Aug. 1, 1950 L. C. HEINSE 2,516,986

STAINLESS STEEL FINISH

Filed June 22, 1945

Fig. 1

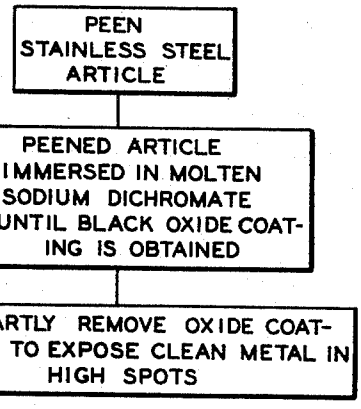


Fig. 2

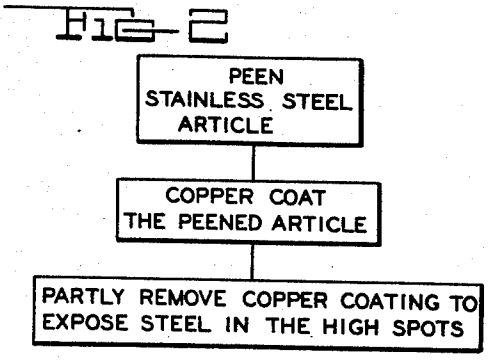


Fig. 3

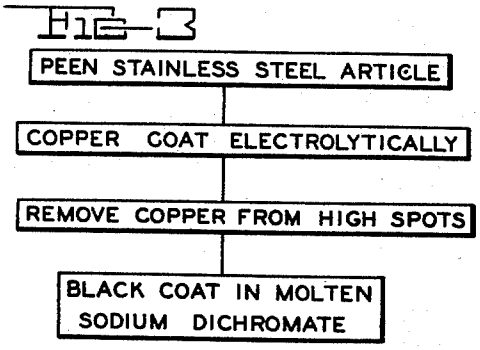


Fig. 4

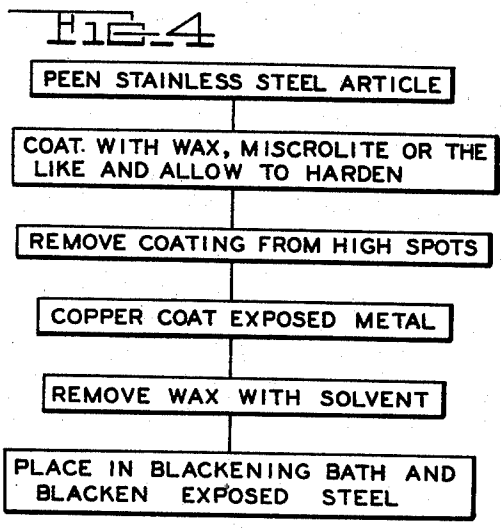
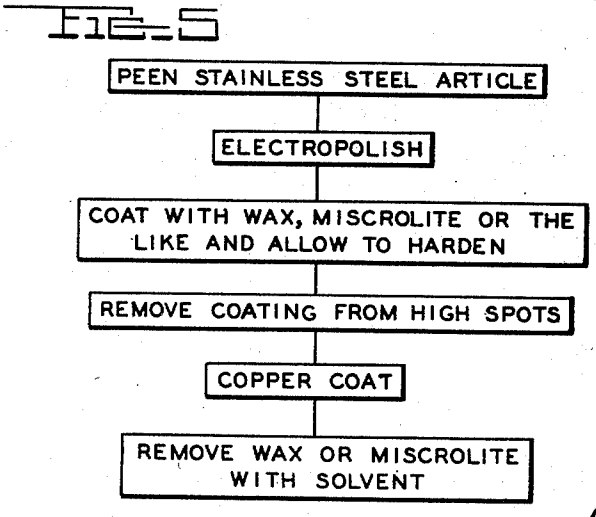


Fig. 5



INVENTOR.
LEROY CHARLES HEINSE
BY
HIS ATTORNEY

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2,516,986

STAINLESS STEEL FINISH

Leroy Charles Heinse, Baltimore, Md., assignor, by mesne assignments, to Armco Steel Corporation, a corporation of Ohio

Application June 22, 1945, Serial No. 600,875

3 Claims. (Cl. 41—18)

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My invention relates to stainless steel products, more particularly to a method of producing stainless steel articles of novel, pleasing and ornamental appearance, adapted for the decoration and ornamentation of home, office, and the like.

