

APPLICATION FOR A STANDARD PATENT
OR A STANDARD PATENT OF ADDITIONForm 1
Regulation 9

618145

X MITSUBISHI JUKOGYO KABUSHIKI KAISHA,.....
of 5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan.

hereby apply for the grant of a ^{standard patent}
~~patent of addition~~ ~~XXXXXXXX~~ for an invention entitled

"ANTI-FOULING SYSTEM FOR SUBSTANCES IN CONTACT WITH SEAWATER"

which is described in the accompanying ~~XXXXXXXX~~
complete specification.

*(To be included in the case of a Convention application)

Details of basic application(s) -

Number of basic application 287190/1988 and 139973/1989

Name of Convention country in which basic application was filed JAPAN

Date of basic application November 14 1988 and June 1 1989 respectively.

*(To be included in the case of an application made by virtue of section 51)

Number of original application

Person by whom made

*(To be included in the case of an application for a patent of addition)

I request that the patent may be granted as a patent of addition to the patent applied for on Application

No. Patent No.

in the name of

I request that the term of the patent of addition be the same as that for the main invention or so much of

the patent for the main invention as is unexpired.

My address for service is KELVIN LORD AND COMPANY, Patent & Trade Mark

Attorneys, of 4 Douro Place, West Perth, Western Australia,
Australia, 6005.

Dated this 1st day of NOVEMBER 19 89

To :

(Signature)

THE COMMISSIONER OF PATENTS

MITSUBISHI JUKOGYO KABUSHIKI KAISHA
By their Patent Attorneys
KELVIN LORD AND COMPANY

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This form must be accompanied by either a provisional specification (Form 9 and true copy) or by a complete specification (Form 10 and true copy).

* These sections are to be completed only where applicable..

AUSTRALIA

Patents Act 1990

NOTICE OF ENTITLEMENT

WE, MITSUBISHI JUKOGYO KABUSHIKI KAISHA

of 5-1 Marunouchi 2-Chome, Chiyoda-Ku, Tokyo, JAPAN

being the Applicant in respect of Application No. 44552/89,
state the following:-

Part 1

The actual inventors are:

MASAHIRO USAMI, of, C/- Nagasaki Technical Institute,
Mitsubishi Jukogyo Kabushiki Kaisha, 1-1, Akunoura-machi,
Nagasaki, Nagasaki Pref., JAPAN,

KENJI UEDA, of, C/- Nagasaki Technical Institute, Mitsubishi
Jukogyo Kabushiki Kaisha, 1-1, Akunoura-machi, Nagasaki,
Nagasaki Pref., JAPAN,

KIYOMI TOMOSHIGE, of, C/- Nagasaki Shipyard & Engine Works,
Mitsubishi Jukogyo Kabushiki Kaisha, 1-1, Akunoura-machi,
Nagasaki, Nagasaki Pref., JAPAN,

SHOZO OHTA C/- Chouryou Engineering Kabushiki Kaisha,
Ryokou-biru Bekkan 5 Floor, 5-7, Akunoura-machi, Nagasaki,
Nagasaki Pref., JAPAN,

TSUTOMU HORIGUCHI, of, Chouryou Engineering kabushiki
Kaisha, Ryokou-biru Bekkan 5 Floor, 5-7, Akunoura-machi,
Nagasaki, Nagasaki Pref., JAPAN,

HIROSHI YAMAZAKI, of, Chouryou Engineering kabushiki Kaisha,
Ryokou-biru Bekkan 5 Floor, 5-7, Akunoura-machi, Nagasaki,
Nagasaki Pref., JAPAN,

WE, MITSUBISHI JUKOGYO KABUSHIKI KAISHA, have entitlement
from the actual Inventors by virtue of being the Assignee of
the said actual Inventors.

Part 3

ITSUBISHI JUKOGYO KABUSHIKI KAISHA are the applicants of
the basic applications listed on the Patent Request Form.
The basic applications listed on the Application form are
the first Applications made in a Convention Country in
respect of the invention.

Continued....

DATED THIS 27TH DAY OF SEPTEMBER 1991.

Kelvin Lord

MITSUBISHI JUKOGYO KABUSHIKI KAISHA
By their Patent Attorneys
KELVIN LORD AND COMPANY
PERTH, WESTERN AUSTRALIA.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-44552/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 618145

(54) Title
ANTI-FOULING SYSTEM FOR SUBSTANCES IN CONTACT WITH SEAWATER

(51)⁴ International Patent Classification(s)
C23F 013/02

(21) Application No. : 44552/89 (22) Application Date : 10.11.89

(30) Priority Data

(31)	Number	(32)	Date	(33)	Country
	63-287190		14.11.88		JP JAPAN
	1-139973		01.06.89		JP JAPAN

