular to plane of anchor)
28	ribs
30	thickness of centre web/flange
32	flange
34	central anchorage edge
36	anchorage corner
38	rounded anchorage edge

40 throat
42 central portion
44 linear portion
46 aperture for incorporating a tension bar

Claims

1. An anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein a flange is provided between the legs to increase strength of the anchor when shear loaded.

2. An anchor as claimed in claim 1, wherein the flange extends at least partially around a throat of the anchor.

3. An anchor as claimed in claim 1 or claim 2, wherein the flange extends along an inner periphery of the throat.

4. An anchor as claimed in claim 2 or claim 3, wherein the throat is round.

5. An anchor as claimed in claim 4, wherein the throat is substantially horseshoe shaped.

6. An anchor as claimed in claim 1 or claim 2, wherein the flange extends around an aperture for incorporating a tension bar.

7. An anchor as claimed in any one of claims 1 to 6, wherein the flange provides the anchor with a cross-section substantially in the manner of an I-Beam.

8. An anchor as claimed in claim 7, wherein the flange provides the anchor with a cross-section substantially in the manner of an I-beam along a cross-section between the throat and an outside edge of each leg.

9. An anchor as claimed in any one of claims 1 to 8, wherein the flange runs only along a head side of the throat or the tension bar aperture.

10. An anchor as claimed in any one of claims 1 to 9, wherein the flange provides formation of an I-Beam section taken diagonally across a shoulder of the anchor, at an angle substantially mid-angle between a transverse axis of the anchor and a longitudinal axis of the anchor.

11. An anchor as claimed in any one of claims 1 to 10, wherein each leg has a plurality of anchorage formations along its length, and wherein a transverse dimension of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg, is varied between the formations.

12. An anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein a formation is provided to increase strength of the anchor when shear loaded, wherein the formation provides an I-Beam section taken diagonally across a shoulder of the anchor, at an angle substantially mid-angle between a transverse axis of the anchor and a longitudinal axis of the anchor.

13. An anchor as claimed in claim 12, wherein the formation is in the form of a flange or rib.

14. An anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein each leg has a plurality of anchorage formations along its length, and wherein a transverse dimension of the anchorage formations, in a direction transverse to a longitudinal direction of the respective leg, is varied between the formations.

15. An anchor for embedment in a concrete body for lifting the concrete body, wherein the anchor includes a head having an aperture for engagement with a lifting device, and a pair of legs adapted for embedment within the concrete body, wherein each leg has a central flange in a plane of the anchor, each leg has an outer rib extending along the leg and protruding in a direction transverse to the central flange, and wherein the central flange varies in thickness along its length.

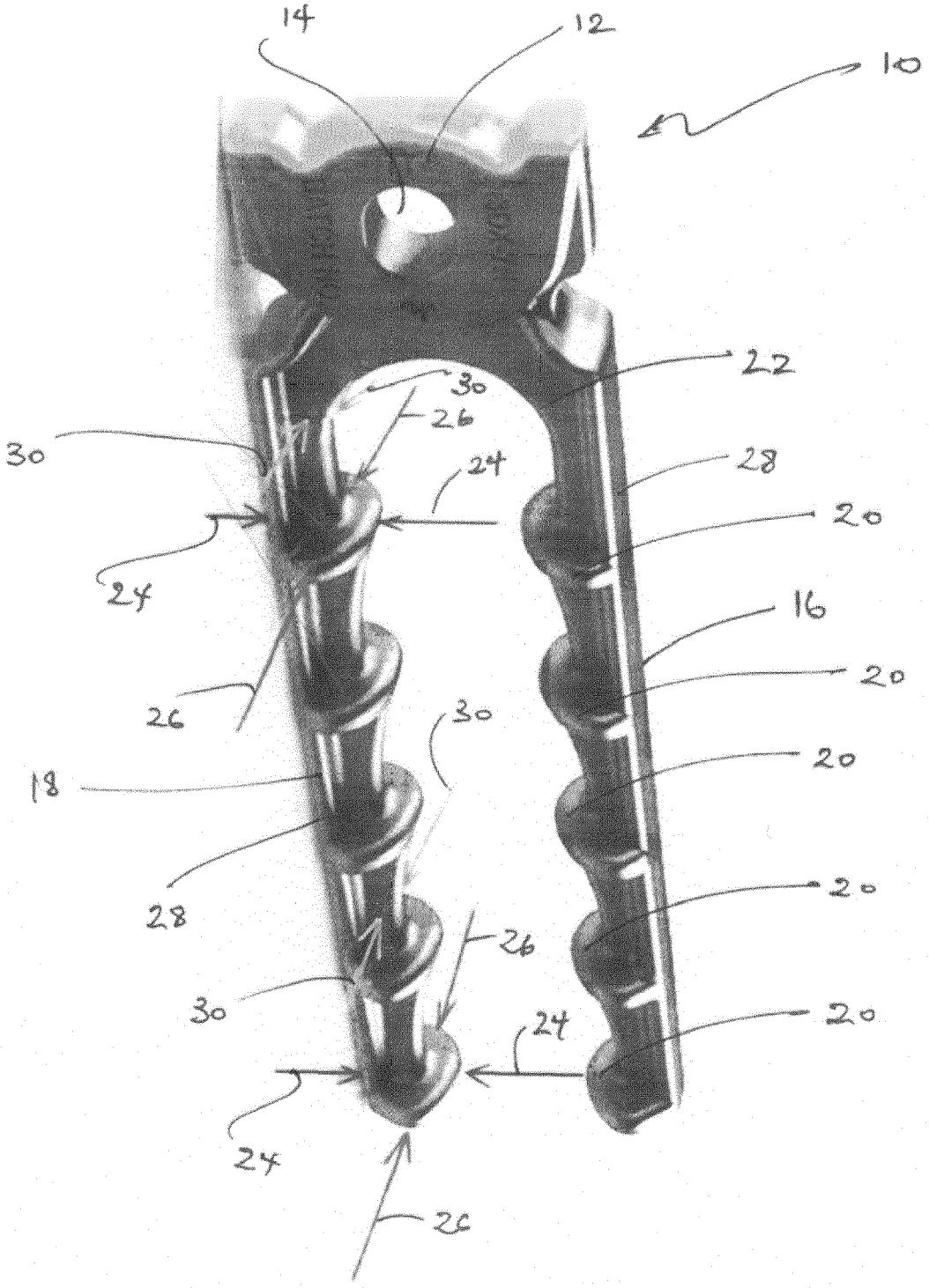
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Figure 1

