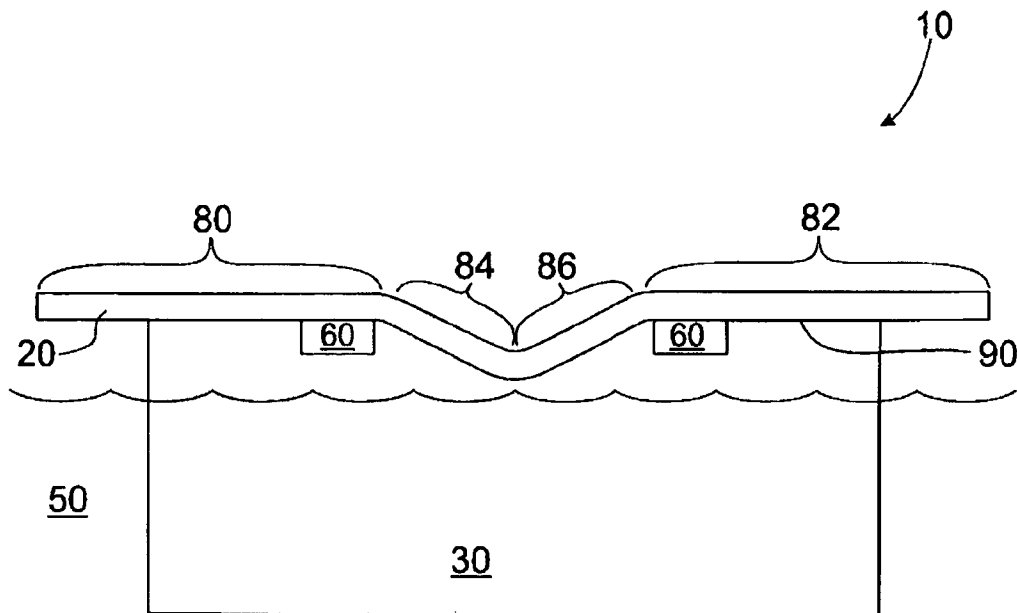




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An electrode for electrolytic processes, the electrode comprising a conducting bar and a plate attached to the conducting bar, wherein the conducting bar has a conducting member attached thereto to increase the conductivity of the conducting bar.

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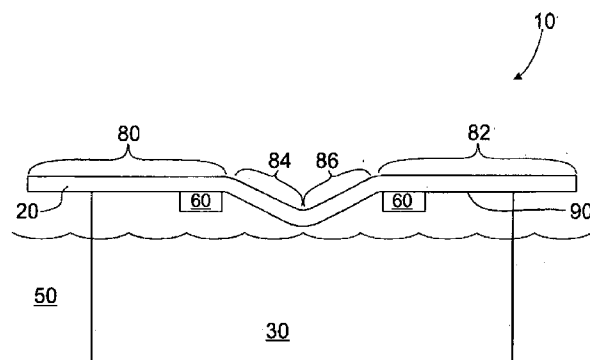


FIG. 12

TITLE

"A CATHODE AND METHOD OF MANUFACTURING"

FIELD OF THE INVENTION

This invention is concerned with an electrode for electrolytic
5 processes. The invention is concerned particularly, although not exclusively,
with a cathode for an electrolysis process.

BACKGROUND OF THE INVENTION

Cathodes for electrolytic processes consist of a conducting bar and a
plate of stainless steel or titanium placed in an electrolytic solution hanging
10 from the conducting bar.

A problem with existing cathodes is that the conducting bar made of
copper (which is a highly conductive metal) is welded to the stainless steel or
titanium plate. The problem is that such a weld is difficult to produce and has
bad resistance to acid mist which is produced, potentially resulting in the
15 weld being quickly corroded and the plate becoming detached.

A problem with replacing the copper with a different metal is that there
would be a significant voltage drop, this, multiplied by the number of
electrodes in use and the high currents increases the operating costs
substantially. One way around this is to coat a stainless steel conducting bar
20 in copper, however, the copper coating separates from the stainless steel
after a while due to the corrosion produced by the acid mist of the electrolytic
operation, leading to a larger voltage drop.

Another prior art solution is to weld the stainless steel to the copper in
a three part process where the first zone is formed of a copper-nickel alloy,

an intermediate zone of mostly a nickel alloy and a second zone of stainless steel-nickel. This results in a satisfactory solution but requires a special welding process using nickel electrodes.

Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed before the priority date of each claim of this application.

OBJECT OF THE INVENTION

It is an object of the invention to overcome or at least alleviate one or more of the above problems and/or provide the consumer with a useful or commercial choice.

Other preferred objects of the present invention will become apparent from the following description.

SUMMARY OF THE INVENTION

In one form, although it need not be the only or indeed the broadest form, the invention resides in an electrode for electrolytic processes, the electrode comprising:

a conducting bar; and

a plate attached to the conducting bar;

wherein the conducting bar has a conducting member attached thereto to increase the conductivity of the conducting bar.

Preferably, the electrode is a cathode. More preferably, the cathode can be used for electrolytic processes of copper production.

Preferably, the electrolytic processes are electrolytic processes of copper production. For example, copper electro refining or electro winning.