An object of my invention is to provide a method of producing ornamental and decorative stainless steel articles for household, office and similar uses, which is simple, rapid and inexpensive, requiring a minimum number of manipulative and procedural steps with minimum requirement of skilled supervision of equipment and of plant investment.

Another object is to provide a series of stainless steel articles, each characterized by its pleasing and novel two-toned effect, lasting and enduring in nature, adapting it admirably for novel and pleasing interior decoration and ornamentation, whether it be household, office, storeroom or the like; in which incident light is reflected in multi-facet manner, with interesting and pleasing highlights, in which a variety of varying and eye-appealing color combinations can be readily and effectively achieved.

Other objects in part will be obvious and in part pointed out hereinafter during the course of the following description taken in the light of the accompanying drawings.

My invention accordingly resides in the several combinations of parts, associations of elements and features of construction, in the several manipulative and procedural steps, and in the combination of each of the same with one or more of the others, the scope of the application of all of which is more fully set forth in the claims at the end of this specification.

In the drawings forming part of this application, I have provided flow sheets, constituting Figures 1 through 5, inclusive, graphically illustrating certain features of my invention and several specific embodiments thereof.

To facilitate a more thorough understanding of my invention it may be noted that alloy steels when first introduced into the market, were employed substantially entirely on the basis of their functional utility. The chrome, vanadium and cobalt steels were utilized because of their varying important degrees of hardness. Carbon steels possessed certain functional qualities which dictated their use for specific purposes. Similarly, substantially all other alloy steels, as well as nonferrous alloys such as aluminum and magnesium alloys, were utilized in accordance with the dictates of certain specialized functional qualities

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inherent therein, such as strength hardness, lightness in weight and the like.

The high chromium steels not only possess valuable qualities of hardness, but as well, display high resistance to corrosion, whence springs the name stainless steel. Because of this property, efforts were undertaken, at an early date, to invade the field of both exterior and interior structural ornamentation, by which is meant, of course, incorporation of ornamental stainless steel parts in the structure itself. Cornices, ornamental spouting, ornamental mantles and the like are typical instances of such exploitation. Encroachment also was made upon the field of store interiors, the metal being incorporated into showcases, counters, store and light fixtures, elevator panels and being employed for generally similar purposes.

Finally, as still another possible region of exploitation are the casual ornaments which contribute to the employment of the home, such as book ends, ink wells, ash trays, vases, napkin rings, table decoration, constituting collectively simply a few typical illustrations of the myriad diversified embodiments by means of which this particular concept may be manifested. Similar and substantially parallel fields of utilization are of course available both in the office and in commercial enterprises such as department and specialty stores and the like.

Considerable resistance to the general acceptance of stainless steel in ornamental applications has been interposed, however, both by the manufacturer and the prospective purchasers, because of the rather cold and dark surface appearance of stainless steels. The characteristic gray-blue color of stainless steel particularly those grades that are used where mildly corrosive conditions are encountered, is inclined to be cold, uninteresting and generally monotonous. A warm receptive feeling is seldom engendered in the heart of the prospective purchaser, no matter how superlative the detail nor how graceful or ornamental the underlying design concept. Moreover, to maintain such treatment within a sound economy, it was required that it be comparatively rapid and inexpensive, long-lasting and enduring. Warm, pleasing and sparkling appearance had to be imparted to the steel.

Over a period of years, much effort has been directed to the general objective of imparting diversified and pleasing surface treatment to the chrome steels. For one reason or another, however, the results have been somewhat dis-

appointing. Either the processes were too costly, required too great a treatment time, were unpredictable and unreliable in their finishes. Any combination of two or more of these various defects, along with or supported by many other observed deficiencies, effectively inhibited any widespread acceptance of stainless steel ornamentation.

An important object of my invention, therefore, is to provide a method of preparing an ornamental finish for stainless steel, as well as in the production of the article itself, which method is simple, rapid, entirely reliable, involving a minimum number of procedural steps, each simple and rapid in itself, requiring inexpensive readily available treating compounds and requiring supervision and attendance of but moderate skill.

