

(86) Date de dépôt PCT/PCT Filing Date: 2002/03/14
(87) Date publication PCT/PCT Publication Date: 2002/11/14
(45) Date de délivrance/Issue Date: 2009/04/14
(85) Entrée phase nationale/National Entry: 2003/11/07
(86) N° demande PCT/PCT Application No.: DE 2002/000890
(87) N° publication PCT/PCT Publication No.: 2002/090622
(30) Priorité/Priority: 2001/05/08 (DE101 22 326.9)

(51) Cl.Int./Int.Cl. *C25C 7/02* (2006.01)

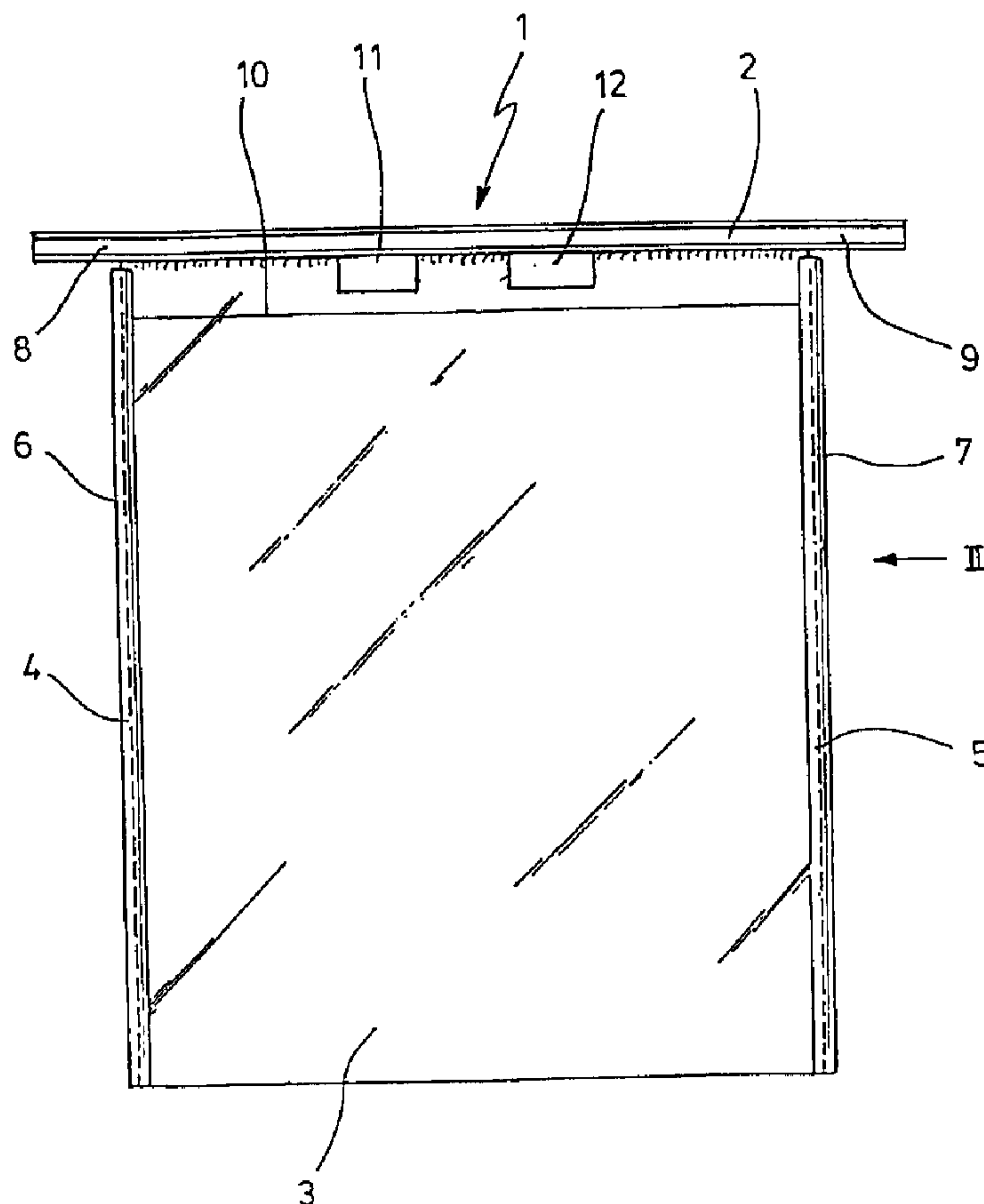
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(54) Titre : PROCEDE DE REPARATION DE CATHODES D'ELECTROLYSE