5 Preferably, the conducting bar is made of stainless steel. Alternatively, the conducting bar may be made from another suitable metal or alloy, such as titanium. It will be appreciated that the conducting bar may also be referred to as a hanger bar. Preferably the conducting member is attached to the conducting bar by welding. The conducting bar preferably has an inside
10 surface. Preferably the conducting bar is hollow. More preferably the conducting bar has a tubular shape that is made by roll forming.

Roll forming is typically a continuous bending operation in which a long strip of sheet metal is passed through sets of rolls mounted on consecutive stands, each set performing only an incremental part of the
15 bend, until the desired cross-section profile is obtained. Design of the rolls used in the roll forming operation typically starts with a flower formation, which is the sequence of profile cross-sections, one profile for each stand of rolls.

Preferably the conducting member is made of copper or a copper
20 alloy. Alternatively, the conducting member may be made from another suitable metal or alloy having low resistivity. Typically the conducting member is welded to an inside surface of the conducting bar. Preferably the conducting member is welded to an inside surface of the conducting bar before the conducting bar is formed. For example, the conducting member is

welded to a sheet or plate which is then roll formed into a conducting bar.

Preferably the plate is made from stainless steel. Alternatively, the plate may be made from another suitable metal or alloy, such as titanium.

Preferably the conducting bar is made from the same material as the
5 plate. More preferably the conducting bar and plate are made of stainless steel. Typically the plate is welded to the conducting bar. Alternatively, the plate may be integrally formed with the conducting bar.

In one embodiment, the conducting bar may have a first and second
portion substantially in axial alignment, a third portion axially offset from the
10 first and second portion, a fourth portion disposed between the first and third portion and a fifth portion disposed between second and the third portion. Typically the plate is attached to the third portion. Preferably the axis of the third portion is below the level of the axis of the first and second portion. A benefit of this is that more of the plate can be in contact with an electrolyte
15 solution. Preferably the conducting bar is roll formed into such a shape.

In another form, the invention resides in a method of manufacturing an electrode, the method including the steps of:

attaching a conducting member to an inside surface of a conducting
bar; and

20 attaching a plate to the conducting bar.

Preferably the step of attaching the conducting member to an inside surface of the conducting bar involves welding the conducting member to the conducting bar.

Preferably the step of attaching the plate to the conducting bar

involves welding the plate to the conducting bar.

Preferably the method includes the step of forming the conducting bar into a hollow shape and/or a tubular shape. Preferably, the step of forming the conducting bar into a hollow shape and/or a tubular shape involves roll forming the conducting bar.

Preferably the method includes the step of forming the conducting bar such that a first and second portion are substantially in axial alignment, a third portion is axially offset from the first and second portion, a fourth portion is disposed between the first and third portion and a fifth portion is disposed between second and the third portion. Preferably, the step of forming the conducting bar into such a configuration involves roll forming the conducting bar. More preferably the method includes the step of forming the conducting bar such that a first and second portion are substantially in axial alignment, a third inclined portion and fourth inclined portion are disposed between the first and second portions, wherein the axes of the third inclined portion and fourth inclined portion are angled relative to the axes of the first and second portions. Preferably the third inclined portion and the fourth inclined portion form an obtuse angle. Alternatively the third inclined portion and the fourth inclined portion form a right angle or an acute angle. Preferably the third inclined portion is adjacent to the fourth inclined portion.

In a further form, the invention resides in an electrode for electrolytic processes, the electrode comprising:

a conducting bar; and

a plate attached to the conducting bar;

wherein at least part of the conducting bar dips below an upper edge of the plate.

Preferably at least a top part of the conducting bar dips below an upper edge of the plate. Preferably, the conducting bar has a first and second portion substantially in axial alignment, a third inclined portion and fourth inclined portion disposed between the first and second portions, wherein the axes of the third inclined portion and fourth inclined portion are angled relative to the axes of the first and second portions. Preferably the third inclined portion and the fourth inclined portion form an obtuse angle. Alternatively the third inclined portion and the fourth inclined portion form a right angle or an acute angle. Preferably the third inclined portion is adjacent to the fourth inclined portion. Preferably the third inclined portion and the fourth inclined portion are inclined inwardly relative to an upper edge of the plate.

Preferably the plate comprises at least one cut-out. Preferably the at least one cut-out is located between a plane defined by the upper edge of the plate and a plane defined by the lowest part of the conducting bar.

Preferably the conducting bar is a conducting bar as disclosed in this specification. Alternatively, the conducting bar may be made of copper and/or a copper alloy.

In another form, the invention resides in a hollow conducting bar for an electrode having:

a conducting member attached to an inside surface of the conducting bar.

7

Preferably, the conducting bar is made of stainless steel. Alternatively, the conducting bar may be made from another suitable metal or alloy, such as titanium. Preferably the conducting member is attached to the conducting bar by welding.

- 5 Preferably the conducting member is made of copper or a copper alloy. Alternatively, the conducting member may be made from another suitable metal or alloy having low resistivity. Preferably the conducting member is welded to an inside surface of the conducting bar before the conducting bar is formed. For example, the conducting member is welded to
- 10 a sheet or plate which is then roll formed into a conducting bar.

Preferably the conducting bar has a first and second portion substantially in axial alignment, a third portion axially offset from the first and second portion, a fourth portion disposed between the first and third portion and a fifth portion disposed between second and the third portion.