(43) Publication Date : 31.05.90

(44) Publication Date of Accepted Application : 12.12.91

(71) Applicant(s)
MITSUBISHI JUKOGYO KABUSHIKI KAISHA

(72) Inventor(s)
MASAHIRO USAMI; KENJI UEDA; KIYOMI TOMOSHIGE; SHOZO OHTA; TSUTOMU HORIGUCHI;
HIROSHI YAMAZAKI

(74) Attorney or Agent
KELVIN LORD & COMPANY , 4 Douro Place, WEST PERTH WA 6005

(56) Prior Art Documents
GB 1597305

(57) Claim

1. An anti-fouling system for a substance having an outer surface in contact with seawater such as ships and marine structures comprising:

an electric insulator coating on said outer surface of the substance and having an outer surface;

a first conductive membrane coating on said outer surface of said electric insulator coating, said first conductive membrane coating having an outer surface and comprising a thin sheet of material selected from the group consisting of metals having low electrical resistance, titanium, niobium, metal oxide, spray-coated membrane, evaporated membrane, and fused membrane;

a second conductive anti-fouling membrane coating having higher electrical resistance than said first conductive membrane coating on said outer surface of said first conductive membrane coating and comprising an

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oxidation-resistant insoluble material and an organic binder;

an electric conductor made of a material selected from the group consisting of steel, iron, copper and carbon and mixtures thereof positioned in the seawater in opposed spaced relation to said second conductive membrane coating; and

a power source connected between said first conductive membrane coating and said electric conductor for supplying direct current flowing from said first conductive membrane coating through said second conductive membrane coating toward said electric conductor.

COMPLETE SPECIFICATION

(ORIGINAL)

618145

FOR OFFICE USE:

Application Number:
Lodged:

Class

Int. Class

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

Name of Applicant(s):

MITSUBISHI JUKOGYO KABUSHIKI KAISHA

Address of Applicant(s):

5-1, Marunouchi 2-Chome,
Chiyoda-Ku, Tokyo
JAPAN

Actual Inventor(s):

MASAHIRO USAMI
KENJI UEDA
KIYOMI TOMOSHIGE
SHOZO OHTA
TSUTOMU HORIGUCHI and HIROSHI YAMAZAKI

Address for Service:

Kelvin Lord & Co.,
4 Douro Place,
WEST PERTH,
Western Australia 6005.

Complete Specification for the invention entitled:

"ANTI-FOULING SYSTEM FOR SUBSTANCES IN
CONTACT WITH SEAWATER"

The following statement is a full description of this invention, including the best method of performing it known to me/us

SPECIFICATION

1. TITLE OF THE INVENTION:

ANTI-FOULING SYSTEM FOR SUBSTANCES IN CONTACT
WITH SEAWATER

2. FIELD OF THE INVENTION AND RELATED ART STATEMENT:

The present invention relates to an anti-fouling system for substances in contact with seawater such as ships, offshore structures, undersea structures, bridge beams, rearing crawls, quaywalls, canals, gates, power plants, water intake-drainage pipes, water intake-drainage ducts, etc.

In order to prevent fouling on substances such as ships, offshore structures and the like being in contact with seawater, the method to coat the areas contacting with seawater with anti-fouling paint has been generally used.

There are, however, following drawbacks in this method.

(1) The conventional method can comply with changes in seasons, ocean currents, and water quality with flexibility due to its inability to control the elution speed of anti-fouling ingredients.

(2) As the poison content in the anti-fouling paint is not permitted to exceed a limit, the anti-fouling paint must be

recoated every two years.

5 Upon this, the applicant has developed an equipment to generate effective ingredients to prevent adhesion of marine organism wherein insulating paints 3 such as epoxy resin and conductive paints 5 in which carbon powder is mixed with the organic binder are coated on a structure 1 in contact with seawater 2, and direct current is supplied from a power source box 7 between the conductive paints 5 and an electric conductor 6 composed of steel and the like with the conductive paints 5 as an anode and the electric conductor 6 as a cathode wherein the effective ingredients are generated on the conductive paints 5, which is shown in FIG. 10 and disclosed in Japanese ~~Patent~~ ^{Patent} Provisional Publication No. 63-101464 (No. 101464 1988) and No. 63-103789 (No. 103789 1988).

15 However, it has become clear that this method has the following disadvantages;

(1) Though electric current density in seawater 2 must be maintained at more than fixed value, due to a rise in resistance caused by consumption of the conductive paints 5, electric current density tends to be concentrated near to a connecting terminal which makes the effective anti-fouling range narrow.

20 (2) Due to a difference in electric current density caused by irregularity of thickness of the conductive paints 5,



it is hard to maintain an expected performance.

(3) The conductive paints of low resistance are required for uniforming of electric current density. To produce the paints of such properties, a large quantity of conductive powder must be mixed which makes the production troublesome.

(4) Because the effective anti-fouling range, a reaching distance of electric current density required for prevention of fouling, is short, the system is difficult to apply to large-size structures.

3. OBJECT AND SUMMARY OF THE INVENTION:

It is therefore one of the objects of this invention to provide an anti-fouling system for the substance in contact with seawater wherein a rise in resistance caused by consumption of the conductive paints is prevented and the problem of non-uniforming of electric current distribution due to irregularity of thickness of the conductive paints is solved and a high performance of prevention of fouling owing to low-resistant conductive paints is achieved.

It is another object of the current invention to provide the anti-fouling system for the substance in contact with seawater in which the capacity of direct current power source is reduced without having the electric conductor (e.g. a cathode) equipped separately and by which large-sized structures can be protected at a lower cost.

It is a further object of this invention is to provide the anti-fouling system for the substance in contact with seawater wherein the application cost for the conductive paints is reduced and the debonding of the conductive
5 paints is prevented as well.

To achieve the above-mentioned objects, this invention is constituted of the following (1), (2), and (3).

