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

(11) EP 0 487 675 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
03.09.1997 Bulletin 1997/36

(21) Application number: **91910909.0**

(22) Date of filing: **19.06.1991**

(51) Int Cl.[6]: **C23F 13/08**, C23F 13/10

(86) International application number:
PCT/FI91/00191

(87) International publication number:
WO 91/19829 (26.12.1991 Gazette 1991/29)

(54) A METHOD FOR FIXING AN ELECTRODE ARRANGEMENT TO BE USED IN THE CATHODIC PROTECTION OF CONCRETE STRUCTURES AND A FIXING ELEMENT

VERFAHREN ZUR BEFESTIGUNG EINER ELEKTRODENANORDNUNG ZUM KATHODISCHEN KORROSIONSSCHUTZ VON BETONSTRUKTUREN UND BEFESTIGIGUNGSELEMENT

PROCEDE DE FIXATION D'UN AGENCEMENT D'ELECTRODES DESTINE A ASSURER LA PROTECTION PAR VOIE CATHODIQUE DE STRUCTURES EN BETON ET ELEMENT DE FIXATION

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

(30) Priority: **20.06.1990 FI 903119**

(43) Date of publication of application:
03.06.1992 Bulletin 1992/23

(73) Proprietor: **SAVCOR-CONSULTING OY**
SF-50100 Mikkeli (FI)

(72) Inventors:
- **PULLIAINEN, Martti**
  SF-52100 Anttola (FI)
- **RÄMÖ, Tarja**
  SF-50100 Mikkeli (FI)

(74) Representative: **Pellmann, Hans-Bernd, Dipl.-Ing.**
Patentanwaltsbüro
Tiedtke-Bühling-Kinne & Partner
Bavariaring 4
80336 München (DE)

(56) References cited:
EP-A- 0 262 835
WO-A-86/06759
WO-A-89/10435
DE-A- 3 826 926

EP 0 487 675 B1

Description

The invention relates to a method for fixing an electrode arrangement to be used in the cathodic protection of concrete structures.

The invention also relates to a fixing element of an electrode arrangement to be used in the cathodic protection of concrete structures.

In the protection of steel parts of concrete structures, e.g. concrete reinforcements, the anodes of an electrode arrangement are generally fixed to an existing concrete surface, and the anode is covered with shotcrete or with another corresponding conductive material. However, problems have been caused by the poor fixability of the electrode arrangement during the casting. Additional problems have also been caused by the fact that the anode is during the casting bent into contact with the steel constructions to be protected.

The above-mentioned situtations have made it considerably more difficult and slower to carry out the actual concrete casting.

Document EP-A-0 262 835 discloses a fixing element of an electrode arrangement to be used in the cathodic protection of concrete structures, comprising an anode arranged in a planar manner. The planar-shaped anode is made of a mesh formed by electrodes and is intended to be layed out on the surface of a concrete structure after the concreting step.

Other anode arrangements to be fixed to the concrete structure after the concreting step are described in documents WO-A-8 910 435 and WO-A-8 606 759.

Since the above anode arrangements are fixed to an existing concrete surface, additional work steps are required for fixing the arrangement and for covering it with an additional conductive material.

Document DE-A-3 826 926 discloses a precast anode arrangement having an electron-conductive core and an ion-conductive coating made of mortar in order to prevent shortcircuits between the anode and the enforcement. The anode arrangement is adapted to be fixed to the reinforcement structure prior to the concreting step.

It is an object of the present invention to provide an improved method for fixing an electrode arrangement and an improved fixing element of an electrode arrangement, to be used in the cathodic protection of concrete structures.

This object is solved by a method for fixing an electrode arrangement according to claim 1 and a fixing element of an electrode arrangement according to claim 2.

Such an inventive anode element placed in position before the concreting is in certain cases the only technically sensible solution. When, for example, protecting underwater concrete structures, a considerable advantage is obtained in the preparation step, when the anode arrangement is of an element-structional type.

When using the inventive anode fixing arrangement, the pressing effect of the additional mass caused by shotcreting is avoided. Furthermore, the number of the work phases needed decreases, since the anode element is prefabricated, and only the fixing of the anode element has to be performed in connection with concreting.

The fixing of the inventive element is easy and it saves mounting time, since a separate fixing and insulating work of the anode in the mounting step is eliminated.

The inventive element remains fixed on the concrete structures, whereby no special precautionary measures are needed in the concreting step, e.g. it is not necessary to use a slower concreting rate.

The construction of the anode element according to the invention is mechanically rigid such that it cannot come into an electrical contact with the concrete reinforcements to be protected. From the point of view of the operation of the protection, the avoidance of the electrical contact is one of the basic prerequisites. In addition, the inventive anode element cannot move during the concreting owing to its fixing means.