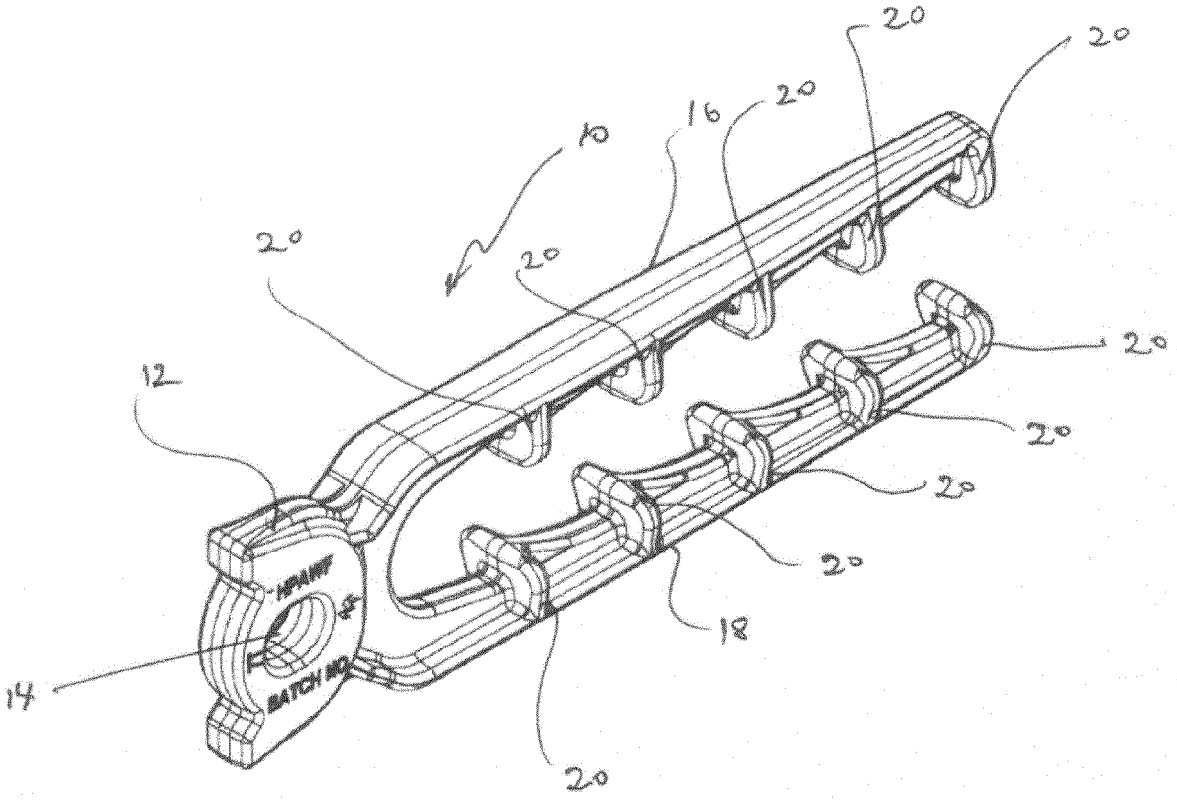

Figure 2

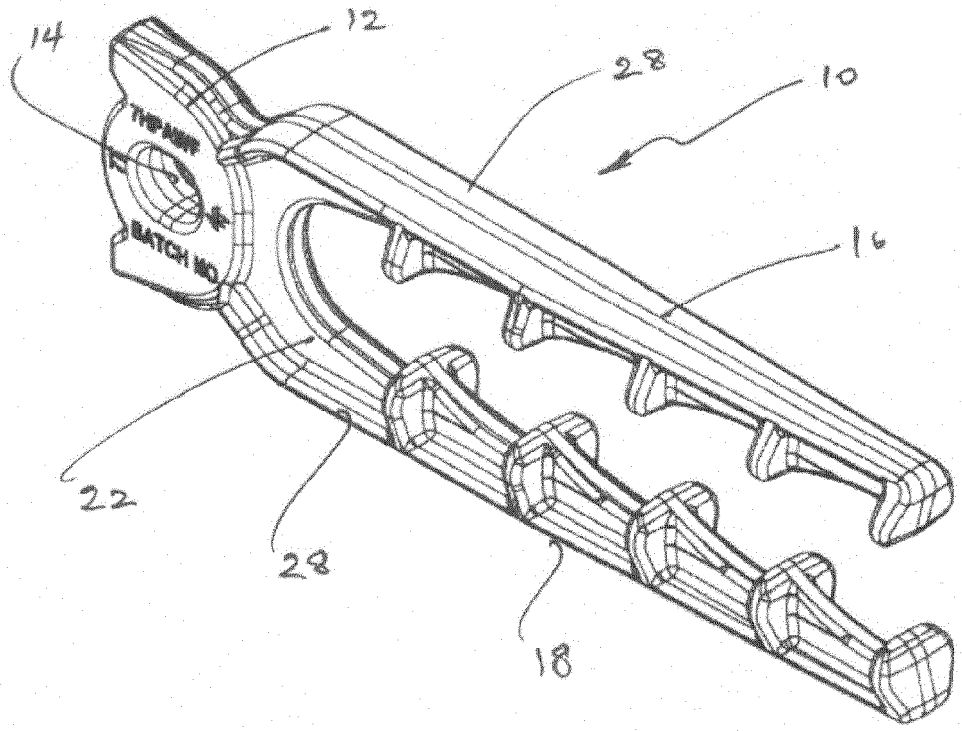

Figure 3

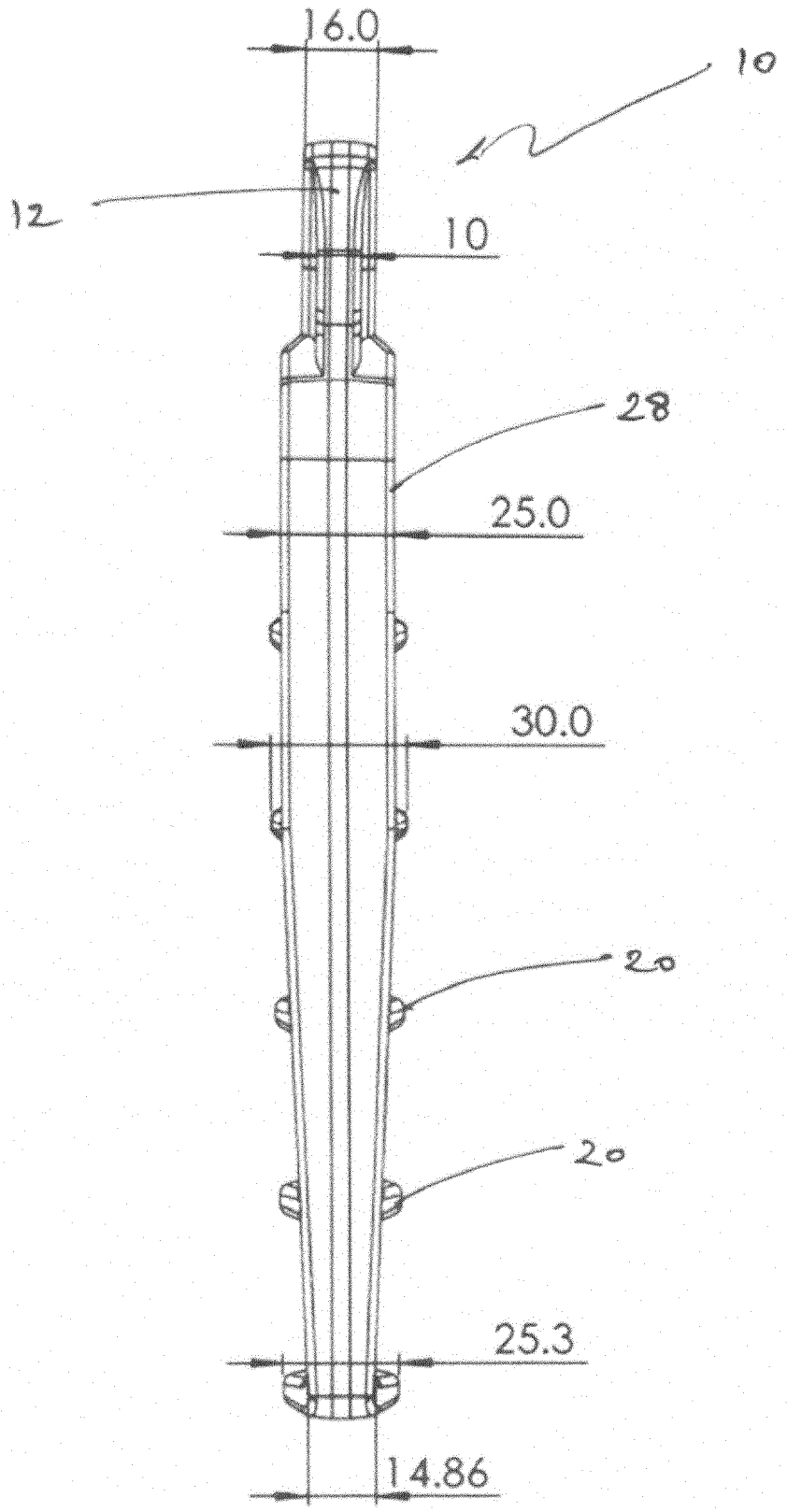

Figure 4

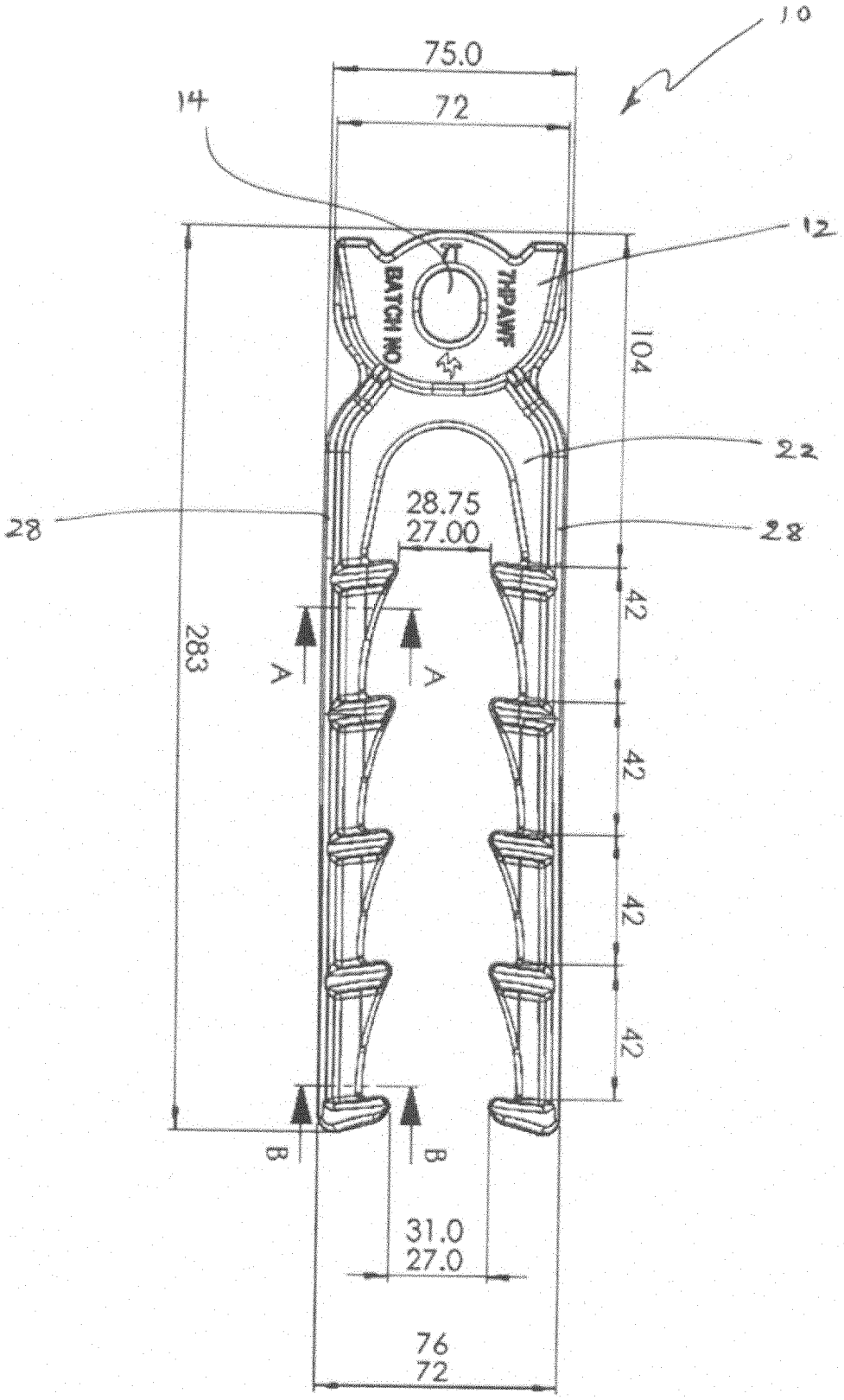
