Aug. 1, 1944. A. J. MITCHELL 2,355,007

MEASURING-GAUGE AND METHOD OF MAKING THE SAME

Filed June 19, 1943

Fig. 1.

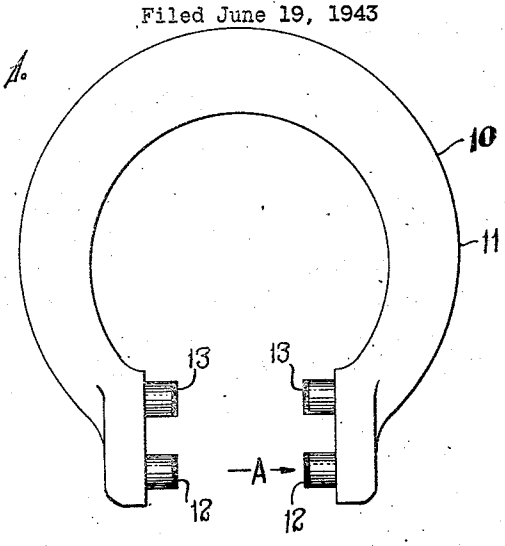


Fig. 2.

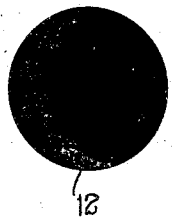


Fig. 3.

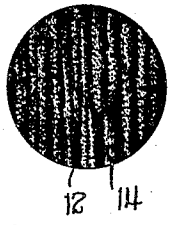


Fig. 4.

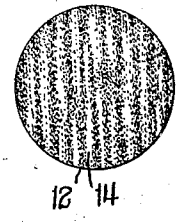


Fig. 5.

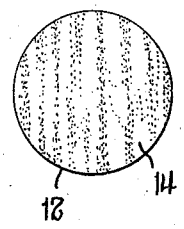
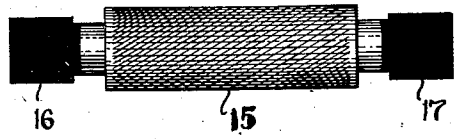


Fig. 6.



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MEASURING GAUGE AND METHOD OF MAKING THE SAME

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Application June 19, 1943, Serial No. 491,534

2 Claims. (Cl. 33—168)

This invention relates to improvements in measuring-gauges, and more particularly relates to the gauge-surfaces thereof.

Heretofore in the case of gauges, and particularly the kind of gauges known as "go, no-go" gauges, the checking of the accuracy-condition of these gauges as a result of wear, has entailed a heavy expense owing to the considerable amount of time required by a highly skilled mechanic. The usual gauge-surfaces are hardened steel finished to proper gauging size and finish. After a greater or less length of time, depending upon the amount of use of a gauge, the gauging-surfaces wear so as to bring about lack of a proper degree of trueness and lack of a proper degree of dimensional size, or of distance between two complemental gauge-surfaces, which is not readily detectable by the eye, and therefore it is necessary for a skilled mechanic to periodically take each of the gauges used in a manufacturing plant using them, and subject them to careful time-consuming tests to determine whether or not the inaccuracy-condition of any of the gauge-surfaces is sufficient to require the re-correction of the gauge or the discarding of the same.

I have discovered that by treating the hardened finished steel gauge-surfaces with an aqueous liquid chemical treatment which will change the iron of the gauge-surface to black iron oxide, this treatment does not add any additional thickness of surface upon the finished steel gauge-surface, but rather that it chemically changes the iron of the surface down to a predeterminable depth to the black oxide of iron, so that in the final finished condition, no position or dimension of the gauge-surface, or distance between gauge-surfaces, is changed. Thus it will be seen that in accordance with my invention, the gauge-surfaces can be hardened and finished to final proper gauging size and finish without making any allowance whatever for the final forming of the iron oxide surface, since this does not superimpose any additional depth on top of the steel gauge-surface, but instead, chemically forms itself as a black oxide which extends from the position of the original finished steel gauge-surface downward to a predetermined depth of a small fraction of one-thousandth of one inch. Thus it will be seen that as the gauge is used and as areas of the black-oxide surface are worn down to the underlying metallic iron or bright steel surface, the underlying bright steel surface-portions are exposed, and owing to the contrast in color or optical appearance between the thus-exposed steel areas and the adjacent not-worn-through black-oxide areas, the worn-through areas are immediately visible on inspection, thus acting as a tell-tale indication of the worn or inaccuracy-condition in the gauge-surface, and the number of these worn-through areas and their total area thus optically indicates the degree of the worn or inaccuracy-condtion of the gauge-surface.