When using the inventive element, the uninterruptibility of a cathodic contact is also ensured, since the connection of all concrete reinforcement layers to the cathode circuit can be guaranteed by means of several fixing points.

The anode element according to the invention forms a system of several elements such that each element can, when so desired, be controlled as a separate electric circuit. The operation of the anode system is thereby ensured.

The invention is next described in more detail with reference to the figures of the accompanying drawing, to which the invention is, however, in no way narrowly limited.

Fig. 1A and 1B show schematically an inventive anode element.

Fig. 2 shows as a schematic partial view an inventive anode element fixed to a concrete structure.

An inventive anode element 10 shown in Fig. 1A and 1B comprises a framework 11, anodes 20 and fixing means 15. The framework 11 is made of an electrically insulating material, e.g. of plastics or ceramics or of an electrolytically conductive material, e.g. of concrete, plastics or ceramics. When so desired, a steel reinforcement or some other reinforcement is used for improving the strength properties of the framework 11, which is, however, not necessary.

In one preferred embodiment of the invention, the framework 11 of the anode element 10 is made of concrete, since a good adherence to the concreting is then obtained. Furthermore, when the framework 11 is made of concrete, possible detrimental heat expansion phenomena are eliminated.

The anode element 10 is fixed to a concrete surface, to concrete reinforcements or to other fixed parts of the construction or to parts used during the mounting

with the fixing means 15 of the framework 11, e.g. with plastic hooks, nails, wires, screws or the like.

The fixing means 15 shown in Fig. 1A and 1B are made of concrete reinforcement pins, which are fixed to the concrete reinforcements of the actual concrete reinforcement structure.

The anode 20 is placed in the concreting of the framework 11, or the anode 20 is mechanically fixed e. g. with metallic or plastic nails, screws, anchors, lists or the like to the framework 11.

The anode 20 is located on the opposite side relative to the fixing means 15 of the framework 11.

The anode 20 is a net, wire, strip, rod, plate or the like.

The material used in the anode 20 is a composite material, e.g. an alloy-metal coated titan, magnetite, platinated titan or an iron mixture, e.g. ferrosilicon or graphite or a noble metal, e.g. platinum or a conductive plastic.

As described above, the anode element 10 can either be comprised of the material of the anode 20 or of the material of the anode 20 and another material joined thereto. Several anode elements 10 form a system, by means of which the steel parts of the concrete structure can be cathodically protected. Electricity is supplied to the anode element 20 e.g. via a conductor 30. The electricity is supplied separately to each anode element 20 via one or more of its points or to all anode elements 20 of the system together or by means of some combination of the two separate above-mentioned systems.

The framework 11 of the anode element is arranged in a wedge-like form such that the width of the crosspiece of the framework 11 is on the side of the anode 20 greater than on the side of the fixing means 15, whereby the concrete can during the casting easily flow also inside the framework.

In accordance with Fig. 2, the anode element 10 is fixed to the steel parts 50 of the concrete reinforcement structure so that the fixing means 15 of the anode element 10 are fixed to the steel parts 50. The anode element 10 is fitted between the outermost concrete reinforcement layer and the concreting wood lining 60, into which the concrete 70 is cast.

As shown in Fig. 2, the anodes 20 of the anode element 10 are located on the other side of the framework 11 relative to the steel parts 50, whereby the anode 20 cannot come into contact with the steel parts 50.

Claims

1. A method for fixing an electrode arrangement to be used in the cathodic protection of concrete structures, **characterized by the steps of**

   a) mounting a plurality of anode structures **(20)** arranged in a planar manner into a framework **(11)** such that said planar anode structures **(20)** are framed by said framework **(11)**;

   b) providing said framework **(11)** with a plurality of fixing means **(15)** extending from a side of said framework **(11)**; and

   c) fixing said framework **(11)** with its planar anode structures **(20)** to the reinforcement structure **(50)** of the concrete structure by said fixing means **(15)** at a production plant or in the mounting step before the concreting step.

2. A fixing element of an electrode arrangement to be used in the cathodic protection of concrete structures, comprising:
   a) an anode structure **(20)** arranged in a planar manner,
   characterized by
   b) a framework **(11)** into which said planar anode structure **(20)** is mounted such that it is framed by said framework **(11)** and which is provided with fixing means **(15)** extending from a side thereof, said framework **(11)** being adapted to be fixed by said fixing means **(15)** to the reinforcement structure **(50)** of the concrete structure prior to the concreting step.