- 15 More preferably, the conducting bar has a first and second portion substantially in axial alignment, a third inclined portion and fourth inclined portion disposed between the first and second portions, wherein the axes of the third inclined portion and fourth inclined portion are angled relative to the axes of the first and second portions. Preferably the third inclined portion and
- 20 the fourth inclined portion form an obtuse angle. Alternatively the third inclined portion and the fourth inclined portion form a right angle or an acute angle. Preferably the third inclined portion is adjacent to the fourth inclined portion.

BRIEF DESCRIPTION OF THE DRAWINGS

To assist in understanding the invention and to enable a person skilled in the art to put the invention into practical effect, preferred embodiments of the invention will be described by way of example only with
5 reference to the accompanying drawings, wherein:

FIG 1 shows a section of a prior art cathode;

FIG 2 shows perspective schematic view according to an embodiment of the invention;

FIG 3 shows a schematic cross sectional view of a conducting bar and
10 a conducting member according to an embodiment of the invention;

FIG 4 shows a schematic cross sectional view of the conducting bar and a conducting member of figure 3 welded together;

FIG 5 shows a schematic cross sectional view of the conducting bar of figure 4 formed into a hollow shape;

15 FIG 6 shows a schematic cross sectional view of the conducting bar of figure 5 welded;

FIG 7 shows a schematic cross sectional view of the conducting bar of figure 6 and a plate;

20 FIG 8 shows a schematic cross sectional view of the conducting bar and the plate of figure 7 welded together;

FIG 9 shows a schematic cross sectional view of a conducting bar according to an embodiment of the invention;

FIG 10 shows a schematic view of an electrode according to an embodiment of the invention;

FIG 11 shows a schematic view of an electrode according to an embodiment of the invention;

Fig 12 shows a schematic view of an electrode according to an embodiment of the invention.

5

DETAILED DESCRIPTION OF THE DRAWINGS

Figure 1 shows a prior art cathode 100 having a copper conducting bar 101 and a stainless steel plate 103. The stainless steel plate 103 is welded to the conducting bar 101 by welds 105. A problem with the stainless steel/copper welds 105 is that they are susceptible to corrosion and do not provide welds of high structural strength.

10

With reference to figure 2, there is shown an electrode in the form of a cathode 10. The cathode 10 comprises a conducting bar 20 attached to a plate 30 by welds 32. A conducting member 26 is attached to the conducting bar 20 by welds 28.

15

The conducting bar 20 and the plate 30 are made of stainless steel and as such the welds 32 are stainless steel welds of high structural strength having resistance to corrosion. The conducting bar 20 is hollow, with an inside surface 22. The conducting bar 20 is welded by a weld 24 to provide a tube shaped conducting bar 20.

20

The conducting member 26 is made of copper and the welds 28 are not required to be as strong as the welds 32, as there is minimal structural load placed on welds 28.

The welds 28 are primarily for conductive purposes such that the conductivity of the stainless steel conducting bar 20 is increased by the

copper conducting member 26. A benefit of having the conductive member 26 welded to an inside surface 22 of the conducting bar 20 is that the conductive member 26 and the welds 28 are less susceptible to corrosion. A benefit of welding the conductive member 26 to the conductive bar 20 is that the conductive member 26 is not required to provide structural strength to the conducting bar 20, as such, less copper material can be used, resulting in reduced costs.

With reference to figures 3, 4, 5, 6, 7 and 8, there is shown a cathode 10 during various stages of production. In figure 3, the conducting member 26 is placed on the inside surface 22 (i.e. this will become the inside surface) of conducting bar 20 (i.e. this plate or sheet material will become the conducting bar). In figure 4, the conducting member 26 is attached to the conducting bar 20 by welds 28. In figure 5, the conducting bar 20 is roll formed to provide a hollow shape. In figure 6, the conducting bar 20 is sealed along its length by weld 24. In figure 7, the plate 30 is positioned adjacent to the conducting bar 20. In figure 8, the plate 30 is attached to the conducting bar by welds 32.

With reference to figure 9, there is shown a cross sectional view of a conducting bar 20 according to an embodiment of the present invention. The conducting bar 20 is made of stainless steel and has a conducting member 26 made of copper attached to an inside surface 22 of the conducting bar 20 by welds 28. As can be seen from figure 9, the conducting member 26 has a 'U' shape cross section. A benefit of this is that the conducting member 26 can be made by bending or roll forming a sheet or plate material.

11

With reference to figure 10, there is shown a cathode 10 according to the present invention with a "straight" shaped conducting bar 20 and a plate 30 which is placed in electrolyte solution 50.

With reference to figure 11, there is shown a cathode 10 according to the present invention with conducting bar 20 having a first portion 70 and a second portion 72 substantially in axial alignment, a third portion 74 is axially offset from the first portion 70 and second portion 72, a fourth portion 76 is disposed between the first portion 70 and third portion 74 and a fifth portion 78 is disposed between second portion 72 and the third portion 74. A plate 30 is attached to the third portion 74 of the conducting bar 20. The plate 30 is placed in electrolyte solution 50.