(1) The system is constituted of the first conductive membrane which is coated on the outer side of the electric insulator mounted at the surface of the substance such as
10 ships, marine structures contacting with seawater and is composed of thin sheet of metals having low specific resistance or metal oxide, spray-coated membrane, and evaporated membrane such as Physical Vapor Deposit membrane
15 (PVD membrane) and Chemical Vapor Deposit membrane (CVD membrane), or fused membrane; the second conductive anti-fouling membrane having a higher electric resistance than the first conductive membrane which is coated on the outer
20 side of the above first conductive membrane and which is composed of the oxidation-resistant insoluble substance and the organic binder; and a power source (power supply equipment) connected between the first conductive membrane and an electric conductor, which supplies direct currents
25 flowing from the first conductive membrane through the second conductive membrane toward the electric conductor

made of iron, copper or carbon located in seawater and opposite the second conductive membrane. The functions and effects obtained by this invention include, in the anti-fouling system using conductive membrane, the prevention of rise in resistance due to consumption of the conductive membrane and the solution of the problem of non-uniforming of electric current distribution due to irregularity of thickness of the conductive membrane, and a high anti-fouling performance by using the low-resistant conductive membrane as well.

(2) The system is constituted of the first conductive membrane which is coated on the outer side of the electric insulator mounted at the surface of the substance such as ships, marine structures in contact with seawater and is composed of thin sheet of metals having low specific resistance, or metal oxide, spray-coated membrane, evaporated membrane and fused membrane, and is divided into multiple numbers; the second conductive anti-fouling membrane having higher electric resistance than the first conductive membrane which is coated on the outer side of the above first conductive membrane and is composed of the oxidation-resistant insoluble substance and the organic binder, which is also divided into multiple numbers; and a direct current power source having polarity reversing switching circuit that supplies electric currents in

seawater alternatively flowing from the anode which is arbitrarily selected an end of a divided part of the above first conductive membrane to the cathode which is also arbitrarily selected an end of another divided part of the first conductive membrane.

The functions and effects in this invention are in that by adapting this constitution, the electric current in seawater can be supplied, as an anode, to one of the multiple strip conductive membranes and as a cathode to another of the divided membranes and, moreover, both or either of the anode and the cathode can be switched to other strip conductive membranes timely and suitably without having a new cathode conductor equipped separately, resulting in a reduction of used electric currents and in an increase of the effective fouling length.

(3) In the above (1) and (2), the first conductive membrane is characteristic in that it is formed in a strip or lattice shape. The effects in this invention lies in that by adapting this constitution, the application cost of the first conductive membrane is reduced and the debonding of the membrane can be prevented.

For this reason, the current invention is very useful for industries.

4. BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 shows an illustration of the first embodied example of the anti-fouling system for substances in contact with seawater of the present invention and FIG. 2 is a diagram showing the conductive effective distance in the above system in comparison with conventional equipments.

FIG. 3 is the second embodied example of this invention and general oblique view illustrating application of conductive membranes to a structure. FIG. 4 is a local enlarged view of FIG. 3.

FIG. 5 is the third embodied example of application of this invention to steel structures. FIG. 6 is a horizontal sectional view of FIG. 5 by the VI-VI lines. FIG. 7 is a front view showing the basic test instructions in sea shown in FIG. 5. FIG. 8 is a horizontal sectional view showing a modification of FIG. 6. FIG. 9 is a modification of FIG. 5.

FIG. 10 is an illustration showing a conventional anti-fouling system.

5. DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS:

The examples of embodiments of the anti-fouling system for substances in contact with seawater are described by referring to drawings below.

EXAMPLE 1

FIG. 1 is an illustration of the example and FIG. 2

is a diagram of the conductive effective distance of the conductive membrane in comparison with the conventional system.

In FIG. 1, the number 1 shows a steel plate constituting an outer plate of the structure in contact with seawater; 3 showing an insulating membrane composed of epoxy resin which is coated on the outer side of the steel plate 1 and 4 showing the first conductive membrane composed of the thin plate of metals having low specific resistance or metal oxide, spray-coated membrane, fused membrane and evaporated membrane which is coated on the outer side of the insulating membrane 3, and on one end of which a connecting terminal 4a is mounted.

As metals having low specific resistance, nickel, copper, titanium aluminium, niobium and the like can be used. As metal oxide, magnetite, manganese dioxide and the like can be used.

5 shows the second conductive membrane composed of oxidation-resistant insoluble substance and organic binder which is coated on the outer side of the first conductive membrane 4. As the oxidation-resistant insoluble substances, graphite, carbon black, magnetite, platinum and the like can be used. As the organic binders, epoxy resin, vinyl resin, unsaturated polyester resin and the like can be used. This second conductive membrane 5 has higher electric

resistance than the first conductive membrane 4.

6 shows a cathode electrode composed of iron, copper or carbon which is equipped in seawater 2 opposite the second conductive membrane 5; 7 showing an electric power supply equipment connected between the connecting terminal 4a of the first conductive membrane 4 and the cathode electrode 6, which supplies the direct currents from the first conductive membrane 4 through the second conductive membrane 5 toward the cathode electrode 6. 8 is a lead line to connect the steel plate 1 with the cathode electrode 6.

In this system, when the direct currents are supplied from the first conductive membrane 4 through the second conductive membrane 5 toward the cathode electrode 6 in seawater, the surface of the second conductive membrane 5 is covered with a membrane containing the effective ingredients having a preventive effect on adhesion of marine organism.