(54) Title: METHOD FOR REPAIRING ELECTROLYSIS CATHODES



(57) **Abrégé/Abstract:**

The invention relates to a method for repairing electrolysis cathodes that, together with anodes in a galvanic bath provided for carrying out a galvanic electrolysis, are connected to a power source. The electrolysis cathodes are comprised of a crossbeam,

(57) **Abrégé(suite)/Abstract(continued):**

which is arranged above the galvanic bath for being electrically connected to at least one supply bar, and of a metal cathode that projects into the galvanic bath. At least one portion of the cathode sheet metal is detached from the crossbeam by subjecting it to thermal action in an essentially uniform manner in the area of a first cutting edge. In order to provide a second cutting edge, a replacement sheet metal is cut to size at least in the area of an extension, which can be turned towards the crossbeam, by subjecting it to thermal action in an essentially uniform manner. The replacement sheet metal is welded to the first cutting edge in the area of the second cutting edge by subjecting the sheet metal to thermal action in an essentially uniform manner.

Abstract

The invention relates to a method for repairing electrolysis cathodes that, together with anodes in a galvanic bath provided for carrying out a galvanic electrolysis, are connected to a power source. The electrolysis cathodes are comprised of a crossbeam, which is arranged above the galvanic bath for being electrically connected to at least one supply bar, and of a metal cathode that projects into the galvanic bath. At least one portion of the cathode sheet metal is detached from the crossbeam by subjecting it to thermal action in an essentially uniform manner in the area of a first cutting edge. In order to provide a second cutting edge, a replacement sheet metal is cut to size at least in the area of an extension, which can be turned towards the crossbeam, by subjecting it to thermal action in an essentially uniform manner. The replacement sheet metal is welded to the first cutting edge in the area of the second cutting edge by subjecting the sheet metal to thermal action in an essentially uniform manner.

5 Method for Repairing Electrolysis Cathodes

The present invention relates to a method for repairing electrolysis cathodes, which are connected to a power source together with anodes provided in a galvanic bath for carrying out galvanic electrolysis,. The electrolysis cathodes comprise a cross beam that is arranged above the galvanic bath for being electrically connected to a least one supply bar, and a
10 metal cathode plate that extends into the galvanic bath.

Cathodes of this type can be used, for example, when producing electrolytic copper, when the anode plates are of impure cast copper plates that are dissolved in the electrolyte during electrolysis, the copper from them being then deposited on the stainless steel plates as pure copper. The impurities accumulate within the electrolysis bath, mainly in the form of
15 bottom sludge. A typical procedure is that approximately once each week the cathodes are removed from the galvanic bath, the copper is removed from them, and they are then reinstalled. After approximately three weeks, the copper anodes have dissolved to the point that they have to be replaced. The cross beam of the cathodes typically consists of a copper-plated supporting rod so as to ensure a low transitional resistance between the cross
20 beam and the conductor rail.

Because of the weekly, mechanical cleaning of the cathodes and because of the process conditions that act on the cathodes, these are subjected to wear. This wear leads to the fact that when the copper is being removed from the stainless steel plates, the cathode will be deformed. This deformation of the cathodes results in degraded efficiency during
25 electrolysis and thus slows down the rate at which the copper is deposited on the cathodes.

5 Once a certain degree of deformation has been reached, it is no longer possible to use the cathodes for electrolysis. When galvanic electrolysis is used on an industrial scale to deposit copper, many thousands of cathodes are used at the same time. The useful life of the cathodes is thus an important cost factor when producing copper.