As can be seen by comparing figures 10 and 11, the cathode 10 in figure 11 has more of the plate 30 in the electrolytic solution, this results in a lower voltage drop between the conducting bar 20 and the part of the plate 30 which is in the electrolytic solution 50.

With reference to figure 12, there is shown a cathode 10 according to the present invention with a conducting bar 20 having a first portion 80 and second portion 82 substantially in axial alignment, a third inclined portion 84 and a fourth inclined portion 86 are disposed between the first portion 80 and the second portion 82. The third inclined portion 84 and the fourth inclined portion 86 are angled relative to the first portion 80 and the second portion 82. The plate 30 is attached to the conducting bar 20 and is placed in electrolyte solution 50. As can be seen from figure 12, part of the third inclined portion 84 and the fourth inclined portion 86 of conducting bar 20 dip

below an upper edge 90 of the plate 30. Cut-outs 60 are located adjacent to the conducting bar 20 and an upper edge 90 of the plate 30.

Throughout the specification the aim has been to describe the invention without limiting the invention to any one embodiment or specific
5 collection of features. Persons skilled in the relevant art may realize variations from the specific embodiments that will nonetheless fall within the scope of the invention. For example, individual features from one embodiment may be combined with another embodiment.

It will be appreciated that various other changes and modifications
10 may be made to the embodiment described without departing from the spirit and scope of the invention.

Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but
15 not the exclusion of any other element, integer or step, or group of elements, integers or steps.

CLAIMS

1. A cathode for electrolytic processes, the cathode comprising:
a conducting bar; and
5 a plate attached to the conducting bar;
wherein the conducting bar has a conducting member attached thereto to increase the conductivity of the conducting bar, and
wherein at least a top part of the conducting bar dips below an upper surface of the plate.
- 10 2. A cathode as claimed in claim 1, wherein the plate is integrally formed with the conducting bar.
3. A cathode as claimed in claim 1 or claim 2, wherein the conducting bar
15 has a first portion and a second portion substantially in axial alignment, a third portion axially offset from the first portion and the second portion, a fourth portion disposed between the first portion and the third portion and a fifth portion disposed between the second portion and the third portion.
- 20 4. A cathode as claimed in claim 3, wherein the axis of the third portion is below the level of the axes of the first portion and the second portion.
5. A cathode as claimed in claim 3 or claim 4, wherein the plate is

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attached to the third portion.

6. A cathode as claimed in any one of claims 1 to 5, wherein the
conducting bar has a tubular shape and the conducting member is welded to
5 an inner surface of the conducting bar.

7. A cathode as claimed in any one of claims 1 to 6, wherein the cathode
is used for electrolytic processes of copper production.

10 8. A cathode as claimed in any one of claims 1 to 7, wherein the
conducting bar is made of stainless steel.

9. A hollow conducting bar for a cathode, the hollow conducting bar
having:

15 a first and second portion substantially in axial alignment; and
a third inclined portion and a fourth inclined portion disposed between
the first and second portions;

wherein the axes of the third inclined portion and fourth inclined
portion are angled relative to the axes of the first and second portions, and

20 wherein a conducting member is attached to an inside surface of the
conducting bar,

wherein the cathode includes a plate attached to the conducting bar,
and

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wherein at least a top part of the conducting bar dips below an upper surface of the plate.

10. A cathode or a hollow conducting bar as claimed in any one of claims
5 1 to 9, wherein the conducting bar is formed by roll forming.

11. A method of manufacturing a cathode, the method including the steps
of:
attaching a conducting member to an inside surface of a conducting
10 bar; and
attaching a plate to the conducting bar,
wherein at least a top part of the conducting bar dips below an upper
surface of the plate.

15 12. A method as claimed in claim 11, further including the step of forming
the conducting bar such that a first and second portion of the conducting bar
are substantially in axial alignment, a third portion of the conducting bar is
axially offset from the first and second portion, a fourth portion of the
conducting bar is disposed between the second and third portion.

20 13. A method as claimed in claim 11, further including the step of forming
the conducting bar such that a first and second portion of the conducting bar
are substantially in axial alignment, a third inclined portion and fourth inclined

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portion of the conducting bar are disposed between the first and second portions, wherein the axes of the third inclined portion and the fourth inclined portion are angled relative to the axes of the first and second portions.

5 14. A method as claimed in claim 13, wherein the third inclined portion and the fourth inclined portion form an obtuse angle.

15. A method as claimed in claim 13, wherein the third inclined portion and the fourth inclined portion form a right angle or an acute angle.