3. A fixing element according to claim 2,
   characterized in that
   said framework **(11)** is made of concrete.

Patentansprüche

1. Verfahren zum Befestigen einer Elektrodenanordnung, die bei dem kathodischen Schutz von Betonstrukturen verwendet wird,
   gekennzeichnet durch die Schritte

   a) Montieren einer Vielzahl Anodenstrukturen (20), die in einer ebenen Weise angeordnet sind, in einem Rahmenwerk (11), derart, daß die ebenen Anodenstrukturen (20) durch das Rahmenwerk (11) eingerahmt werden;

   b) Versehen des Rahmenwerks (11) mit einer Vielzahl Befestigungseinrichtungen (15), die sich von einer Seite des Rahmenwerks (11) erstrecken; und

   c) Befestigen des Rahmenwerks (11) mit seinen ebenen Anodenstrukturen (20) an einer Verstärkungsstruktur (50) einer Betonstruktur durch die Befestigungseinrichtungen (15) in einer Produktionsanlage oder in dem Montageschritt vor dem Betonierschritt.

2. Befestigungselement einer Elektrodenanordnung, die bei dem kathodischen Schutz von Betonstrukturen verwendet wird, mit:
   a) einer Anodenstruktur (20), die in einer ebenen Weise angeordnet ist,

gekennzeichnet durch

b) ein Rahmenwerk (11), in das die ebene Anodenstruktur (20) derart montiert ist, daß sie durch das Rahmenwerk (11) eingerahmt ist, und das mit Befestigungselementen (15) versehen ist, die sich von einer seiner Seiten erstrecken, wobei das Rahmenwerk (11) derart angepaßt ist, daß es durch die Befestigungseinrichtungen (15) an eine Verstärkungsstruktur (50) einer Betonstruktur vor dem Schritt des Betonierens befestigt wird.

3. Befestigungselement nach Anspruch 2, **dadurch gekennzeichnet, daß** das Rahmenwerk (11) aus Beton hergestellt ist.

Revendications

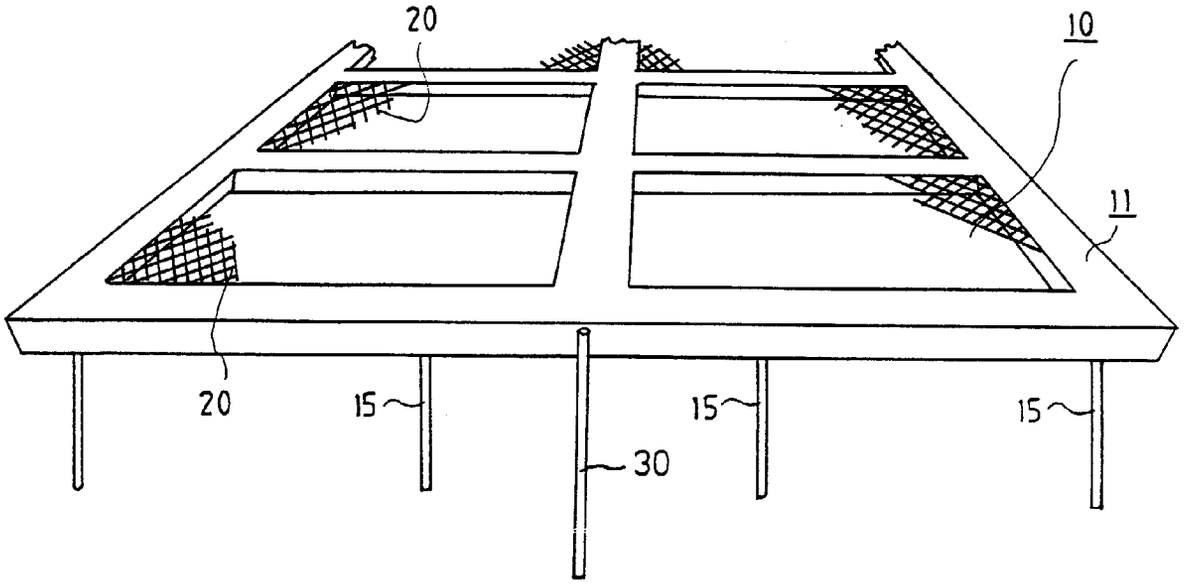
1. Procédé de fixation d'un agencement d'électrode devant être utilisé dans la protection cathodique de structures en béton, caractérisé par les étapes de

   a) montage d'une pluralité de structures d'anode (20), agencées de manière planaire sous la forme d'un cadre (11), de manière que lesdites structures d'anode (20) planaires soient encadrées par ledit cadre (11);
   b) l'agencement dudit cadre (11) avec une pluralité de moyens de fixation (15) s'étendant depuis un côté dudit cadre (11); et
   c) la fixation dudit cadre (11), ainsi que ses structures d'anode (20) planaires, à la structure de renforcement (50) de la structure en béton, par lesdits moyens de fixation (15), au niveau d'une installation de production, ou lors de l'étape de montage précédent l'étape de bétonnage.