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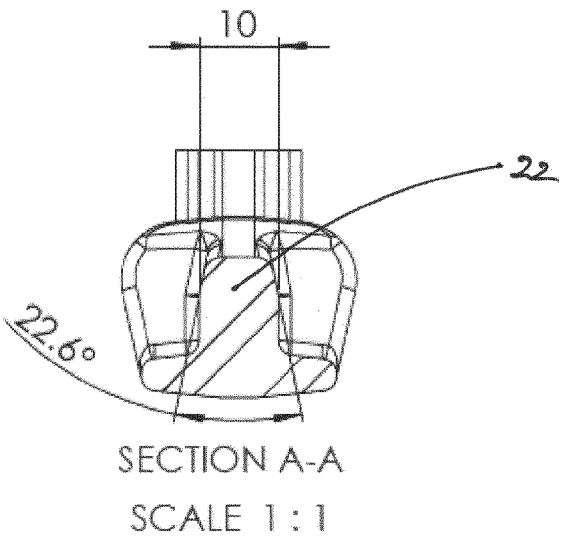
Figure 5



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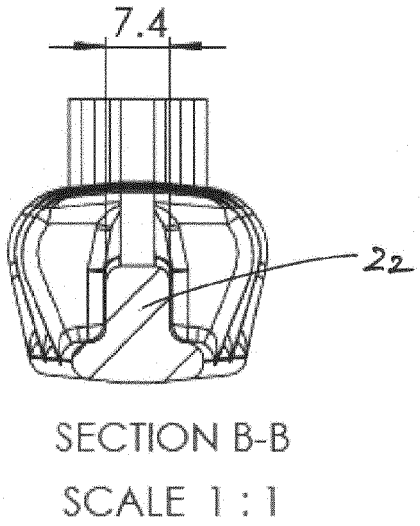