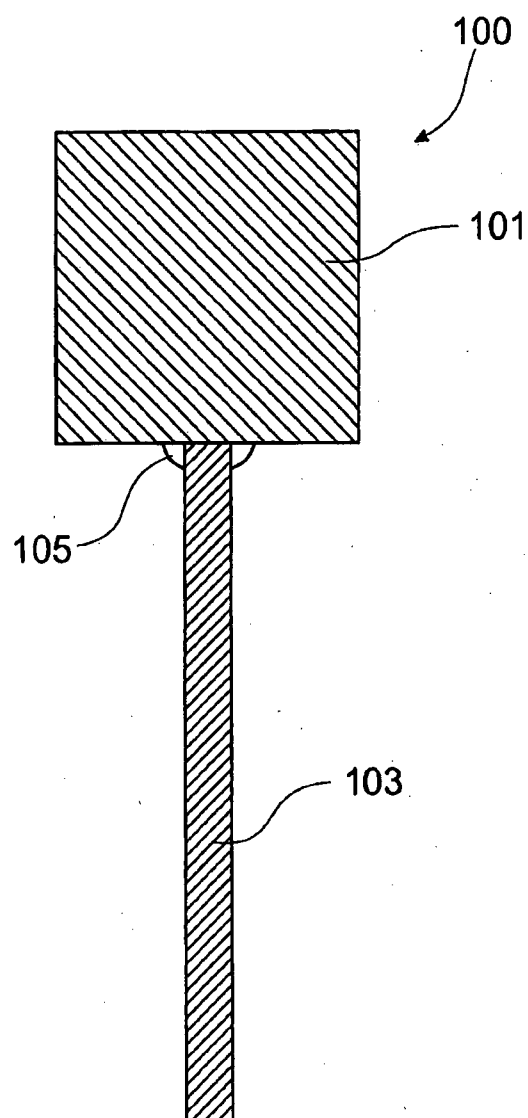
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16. A method as claimed in any one of claims 12, 13, 14 or 15 wherein the step of attaching a conducting member to an inside surface of a conducting bar involves welding the conducting member to an inside surface of the conducting bar before the conducting bar is formed.

15

17. A method as claimed in any one of claims 12, 13, 14, 15 or 16, wherein the step of forming the conducting bar involves roll forming the conducting bar.

1 / 7



(Prior Art)

FIG. 1

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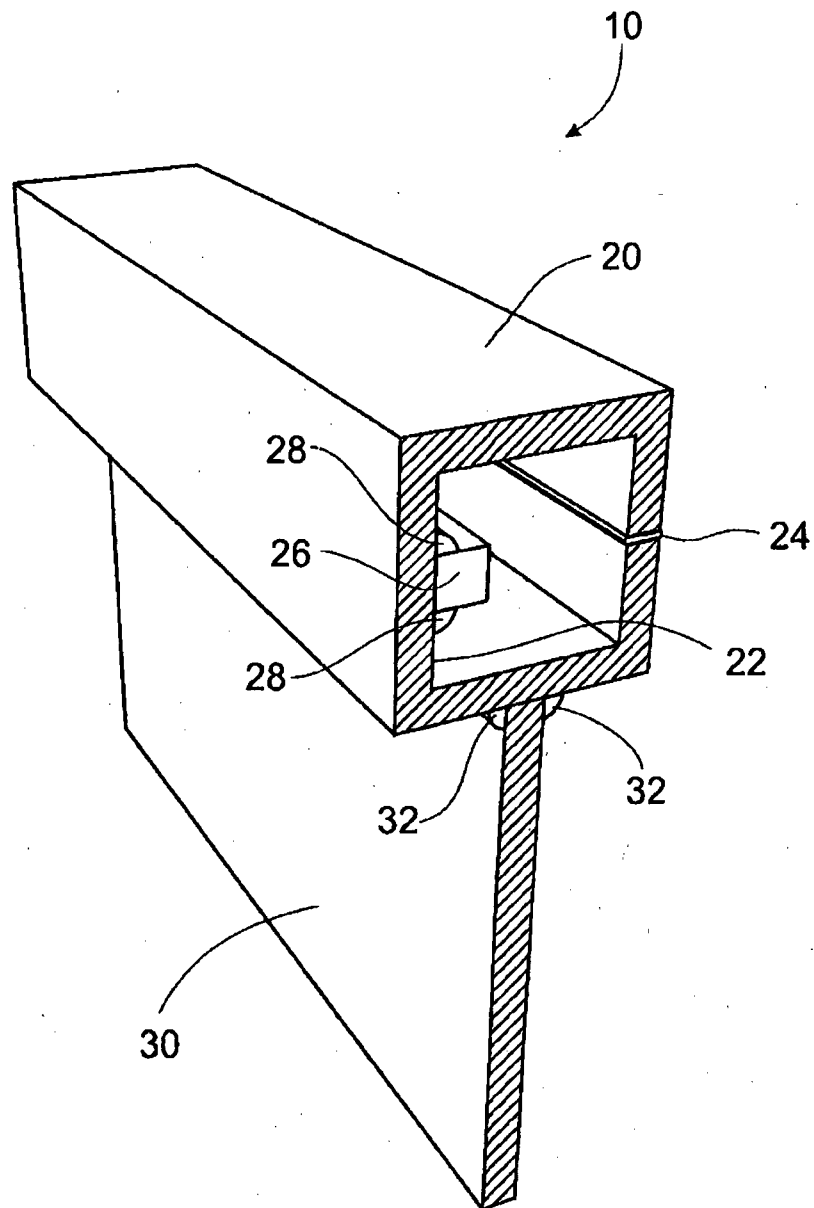