10 Since the cross beam for the cathodes exhibits almost no signs of wear, attempts were made to cut off the used stainless steel plate and weld new stainless steel plate onto the cross beam. When this was done, however, it turned out that using the procedure that was tried, considerable stresses were generated in the stainless steel sheet metal and this led to the fact that cathodes repaired in this way warped very rapidly in the hot electrolysis bath. For this reason, known repair procedures have been unsatisfactory and this has led to the fact
15 that once the cathode sheet metal has reached a degree of deformation that is no longer acceptable, the complete cathode together with the cross beam must be replaced by a new cathode, and the old cathode must be scrapped.

For this reason, it is the objective of the present invention to describe a method of the type described in the introduction hereto so that electrolysis cathodes that had been repaired
20 have a sufficiently long service life.

According to the present invention, this objective has been achieved in that at least a portion of the cathode plate is cut off from the cross beam in the area of a first cut edge by subjecting it to thermal action in an essentially uniform manner; in that replacement sheet metal is cut to size at least in the area of its dimension that can be turned towards the
25 cross beam, by subjecting it to thermal action in an essentially uniform manner so as to provide a second cut edge; and in that the replacement sheet metal is welded to the first cut

5 edge in the area of the second cut edge by subjecting it to thermal action in an essentially uniform manner.

By separating the used cathode sheet metal from of the remaining part of the cathode by an essentially uniform thermal action, only a very small amount of thermal load acts on the remaining part. Furthermore, the first cut edge that has been prepared can be subjected to a
10 subsequent welding process without any additional processing. Any extra thermal and mechanical stresses that could occur during an additional processing step are thus avoided.

The same advantages are achieve by cutting with the help of an essentially uniform thermal action in the area of the replacement sheet metal.

Finally, carrying out the welding procedure by an essentially uniform thermal action leads
15 to very small amount of thermal stress, and the residual thermal stress occurs with a very high level of uniformity. Practical test show that electrolysis cathodes repaired in this way display almost the same resistance to deformation as new cathodes. Compared to a total replacement of the cathode, it is thus possible to a achieve a clear cost advantage by doing this.

20 A very high level of uniformity can be achieved when completing the separation procedure in that the used cathode sheet metal is separated from the cross beam in the area of the first cut edge by using a laser.

As far as assembly of the replacement sheet metal is concerned, it is advantageous if the first replacement sheet metal be cut to size with a laser, at least along its dimension that can
25 be turned to face the cross beam, so as to produce the second cut edge.

5 Minimal thermal warping can also be ensured if the second cut edge is welded to the first cut edge by using a laser.

In order to produce a very uniform weld, it has been found to be advantageous if the structural elements that are to be joined are clamped prior to the welding process.

10 Similarly, a uniform weld and uniform heat dispersion can be facilitated if the structural elements that are to be joined to each other are oriented so as to be parallel relative to each other, before the welding process is carried out.

In order to ensure low additional electrical resistance in the area of the weld, it is suggested that the first cut edge be braced relative to the second cut edge during the welding process.

15 Similarly, a reduction of cross section in the area of the weld, and the resulting increase of electrical resistance, can be avoided in that a covering between the weld seam and the weld root be produced in the area of the weld seam.

In order to ensure a long service life for the electrolysis cathodes, it is also useful if recesses for securing insulating rails are made in the cathode sheet metal with the help of a laser.

20 Embodiments of the present invention are shown in the drawings appended hereto. These drawings show the following:

Figure 1: a side view of an electrolysis cathode;

Figure 2: a side view as seen in the direction II indicated in Figure 1;

Figure 3: an enlarged view of the detail III indicated in Figure 2;

- 5 Figure 4: an enlarged view of one end area of a cross beam of the electrolysis cathode;
Figure 5: a perspective view of the electrolysis cathode shown in Figure 1;
Figure 6: a cross section through an electrolysis cathode that is clamped in the area of a
welding device and which is to be provided with new cathode sheet metal;
Figure 7: an enlarged cross sectional view in the area of the weld seam.

10 Figure 1 shows an electrolysis cathode (1) that has a cross beam (2) and cathode plate (3).

The cathode plate (3) is of stainless steel and is welded to the cross beam (2). It is preferred that the cross beam (2) be a copper-coated supporting rod.

The cathode plate (3) is provided with insulating rails (6, 7) along its side edges (4, 5).

