This invention relates to instrumentation and the method of use for measuring the intensity of a cold working operation and more specifically the shot blasting of metal parts.

As is well known, cold working by shot blasting improves fatigue durability of machine parts. Its effectiveness depends upon producing a thin surface layer stressed in compression by the peening action of the shot. This peening action varies with the velocity of the shot, with the size of the shot and with the number of shots directed at the work. To assure that the operation will be properly performed it is desirable to be able in a simple and inexpensive manner to measure intensity of shot blasting. Likewise it is necessary that manufacturing standards be set and that engineering specifications show the extent of shot blasting required for a given piece of work. To meet these demands the present invention has for its object the provision of instrumentation and a plan for use whereby the effectiveness of shot blasting can be easily and quickly measured.

In the accompanying drawing Figure 1 is a plan view of a fixture for securing a test specimen in the form of a thin flat plate having one face exposed to the shot blasting treatment: Figure 2 is a transverse section on line 2-2 of Figure 1; Figure 3 is a perspective view illustrating the concave-convex shape assumed by the shot blasted test specimen, the convex face being a test plate of compression due to the peening action of the shot; Figures 4 and 5 are an elevation and a side view, respectively, of a gage for measuring the radius of curvature of a shot blasted plate, and Figure 6 is a plot to illustrate removal of material from the shot blasted surface in successive steps and the radius of curvature at each stage.

When the effectiveness or intensity of a shot blast operation is to be determined, whether for initially setting standards or for checking to meet given specifications, it is here proposed to submit to the shot blast one thin flat plate having one face exposed to the shot blast treatment: Figure 2 is a transverse section on line 2-2 of Figure 1; Figure 3 is a perspective view illustrating the concave-convex shape assumed by the shot blasted test specimen, the convex face being a test plate of compression due to the peening action of the shot; Figures 4 and 5 are an elevation and a side view, respectively, of a gage for measuring the radius of curvature of a shot blasted plate, and Figure 6 is a plot to illustrate removal of material from the shot blasted surface in successive steps and the radius of curvature at each stage.

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the shot blasting operation performed on the test specimen.

As a laboratory check on the depth of the cold worked surface and its relation to the radius of curvature of the tested plate, a 0.001 inch thick sheet metal plate of equal thickness layer of material can be removed from the shot blasted surface and the plate curvature noted at each removal until the plate returns approximately to its flat form and indicates that substantial stress material has been eliminated and the remainder of the plate resumes its original shape as a result of the applied stress between the shot blasted area and the remainder of the specimen and finally noting the difference in shape as a measure of the amount of material removed after which the remaining compressive stress gives the blade a bowed contour, thereby measuring the height of the arc as reflecting the degree of compressive stress imparted to the blade in the shot blasting operation.

The method of checking the intensity of any shot blasting operation, including selecting a thin sheet metal plate whose original surface contours are under equal stress which gives the plate a flat contour, securing the flat plate in a fixture with one surface covered and its opposite surface exposed, subjecting said exposed surface, while the plate is in the fixture, to the particular shot blasting operation whose intensity is to be checked, then removing the plate from the fixture and allowing the plate to assume the curved contour natural to a plate having greater compressive stress in one surface than in the other surface and taking a reading of the plate curvature resulting from the shot blasting operation and checking the reading with predetermined standards which reflect intensity of shot blasting operations in terms of curvature for the type of plate selected.

The method for testing the intensity of shot blasting operations as described specifically with the measurement of the effect of shot blasting, the invention is applicable to other uses, such, for example, as the measurement of the relief stress due to nitriding, machining operations, and the like. The arrangement has been used, for example, to the measurement of the stress due to nitriding by which the amount of surface stress and the depth of the nitrided and proeessed layer was determined. The surface stressed produced by honing has been measured as well as the stress due to other operations, such as rolling by means of rollers, swaging, peening, etc.

The method for testing the intensity of shot blasting operations comprising securing in a fixture a preselected thin flat sheet metal plate with one face exposed, subjecting the exposed face to the particular shot blasting operation to be tested, then releasing the plate from the fixture and then gaging the extent of such change in outline of said test specimen and then measuring the radius of curvature of the plate as an indication of intensity of that particular shot blasting operation.

The method for determining the intensity of a shot blasting operation comprising selecting one face of a thin steel blade to the shot blasting operation after which the resulting compressive stress gives the blade a bowed contour, then measuring the height of the arc as reflecting the degree of compressive stress imparted to the blade in the shot blasting operation.

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A method for setting measurement standards for various intensity shot blasting operations to be performed on manufactured parts and from which operations can be checked, comprising disposing as a test specimen a type of thin metal plate whose shape is determined by the relative stress in different strata thereof, subjecting such plates to a corresponding number of shot blasting operations on one face only and each plate to a different operation whereby the several plates will be stressed differently from the others and will assume new shapes, then recording the change in shape of each plate as indicative of the intensity and blasting operation performed thereon and against which future operations can be checked by like treatment of other similar test specimens.

The method for measuring the effectiveness of a surface stressing operation, including subjecting only one face of a standard thin sheet metal test specimen, whose shape is dependent on the relative surface stresses in its opposite face, to an operation which will subject the specimen without substantial removal of material of said specimen then taking a reading of the change in shape imparted to the test specimen by reason of the change in relative surface stress effected by said operation and checking said reading against a predetermined scale containing shape equivalents in terms of operation eetrctuations.

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