FIG. 2

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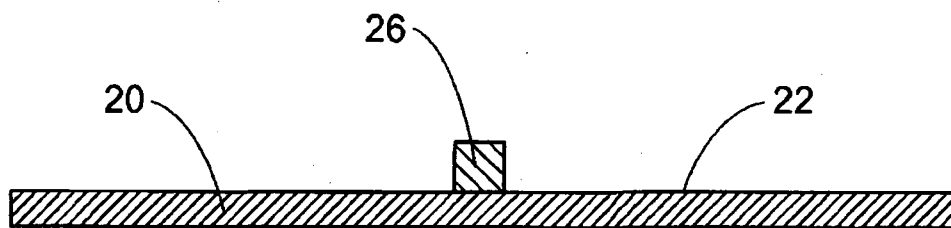


FIG. 3

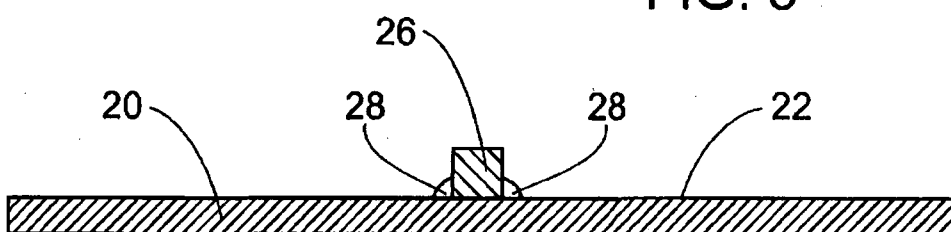


FIG. 4

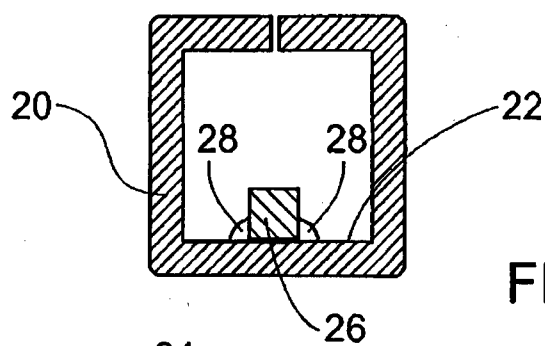


FIG. 5

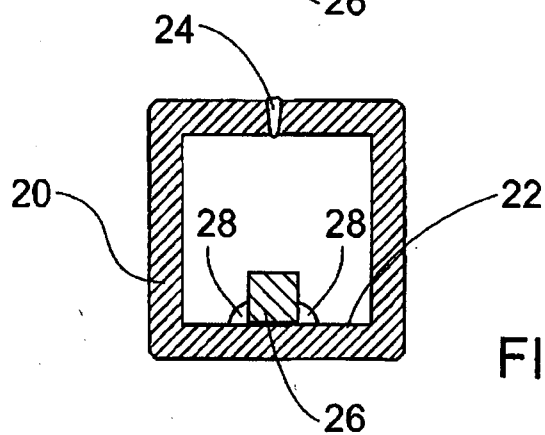


FIG. 6

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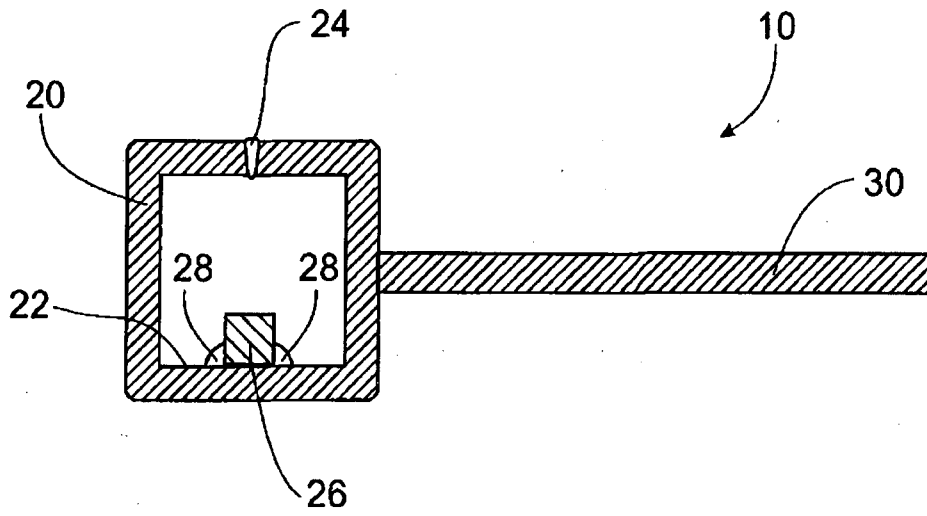