15 These insulating rails (6, 7) can be in the form of plastic rails. In order to secure the insulating rails (6, 7), the cathode plate (3) incorporates recesses through which attachment elements extend. End segments (8, 9) of the cross beam (2) extend beyond the insulating rails (6, 7), so that the electrolysis cathode (1) can be suspended in an electrolysis bath (not shown herein).

20 Figure 1 shows an electrolysis cathode (1) from which original cathode sheet metal (3) has been separated and replaced by new sheet metal, so that a welded seam (10) extends from one side edge (4) to the other side edge (5). In order to simplify transportation, the electrolysis cathode (1) incorporates two recesses (11, 12) beneath the cross beam (2), through which the holding devices of a transportation apparatus can be passed.

25 Positioning the welded seam (10) slightly below the recesses (11, 12) entails the advantage that the welding process can be completed in one operation, without having to reposition

5 the welding electrodes. However, in order to provide for the greatest possible space
between the welded seam (10) and the surface of the electrolysis bath, thought was also
given to having the weld seam extend at the level of lower limits of the recesses (11, 12).
Admittedly, if this is done, the welding electrodes must be repositioned three times during
the welding process, but if this is done the distance between the welded seam and the
10 surface of the electrolyte when it has been immersed in the electrolysis bath can be
increased. Furthermore, the actual length of the welded seam is reduced by the extent of
the recesses (11, 12).

The side view in Figure 2 shows that the cross beam (2) can be configured as an I-beam. It
can also be seen that the insulating rails (6, 7) essentially cover the whole area of the side
15 edges (4, 5).

From the enlarged view shown at Figure 3, it can be seen that the cathode plate (3) is
connected to the cross beam (2) through welded seams (13).

Figure 4 is a cross section through one of the end segments (8, 9). It can be seen that a
lower area of the end segments (8, 9) is configured as a taper (14). This configuration
20 ensures that when the end segments (8, 9) rests on a conductor rail (15), there is greater
contact pressure per unit area and thus less transitional resistance to electric current.

Figure 5 is a perspective view that illustrates the structure of the electrolysis cathode (1).
The rugged configuration of the cross beam (2) as well as the lateral extension of the end
segments (8, 9) of the cross beam (2) can be seen in particular.

5 Figure 6 shows the arrangement of the electrolysis cathode (1) in the area of a welder (25) that is used to produce the welded seam (10). Both the new cathode sheet metal (3) and the cross beam (2) with the residual portion (16) of the original cathode sheet metal (3) are held in place by clamping devices (17, 18) and acted upon by clamping forces (19, 20, 21, 22). A transverse force (24) is generated by means of a feed device (23) that guides the
10 new cathode sheet metal (3) and the segment (16) of the old sheet metal together with a specific amount of contact pressure on their surfaces. In this state the welder (25) is moved along the welded seam (10) that is to be produced.

The structure of the welded seam (10) is shown in detail in Figure 7. The welded seam (10) has a seam root (26) and a seam cover (27) that extend along opposite sides of the
15 electrolysis cathode (1). The seam root (26) and the seam cover (27) are joined to one another by a weld (28) that runs between a first cut edge (29) of the segment (16) of residual sheet metal and the second cut edge (30) of the new cathode sheet metal (3).

Patent Claims

1. Method for repairing electrolysis cathodes, which are connected to a power source together with anodes provided in a galvanic bath for carrying out a galvanic electrolysis, said electrolysis cathodes comprising a cross beam that is arranged above the galvanic bath for being electrically connected to a least one supply bar, and cathode plate that extends into the galvanic bath, characterized in that least a portion of the cathode sheet metal is cut off from the cross beam in the area of a first cut edge of the cross beam (2) by subjecting it to thermal action in an essentially uniform manner; in that replacement sheet metal is cut to size at least along its dimension that can be turned towards the cross beam (2), by subjecting it to thermal action in an essentially uniform manner so as to provide a second cut edge; and in that the replacement sheet metal is welded to the first cut edge in the area of the second cut edge by subjecting it to thermal action in an essentially uniform manner.
2. Method as defined in Claim 1, characterized in that the used cathode sheet metal (3) is separated from the cross beam (2) in the area of the first cut in edge by using a laser.
3. Method as defined in Claim 1 or Claimed 2, characterized in that the replacement sheet metal is cut to size with a laser, at least along its dimension that can be turned towards the cross beam, so as to prepare the second cut edge.

