

UNITED STATES PATENT OFFICE

2,106,882

PASTE OF PARAMAGNETIC PARTICLES FOR USE IN THE EXAMINATION OF PARAMAGNETIC MATERIALS FOR FLAWS BY THE MAGNETIC METHOD

Carl E. Betz, Park Ridge, Ill., assignor to Magnaflex Corporation, Chicago, Ill., a corporation of Pennsylvania

No Drawing. Application December 12, 1936, Serial No. 115,640

3 Claims. (Cl. 175-183)

This invention relates to a paste of paramagnetic particles for use in the examination of paramagnetic materials for flaws by the magnetic method.

In the magnetic method of examining articles made of iron or steel or other paramagnetic material for the detection of cracks and flaws it has been customary in the past to use a fine iron powder, finely ground mill-scale or the like, by dusting the dry powder over the surfaces of the previously magnetized articles undergoing examination. The use of such powders suspended in a liquid bath of a light oil or water has also been suggested and attempted but with rather indifferent success, especially where very fine cracks or flaws are to be detected. The lack of success, using such powders, has been due to the fact that the powders were of such high specific gravity and of such coarse particle size that the particles would not stay suspended in the liquid medium, and also to the fact that the particle size was too coarse to show very fine cracks, which produce only a relatively weak external leakage field that is capable of holding only very fine particles of very small mass.

The present invention overcomes these difficulties by utilizing a powder of paramagnetic material of very fine size, in general less than 5 microns, and by employing a dispersing agent capable of preventing agglomeration of the particles and of effecting uniform dispersion thereof upon dilution of the paste to form a testing bath. The fine particles of paramagnetic material in the testing bath are thus free to move and align themselves at a defect as individuals, with the result that the magnetic method of testing for the detection of cracks, flaws, and the like, is rendered much more accurate and sensitive.

It is therefore an important object of this invention to provide a paste of paramagnetic particles containing a dispersing agent capable of preventing agglomeration of the particles and of causing a uniform dispersion of the particles upon dilution to form a bath for use in the detection of flaws by the magnetic method.

Other and further important objects of this invention will become apparent from the following description and appended claims.

In preparing a paste of paramagnetic particles for the purpose described, various paramagnetic materials in finely divided powder form may be used, such as nickel, cobalt, paramagnetic aluminum alloys, iron, or various iron oxides, but I prefer to use the magnetic or black oxide of

iron (Fe_3O_4). A powder of a particle size less than 10 microns and preferably less than 5 microns, is used.

In order to accomplish the initial dispersion for complete wetting of the individual particles of paramagnetic material, the dry powder is ground with a non-polar liquid medium or a medium of low polar moment such as a light oil, in an ordinary paint mill, thereby causing the oil to mix with and wet the powder. The oil used in this initial dispersion of the powder is the same, or similar to that to be used in dilution of the paste to form a testing bath. Sufficient oil is employed in the grinding operation to result in a stiff paste of the powder and oil.

In order to prevent agglomeration of the particles and to effect a uniform dispersion thereof upon subsequent dilution in forming the testing bath, a dispersing agent is incorporated into the powder and oil, preferably during the grinding operation. A substance, such as oleic or stearic acid, or a metal soap thereof, serves as a satisfactory dispersing agent. The amount of the dispersing agent required is in general less than 5% and need be only sufficient to be effective in the subsequent dilution of the paste to give a uniform dispersion of the paramagnetic particles and prevent rapid settling thereof in the testing bath. If settling in the testing bath does occur, the dispersing agents facilitate the re-mixing of the settled out particles by preventing the caking of the particles. As a result, the paramagnetic particles in the final testing bath show little if any tendency to agglomerate and are substantially free to act and move as individuals in the bath.

A preferred formula of the paste is as follows:

	Per cent
Black oxide of iron.....	60
Light petroleum oil.....	37
Stearic acid.....	3

A light petroleum oil suitable for the purpose is one having a Baumé of 46° A. P. I., a Saybolt viscosity of 31 seconds, a flash point tag open cup of 155 to 175° F., an initial boiling point of 390° F. and an end boiling point of 490° F., and a color of 25 Saybolt.

In preparing a paste of the foregoing formula, in which the percentages are by weight, the stearic acid is first dissolved in the light petroleum oil, which is then mixed with the oxide and the mixture ground together in a mill. Any fine powder of a suitable paramagnetic material may be substituted for the black oxide of iron.

Coal tar distillates, such as naphtha or benzol can be used in place of the mineral oil distillate or as a blend therewith.

5 In making up the final testing bath, from 3 to 5 lbs. of the paste are added to 10 gallons of the same or a similar light oil to that used in the paste. The testing of a paramagnetic material for cracks, flaws, or the like is performed 10 either by immersing the article in the bath or by flowing some of the bath over the article in a magnetized condition and allowing the film adhering to the article to drain and dry. The article is then examined for cracks or flaws in the manner familiar to those acquainted with the 15 magnetic method of testing.

I am aware that numerous details of the process may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting 20 ing the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. A plate for use in examining paramagnetic materials for flaws by the magnetic method, said

paste comprising a uniform dispersion of finely divided paramagnetic particles in an oily vehicle and a small percentage of a dispersing agent effective to prevent agglomeration of said particles and to disperse said particles upon dilution of said paste. 5

2. A paste for use in examining paramagnetic materials for flaws by the magnetic method, said paste comprising powdered black oxide of iron of less than 5 micron particle size, a light petroleum oil and a few percent of stearic acid 10 effective to prevent agglomeration of said particles and to disperse said particles uniformly upon dilution of said paste.

3. A paste for use in examining paramagnetic materials for flaws by the magnetic method, said paste comprising 60% of powdered black oxide of iron of less than 5 micron particle size, 30% of a light petroleum oil and 3% of stearic acid 15 effective to prevent agglomeration of said particles and to disperse said particles uniformly upon dilution of said paste. 20

CARL E. BETZ.