United States Patent [19]

Fujii et al.

[11] **3,888,575**

[45] **June 10, 1975**

[54] **PREFABRICATION PRIMER FOR HIGH TENSILE STEEL**

[75] Inventors: **Masao Fujii**, Okayama; **Shiro Shimatani; Ryoji Orita**, both of Tamano; **Isao Takemoto**, Osaka, all of Japan

[73] Assignee: **Mitsui Shipbuilding and Engineering Co., Ltd.**, Tokyo, Japan

[22] Filed: **Dec. 7, 1972**

[21] Appl. No.: **312,908**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 143,553, May 14, 1971, abandoned.

[52] **U.S. Cl.** ..... **252/513;** 106/14; 106/290; 106/304; 106/306; 117/227; 117/230; 252/500; 252/514; 260/37 EP; 260/37 M

[51] **Int. Cl.** **H01b 1/00**

[58] **Field of Search** ..... 252/500, 513, 514, 521; 106/241, 290, 304, 306, 14; 117/223, 227, 230; 260/37 EP, 37 M

[56] **References Cited**

UNITED STATES PATENTS

2,456,313	12/1948	Pratt	106/290
2,718,506	9/1955	Elleman	252/513
2,795,680	6/1957	Peck	252/519 X
3,175,991	3/1965	Levine et al.	252/521 X
3,247,147	4/1966	Jarboe	106/14
3,287,142	11/1966	Russell	106/14
3,325,432	6/1967	Kellert et al.	106/14
3,410,722	11/1968	Flanders et al.	117/227
3,493,369	2/1970	Busch et al.	252/500 X
3,755,554	8/1973	Lailach et al.	106/304 X

FOREIGN PATENTS OR APPLICATIONS

1,117,982	6/1968	United Kingdom	106/290
2,000,199	7/1971	Germany	106/290
885,354	11/1971	Canada	106/290
823,003	11/1959	United Kingdom	106/290

Primary Examiner—Benjamin R. Padgett
Assistant Examiner—R. E. Schafer
Attorney, Agent, or Firm—Howson and Howson

[57] **ABSTRACT**

A prefabrication primer paint composition is formulated by combining an ethyl silicate solution or a phenoxy resin paint base, a semiconductive pigment, and a rust preventative pigment is sufficient quantities such that a solid paint film of the primer paint contains from about 10 to about 45% of said paint base, from about 5 to about 65% of said rust preventative pigment and the balance of said semiconductive pigment.

1 Claim, 4 Drawing Figures

composition	test item				
	outdoor exposure test result		final coating test result one year		weldability test result
	2 months	4 months	chlorinated rubber A 100 μ	tar epoxy 100 μ	X-ray inspection
no paint	overall rusting	overall rusting	×	△	1 class
phenoxy resin solution only	50% rusting	"	○	○	2 class
phenoxy resin+40% Fe-Si	no change	10% pitting	◎	◎	1 class
phenoxy resin+40% Fe-Si 20% zinc powder	"	no change	◎	◎	"
phenoxy resin+40% Fe-AL	"	20% pitting	◎	◎	"
phenoxy resin+40% Fe-AL 20% zinc powder	"	no change	◎	◎	"
ethyl silicate solution +40% Fe-Si	"	10% pitting	◎	◎	"
ethyl silicate solution +40% Fe-Si 20% zinc powder	"	no change	◎	◎	"
ethyl silicate solution +40% Fe-AL	"	10% pitting	◎	◎	"
ethyl silicate solution +40% Fe-AL 20% zinc powder	"	no change	◎	◎	"
zine rich paint	"	"	◎	◎	4 class
wash primer	20% pitting	overall rusting	△	○	2 class

NOTE

1) ◎---very good ○---good △---ordinary ×---no good

2) The weldability test for steel plate with no paint film was conducted immediately after removal of rust by sand blasting.