4. Method as defined in one of the Claims 1 to 3, characterized in that the second cut edge is welded to the first cut edge by using a laser.
5. Method as defined in one of the Claims 1 to 4, characterized in that the structural elements that are to be joined to one another are clamped prior to the welding process.
6. Method as defined in one of the Claims 1 to 5, characterized in that prior to the welding process the structural elements that are to be joined to one another are oriented so as to be parallel to one another.
7. Method as defined in one of the Claims 1 to 6, characterized in that the first cut edge is clamped relative to the second cut edge during the welding process.
8. Method as defined in one of the Claims 1 to 7, characterized in that in the area of the welded seam, a cover is produced between the welded seam and the weld root
9. Method as defined in one of the Claims 1 to 8, characterized in that the recesses in the cathode sheet metal (3) for attaching the insulating rails (6, 7) are produced with the help of a laser.
10. Method as defined in one of the Claims 1 to 9, characterized in that plates of stainless steel are used as the cathode sheet metal (3).
11. Method as defined in one of the Claims 1 to 10, characterized in that copper plates are used as the anodes.

12. Method as defined in one of the Claims 1 to 11, characterized in that a source of DC power is used as the power source.

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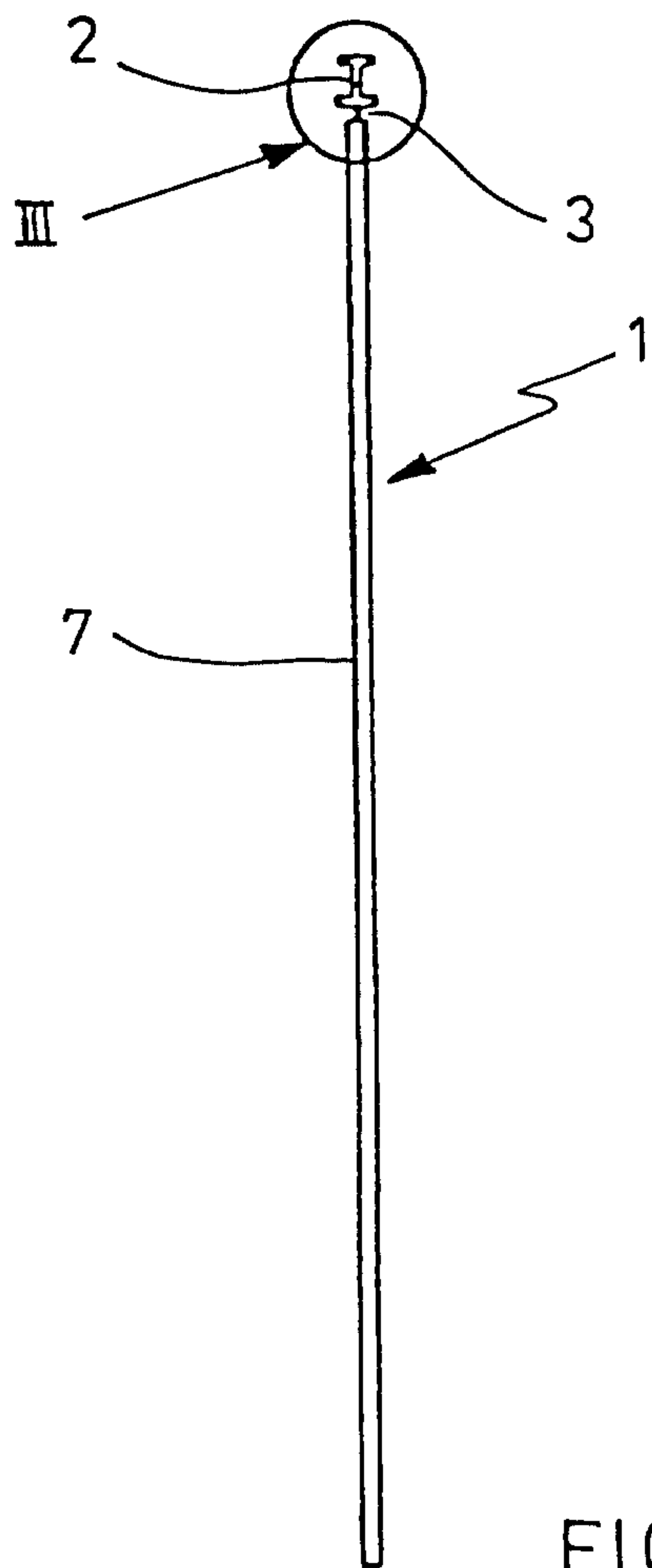


