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METHOD AND MATERIAL FOR POLISHING METAL ARTICLES

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This invention relates to improvements in method and material for polishing metal articles.

This application is a continuation in part of our copending applicttion, Serial No. 341,968, filed June 22, 1940.

The main objects of this invention are:

First, to provide an aggregate material for use in tumbling barrel burnishing or polishing of metal articles which is highly efficient and very economical, both in initial cost and in use.

Second, to provide a material for tumbling barrel burnishing or polishing which is particularly well adapted for use in the "wet" method.

Third, to provide a polishing material which greatly expedites the work of "wet" tumbling barrel polishing and leaves the work without turned over edges or indentations commonly resulting from the now extensively used process employing steel balls.

Fourth, to provide a polishing material which is well adapted for the polishing of irregular-shaped articles or articles having recesses or depressions within of course certain dimension limits.

Fifth, to provide a polishing material which not only results in a highly satisfactory finish but also results in a very substantial saving in the matter of time as compared to operations which have heretofore been quite generally practiced in using the so-called "wet" materials and methods.

Sixth, to provide an improved tumbling barrel type method of polishing metal articles.

Seventh, to provide a method of treating material to convert the same to satisfactory form for use as an aggregate in tumbling barrel polishing mixtures.

We are familiar with the "wet" methods of burnishing or polishing metal articles which have heretofore been practiced, such methods commonly involving the use of steel burnishing balls or other aggregate elements with a soapy fluid of one sort or another in such proportions as to flood the articles and the burnishing or aggregate elements as they are tumbled about in a tumbling barrel. However, while such hitherto known processes have been extensively practiced or used, the results are not entirely satisfactory inasmuch as the aggregate or burnishing elements in themselves do not have a substantial cutting or abrasive action to produce the desired finish expeditiously and likewise it has been found that the burnishing or aggregate elements hitherto employed are very likely to leave undesirable imprints or indentations on the surface of the articles finished, particularly where the articles have relatively large or flat surfaces, also to leave the work with burred edges. As a result of these conditions, such processes have been largely confined to use in connection with the production of articles in which the defects in polishing or damaging of the surface of the articles are balanced by a price consideration—that is, the methods are used on cheaper articles or where a high finish is not considered essential.

The method and materials of our invention minimize or, in fact substantially eliminate the foregoing objections and enable the production of a highly satisfactory polished surface on many types of articles by tumbling barrel procedure or methods. The particular nature of the materials to be described enables the process to be rapidly and economically performed due to the fact that the aggregate material is relatively inexpensive and at the same time very durable and efficient over long periods of use.

The subject matter of the present application is related in certain features to the material and method described in our application pertaining to "dry" polishing, Serial No. 415,828, filed concurrently herewith, it being understood that the "wet" polishing procedure is desirable for some types of work wherein the "dry" method is not desirable and vice versa and that sometimes the "dry" process is desirable in connection with the "wet" process as a final finishing step.

In the practice of the method of this invention, we employ certain materials and certain successive steps, the steps being as follows: (*a*) a preliminary finishing or burnishing step sometimes called "grinding" in metal-finishing or polishing parlance, (*b*) a secondary finishing or burnishing step sometimes called "honing" in metal-finishing or polishing parlance, and (*c*) a "coloring" step, the word coloring being here used as it is used in metal-finishing or polishing parlance. The materials and the preparation thereof for use in the several steps will first be described, after which their use in practice of the process will be described.

(*a*) *Preliminary finishing material.*—In the first step of our improved "wet" process, we employ as an important constituent of the tumbling material, fragments of granite or pieces of crushed granite preferably ranging in size from approximately ½ inch to 1½ inches. These pieces of granite are irregular in outline or shape and vary widely in size as results from quarry operations or from crushing or fracturing opera-

tions and in that condition they ordinarily have sharp points and edges. These granite fragments are very hard which is a quality desired for the preliminary finishing step in metal polishing of our method and have a decided cutting or grinding action in use rendering them highly efficient and effective in the removal of the sharp points and edges, burrs, flashes, and the like from sand castings, die castings, punch press stampings, screw machine parts, and other metal parts to be finished. This hardness characteristic of the granite fragments renders them unsatisfactory for use in the second finishing step or "honing" step of our improved "wet" process inasmuch as they do not so readily attain the desired smoothness and polish which we obtain by other materials. However, because of this characteristic of hardness, the granite fragments are very satisfactory and very economical for use in the more severe finishing operations.

