Aug. 30, 1966 J. C. STRAUB 3,269,066

METHOD FOR PRODUCTION OF ABRADED DESIGN ON WORK SURFACES

Filed Jan. 9, 1963

2 Sheets-Sheet 1

FIG. 1

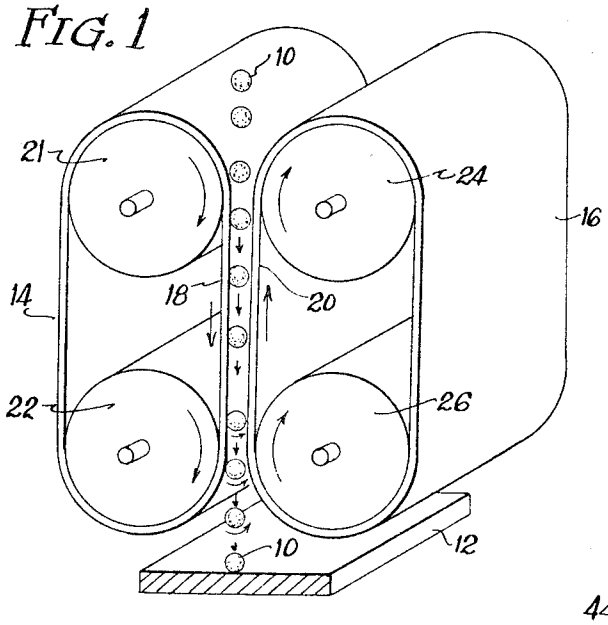


FIG. 2

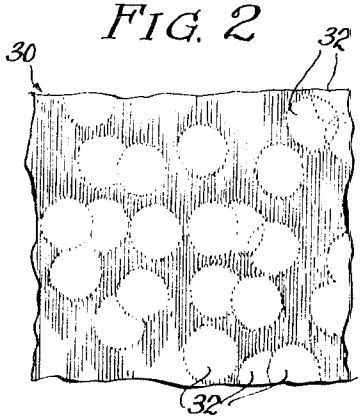


FIG. 3

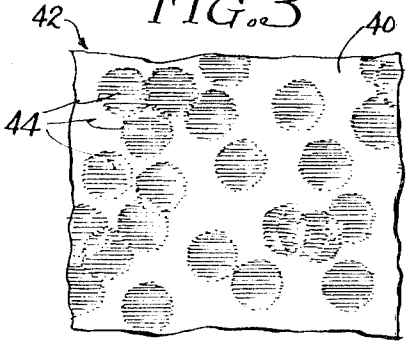


FIG. 4

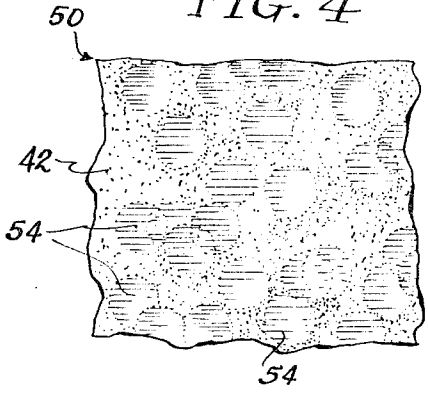
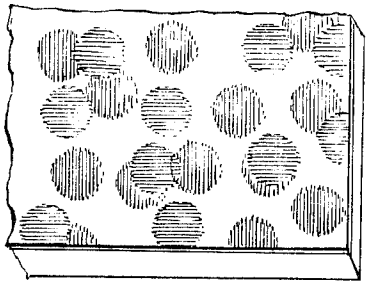