FIG. 2

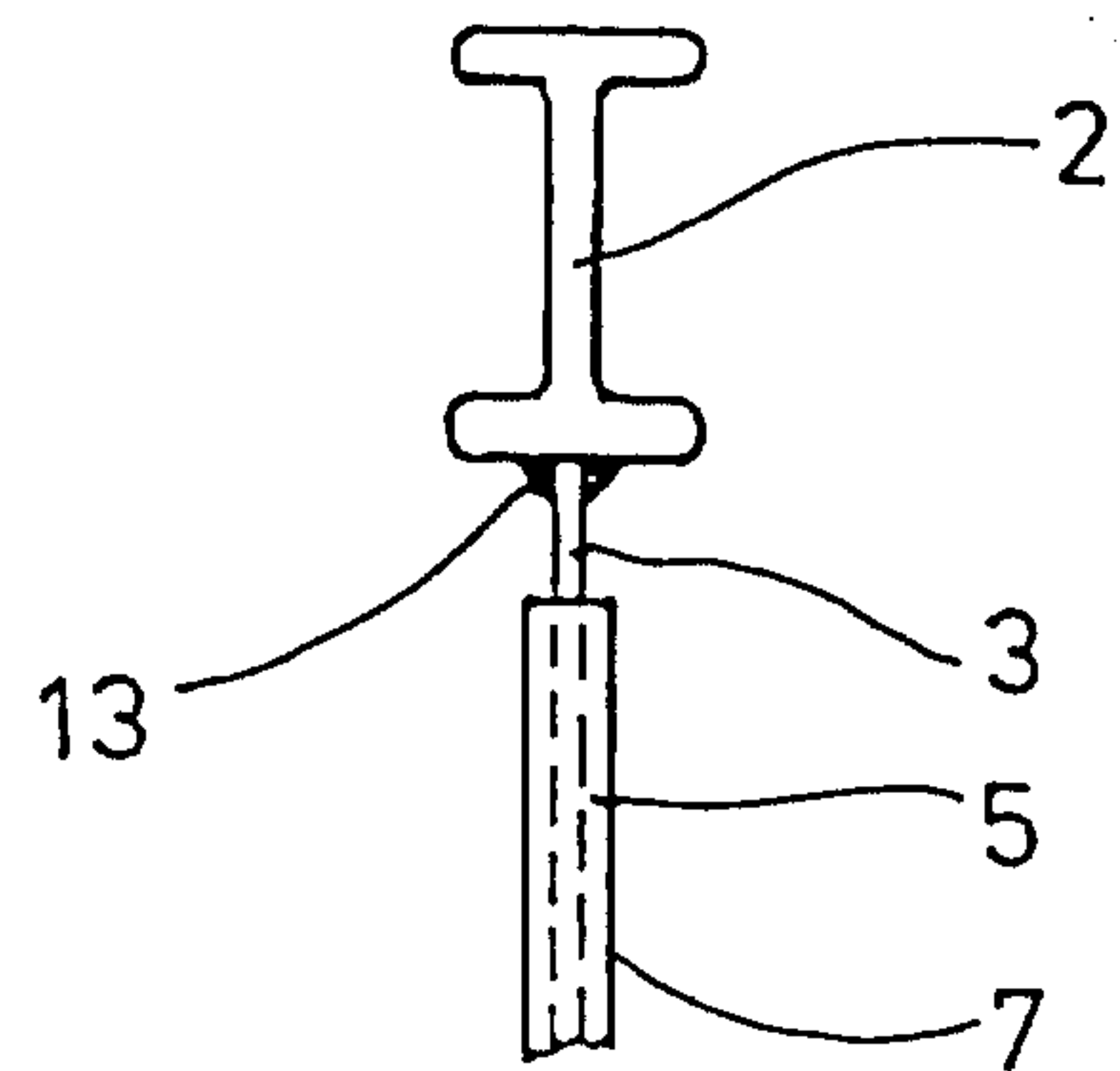