In this system, the direct currents are supplied from the connecting terminal 4a connected to the first conductive membrane 4 through the first conductive membrane 4 having low electric resistance in the direction of thickness of the second membrane 5. Therefore, there is no concentration of electric current density near to the connecting terminal 4a even in the exhaustion of the second conductive

membrane 2. For this reason, stable and uniform distribution of electric current density is maintained for a long period resulting in a high performance of anti-fouling with less power consumption.

5 With the lead line 8, the steel plate 1 is connected so as to be in the (-) electric potential and both the first conductive membrane 4 and the second conductive membrane 5 are connected so as to be in the (+) electric potential, and therefore, when the exposed surface appears on the
10 steel plate 1 due to local damages on the first conductive membrane 4 and the second conductive membrane 5, a part of direct currents flowed out from the conductive membrane 4 and 5 flows into the exposed surface of the steel plate 1, from which the currents are returned to the cathode of the
15 direct current power supply equipment 7 by which the corrosion of the steel plate 1 is prevented.

 In consideration of the case where the second conductive membrane 5 is damaged and the exposed surface of the first conductive membrane 4 appears, in order to
20 prevent chemical elusion, the adaption of titanium, niobium, metal oxide and the like as the materials for the first conductive membrane 4 is effective for long and stable operation of this system.

 Further, in this system, the electric resistance R_4
25 in parallel with the steel plate 1 of the first conductive

membrane is lower than the resistance R_5 in parallel with the second conductive membrane 2, and therefore, in order to achieve uniforming of electric current density distribution by supplying about 95% of currents flowed from the connecting terminal 4a through the first conductive membrane 4, $(R_4/R_5) \leq 0.1$ is preferable. Moreover, when the thickness of the first conductive membrane 4 and the second conductive membrane 5 is decided, the volume resistivity as well as damages due to the current supply through the conductive membrane 5 and external circumstances must be taken into consideration.

Especially, to apply this invention to large-scaled structures, the resistance of the first conductive membrane must be lower than that of the metal conductive membrane composed of metals having low specific resistance or metal oxide and the organic binder. For this reason, although there is a metal-thin-plate attaching method for the above purpose, spray-coating is the most effective membrane-forming method when easiness of fabrication and practicality are considered.

FIG. 2 shows a test example where the effective conductive distance from the connecting terminal of the conductive membrane in this invention is compared with that in the conventional equipment. The conditions of each conductive membrane is as below.

Equipment in this invention:

First conductive membrane: resistance $1.6 \times 10^{-3} \Omega\text{-m}$,
thickness of membrane $20 \mu\text{m}$
Second conductive membrane: resistance $30 \Omega\text{-m}$,
thickness of membrane $200 \mu\text{m}$

5 Conventional equipment:

Conductive membrane: resistance $3 \Omega\text{-m}$,
thickness of membrane $200 \mu\text{m}$

Thus, when 80 mA of currents are supplied from the
connecting terminal to such conductive membrane, although
10 the effective length, in the conventional equipment(b), to
maintain required electric current density A is 3 m, it is
45m in this equipment of the current invention. When the
thickness of the second conductive membrane in the system
of the current invention is changed from $200 \mu\text{m}$ to $100 \mu\text{m}$,
15 no change in the effective length is found, however, it is
reduced to 1 m in the conventional system as the (c) line
shows.

EXAMPLE 2

The example shows an improvement in which the applica-
20 tion cost is reduced more than in EXAMPLE 1 and the conduc-
tive membrane is coated by a spray-coating method and the
debonding of spray-coated membranes due to residual stress
is prevented.

FIG. 3 is a general oblique view. FIG. 4 is a local
25 enlarged view. In these figures, the numbering of the same

one as FIG. 1 shows the same material numbered in FIG. 1.

3 is an insulating membrane and 3a is an insulating membrane which partitions the strip conductive membrane 4 into multiple parts to be described later. 4 shows the first conductive membrane, as shown in EXAMPLE 1, composed of metals having low specific resistance, the thin plate of metal oxide, the spray-coated membrane, the fused membrane and the evaporated membrane, which is coated on the outer side of the insulating membrane 3. The first conductive membrane 4 is formed on the insulating membrane 3 in multiple longitudinal strip in parallel with each other at short interval and the adjoining strip conductive membrane 4 is partitioned by the insulating membrane 3a. 4a and 4b are connecting terminals respectively mounted on both ends of strip conductive membrane 4.

5 is the second conductive membrane coating the outer side of each strip conductive membrane 4, which is composed of oxidation-resistant insoluble substance and the organic binder. As the oxidation-resistant insoluble substance, graphite, carbon black, magnetite and platinum can be used and, as the organic binder, various resins as described above can be used. Moreover, the electric resistance of the second conductive membrane 5 is higher than that of the first conductive membrane 4.