One object of this invention, therefore, is to provide an improved measuring-gauge having one or more mainly-metallic-iron hardened-steel gauge surface-parts each of which has first been hardened and finished to form one or more mainly-metallic-iron and hardened-steel gauge-surfaces of proper gauging size and finish, and then has been treated by an aqueous liquid chemical which changes the metallic iron of the gauge-surface to black oxide without changing any position or dimension of the gauge-surface, so that the gauge can be manufactured and have its gauge-surfaces finished true and to size before the black oxide or colored surface is formed thereon without having to make any allowance for the addition of the black-oxide surface.

Another object of this invention is to provide an improved method of making the foregoing described measuring-gauge.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the description and claims, the various parts and steps are identified by specific terms for convenience, but they are intended to be as generic in their application as the prior art will permit.

In the accompanying drawing forming part of the present disclosure, in which two different gauges are shown with the present invention applied thereto:

Fig. 1 is a front elevation of a gauge made in accordance with the present invention;

Fig. 2 is a face view in the direction of arrow A of Fig. 1, illustrating a face view of one of the gauge-surfaces in its completely-finished form with the black-oxide surface thereon;

Fig. 3 is a view similar to Fig. 2 schematically illustrating the black-oxide surface after portions thereof have been worn through and have exposed areas of the underlying steel surface;

Fig. 4 is a view similar to Fig. 3 but where the further wearing-through of the black-oxide surface has exposed an additional number of underlying steel areas;

Fig. 5 is a view similar to Fig. 4 after the black-oxide surface has nearly all been worn off to leave but a relatively-few remaining areas of black oxide thereon; and

Fig. 6 is a front elevation of another form of gauge having its gauging-surfaces treated to form the black-oxide gauge-surfaces thereon.

Referring to Figs. 1 to 5 of the drawing, the gauge 10 which is one form of a "go, no-go" gauge, includes a body 11 carrying the two opposed complemental "go" gauge surface-parts 12 and the two opposed complemental "no-go" gauge surface-parts 13, the form of which is well known to those skilled in the art.

The gauge surface-parts 12 and 13 are formed of hardenable tool steel and after they have been hardened and ground, lapped and polished to form proper truly-flat, parallel gauging-surfaces with proper space between each pair of complemental surfaces, the gauge has been ready for use prior to my invention, with the defect or drawback, however, that wear of any of the gauge-surfaces out of true and/or out of proper dimensional spacing to one another is not detectable by the eye, but must be found by a careful test by a mechanic especially skilled in carrying out such testing of gauges.

In making the gauge in accordance with my invention, however, I take the gauge 10 in its finished size and form just as illustrated in Fig. 1 but without any black oxide having been formed on the black-indicated areas as yet, and I then treat it in an aqueous chemical bath at a moderate temperature in the neighborhood of 300° F. which will produce the black-oxide areas without substantially reducing the hardness of the hardened carbon tool steel gauge surface-parts 12 and 13 and without changing any position or dimension of a gauge-surface or position of one of them relatively to another, so that after the black-oxide gauge-surfaces are formed, the distance between the complemental gauge-surfaces is just the same as it was before the black-oxide-forming treatment.

In carrying out this black-oxide-forming treatment, the entire gauge can be immersed in the chemical bath in which instance all exposed iron-containing surfaces would be changed into black-iron oxide, so that where, as is usual, the entire gauge shown in Fig. 1 has surfaces which are mainly metallic iron, the entire gauge would be black after removal from the black-oxide-forming bath. Or instead of blacking all the surfaces of the gauge, all except the blakened areas illustrated in Figs. 1 and 2 can be blacked out by applying a suitable coating to all areas which it is desired to prevent forming the black oxide on, so as to prevent the chemical treatment from forming an oxide surface anywhere except on the areas indicated in solid black in Figs. 1 and 2. It is only necessary to have the gauge-surface itself, shown in Fig. 2, formed into the black oxide, but in order to make sure that the entire gauge-surface and its boundary edge is changed to black oxide, it is easier to have the black oxide extend back at least a short distance beyond the gauge-surface as illustrated in Fig. 1.

One suitable coloring or black-oxide-forming bath or solution can be made by taking 90% sodium hydroxide, 5% potassium nitrate and 5% sodium nitrate and adding them to sufficient water to give a convenient consistency and preferably in relationship to the water content which will result in the bath having a boiling point substantially between 280° F. and 320° F. From six to eight pounds of the combined salts referred to together with about three quarts of water, will result in about one gallon of solution having a boiling point within the range stated.

Another suitable coloring or black-oxide-forming solution can be made by having an aqueous solution of the proper strength for the desired boiling point, by employing solids consisting of 85% sodium hydroxide, 10% sodium nitrate and 5% sodium nitrite.

Normally, a few minutes will generally secure a good depth of coloring, and this coloring will be substantially of uniform depth or penetration throughout the surface treated.