FIG.1

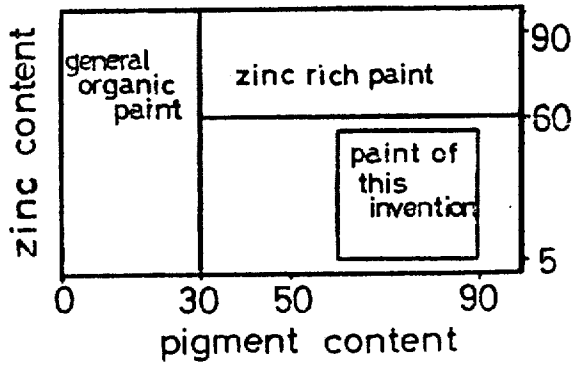
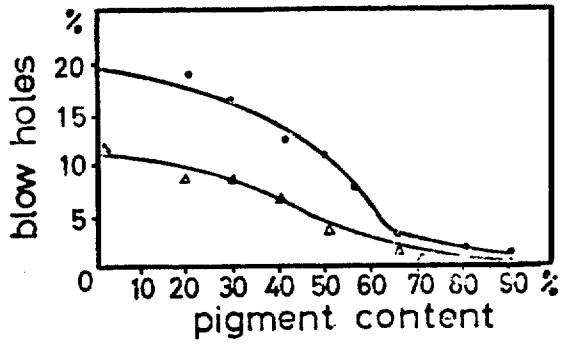


FIG.2



NOTE
•---phenoxy resin / ferro-AL
△---ethyl silicate solution / ferro-AL

FIG.3

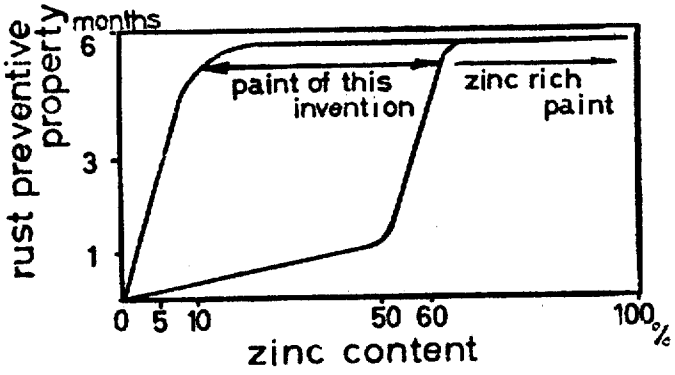


FIG.4

composition	test item				
	outdoor exposure test result		final coating test result one year)		weldability test result
	2 months	4 months	chlorinated rubber A 100 μ	tar epoxy 100 μ	X-ray inspection
no paint	overall rusting	overall rusting	×	△	1 class
phenoxy resin solution only	50% rusting	〃	○	○	2 class
phenoxy resin+40% Fe-Si	no change	10% pitting	◎	◎	1 class
phenoxy resin+40% Fe-Si 20% zinc powder	〃	no change	◎	◎	〃
phenoxy resin+40% Fe-AL	〃	20% pitting	◎	◎	〃
phenoxy resin+40% Fe-AL 20% zinc powder	〃	no change	◎	◎	〃
ethyl silicate solution +40% Fe-Si	〃	10% pitting	◎	◎	〃
ethyl silicate solution + 40% Fe-Si 20% zinc powder	〃	no change	◎	◎	〃
ethyl silicate solution + 40% Fe-AL	〃	10% pitting	◎	◎	〃
ethyl silicate solution + 40% Fe-AL 20% zinc powder	〃	no change	◎	◎	〃
zine rich paint	〃	〃	◎	◎	4 class
wash primer	20% pitting	overall rusting	△	○	2 class

NOTE

1) ◎---very good ○---good
△---ordinary ×---no good

2) The weldability test for steel plate with no paint film was conducted immediately after removal of rust by sand blasting.