FIG. 3

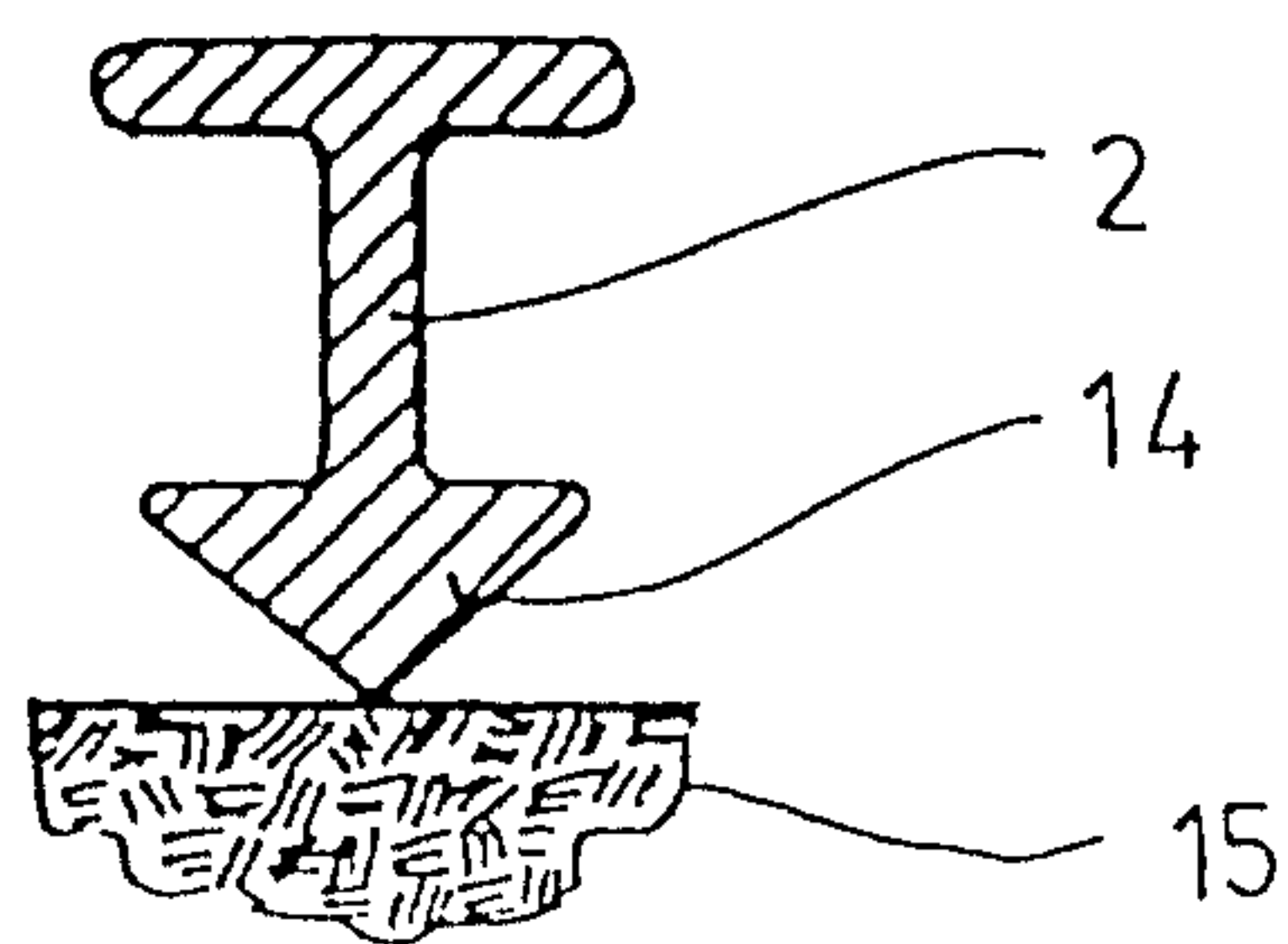


FIG. 4