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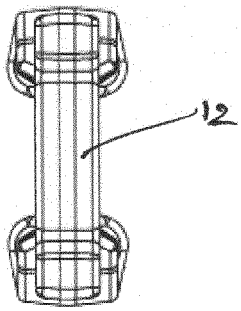


Figure 8

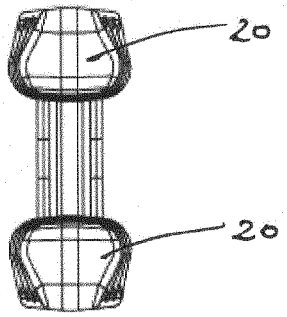


Figure 9

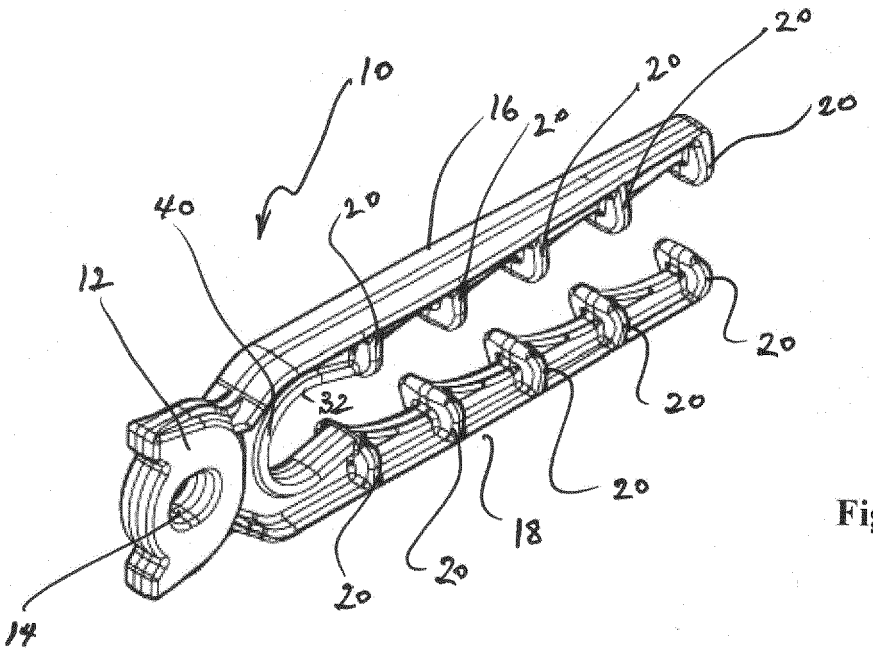


Figure 10

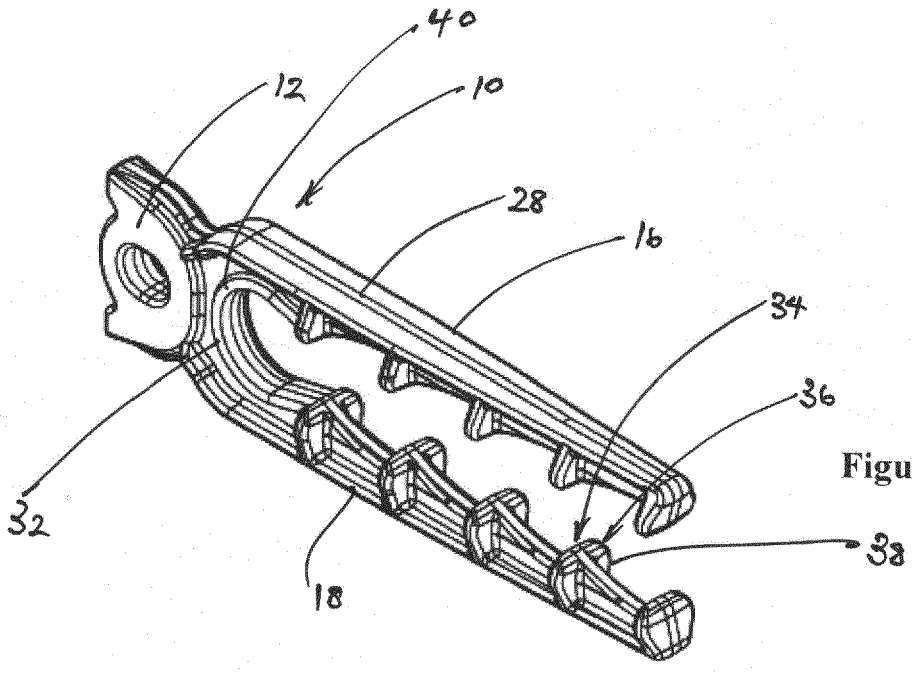


Figure 11

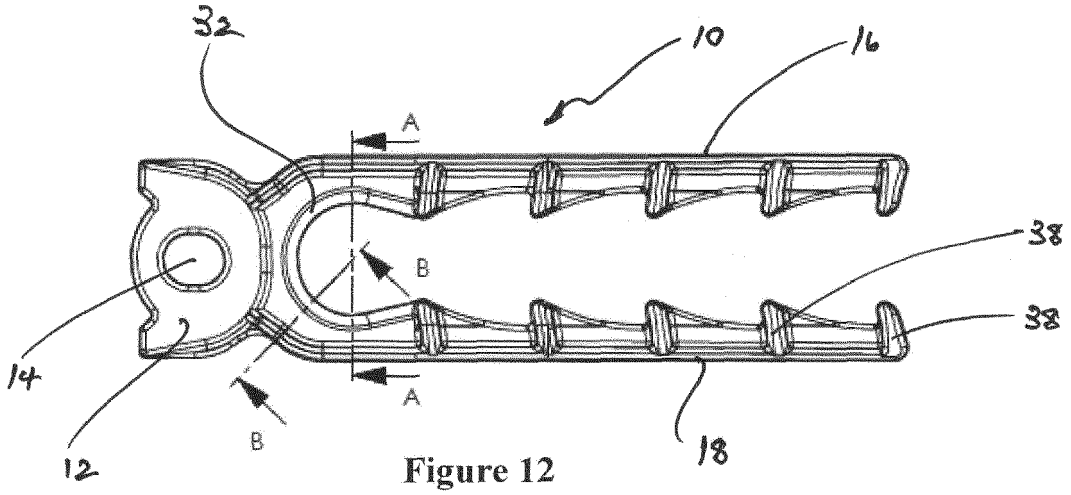


Figure 12

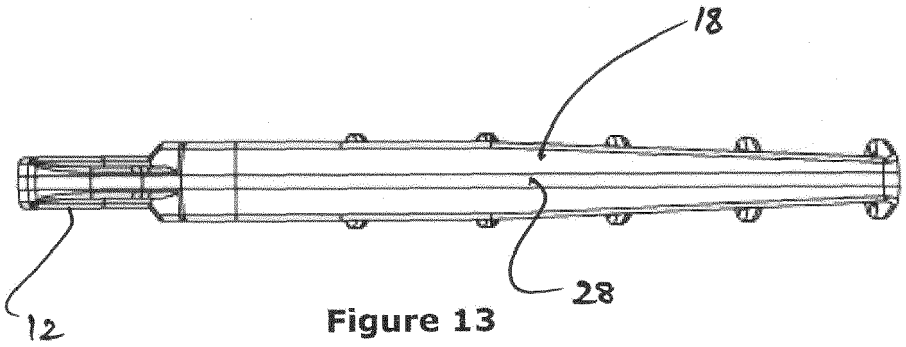


Figure 13

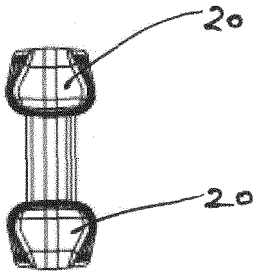
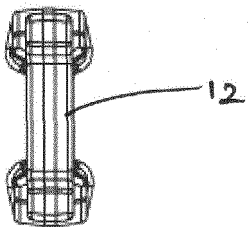


