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MAGNETIC TESTING MATERIAL AND METHOD OF PREPARING THE SAME

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3 Claims. (Cl. 175—21)

The present invention relates to the testing of iron or steel bodies to locate and evaluate cracks, flaws or discontinuities or the presence of inhomogeneities of any kind in, on or near the surface regions of the body under test.

In my copending application Serial No. 375,984, filed July 5, 1929, I describe a method of testing in which a body is subjected to the action of a magnetizing force so that lines of magnetic flux are set up in the body. The existence and degree of deviation of the lines of flux from their theoretical path is then determined by bringing the body into contact with finely divided particles of magnetic material. Such particles are attracted by and cling to the surface of the body at regions of the latter where discontinuities or other defects exist, by reason of the magnetic polar effects exhibited by the body with their consequent leakage lines of flux.

The present application is a division of said copending application and is directed particularly to the testing material employed in the process and the method of preparing such material.

I am aware that it is not broadly new to employ iron fillings for detecting such defects as cracks, seams or inclusions and that in some cases magnetizable particles are held in suspension in a liquid medium in which the magnetized body to be tested is immersed. However, it is an object of my invention to provide a finely divided magnetizable material so treated as to avoid many of the difficulties, uncertainties and complications which surround the proper determination of a defect and the degree of hazard associated therewith.

I have found that there are two major points in reference to the particles themselves which require careful consideration. One has to do with the size and shape and magnetic quality of the particles, and the other with the proper coating of such particles in order to obtain, in the fullest practical measure, by preventing undue magnetic interaction, the advantages of the intrinsic characteristics which they possess as units.

With regard to the first point, the smaller the flaw the less tendency there is for the particle to adhere and therefore the proper choice of size, shape and quality permits of discrimination between flaws which may be of such superficial character as to be wholly removable under an ordinary surface finishing process, and others which are of such depth or extent as to warrant immediate discarding of the material under test. As for the second point, while it is often desirable that the particles be in a fine state of subdivision, as this increases their sensitivity as a detecting means, if this subdivision is carried too far there is a tendency for the particles to pack or close about faulty regions in mass formation which is often without relation to the extent or character of the flaw.

The particles are preferably of material which is highly magnetic, for example, more or less pure iron or an alloy of high permeability. The particles are coated with a substance which prevents metal to metal contact between such particles and the coating is preferably of such character as to provide a smooth surface so that it will reduce the co-efficient of friction and act more or less as a lubricant. It is also of advantage in certain cases to have the particles pigmented so as to render them more highly visible.

An important additional advantage of the invention is that the particles tend to demagnetize themselves readily when once removed from the magnetizing field, through the absence of direct contact with each other, and hence may be used over and over without loss of efficiency in the detection of flaws. It may also be pointed out that the effective sensitivity of the particles is greatly increased by reason of the lubricating feature of the coating selected, in that such particles may the more freely align themselves without actual contact with the flaw or imperfection. This is of considerable advantage where it is desired to locate flaws in material where the body surface is covered with scale, as in the case of billets or ingots. Hitherto, it has been found advisable to first remove such scale by means of a pickling or sand blast process.

In the process of treating the particles, I prefer to employ a non-hygroscopic compound such as zinc oxide, although it will be understood that other forms of coating, such, for example, as graphite or aluminum powder may be used, or coating processes known as "calorizing" or "sherardizing" may be employed without departing from the spirit of my invention.

In some cases the size of the particles should be substantially uniform while in other cases the particles may of different sizes or shapes to bring out different characteristics in the flaws detected. After selecting particles of the size and quality to the work in hand, I treat them with gasoline or other light oil containing a heavier oil in suspension, permitting the oil to vaporize so as to leave a thin oil film on each particle. Then I bring the particles into intimate contact with an equal volume of zinc oxide, as by agitating both in a container so that each particle is

coated with the oxide, the oil film acting to retain such coating.

The coating of oxide prevents the direct metal to metal contact of the particles with one another and provides a lubricated surface to each particle. Furthermore, the coating of oxide presents a dead white finish and renders the particles highly visible against the darker background of the body under test. Obviously, the particles can be covered with a coating of any color which would contrast with the body under test, although, for most purposes, I find that the dead white color given by zinc oxide is most suitable. At the same time, I wish it to be understood that I reserve the right to use any form of coating and any method of preparing the material that fall within the spirit and scope of the following claims.

I claim:

1. The method of preparing finely divided paramagnetic particles for use in magnetic testing, which consists in treating the particles with a highly volatile oil, permitting the oil to partly vaporize, bringing the particles into contact with a non-magnetic coating material and agitating the particles of said material whereby each particle will be coated with the material.

2. The method of preparing finely divided paramagnetic particles for use in magnetic testing, which consists in forming an oil film on each particle, and agitating the particles in an equal volume of zinc oxide, whereby each particle will be coated with the oxide.

3. A loose pulverulent material for use in magnetic testing, comprising paramagnetic particles, each coated with a film of oil and with a film of zinc oxide secured to the particle by said oil.

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