Further, 9 is a direct current power supply equipment

having a function (e.g. polarity reversing switch) of switching the anode and the cathode at a fixed interval for two strip conductive membranes 4, 4. Thus, the direct currents are supplied to each part of proportioned conductive membranes 4, 4 as the anode and the cathode alternatively. Here, the direct currents, as shown in FIG. 3, flow from connecting terminals 4a, 4b connected to one division used as the anode, of the strip divided conductive membrane 4 to connecting terminals 4a, 4b connected to another division used as the cathode, of the divided conductive membrane 4. In this mechanism, the electrolytic reaction progresses on the surface of the strip conductive membrane 4 used as the anode to produce the effective ingredient (hypochlorous acid) on the surface of the membrane for prevention of adhesion of marine organism. By reversing the strip conductive membrane 4 for the anode or cathode in a fixed cycle, the anti-fouling effect is achieved on the whole surface of the membrane, and by proportioning the membrane into multiple strips and combining the anode and cathode, more economical anti-fouling system is realized.

By adapting this constitution, the additional cathode electrode is not required to be installed opposite the structures and further the currents can be reduced by divisioning of the membrane to which the current is

supplied resulting in reduction of capacity of the direct current power supply equipment and of the required costs.

EXAMPLE 3

FIG. 5 to FIG. 9 illustrates the examples in which the current invention is applied to steel structures and the same numbers as in FIGS. 1 and 2 represent the same parts or materials as in these figures. In an illustration of FIG. 5 and in horizontal sectional view of FIG. 6, 14 shows the first conductive membrane coated on the insulating membrane 3 in multiple and parallel strips, on one end of which the connecting terminal 14a is connected and the material of which is the same as in the first conductive membrane 4 described above and, in this example, spray-coated metal thin plates composed of metal oxide is used in consideration of workability. 5 shows the second conductive membrane coating the outer side of the first conductive membrane 14, the material of which is the same as in the second conductive membrane.

In this system, because the first conductive membrane 14 is equipped in multiple and parallel strips, the quantity of materials of the membrane can be saved to several tens percent of the first conductive membrane 4 in the previous example where the membrane is coated generally without being proportioned. Moreover, the first conductive membrane 14 is in strip shape with narrow width and, therefore,

residual stress at edges on both sides of each strip is reduced. Further, because the second conductive membrane 5 is conductive itself, even if the first conductive membrane 14 is not formed generally, the currents can be supplied to the second conductive membrane 5 generally.

A pair of the first conductive membranes 14 in the right and the left to which the currents are supplied through the connecting terminal 14a equipped on the steel plate 1, which was coated with the second conductive membrane 5, is hung on from a raft on the sea for a testing to confirm the effectiveness as shown in the front view of FIG. 7. The result shows that the effective anti-fouling length was 1 m wherein the direct currents of current density of 1 A/m^2 and less were supplied from the first conductive membrane 14 spray-coated with aluminium to the second conductive membrane 5 of thickness of $300 \text{ }\mu\text{m}$ which is composed of the mixture of vinyl resin paint with graphite powder in particle diameter of $45 \text{ }\mu\text{m}$ and less with a mixing rate of 100:40 in volume concentration.

A horizontal sectional view of FIG. 8 is a modification of FIG. 6 in which 15 shows the first conductive membrane coated on the insulating membrane 3 in lattice vertically and horizontally at suitable interval, on one end of which the connecting terminal 14a is connected; 16 shows the second conductive membrane coating on the outer side of

the first conductive membrane 15. Thus, the same effects are practically performed in this modification as in EXAMPLE 3. If a part of the first conductive membrane 15 should be cut away by external strength, a bypass is automatically formed to let the current be supplied to downstream side of the circuit.

An illustration of FIG. 9 is a modification of FIG. 5 in which 17 shows the lower layer of the second conductive membrane composed of the paint wherein the quantity of the conductive paint made of metal, graphite and oxidation-resistant insoluble substance is increased to reduce the resistance of the second conductive membrane, which was coated directly on the first conductive membrane 14.

18 shows the upper layer of the conductive membrane composed of the paint wherein the quantity of the paint is reduced to increase the airtightness of the membrane, which is coated, to improve the electrolysation-resistance of the second conductive membrane, on the lower layer 17 of the conductive membrane. Thus, in the modification, the same effects can be practically performed as in the above example and the resistance of the second conductive membrane is decreased and the interval in parallel of the first conductive membrane 14 is increased.

In this connection, the basic test in seawater in the same way as in FIG. 7 was executed wherein the lower layer

17 of thickness of 200 μm of the second conductive membrane composed of the mixture of acrylic resin with graphite powder in particle diameter of 45 μm and less, as the conductive paint, with a mixing rate of 100:60 in volume concentration was coated with the upper layer 18 of thickness of 200 μm of the second conductive membrane composed of the mixture of vinyl resin with graphite powder in particle diameter of 45 μm and less with a mixing rate of 100:40 in volume concentration. The result showed that the effective anti-fouling length l was 5 m.

In the above experiment, when the lower layer 17 of the second conductive membrane was composed of the mixture of the acrylic resin with copper powder with a mixing rate of 100:30 in volume concentration and with thickness of 200 μm , the effective anti-fouling length l was 15 m.

As explained in these examples and modifications, the following effects are achieved by the current invention.

(1) By having the first conductive membrane shaped in multiple parallel strip or lattice, the application area of the first conductive membrane can be reduced to several tens percent compared with that of general application of the membrane and accordingly the cost for the system is reduced as well.

(2) By having the first conductive membrane shaped in multiple parallel strip or lattice, the width dimension of

the first membrane can be made short and the residual stress is not generated at edges on both sides and therefore, there is no fear of debonding of the first conductive membrane.

