

UNITED STATES PATENT OFFICE

2,420,646

METHOD OF DETECTING FLAWS IN METAL ARTICLES

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No Drawing. Application January 25, 1945,
Serial No. 574,601

3 Claims. (Cl. 73-104)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

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This invention relates to a method of detecting cracks and other flaws in articles fabricated of any metallic material.

A variety of methods are already known in the art for detecting flaws in metals. However, as respects ferrous alloys in particular, the methods which have achieved commercial success have depended on the use of magnetic powders, as used with magnetizable steel and iron bodies. Obviously, such methods may not be practiced with non-ferrous metals and alloys or with non-magnetic iron alloys, nor are they well adapted for use with bodies whose structural configuration renders the use of the magnetic powder method of inspection impractical.

It is accordingly an object of this invention to furnish a method of detecting flaws in the surface layers of any type of metallic article, of whatever shape. A more particular object is to furnish such a flaw detection method which is useful with both ferrous and non-ferrous articles, whether magnetizable or non-magnetizable. Still another object of this invention is to furnish a flaw detection method which in no way damages the metallic article under test.

We have discovered that the foregoing objects can be achieved by treating the surface to be tested with an oil mixture containing an oil soluble dye. This dye-bearing solution penetrates any cracks or other flaws which may exist in the surface of the metallic article to which the oil is applied. On removal of the excess oil-dye solution, and on application to the surface of a finely divided absorbent material such as diatomaceous earth or white talc, any oil-dye mixture lying in a crack or other imperfection in the metal surface, seeps out and visibly colors the absorbent material. The extent of the imperfection will then be readily apparent, and the article under test may then be rejected or subjected to other known tests to determine the depth and other characteristics of the flaw. In general, other coloring materials than dyes may also be used.

Particularly good results have been obtained by using the following materials in carrying out our invention. The penetrating oil is made up of 8 per cent soluble cutting oil, 5 per cent oleic acid, and 87 per cent Diesel fuel oil. This oil is saturated with alizarin-type gasoline dye to form an oil-dye solution. Finely divided white talc is used as the absorbing material. Carbon tetrachloride is used as the solvent for the penetrating oil-dye solution. However, it is not the intent of this application to restrict the invention

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to the above materials and proportions. Any other oils of a penetrating nature such as kerosene and lard oil mixtures, for example, may be employed in connection with any oil soluble dye. Likewise, other absorbing powders such as diatomaceous earth may be substituted or intermixed with the finely divided white talc, and other solvents than carbon tetra-chloride may be used.

The preferred method of carrying out our invention is as follows. The surface of the object to be examined is cleaned thoroughly in the area designated for examination with carbon tetrachloride or a like solvent. The oil-dye solution is then applied to the previously cleaned surface. This solution is permitted to remain on the surface for a period of approximately ten minutes, after which it is wiped off using a rag dampened with water, carbon tetra-chloride, or other solvent. The surface is then allowed to dry, a drying period of about one minute usually being sufficient. As the next step in the process, a fine film of white talc is dusted upon the dried surface. If a flaw exists within the so-treated area, it is penetrated by the oil-dye mixture during the soaking period. The oil mixture then seeps back onto the surface where it is absorbed by the white powder film. This particular type of dye vividly outlines the extent of the flaw as a red sear against the white talc background. The red sear may readily be photographed if this is desired.

Within the scope of the appended claims, various modifications and changes in the nature and proportions of the ingredients may be made by those skilled in the art without departing from the nature of the invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon or therefor.

What is claimed is:

1. In a method of detecting the presence of flaws in the surface layers of a metallic article, the steps comprising applying to the surface of said article a solution containing an oil and a coloring material, maintaining the solution in contact with the surface for a period of time of sufficient duration that the solution may penetrate said flaws, removing from the surface the solution which has not penetrated said flaws, and applying to the surface a finely divided absorbent material, the presence of flaws in the surface layers of said metallic article being visibly indicated by a coloring of the absorbent material lying adjacent said flaws by the coloring material contained

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in the solution upon the seeping of the latter out of said flaws onto the surface of the article.

2. In a method of detecting the presence of flaws in the surface layers of a metallic article, the steps comprising applying to the surface of said article a solution containing a penetrating oil and an oil soluble dye, maintaining the solution in contact with the surface for a period of several minutes, removing the solution which is present on the surface, and applying to the surface a finely divided absorbent material the color of which contrasts with the color of the dye, the presence of flaws in the surface layers of said metallic article being visibly indicated by a coloring of the absorbent material lying adjacent said flaws by the dye contained in the solution upon the seeping of the latter out of said flaws onto the surface of the article.

3. In a method of detecting the presence of flaws in the surface layers of a metallic article, the steps comprising applying to the surface of said article an oil-dye solution containing a penetrating oil made up of about 8 per cent soluble cutting oil, 5 per cent oleic acid, and 87 per cent Diesel fuel oil, and an alizarin-type gasoline dye, maintaining the oil-dye solution in contact with

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the surface for a period of time of sufficient duration that the solution may penetrate said flaws, removing from the surface the oil-dye solution which has not penetrated said flaws, and applying to the surface at least one finely divided absorbent material selected from the group consisting of diatomaceous earth and white talc, the presence of flaws in the surface layers of said metallic article being visibly indicated by a coloring of the absorbent material lying adjacent said flaws by the dye contained in the oil-dye solution upon the seeping of the latter out of said flaws onto the surface.

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The following references are of record in the file of this patent:

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