In general it may be said that my invention contemplates imparting a designed, studied and intended irregularity to the surface of the metal. This irregularity to the surface consists of a large number of small shallow indentations, troughs or valleys, and a corresponding sequence of hills, raised spots, plateaus, or elevations. Thereafter the metal is treated so as to impart say, one color to the depressions and another color to the elevations. The colors can be reversed from article to article and any number of different color combinations can be employed. Further pleasing variation in final appearance can be achieved through polishing technique.

Thus, illustratively, a sheet of stainless steel is effectively peened in any desired manner and then blackened by immersion in a molten sodium dichromate bath, following which it is ground so that the bright metal at the tops of the peaks or elevations is exposed. In some applications, the metal is left as it is. In others, it is polished so as to produce a desired multi-faceted appearance. This constitutes the basic process according to my new method. The metal in some cases is treated prior to fabrication into the final product. In others, it is fabricated first and thereupon the article is subjected to the surface finishing treatment. As illustrative of various applications of my new invention, reference is had to the following specific embodiments, a flow sheet therefor being found in the accompanying drawings to which attention now is directed.

Example 1

Example 1 has reference more particularly to the flow sheet of Figure 1. The stainless steels to be decorated which may be either in the form of a sheet of metal to be subsequently shaped into the finished article or the manufactured article itself, is first peened in suitable manner. I accomplish this either with a hammer, or with large or small shot, or ball bearings under the action of a blast of air under pressure. By this step a typical hammered or beaten effect is imparted to the metal. It is this peening which gives rise to the multiple number of facets which thereafter contribute so effectively to the production of the desired large number of reflecting surfaces.

The next step is to produce a black oxide coating which while but a comparatively few microns in thickness is tightly clinging to the metal and permanent and enduring in nature. To this end I immerse the peened metal in a bath of molten sodium dichromate for a length of time sufficient to bring about the desired oxide coating. Typically this may endure for about 2 to 30 minutes at a bath temperature of approximately 360° to

380° C. The production of this coating does not per se form part of this invention; it forms the subject of the copending application of Irvine C. Clingan, Serial No. 470,853 filed December 31, 1942, and entitled Stainless Steel and Method, now U. S. Letters Patent 2,394,899 of February 12, 1946. Further description of the blackening operation is omitted from this specification in the interests of clarity. Moreover, while I prefer to use a sodium dichromate bath, a molten potassium dichromate bath may be employed or where desired a mixed bath of these dichromates.

Following the production of the black oxide coating, a part thereof is thereupon removed by a suitable abrading action as by burnishing, sanding, or grinding the high spots on the peened metal until the black oxide coating is removed therefrom and the clean, bright metal exposed. If desired, the ground or burnished metal thus produced may be retained with its dulled abraded surface, or it may be finished with a bright polish. In either instance, the total effect is highly decorative and imparts a two-colored mottled hammered finish.

Steel of this finish is particularly useful in decorative hardware, such as outside door knobs, door hinges, kick or scuff plates, doorhandles, and similar objects where a rustic antique or decorative finish is desired coupled with almost absolute freedom from corrosion or rust attack. I find that this two-toned effect also possesses substantial and desirable application in table wear, such for example as napkin rings, cutlery, ash trays, and the like, or in architectural trim.

Example 2

In the example according to my second method, the steel undergoing treatment is first peened in accordance with method No. 1. I thereupon copper plate the same by any suitable electrolytic method, a number of satisfactory methods for accomplishing this being known in the art.

I then abrade the copper from the high spots by a suitable burnishing, sanding or grinding operation. A characteristic effect is thereby achieved, broadly similar to that according to Figure 1 except for the difference in color. This comprises a combination of copper in the valleys and troughs with the chrome alloy exposed in the high spots. This method is illustrated in the flow diagram according to Figure 2. The method has the advantage of a pleasing variation in color produced by a minimum number of operational steps, comprising first peening, electroplating, and then abrading.

Example 3

In the method according to Example 3, I first peen the steel in the manner hereinbefore described with respect to Example 1. I then copper plate electrolytically in accordance with method No. 2. Abrading is then resorted to just as in Example 2 for removing the copper from the high spots. I then produce a black oxide coating on the exposed chrome steel high spots by immersing the articles for a suitable length of time in a bath of molten sodium dichromate. The copper possesses the advantageous quality, for its intended purpose, that it is not subject to attack by the sodium dichromate and retains its original color. The finished product thus appears as a hammered two-toned article, having copper-covered troughs or valleys with black oxide coated high spots. A flow sheet for this method is given in Figure 3.