The Claims defining the invention are as follows:-

1. An anti-fouling system for a substance having an outer surface in contact with seawater such as ships and marine structures comprising:

- 5 an electric insulator coating on said outer surface of the substance and having an outer surface;
- a first conductive membrane coating on said outer surface of said electric insulator coating, said first conductive membrane coating having an outer surface and comprising a
- 10 thin sheet of material selected from the group consisting of metals having low electrical resistance, titanium, niobium, metal oxide, spray-coated membrane, evaporated membrane, and fused membrane;
- a second conductive anti-fouling membrane coating having
- 15 higher electrical resistance than said first conductive membrane coating on said outer surface of said first conductive membrane coating and comprising an oxidation-resistant insoluble material and an organic binder;
- 20 an electric conductor made of a material selected from the group consisting of steel, iron, copper and carbon and mixtures thereof positioned in the seawater in opposed spaced relation to said second conductive membrane coating; and
- 25 a power source connected between said first conductive membrane coating and said electric conductor for supplying direct current flowing from said first conductive membrane coating through said second conductive membrane coating toward said electric conductor.



2. An anti-fouling system as claimed in Claim 1, wherein:
said first conductive membrane coating comprises a plurality
of spaced strips.

3. An anti-fouling system as claimed in Claim 2 wherein:

5 said second conductive membrane coating comprises a
plurality of spaced strips.

4. An anti-fouling system as claimed in Claim 2 wherein:
said plurality of strips lie substantially in the same
plane;

10 and

electrical insulation is provided between said strips.

5. An anti-fouling system as claimed in Claim 4 wherein:
said plurality of second conductive membrane coating strips
lie substantially in the same plane; and

15 electrical insulation is provided between said strips.

6. An anti-fouling system as claimed in Claim 2 wherein:
said strips of said first conductive membrane coating have
end portions; and

said power source further comprises a polarity switching
20 circuit for alternating current flow from an anode at one of
said end portions of each strip to a cathode at the other of
said end portions of each strip.

7. An anti-fouling system as claimed in Claim 3 wherein:
said strips of said first conductive membrane coating have

25 end portions; and

said power source further comprises a polarity switching
circuit for alternating current flow from an anode at one of
said end portions of each strip to a cathode at the other of
said end portions of each strip.



8. An anti-fouling system as claimed in Claim 1 wherein:
said first conductive membrane coating comprises a plurality
of strips.

9. An anti-fouling system as claimed in Claim 8 wherein:
5 said plurality of strips comprises a lattice form.

10. An anti-fouling system for substances in contact with
seawater substantially as hereinbefore described with
reference to Figures 1 and 2, Figures 3 and 4, Figures 5 to
7, Figure 8 or Figure 9 of the accompanying drawings.

10

DATED SEPTEMBER 10 1991

MITSUBISHI JUKOGYO KABUSHIKI

KAISHA

By their Patent Attorneys

KELVIN LORD AND COMPANY

15

PERTH, WESTERN AUSTRALIA.