PREFABRICATION PRIMER FOR HIGH TENSILE STEEL

This application is a continuation-in-part of our copending application Ser. No. 143,553, filed May 14, 1971, now abondoned.

This invention relates to a prefabrication primer to be painted on the high temsile steel having a tensile strength of 50 Kg/mm^2 or more which has a superior rust preventive performance and provides a good weldability.

Heretofore, the long exposure type wash primer or the organic or inorganic zinc rich paint has been generally employed as a prefabrication primer. However, each of these paints has the following disadvantages. The wash primer comprising the basis agent of butyral resin and phosphoric acid and the inhibitive pigment of zinc chromate, chrome yellow or the like is superior to the organic or inorganic zinc rich paint in the effect on weldability and cutting workability of the steel and in the paint that less poisonous gas generation during cutting operation. However, the wash primer has an inferior weather resistance thereby the long period exposure of the steel being impermissible and a disadvantage that final coating paint must be selected from the limited paints. On the other hand, the organic or inorganic zinc rich paint is an excellent prefabrication primer because of its high weather resistance (generally, over 6 months), but this paint when applied in a thick film, has deleterious effects on the welding and cutting operations and particularly in a high content of zinc, has a tendency to generate a large amounts of blow holes in the welded part, thereby causing the deterioration of mechanical strength of the welded part. Accordingly, the film of the zinc rich paint on the portion to be welded must be removed, when welding working, which results in a remarkable lowering of the operation efficiency. Furthermore, the zinc rich paint has a disadvantage of generating of toxic zinc hume when carrying out welding or cutting operation.

This invention is directed to eliminate the above described disadvantages. The paint in accordance with this invention is characterized by mixing a basis agent consisting of resin such as phenoxy resin or ethyl silicate solution and appropriate amounts of solvent and hardener with a semiconductive pigment such as farroaluminium, calcium silicide, metallic silicon, ferrosilicon, ferrochromium, iron oxide and the like and a rust preventive pigment such as zinc, aluminium or the like, in such a proportion that the solid film formed thereby contains the resin of 10 to 45% by volume and zinc in the pigments of 5 to 65% by volume. In addition, silica or alumina may be added as slag forming agent.

This invention is more fully set forth with reference to the accompanying drawings in which:

FIG. 1 is a graphical illustration indicating a difference between the conventional paints and the paint of this invention;

FIG. 2 is a graph showing a relationship between the amount and the weldability of phenoxy resin and ethyl silicate solution;

FIG. 3 is a graph showing a rust preventive property of the paint of this invention and a conventional paint; and

FIG. 4 is a table showing results of experiments of this invention.

A comparison of the construction of the paint of this invention and conventional paints is illustrated in FIG. 1. As seen from FIG. 1, the conventional organic paint generally has a resin content not lower than 70% and a pigment content not exceeding 30%. This indicates that the corrosion preventing nature of the film of this paint is solely intended to provide reduction of the water permeability. Such large amount of resin generates hydrogen and other gases when combustioned during welding, so that blow holes are formed. With respect to this point, experiments on weldability were conducted using ferroaluminium as a pigment and varying the amount of phenoxy resin or ethyl silicate solution, the results of which are indicated in FIG. 2. As seen from FIG. 2, it has been found that a pigment content of 65 to 90% remarkably reduces the formation of blow holes in the welded part to a degree sufficient to be practical.

On the other hand, the conventional zinc rich paint has a pigment content of 50 to 90% including zinc of 60 to 80% therein, and the amount of blow holes increases as the zinc content increases. It has been found, however, that a pigment consisting of semi-conductive materials such as ferroaluminium, ferrosilicon, ferromanganese, ferrochromium, metallic silicon, iron oxide, and the like, and zinc powders mixed therewith provides the same rust preventive property as the zinc rich paint and further improves the weldability and cutting performance. FIG. 3 shows a comparison of rust preventive property of the paint systems of this invention and the conventional zinc rich paint. Whereas the conventional zinc rich paint requires a zinc content not lower than 60% to attain a long period rust prevention (over 6 months), the paint system of this invention comprising conductive pigments such as ferro alloys and zinc of 5 to 65% provides the same degree of rust prevention as that of the zinc rich paint.