FIG. 7

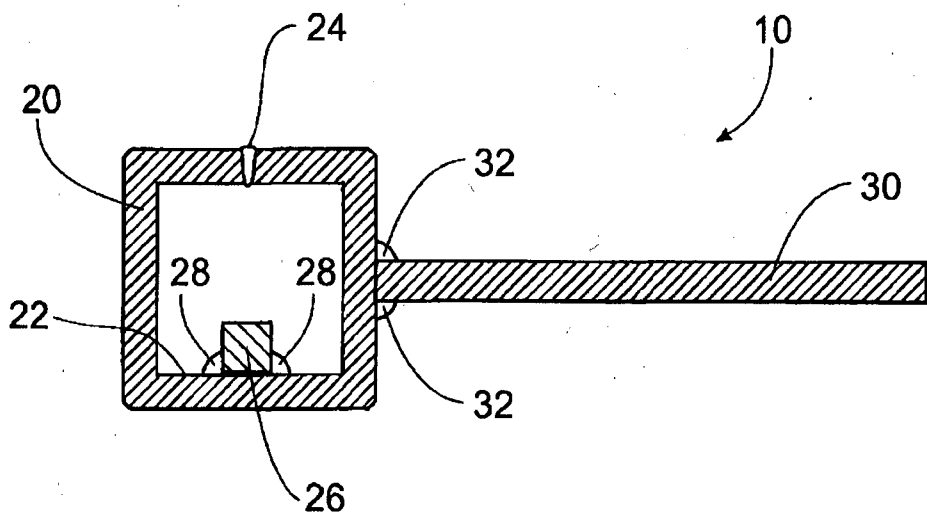


FIG. 8

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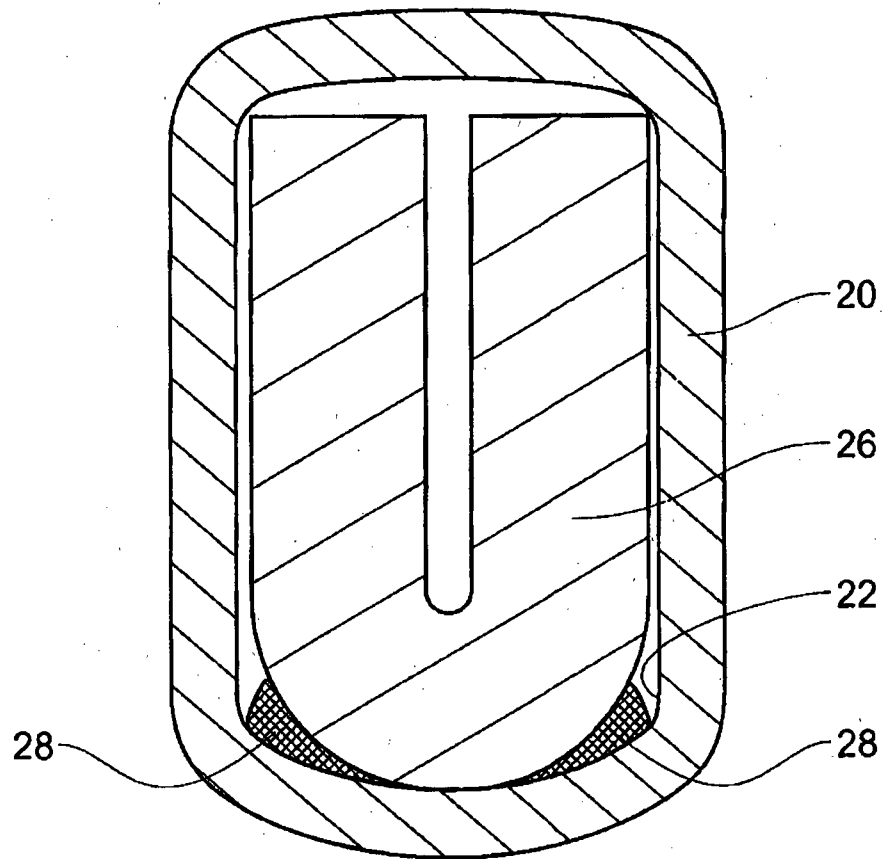


FIG. 9

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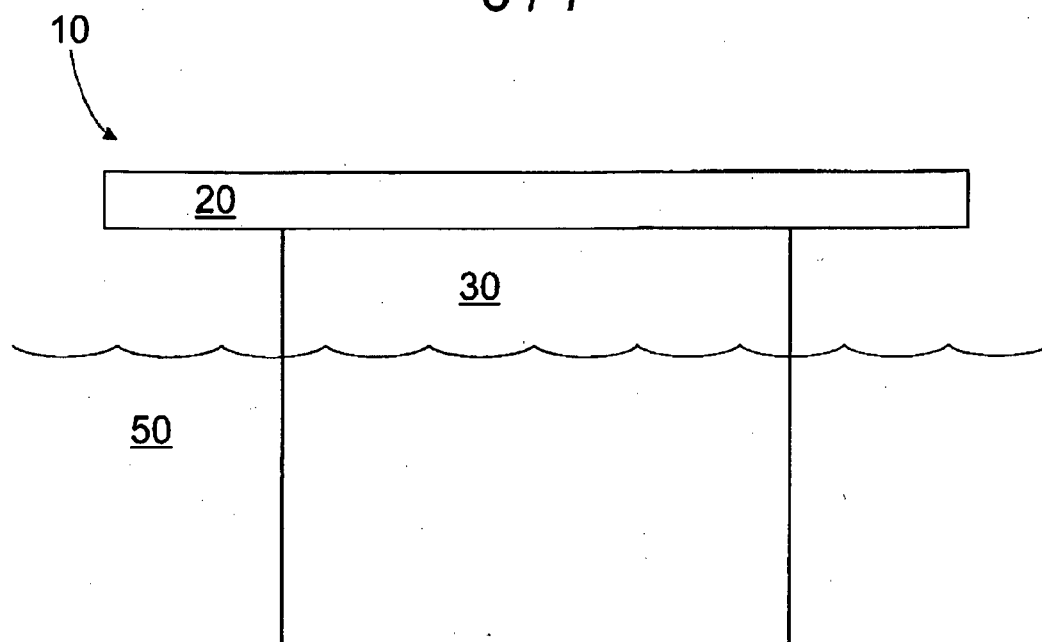