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FIG. 1

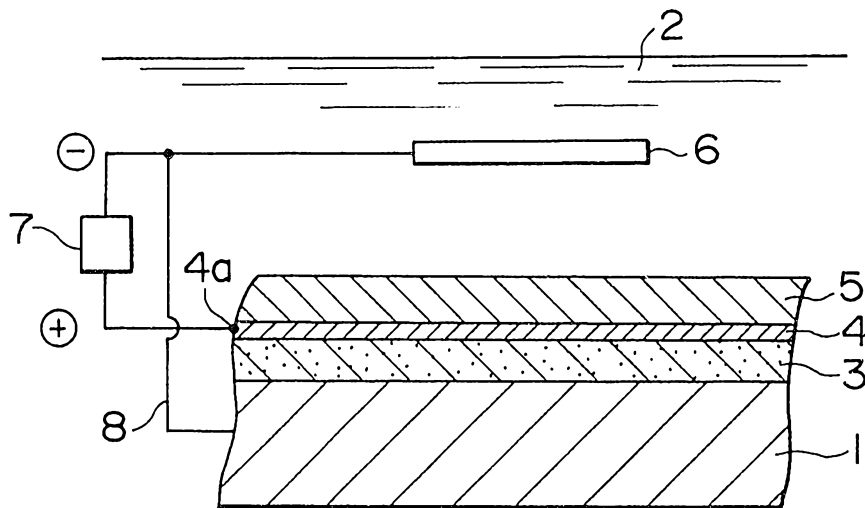


FIG. 2

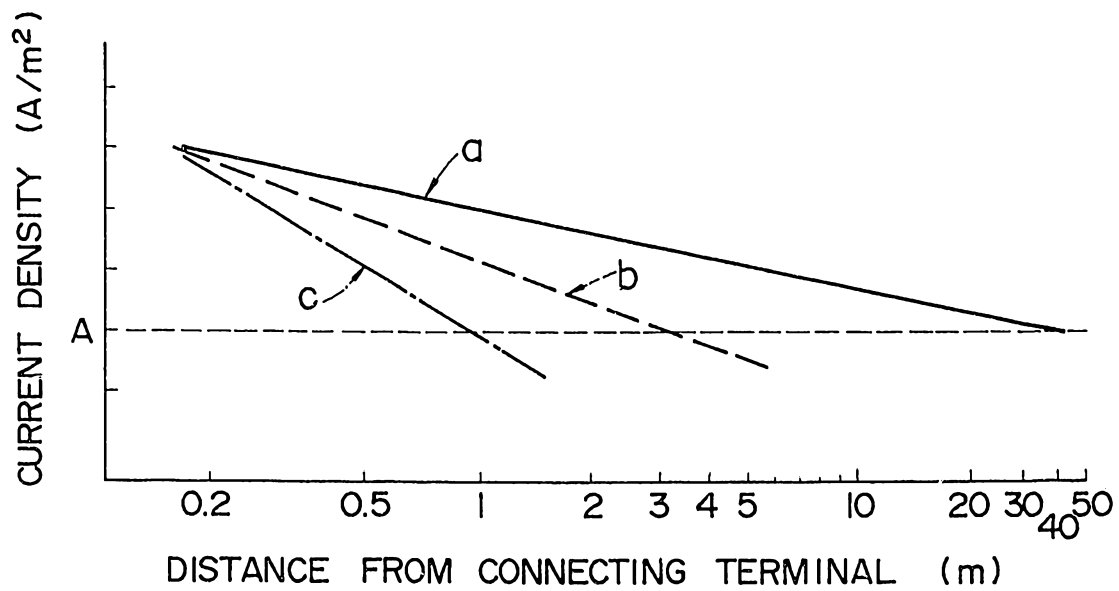


FIG. 3

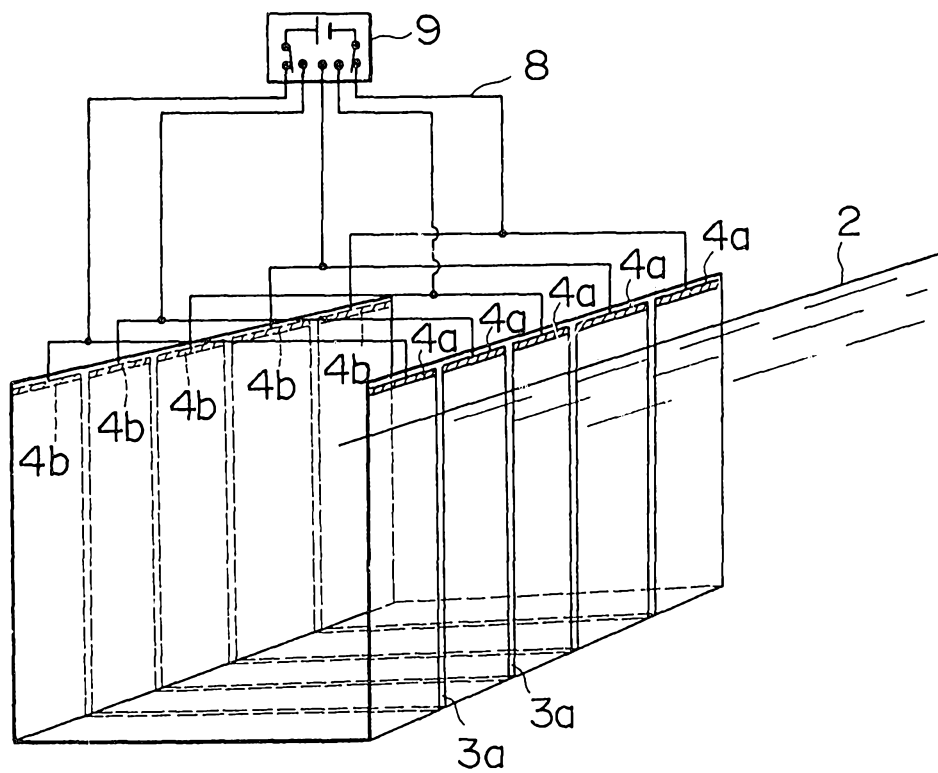


FIG. 4

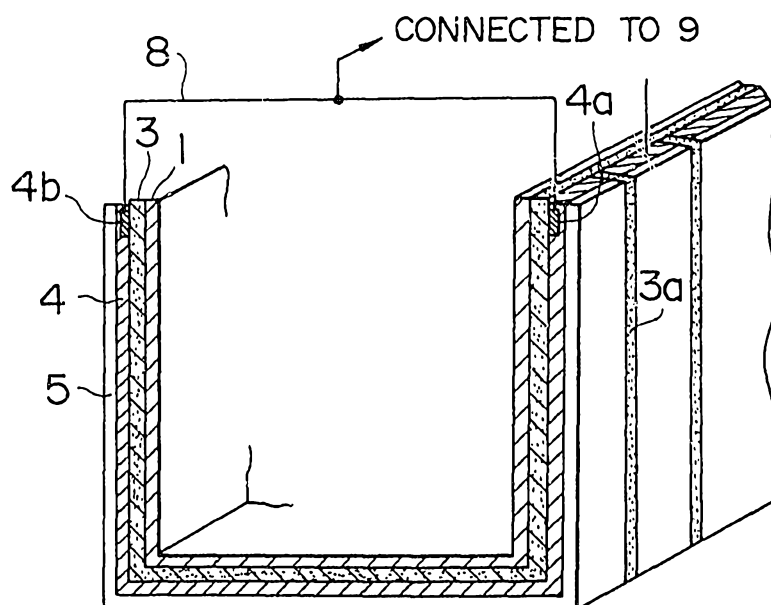