Figure 14



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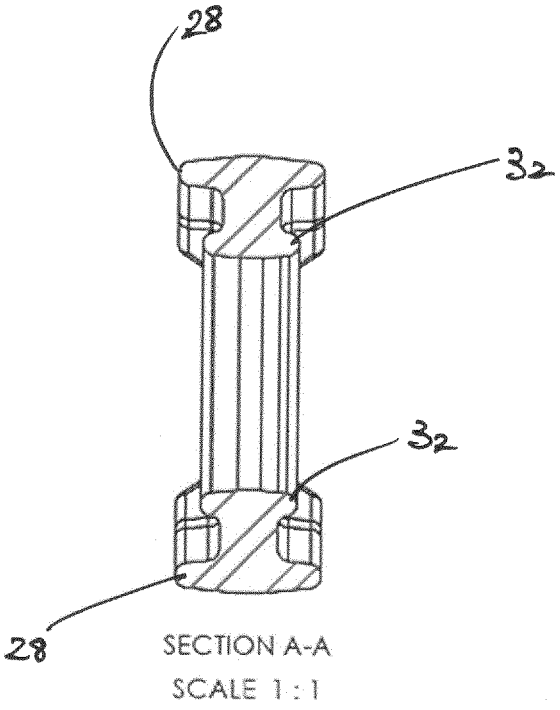

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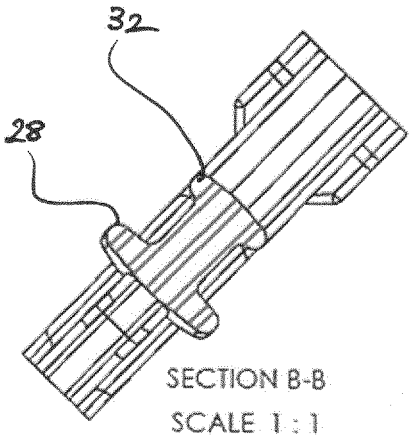

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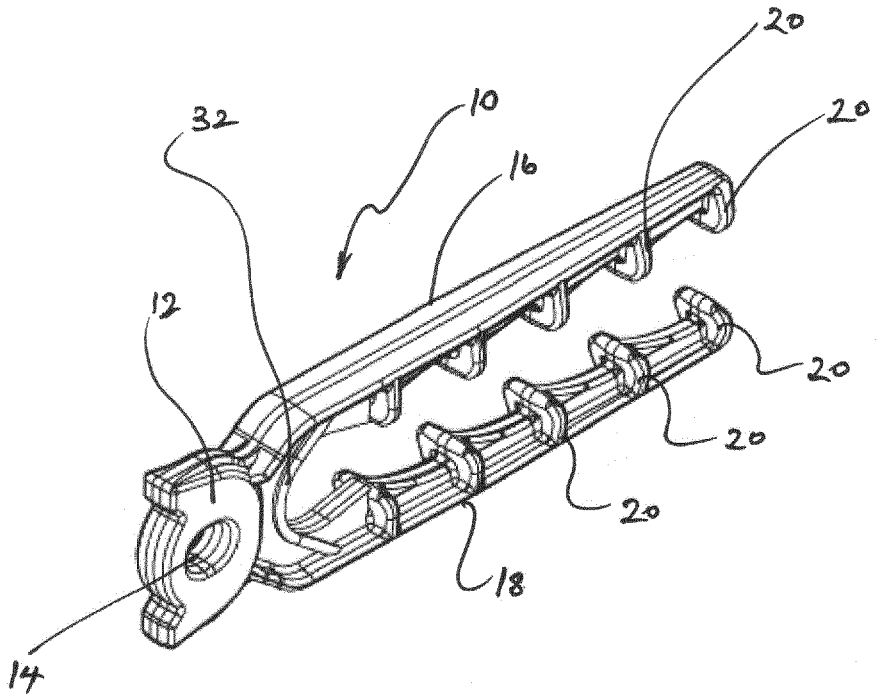

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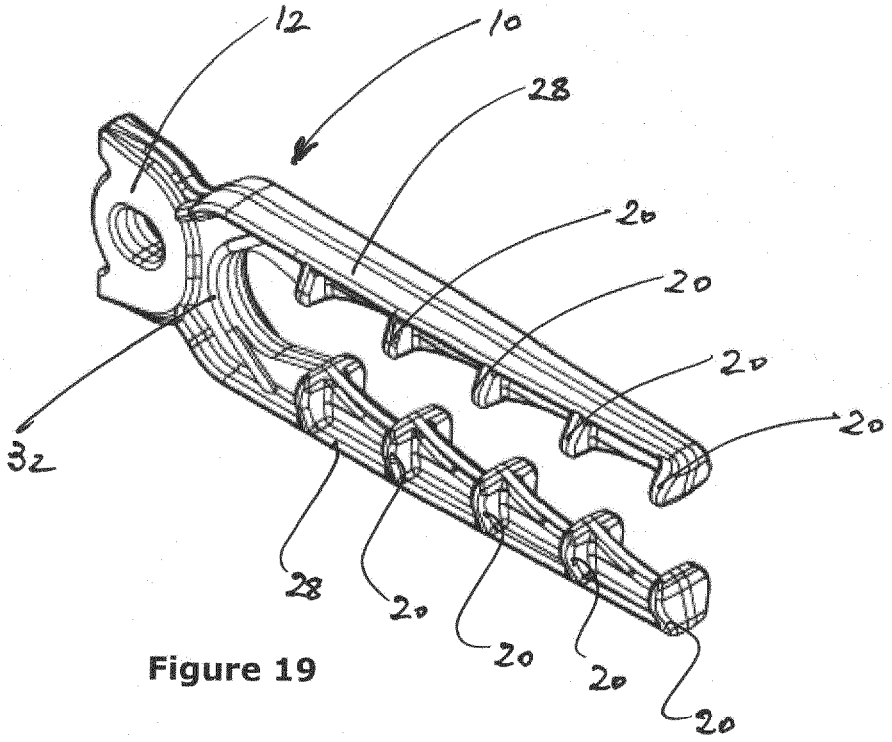