2. Elément de fixation d'un agencement d'électrode devant être utilisé dans la protection cathodique de structures en béton, comprenant :
   a) une structure d'anode (20) agencée de manière planaire,
   caractérisé par
   b) un cadre (11) dans lequel ladite structure d'anode (20) planaire est montée, de manière à être encadrée par ledit cadre (11) et qui est pourvue de moyens de fixation (15) s'étendant depuis l'un de ses côtés, ledit cadre (11) étant adapté de façon à être fixé par lesdits moyens de fixation (15) à la structure de renforcement (50) de la structure en béton, avant l'étape de bétonnage.

3. Elément de fixation selon la revendication 2, caractérisé en ce que ledit cadre (11) est réalisé en béton.

FIG.1A



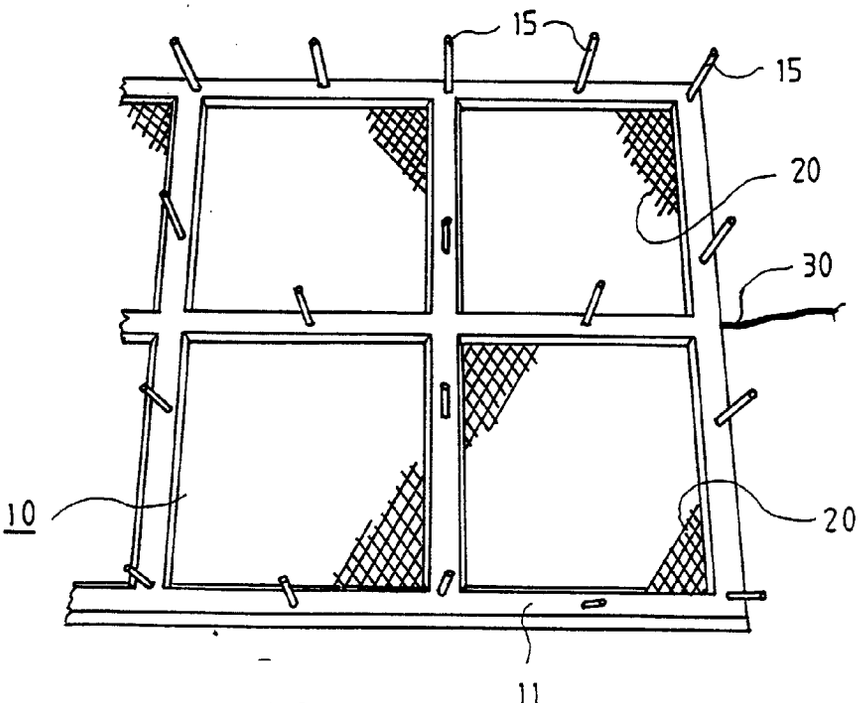


FIG.1B

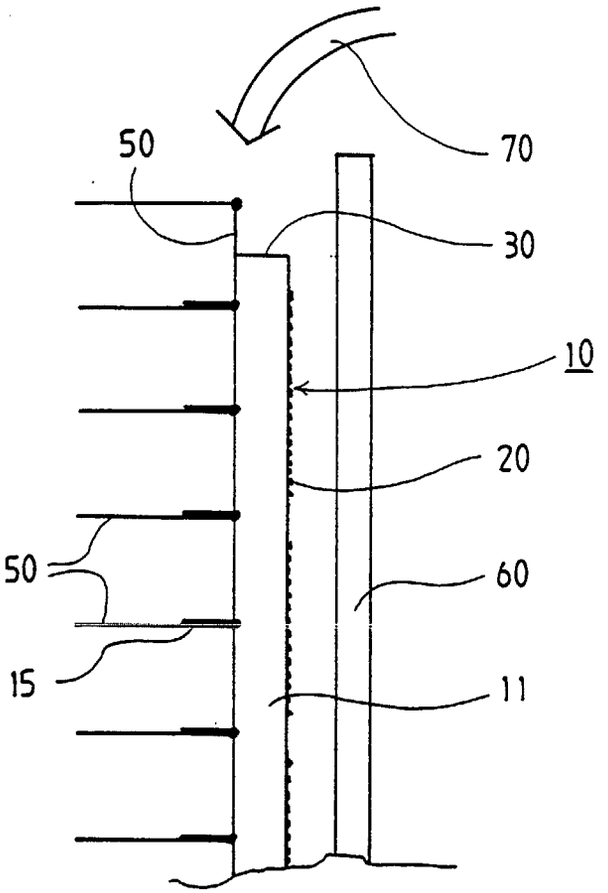


FIG.2