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PROCESS FOR HARDENING METALLIC SURFACES

Verne E. Minich, Mishawaka, Ind., assignor to The American Foundry Equipment Company, Mishawaka, Ind., a corporation of Delaware

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This invention relates to process for hardening metallic surfaces and more particularly to a process for surface hardening steel products and other metallic objects by the working action of steel shot.

The invention consists in the new and novel features of operation and the new and original arrangements and combinations of steps in the process hereinafter described and more particularly set forth in the claims.

It has been discovered that steel products and other formable metallic objects can be surface hardened quickly and economically by treating the surface with a blast of steel shot. The steel shot used must be free from sharp angles and corners which tend to rupture the surface treated. Preferably round or substantially round steel shot is used. The shot is hurled or fired at a velocity of from 5,000 lineal feet to 15,000 lineal feet per minute, the impinging velocity necessary to effect the desired hardening action varying with the material treated. It is generally preferable to use steel shot which is as hard or harder than the surface treated to obtain the best results.

The intensity of impingement to effect the desired hardness varies with the material treated. In treating manganese steel sheets, for example, from about 2 to 8 pounds of steel shot per square inch of surface treated thrown at a velocity of 5,000 feet and upwards is desirable.

The following more particular description is given for purposes of illustration and explanation but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Most unexpected results have been obtained by throwing the shot by means of a throwing wheel having throwing blades rotating at a peripheral speed of from 5,000 to 15,000 lineal feet per minute. The steel shot is fed into the center of the wheel and conducted to the periphery of the rapidly rotating throwing blades. The abrasive is thrown or hurled from the tip of the throwing blades and impinges the surface treated at a lineal velocity of from 5,000 to 15,000 lineal feet per minute.

In surface hardening manganese steel sheets, for example, approximately 300 pounds of steel shot are thrown by the wheel per minute, over a surface area of from 60 to 120 square inches. Thus, approximately 3 to 6 pounds of steel shot per minute strike each square inch of surface treated. Shot known in the trade as No. 6 shot has proven very effective in hardening manganese steel sheets, although it is understood that shot of smaller or larger size may be used within the purview of this invention best suited to the particular material treated.

By way of example, manganese steel bars have been satisfactorily treated with No. 6 steel shot thrown from an abrasive throwing wheel approximately 20 inches in diameter rotating at approximately 2,000 to 2,500 R. P. M. and hurling the shoe at a velocity of 9,000 to 14,000 lineal feet per minute. Such a wheel is disclosed in United States Patent No. 1,953,566 and also in United States Patent No. 2,049,466. The angle of impingement varies from 45 degrees to 90 degrees. Approximately 300 pounds of shot were fed into the wheel and thrown against the manganese steel bars at an impingement intensity of 3 to 6 pounds of shot per square inch of surface treated. The treatment required 50 seconds to execute. The sheet possessed a Brinell hardness before treatment of 140, and after treating the sheet for 50 seconds with No. 6 steel shot, as above stated, the Brinell hardness was increased to 480 B. H., representing a hardness increase of approximately 340 points. The hardness penetration resulting from the above treatment was one-tenth of an inch. Thus a greatly increased hardness penetration is obtained by this process of surface hardening as compared with surface hardening process heretofore practiced. It will also be observed that the bars were cold treated, no heat being used in the process except only that developed by the impinging action of the shot against the surface. The surface of the bars was thus hardened while in substantially a cold condition. Where round or substantially round shot is used there is little or no danger that the surface will become ruptured.

The action of the steel shot operates to harden the surface to a considerable depth by working or impact. It is believed that the action of the shot operates to compact the crystalline structure of the surface metal as by forging or breaking down the crystalline structure so as to produce a greater surface density. The impacting also cleans from the sheet undesirable scale and dirt and, in addition, produces closely compacted, very minute indentations in the metal surface, said indentations being substantially microscopic in size. The indentations define substantially microscopic projections or protrusions which provide an excellent anchorage for adherent coatings, such as galvanizing, plating and other surface coatings, as well as improving the surface for later pickling treatments. The intensity of impingement of the steel shot is such as to provide closely compacted

indentations and the nature of the shot is such as to work harden the surface without causing surface rupture.

The process represents a great saving in surface-hardening metals over the processes heretofore practiced. The operation here described can be performed on any object having formable qualities such as steel bars and other steel and wrought iron objects of regular or irregular shape.

What is claimed is:

1. A process for surface hardening formable metallic objects comprising bringing the surface to be hardened into the zone of discharge of a high speed centrifugal throwing wheel and mechanically impelling from two to eight pounds of round steel shot per square inch of surface treated from the periphery of said wheel and against the surface being hardened at a velocity of approximately five thousand to fifteen thousand feet per minute.

2. A process for surface hardening formable metallic objects comprising bringing the surface to be hardened into the zone of discharge of a high speed centrifugal throwing wheel, mechanically impelling from two to eight pounds of round steel shot per square inch of surface treated from the periphery of said wheel and against the surface being hardened at a velocity of approximately five thousand to fifteen thousand feet per minute, and maintaining the surface being treated in the zone of discharge of said wheel for a period not substantially in excess of one minute.

3. A process for surface hardening formable metallic objects comprising bringing the surface to be hardened into the zone of discharge of a high speed centrifugal throwing wheel, mechanically impelling from two to eight pounds of round steel shot per square inch of surface treated from the periphery of said wheel and against the surface being hardened at a velocity of approximately five thousand to fifteen thousand feet per minute, and varying the speed of the wheel and the rate of feed of the shot to meet the surface hardening requirements of the particular metal treated.

VERNE E. MINICH.