Example 4

In accordance with the teaching of the method No. 4, a finish is produced on the stainless steel article which is substantially the reverse of that obtained from the method of Example 3. In accordance with the present embodiment, I first peen the metal. I then coat the steel with some protective wax-like substance, such as wax, miscrolite or the like, and allow the same to harden. By any suitable method of abrasion I remove this protective coating from the high spots, exposing the raised areas of stainless steel. I then copper-coat these raised areas by suitable electrolytic process. The wax subserves the function of protecting the underlying metal from deposition of an overlying copper layer. After copper coating the high spots of the steel, I remove the wax or miscrolite from the low areas through the use of any suitable solvent. I then dry the product and immerse the same in a bath of molten sodium dichromate or similar suitable material for black oxide-coating the unprotected surface of the steel. Since the copper-coated materials are not subject to attack by the sodium dichromate, a pleasing resultant product is obtained wherein the low spots are of bright, stainless steel while the high spots are copper coated. The flow sheet according to Figure 4 illustrates this embodiment.

Example 5

Finally, as a last embodiment of my invention, I first peen the steel by hammer, shot mill or the like exactly in conformity with the procedure outlined in Example 1, and then electro-polish the same so as to impart a high luster thereto. I then coat the entire surface with wax, miscrolite or similar protective coating and thereupon abrade the high spots in suitable manner so as to expose the polished metal high spots through the layer of wax. I then copper-coat the exposed metal surface in any suitable manner. Finally, I remove the remaining wax coating by means of a suitable solvent. A copper finish is thus produced, high-lighted by the high polish of the underlying steel recesses.

It will be seen from the foregoing examples that in accordance with my invention I peen the metal surface in any desired manner and thereupon treat the steel to impart a permanent and lasting two-toned color finish thereto, the high spots having one characteristic color and the low spots another. In each instance, an essentially new two-toned artistic effect is achieved, not heretofore available in the art. The color changes produced are lasting and permanent in nature. The resultant product has eye appeal. Moreover, the variety of pleasing color combinations which are obtained insures widespread acceptance of the formed article in a multiplicity of widely diversified fields of ornamentation. Particularly is this acceptability enhanced due to the faceted appearance resulting from the peening or other roughening or surface-indenting technique. The total number of color combinations which are available in accordance with the practice of my

invention and as is already seen from a consideration of the typical examples hereinbefore set forth can be practically doubled simply by reversing the colors from trough to elevation.

In my process the procedural steps themselves are comparatively simple and involve a minimum of time. Merely routine supervision is required for the successful carrying out of the processing stages. The materials employed are in themselves comparatively inexpensive. The total costs of my new practice is not at all disproportionate considered in the light of the appreciably enhanced value of the processed articles. The coatings obtained are tightly clinging, enduring and of long useful life. All these and many other practical advantages are attendant upon the practice of my new invention.

Thus it will be seen that there has been provided in my invention a new and useful process in which the various objects hereinbefore set forth, together with many thoroughly practical advantages, are successfully achieved. Since many embodiments of my invention will readily occur to those skilled in the art once the basic idea is disclosed, and since many modifications can readily be evolved of the embodiments hereinbefore set forth by way of example, my present disclosure is to be construed as simply illustrative and not by way of limitation.

I claim as my invention:

1. The method of surface-treating stainless steels, comprising, in combination, the sequential steps of roughening the surface of the steel to produce a large number of hills and valleys, black oxide-coating the roughened surface in a bath of molten sodium dichromate, and thereupon grinding away the tops of the hills to expose the underlying metal.

2. The method of surface-treating stainless steels, comprising in combination, the sequential steps of roughening the surface of the steel to produce a large number of hills and valleys, black oxide-coating the roughened surface in a bath of molten sodium dichromate, thereupon grinding away the tops of the hills to expose the underlying metal, and finally electro-polishing the surface of the steel.

3. The method of preparing stainless steel articles comprising peening the surface thereof to produce a large number of hills and valleys, electrolytically copper-coating the peened metal, abrading the copper from the high spots on the metal, and black oxide-coating the exposed steel surfaces in molten sodium dichromate.

LEROY CHARLES HEINSE.

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