Prior to use, however, the granite fragments, as they come from the quarry, from the stone cutter, or from the crushing operation, vary greatly in size and shape and this irregularity is a highly desirable feature. However, in that condition they have, as stated, the sharp points and edges which we remove. This we attempt by the use of a tumbling barrel which is loaded with the granite fragments and enough water added to submerge the same. A wet abrasive or grinding compound is then added or charged to the barrel, the following ingredients and compounds being quite satisfactory—

Pumice	lbs.	10
Soap	lb.	1
Rouge	lb.	⅛
Water	pints	3

The loaded barrel is then rotated for approximately 60 hours after which the barrel is discharged and the granite fragments flushed with clean water. The resulting fragments have the objectionable sharp points and edges removed from their surface although the general angularity of the fragments remains so that they are well adapted for use as polishing aggregate for metal articles of various shapes or configurations and sizes.

Secondary finishing material.—The aggregate for the second step of our improved "wet" process, sometimes called "honing" includes a mixture of prepared limestone fragments and steel balls in approximately the proportion of two to one. The limestone fragments are also of varying sizes and irregular shapes, preferably ranging from about ½ inch to 1½ inches. As is the case with the granite fragments, the limestone fragments as they come from the quarry, the stone cutter, or from a crushing or breaking operation, not only vary greatly in size and shape which is a desired feature but they have numerous sharp points and edges which is not desired. Hence we prepare them by a preliminary treatment with water and an abrasive compound similar to that described for the treatment or preparation of the granite fragments with the exception that the time for processing, instead of from 60 or more hours, is reduced to about 48 hours—that is, that is found to result in a very desirable product. The resulting treated limestone fragments still maintain their desired irregularity in outline or shapes and sizes, their original shapes and outline being in fact maintained. However, the sharp edges and points thereof have been removed so that in use they provide a distinct polishing or finishing action without excessive or undesired abrasion of the articles treated.

"Coloring" aggregate or material.—As stated, the term "coloring" is here employed as it is commonly used in polishing parlance and the aggregate material employed in this step is steel balls with soapy water as hereinafter described. We claim no invention for the use of this polishing material or mixture other than its use in the particular process of this invention.

Preliminary rough burnishing or "grinding" operation.—This step or operation is performed wherever a relatively severe abrading action is desired to remove relatively large quantities of material and is in general comparable to the polishing finishing operations performed on a grinding wheel. The step is suitable for sand castings, die castings, punch press stampings, screw machine parts, etc., and is highly effective in removing surface scratches, sharp edges, and the like commonly found on such parts or resulting from the manufacturing steps of such parts in the various methods indicated. In practice, in this step of our "wet" process, we preferably employ a tumbling barrel of the octagonal type. These quite commonly have two separate compartments and are more or less of standard commercial sizes although of course special tumbling barrels may be employed. With the standard type, each compartment is loaded or charged with about 200 lbs. of the prepared granite fragments and from 8 to 12 lbs. of the wet pumice base or other desired abrasive compound. The pumice base compound referred to as being desirable for the treatment of the aggregate may be used with satisfactory results. Water is then added in such quantities as to submerge the aggregate after which the parts to be ground are charged or introduced. The quantity or number of parts may vary greatly, depending entirely upon the weight, size and shape. However, they should be in proper proportion to the aggregate so that when introduced and dispersed to the aggregate they are surrounded thereby. The tumbler is then operated for the desired length of time which may vary from 4 to 24 hours, or even 48 hours, depending upon the hardness of the articles being burnished, the amount of metal to be removed, and the finish desired. After this tumbling operation, the water containing the abrasive is drained, and the clean fragments flushed until clean either in the barrel or otherwise.

Following this rough or preliminary burnishing or grinding operation, the articles are subjected to the second polishing or burnishing step, sometimes as stated called the "honing" step and this might be compared to buffing on a buffing wheel. The purpose is to further polish or burnish the articles and prepare them for the surface or the so-called "coloring" or lustering step, if that is desired, although for a great many operations the "coloring" step is not necessary as the articles come from the second operation in a very satisfactory condition for plating, if a plating step is desired, or for direct use where plating is not desired. This second finishing or honing operation is well suited for the removal of slight burrs or irregularities on relatively delicate parts without the previous preliminary burnishing treatment described. This second step of the complete method is of the "wet" type and is performed in the same way as the preliminary step described—that is, in a tumbling barrel, but care should be taken that the lining

of the barrel is smooth and free from abrasives. In performing this second polishing step, the barrel is charged with the desired quantity of the prepared limestone fragments described above and steel burnishing balls preferably in the proportion of 200 lbs. of the prepared limestone fragments to 100 lbs. of the burnishing balls. To this is added about ¾ of a pound of good soap and the compartment filled with water to the point of submerging the aggregate. The parts to be treated are then placed in the compartment and again the load varies, depending on the size, weight, shape and the desired finish. However, the part to be finished, when mixed with the aggregate, should be well surrounded by the aggregate. The barrel is then operated for the desired period, from 3 to 7 hours having been found to be practical for many articles, the water drained, and the mass flushed with clean water. It will be understood that the length of time in both steps varies greatly according to the shapes and sizes and the character of the metal—that is, whether it is hard or soft.