FIG. 5

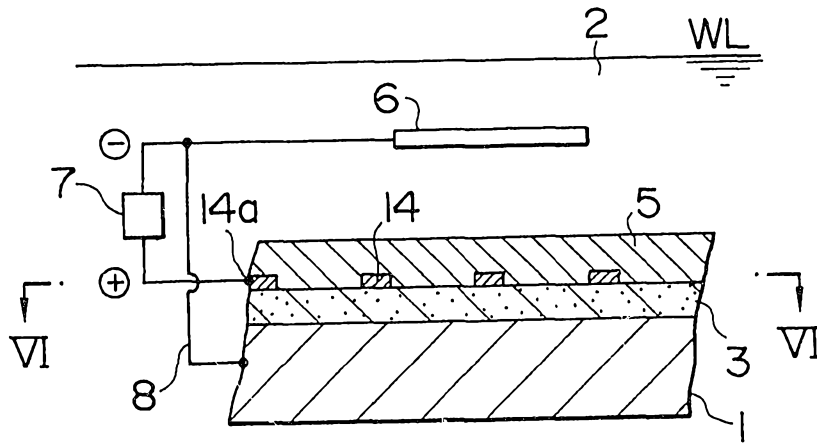


FIG. 6

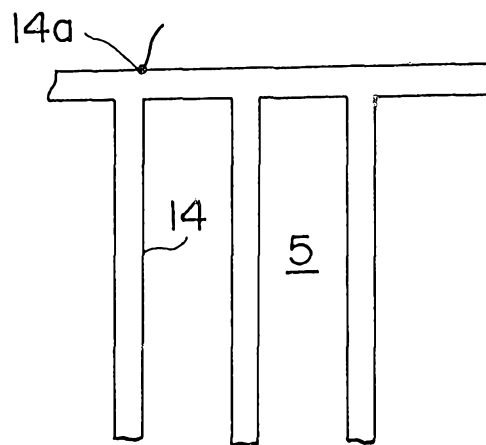


FIG. 7

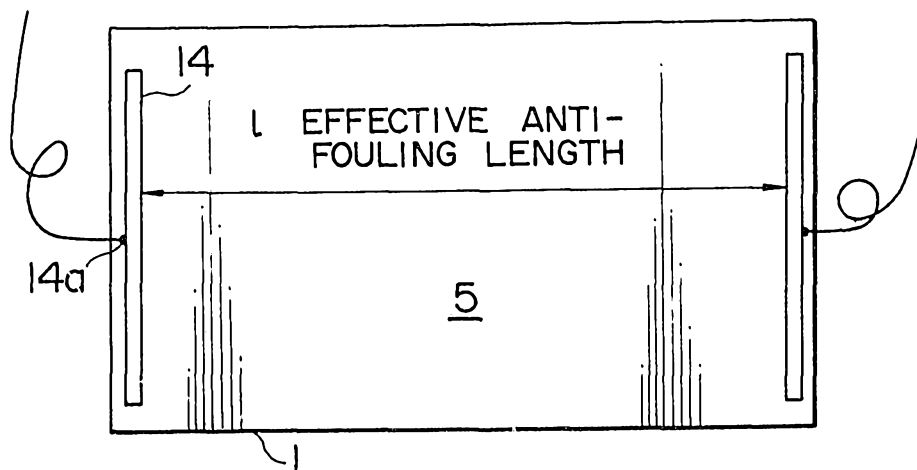


FIG. 8

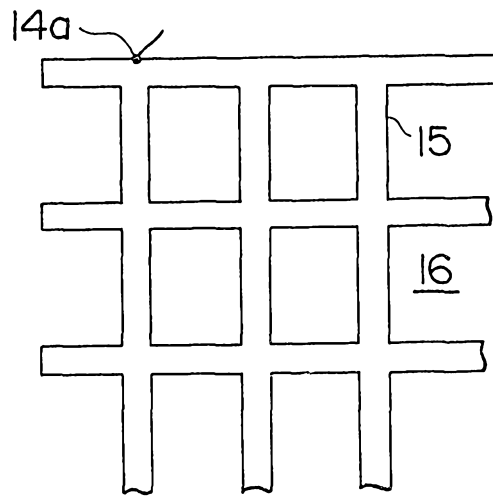


FIG. 9

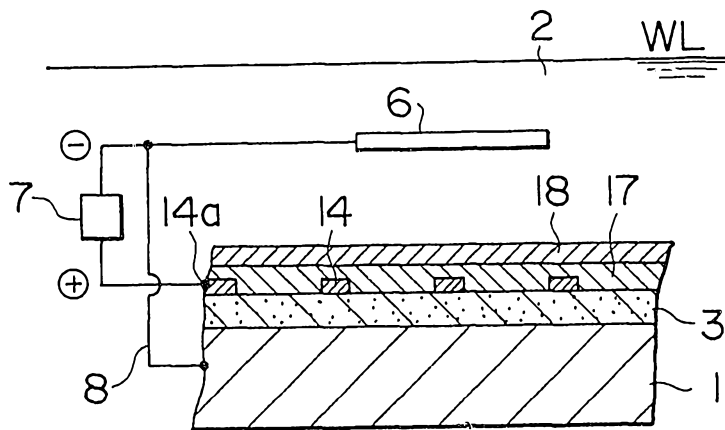


FIG. 10