EXAMPLE 1

54 parts of resin solution consisting of 20 parts of phenoxy resin (Union Carbide Corp. Bakelite Phenoxy Resin) and 80 parts of aromatic hydrocarbon, ketone and ester type solvents is mixed with 45 parts of pigment powders consisting of 35 parts of metallic silicon, 15 parts of iron oxide and 50 parts of zinc powder, and 1 part of anti-settling agent.

EXAMPLE 2

52 parts of resin solution consisting of 20 parts of phenoxy resin and 80 parts of aromatic hydrocarbon, ketone and ester type solvents is mixed with parts of pigment powders consisting of 20 parts of ferroaluminium, 40 parts of ferrosilicon, 10 parts of calcium silicide and 30 parts of zinc powder, and 1 part of anti-settling agent.

EXAMPLE 3

Ethyl silicate	24	%
Butanol	4.5	%
10% hydrochloric acid solution	0.5	%
Water	1	%
	30	%
Zinc powder	50	%
Ferroaluminium	20	%
	70	%
	100	%

The rust preventive paint thus prepared was coated on a high tensile steel from which the mill scales and rust have been removed by means of blasting or acid pickling, and an outdoor weathering test for 6 months was made which produce excellent results that no rusting is formed and an adhesion between the film and steel substrate is kept strongly. The same paint was coated to a high tensile steel and weatherbeaten for 1 month and, thereafter, a chlorinated rubber base anticorrosion paint and a tar epoxy paint were applied thereto as final coating. The steel was subjected to a sea water immersion test for 1 year, which produced no resuting, blistering and deterioration of adhesion.

In addition, hereinafter described other tests were made. Above described paints of this invention were coated on high tensile steels (over 50 Kg/mm^2) and subjected to horizontal fillet welding test and butt arc welding test by submerged arc welding, gravity arc welding, hand welding and non-gas semiautomatic welding. X-ray inspection of the welded parts gave the acceptable X-ray radiography standard Class 1 and Class 2 as shown in FIG. **4.**

As described above, it is evident that whereas the phenoxy resin per se, though providing a good weldability; is deficient in the rust preventive property, each of the pigments added thereto have the powerful rust preventing effect due to its conductivity, as well as the weldability. This invention will be summarized as follows: A paint is prepared by mixing a resin solution consisting of phenoxy resin alone or ethyl silicate alone or phenoxy resin with an addition of various hardeners

with ferroaluminium, metallic silicon, calcium silicide, ferrosilicon, ferrochromium and iron oxide which are conductive and contribute to the improved weldability, and zinc powders as rust preventive pigment. The paint thus prepared is applied to the high tensile steel or high tensile steel structure prior to working thereof where the welding is to be performed and the mill scales and rust have been removed by means of blasting and acid pickling. In accordance with this invention, there are formed no rusting on the high tensile steel for a long period and eliminated difficulties having prevented the application of various welding processes therefor and thereby producing a highly improved operation efficiency and a remarkable cost reduction.

We claim:

1. A prefabrication primer paint composition comprising a paint base selected from the group consisting of an ethyl silicate solution and a phenoxy resin; a semiconductive pigment selected from the group consisting of ferroaluminum, ferrosilicon, ferromanganese, ferrochromium, silicon and iron oxide; a rust preventative pigment selected from the group consisting of zinc and aluminum; said paint base semiconductive pigment and rust preventative pigment being present in the primer paint in a sufficient quantity such that a solid film of said primer paint contains from about 10 to about 45% of said paint base, about 5 to about 65% of said rust preventative pigment, balance of said semiconductive pigment.

* * * * *