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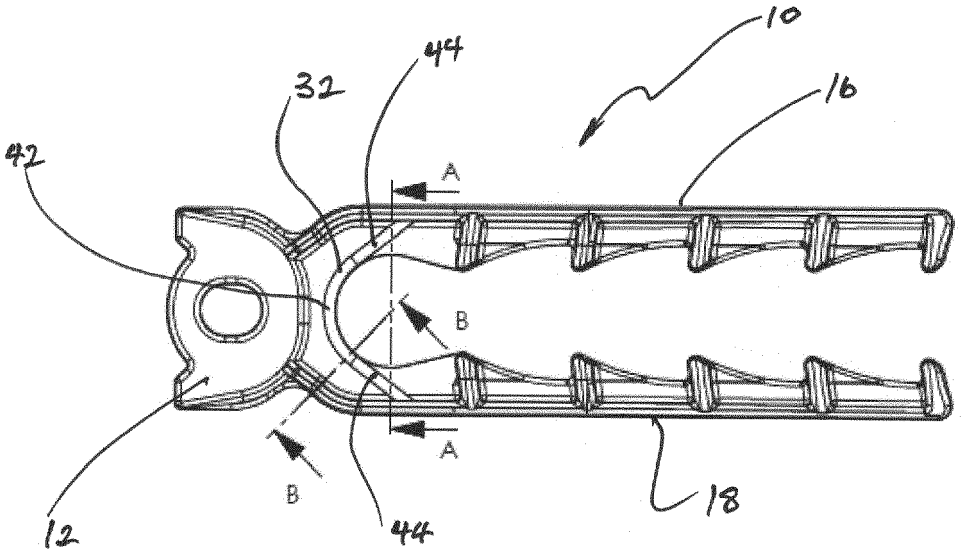

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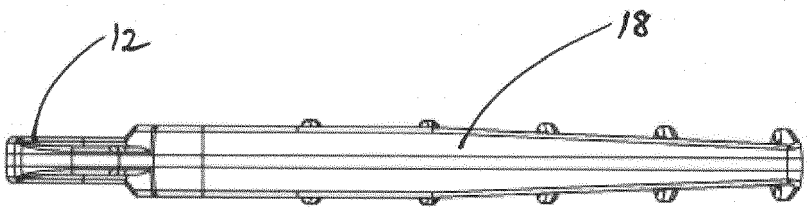

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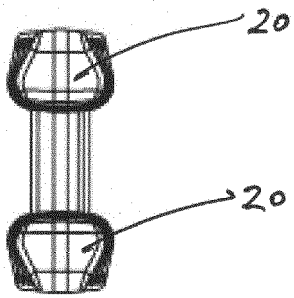

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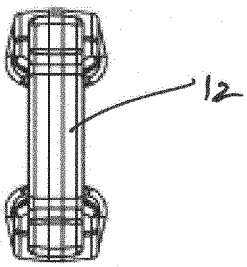

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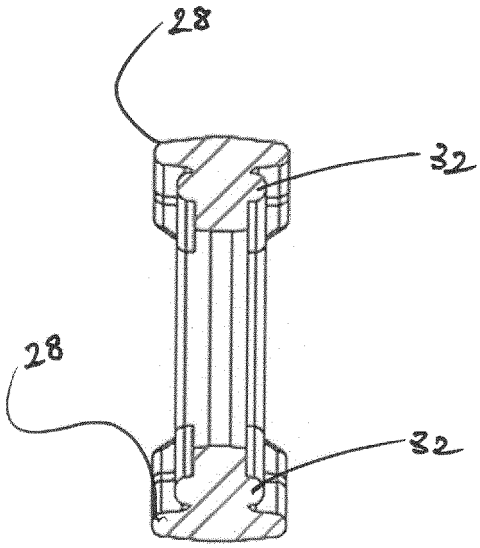

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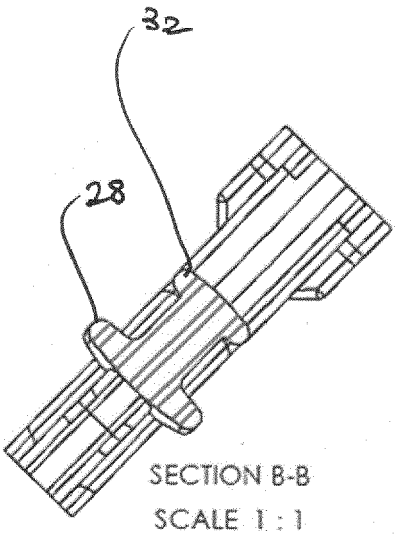

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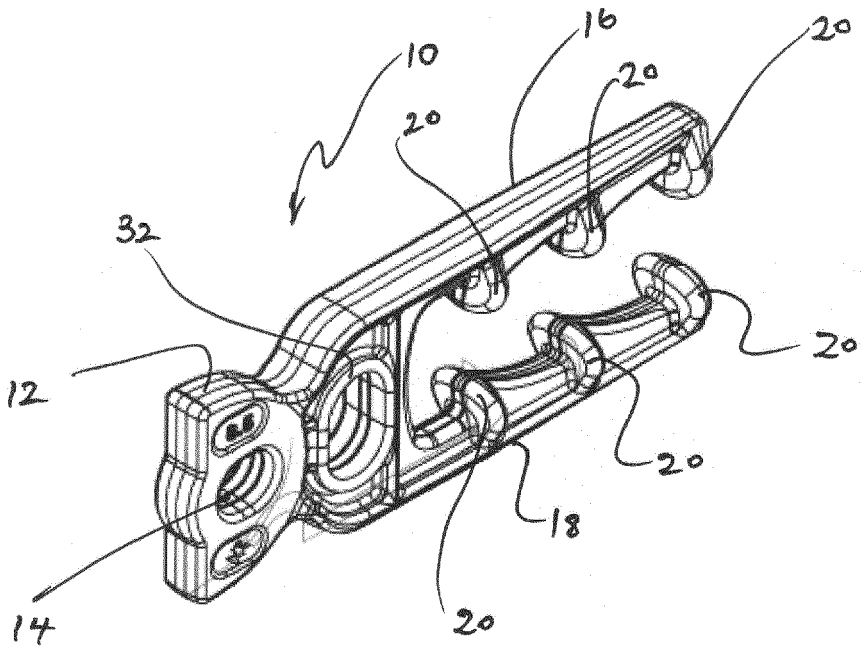