Coloring operation. This final operation, used in our "wet" process, is employed where it is desired to attain a high color or luster preparatory to plating and is comparable to the so-called buffing on a wheel. The coloring operation is suitable and frequently desirable particularly for steel, stainless steel, brass, copper, iron castings and stampings, and the procedure involved is that commonly referred to as ball burnishing except that the time required is very short inasmuch as a very fine finish usually results from the steps previously described. The same type of tumbling barrel machine is used as in the preceding step and as a practical operation it may be as follows: The compartment is loaded with approximately 500 lbs. of steel balls to which ¾ of a lb. of soap is added, plus sufficient water to submerge the mass. The parts to be colored or treated are then added, the load being about the same as in the preceding operations, and the barrel operated for from ½ to 1½ hours after which the water is drained and the work flushed.

This completes the steps of our "wet" process as contemplated by our invention. However, as stated, the final step or coloring step is frequently not required and the character of the finish desired and the nature of the parts to be finished dictate the procedure, particularly in the matter of time periods. For example, in some instances the first or grinding step may not be necessary or advisable. In other instances, the second or finishing step may not be required. Therefore, our invention should not be unduly restricted in interpretation in this respect.

We do regard as entirely novel and inventive the employment in any "wet" polishing process of successive steps of the articles to be polished or burnished as we have pointed out in which the aggregate materials consist respectively of granite and limestone fragments of irregular widely varying sizes and shapes, the sharp points and edges of which have been preliminarily removed by special treatment. We likewise regard as inventive, as embodied in our invention, the method of treating the fragments so as to convert the same from raw materials unsuited for the polishing operations, into materials eminently well adapted for the particular uses set forth.

The polishing process of our invention is rapid and economical both in the matter of inexpensiveness of the material employed and the fact that it is unnecessary to replace the material frequently. As a matter of fact, in practice, relatively small amounts of the aggregate are added after each batch or from time to time, and also in succeeding charges a part of the old or previously used compound is recharged to the barbel with such quantity of new compound as may be desired.

The successive steps employing the granite aggregate and base material and the limestone aggregate and base material enables the quick removal of burrs and other surface projections or irregularities very rapidly and economically and the smaller surface markings or scratches are effectively eliminated by the step employing the limestone fragments as aggregate, and it is found that the final results are in most instances equal to that attained by hand grinding and buffing and at a much less cost.

The aggregates of our improved invention have very wide application as does also the steps of the process and we believe that this disclosure will enable those skilled in the art to embody or adapt the same as circumstances may desire and we wish it to be understood that the terminology we have used is descriptive rather than limiting and it is used with the full intention to include equivalents of the features shown and described within the scope of the following claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. A polishing material comprising irregular angular fragments of granite in varying sizes ranging from approximately ½ to 1½ inches, said fragments having been abrasively treated to remove the sharp points and edges therefrom without destroying the angular character thereof.

2. The method of finishing including the steps of tumbling the work in a mixture including water and an abrasive, and such quantity of irregular fragments of fractured granite of widely varying shapes and sizes as will submerge the work with the work and the granite fragments freely movable relative to each other while being tumbled, the granite fragments having the sharp points and angles thereof previously removed, washing to remove the abrasive, and thereafter further finishing the work by tumbling the same in a mixture including such quantity of irregular fragments of fractured limestone of varying shapes and sizes and having the corners and angles thereof previously removed and having smooth surfaces, and steel balls approximating one-half the weight of the limestone fragments and a soapy solution, the mixture being of such quantity as will submerge the work, and with the limestone fragments and steel balls freely movable relative to each other.

3. The method of finishing including the step of tumbling the work in a mixture including an abrasive, and fragments of fractured granite of varying irregular shapes and sizes substantially as results from the fracturing of the granite which have the sharp points and edges thereof previously removed without destroying the angular character thereof.

4. A material comprising an abrasive and fragments of granite of widely varying irregular outline and in varying sizes ranging from approximately one-half to one and one-half inches, said fragments being of approximately the shapes resulting from the fracturing of the granite but

having the sharp points and edges removed therefrom without destroying the angular character thereof.

5. A material comprising an abrasive and fragments of granite of widely varying irregular angular outline and in varying sizes, said fragments being of approximately the shapes resulting from the fracturing of the granite but having the sharp points and edges removed therefrom without destroying the angular character thereof.

6. The method of treating granite fragments of widely varying irregular outline and in approximately the shapes resulting from the fracturing of the granite comprising subjecting such fragments to a tumbling agitation in the presence of an abrasive for such period that the sharp points and edges are removed from the fragments without destroying the irregular shapes thereof.

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