Inasmuch as the temperature of treatment is in the neighborhood of only about 300° F., it is below any temperature which would substantially draw the temper of the hardened steel gauge-surfaces. Therefore, the providing of the black surface leaves a hard under surface which supports the black oxide so that, in addition to the low friction resistance and high wear resistance of the black-oxide surface, the black-oxide surface will stand considerable mechanical abuse without substantial damage. The depth of the black-oxide surface will be of a predetermined depth of a small fraction of one-thousandth of one inch. Thus, for example, the black-oxide surface can be made about one ten-thousandths of an inch in depth if so desired.

When the black oxide is newly formed, it is uniformly black all over as indicated on Fig. 2. But after the gauge has been used some time so that the gauge-surface is subjected to sliding over the parts to be measured, there is a wearing action which takes place with the result that gradually small areas 14 at various locations on the gauge-surface will be worn through to the underlying metallic steel surface which will thereby be exposed and present a sharp color contrast with the surrounding black area to thus warn anyone inspecting the gauge that the gauge-surface is starting to wear. After still further use, still greater areas 14 will appear and the remaining black portion of the area will become more scattered and of less total area as time goes along so that, as schematically indicated in Fig. 4, the gauge-surface area has worn down still more. And after a still further length of time, nearly all of the black-oxide surface will ultimately be worn off leaving the major portion of the worn-off area 14 of steel while there will be only small scattered areas of black oxide left as schematically indicated in Fig. 5, showing that the gauge-surface has been worn still more and thus acting as an automatic visual telltale indication of the degree of inaccuracy-condition of the gauge-surface. Also, if a black gauge-surface were tampered with, as for example by filing, grinding or buffing, such tampering, or the result of the tampering, would be immediately visible. After the gauge-surfaces have been worn to such an extent as may in any given instance be considered the limit of tolerance, the gauge or gauge-parts are corrected in any of the well-known suitable ways or are discarded and replaced by a new gauge or gauge-parts.

Fig. 6 illustrates a different form of "go, no-go" gauge 15 which has a cylindrical "go" gauge-surface 16 and a cylindrical "no-go" gauge-surface 17 at opposite ends of the gauge. The surfaces 16 and 17 are formed with the black-oxide surface as hereinbefore described. And as the black oxide wears through, it will disclose that fact by gradually uncovering more and greater

areas of underlying steel surface of contrasting color appearance to the adjacent black-oxide areas, all as hereinbefore more fully described in connection with Figs. 1 to 5 inclusive.

While the black oxide coating or treatment has a low coefficient of friction and a high resistance to wear, it also is porous, and permits of applying an oil, grease, wax or other suitable material thereto which is absorbed by the black-oxide coating and which decreases the frictional resistance of the surface and therefore increases the wear resistance. Also, while the black-oxide surface has resistance to rusting, the oil or other impregnating treatment also further increases the resistance to rusting.

One important characteristic of my invention is that the black-oxide surface can be formed at below 350° F. which is important in order that the gauge-surfaces may have substantially the maximum steel hardness that can be given to them, since if the gauge-surfaces were to be subjected to temperatures high enough to substantially soften or draw the temper or hardness of the steel below the high hardness originally given to the gauge-surface prior to the black-oxide-forming treatment, such softening would increase the coefficient of friction and increase the wear on the surface, thus causing it to more readily get out of true.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A measuring-gauge having one or more mainly-metallic-iron hardened-steel gauge-surface parts of proper gauging size and finish, and each of which said gauge-surface parts has one or more black oxidized gauge-surfaces, each black-oxidized gauge-surface being characterized by low-friction resistance and high-wear resistance in gauging operations and of a substantially-uniform depth of a fraction of one-thousandth of an inch throughout the black-oxidized gauge-surface, whereby when one or more portions of the black-oxidized gauge-surface is worn off and exposes the underlying mainly-metallic-iron surface, the marked difference in optical appearance between the thus-exposed mainly-metallic-iron surface-portions and the adjacent black-oxidized surface-portions provides a visual tell-tale indication of the inaccuracy-condition of the gauge-surface.

2. The method of preparing one or more gauge-surfaces of a measuring-gauge having one or more mainly-metallic-iron hardened-steel gauge-surface parts which have been processed to proper gauging size and finish, comprising: treating each gauge-surface at below 350° F. by an aqueous liquid chemical material which oxidizes the metallic iron of the gauge-surface to black iron oxide, each black iron oxide gauge-surface being characterized by low-friction resistance and high-wear resistance in gauging operations and of a substantially-uniform depth of a fraction of one-thousandth of an inch throughout the black iron oxide gauge-surface, whereby when one or more portions of the black iron oxide gauge-surface is worn off and exposes the underlying mainly-metallic-iron surface, the marked difference in optical appearance between the thus-exposed mainly-metallic-iron surface-portions and the adjacent black iron oxide surface-portions provides a visual telltale indication of the inaccuracy-condition of the gauge-surface.

ABRAHAM J. MITCHELL.