FIG. 10

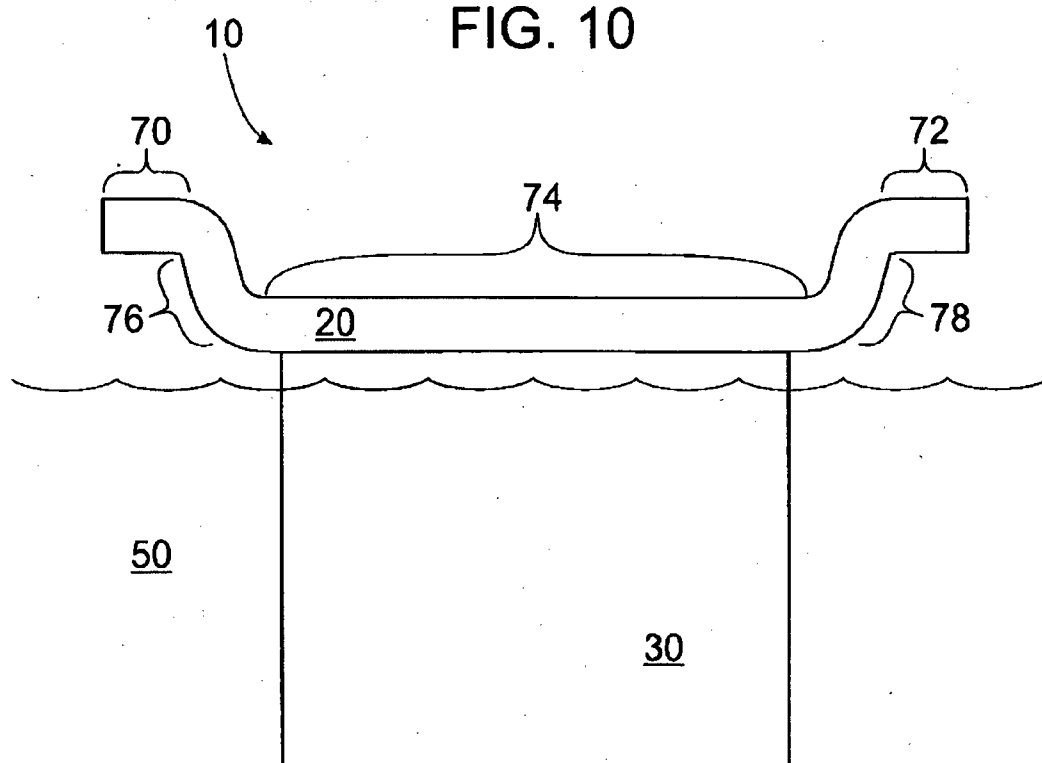


FIG. 11

7 / 7

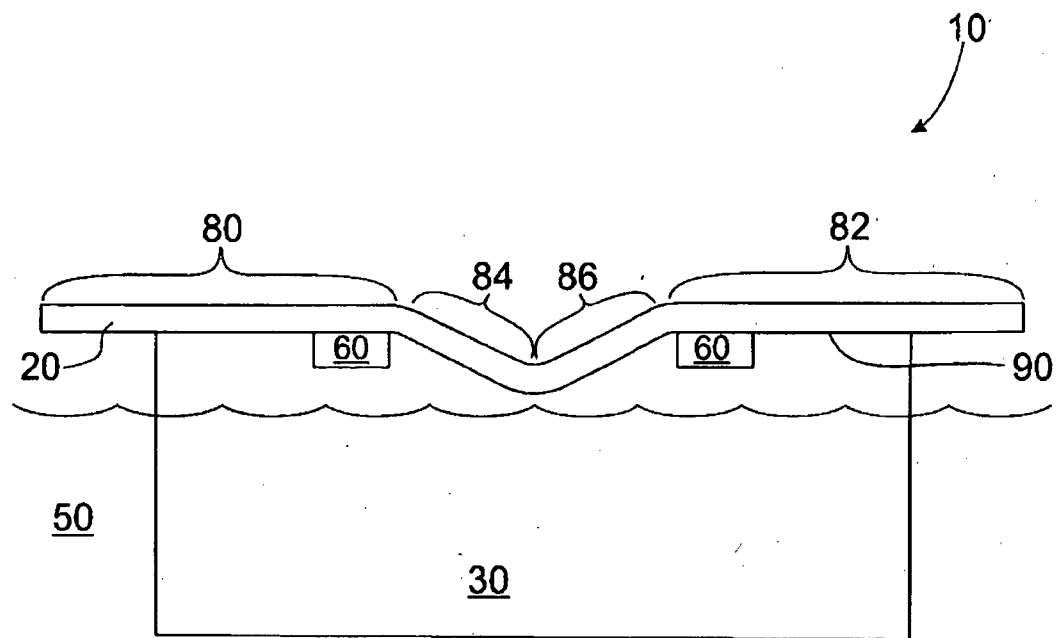


FIG. 12

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