FIG. 5



FIG. 6



INVENTOR.
John Clarence Straub
BY
Ooms, McDougall & Hersh
Att'ys

Aug. 30, 1966 J. C. STRAUB 3,269,066

METHOD FOR PRODUCTION OF ABRADED DESIGN ON WORK SURFACES

Filed Jan. 9, 1963 2 Sheets-Sheet 2

FIG. 7

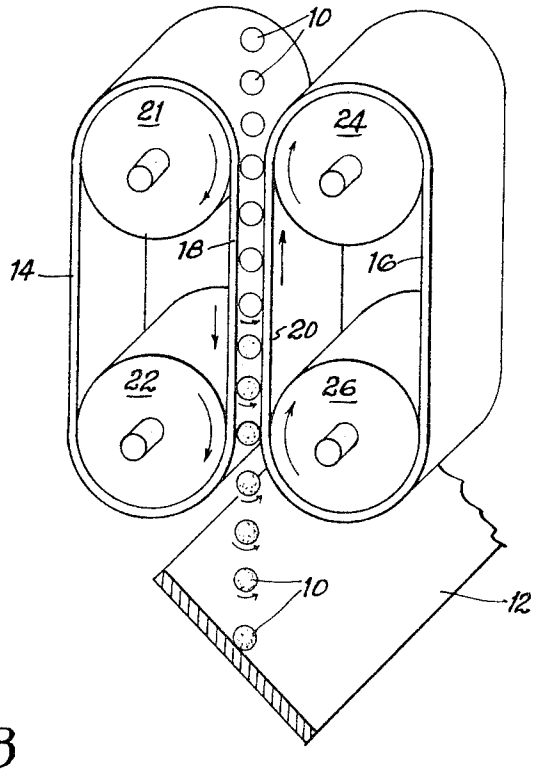


FIG. 8

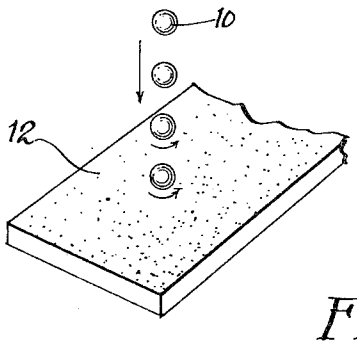


FIG. 9

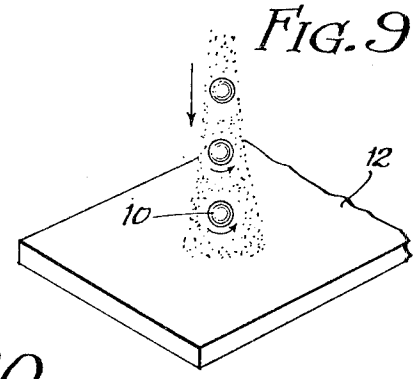
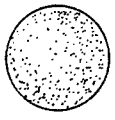


FIG. 10



INVENTOR
John Clarence Straub
by Ooms, McDougall & Kerah
Attys

United States Patent Office 3,269,066 Patented August 30, 1966

3,269,066

METHOD FOR PRODUCTION OF ABRADED DESIGN ON WORK SURFACES

John Clarence Straub, South Bend, Ind., assignor, by mesne assignments, to The Wheelabrator Corporation, Mishawaka, Ind., a corporation of Delaware

Filed Jan. 9, 1963, Ser. No. 250,431
6 Claims. (Cl. 51—319)

This invention relates to the production of a new and attractive surface finish and to the method for producing same. It relates more particularly to a surface finish of novel design and appearance which may be formed on the surfaces of such structural and decorative material as metals, plastics, glass, wood, and the like.

This invention will be described with reference to the method for the production of the new and novel finish of this invention on the surfaces of relatively flat pieces of metal, but it will be understood that the invention can also be practiced to provide the new and novel appearance as a finish on curvilinear surfaces and on the surfaces of other materials such as glass, plastics, rubber, wood and the like structural or decorative materials.

In my copending application Ser. No. 793,764, filed February 14, 1959, and entitled, "Polishing Method and Device," now Patent No. 3,090,166 dated May 21, 1963, and in my copending application Ser. No. 106,938, filed May 1, 1961, and entitled, "Polishing Method and Means," now Patent No. 3,098,324 dated June 23, 1963, description is made of a method and means for polishing surfaces of metals and the like materials by the process of impacting the surfaces of the metal with balls formed of a resilient material and wherein the balls have a concurrent linear and spinning motion and with a polishing agent either present on the surfaces of the metal or applied with the balls of resilient material to reduce surface roughness and to provide a new and novel means for polishing such surfaces.

It has now been found that similar techniques can be utilized to produce a new and novel effect or appearance on such surfaces wherein the appearance embodies a three-dimensional effect of superposed spheroidal shapes and it is an object of this invention to produce such surfaces and to provide a method and means for producing same.

More specifically, it is an object of this invention to provide a three-dimensional, mottled appearance on the surfaces of structural and decorative material and to provide a method for producing same which is simple in construction and easy in operation; which can be carried out on a batch process or in a continuous operation on individual or endless lengths of material respectively; which is low in cost and which requires the utilization of relatively inexpensive and readily available materials; which can be practiced substantially automatically with non-professional help; and which is capable of a number of ramifications to produce different and novel appearances on the surfaces of the material and wherein the appearance is built into the surface to become a permanent lasting part thereof.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, embodiments of the invention are shown in the accompanying drawings, in which—

FIG. 1 is a schematic illustration of but one of the means for imparting linear and rotational movement to resilient particles thrown onto the surfaces of the work for the development of the novel appearance of this invention;

FIG. 2 is a schematic view of one effect capable of being achieved in accordance with the practice of this invention;

FIG. 3 is a schematic view similar to that of FIG. 2 showing another effect capable of being achieved in accordance with the practice of this invention;

FIG. 4 is a schematic view similar to those of FIGS. 2 and 3 showing a still further effect;

FIG. 5 is a schematic view similar to those of FIGS. 2–4 showing a still further effect;

FIG. 6 is a schematic view similar to those of FIGS. 2–5 showing a still further effect;

FIG. 7 is a view similar to that of FIG. 1 showing a different arrangement between the elements;

FIG. 8 is a perspective view showing the abrasive particles present as a coating on the surface of the work;

FIG. 9 is a perspective view similar to that of FIG. 8 showing the abrasive particles thrown with the pellets onto the work surfaces; and

FIG. 10 is a pellet with the abrasive particles forming a part thereof.