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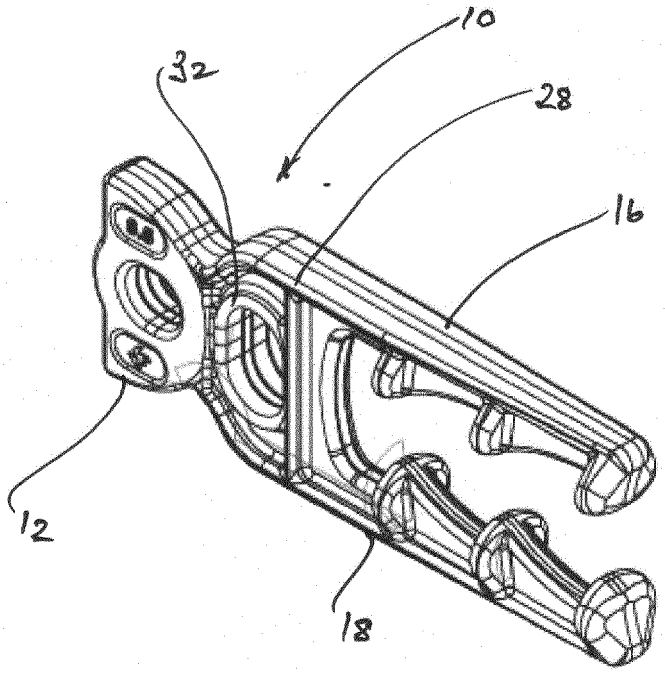

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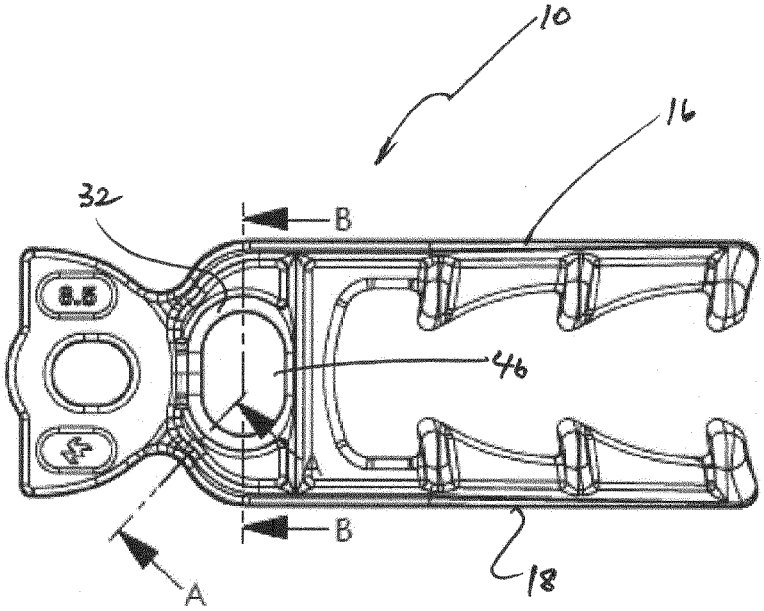

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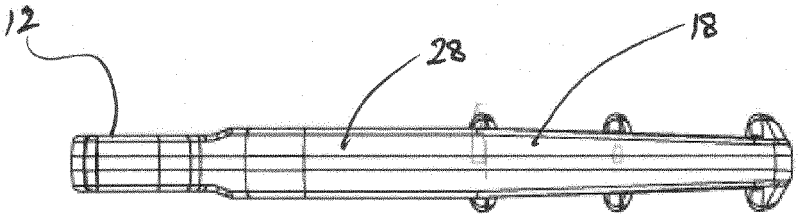
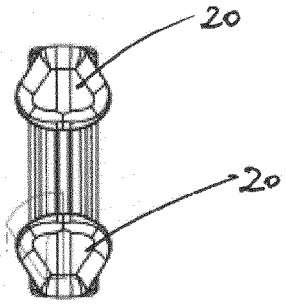


Figure 29



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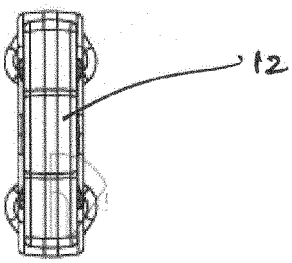

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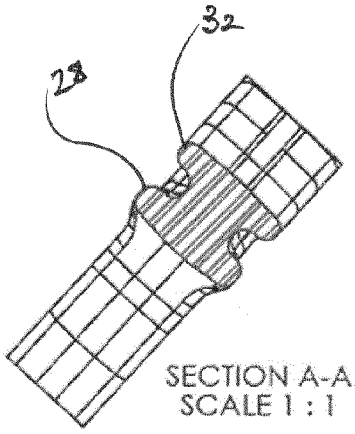
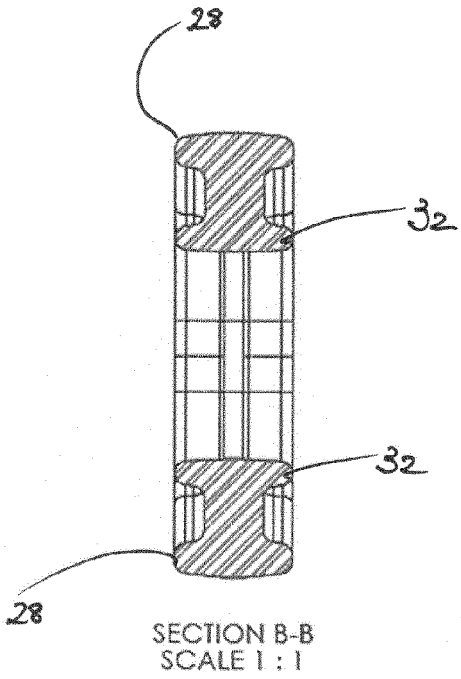


Figure 32



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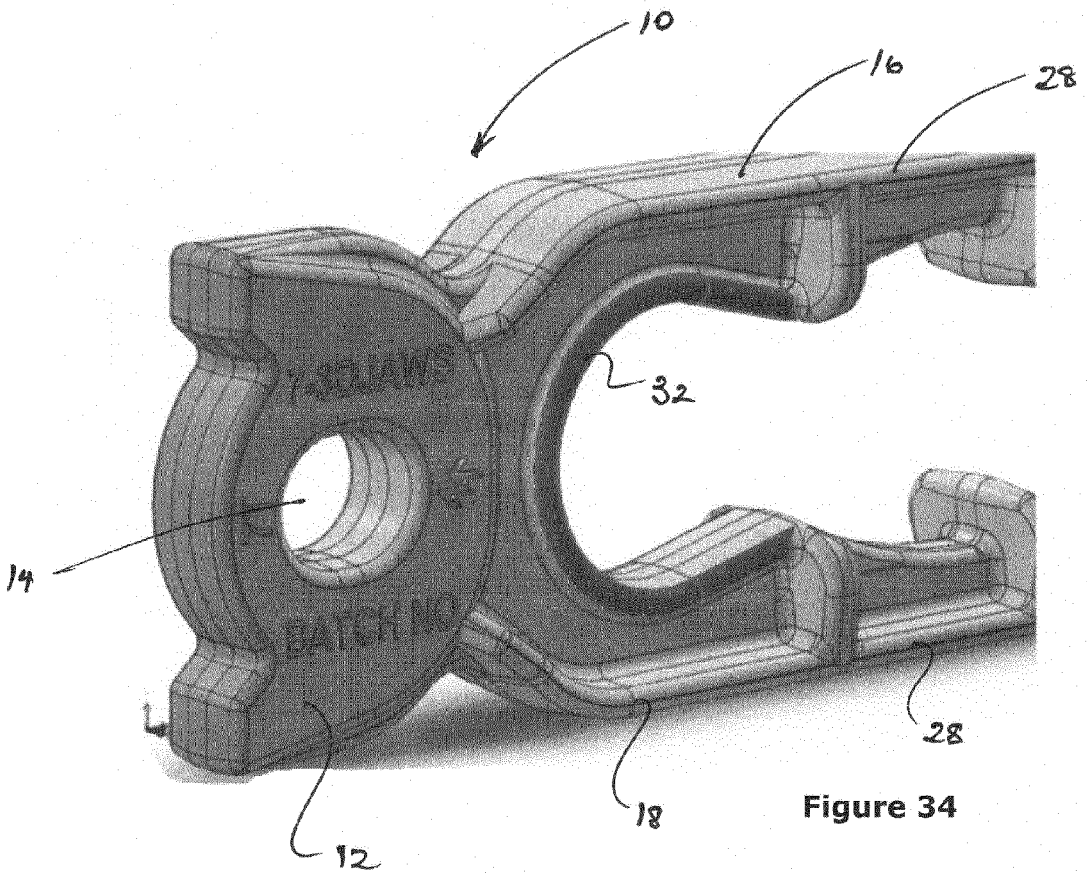

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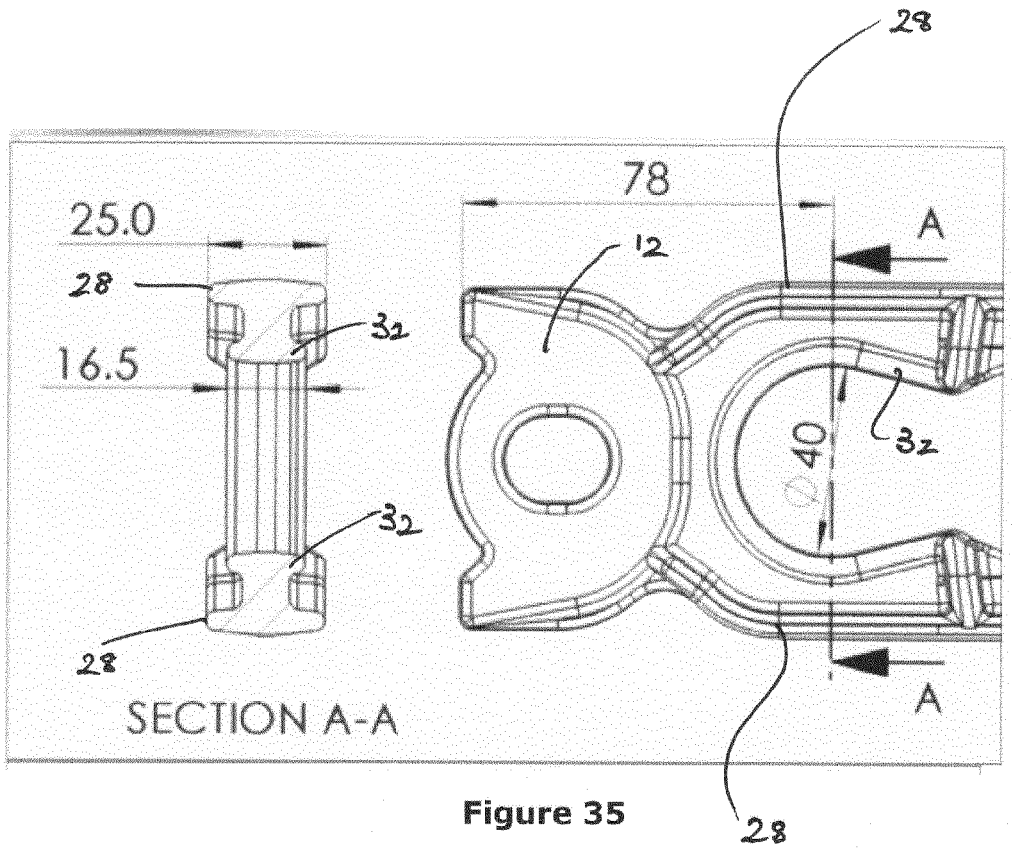

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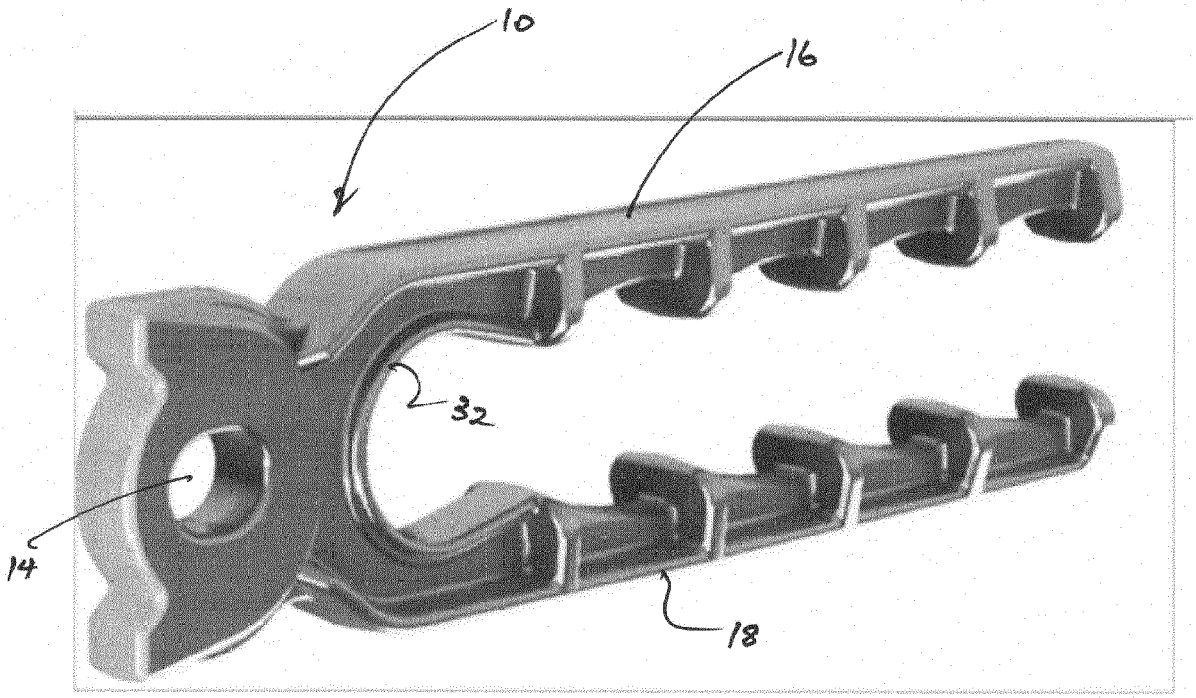

Figure 36

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 4443

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2013/163395 A1 (ILLINOIS TOOL WORKS [US]) 31 October 2013 (2013-10-31) * figure 9 * * page 8, line 9 *	1-15	INV. E04G21/14
X	AU 2019 279 923 A1 (PLASTIC SOLUTIONS AUSTRALIA PTY LTD [AU]) 25 June 2020 (2020-06-25) * figures 2, 2a-2d, 3 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

E04G
B66C
B28B
E04C

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 March 2022	Tryfonas, N

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