The desired combination of linear movement and concurrent rotational movement can be imparted to the pellets in a number of ways described in the aforementioned copending applications. One such means comprises engagement of the pellets at opposite sides between two surfaces moving in the same or in opposite direction but with one surface moving at a higher linear speed than the other. Under such circumstances, the pellets will be displaced linearly in the direction of the faster moving surface, if the surfaces are moving in opposite directions, or in the same direction of such moving surfaces if they are moved in the same direction. The pellets will be given a spinning or turning movement responsive to the differential between the movements of the surfaces so that they will be thrown from between such surfaces with a linear as well as a rotational component. Instead of making use of two moving surfaces between which the pellets are displaced, one surface can be stationary and the other moving, as described in the aforementioned copending applications, or use can be made of a single-bladed surface in a throwing wheel whereby the pellets are caused to roll over the surface of the radially extending blade as the pellets are thrown outwardly centrifugally responsive to rotational movement of the bladed wheel.

It is preferred to make use of pellets of spheroidal shape although pellets that are out of round can be employed. The diameter of the pellets can vary depending upon the dimension of the spheroidal impressions desired to be made in the surface, it being understood that pellets of larger diameter will provide a larger sector in engagement with the surface such that the spheroidal design will be of larger dimension, and vice versa.

It is also desirable to make use of pellets of a resilient material, such as of cured elastomeric material, plastics, textile materials, bonded fibers or the like. Instead of making use of pellets formed entirely of such resilient or elastomeric materials throughout their cross-section, the pellets can be formed of a core of a selected material such as metal, wood, plastics or the like, depending upon the cost, the weight and similar considerations, with only the peripheral surface portions being formed with a coating of resilient or elastomeric material.

As in the process for polishing, it is desirable also to provide a polishing or abrasive material in finely divided form to the surface of the work at the time that it is engaged by the pellets. Such agents in finely divided form can be applied as a coating onto the surface of the work prior to being impacted by the spinning pellets. Instead, the agent, in finely divided form, can be applied onto the surface of the work at the time that it is engaged by the spinning pellets or by incorporating the agent into the stream of pellets thrown onto the work.

In a preferred system, the finely divided polishing or abrasive material is incorporated into the pellets to form a part thereof, preferably by formulation of the surface portions of the pellets to incorporate such finely divided particulate material or else by wetting the pellets with a material which causes a finely divided agent to cling to the surfaces of the pellets so as to be carried thereby to the surface of the work.

Referring now to FIG. 1 for an illustration of a representative means for achieving the desired movement of pellets **10** thrown onto the surface of a piece of work **12**, the device comprises a pair of endless belts **14** and **16** having their adjacent runs **18** and **20** laterally spaced apart one from the other by an amount corresponding to the cross-sectional dimensions or diameters of the pellets **10** for engaging the pellets when displaced therebetween. Each belt **14** and **16** is operable about a separate pair of rollers with the belt **14** operable about spaced rollers **21** and **22** while the belt **16** operates about spaced rollers **24** and **26** with at least one roller in each pair constituting a driven roller for imparting linear displacement to the respective belts. One belt is adapted to be displaced at a linear speed greater than the other with the belt having the higher speed traveling in the direction of the work **12** for displacement of the pellets **10** in the direction of the work.

The belts can be of any desirable width depending upon the coverage desired and the belts can be formed with or without linear grooves for use in alignment of the pellets displaced therebetween. The belts can be displaced for travel in the same direction whereby the pellets **10** are displaced therebetween linearly at a speed greater than the slower but less than the faster belt with a spinning movement corresponding to the differential. Instead, the adjacent runs of the belts can be displaced in opposite directions whereby the linear speed by which the pellets are thrown from the belt will be less than both and corresponding to the differential thereof while the turning movement of the pellets will be maximized. By such variation in the linear speeds of the belts or their relative linear speeds, the linear component and the turning movements of the pellets can be adjusted.

As illustrated in FIG. 1, the pellets **10** leave the end of the adjacent runs of the belts **14** and **16** with a linear component in the direction of the work and with a turning movement which operates to scrub the surface of the work upon engagement. The work **12** can be positioned substantially perpendicular to the direction of travel of the pellets, as illustrated in FIG. 1, or the work can be mounted at an angle with the direction of the travel of the thrown pellets, as illustrated in FIG. 7, whereby the impressions made by the pellets will differ from the appearance obtained by perpendicular impact.

The finely divided powder abrasive or polishing agent can be applied to the surface of the work, as illustrated in FIG. 8, or it can be incorporated in the stream of pellets, as illustrated in FIG. 9, or else embodied in the surface of the pellets, as illustrated in FIG. 10.

A wide variation of effects can be secured by the many ramifications possible in accordance with the practice of this invention.

Example 1

In FIG. 2, illustration is made of the effect secured when the resilient pellets are thrown with a spinning action onto a metal plate **30** having surface roughness of the type intended to be removed by polishing in accordance with the practice of the aforementioned copending applications but wherein treatment is terminated before the polished surface is achieved. It will be seen that the surface is smoothed by the action of the pellets, yet the surface engaged by the pellets is left with marks **32** of spheroidal shape which give the impression of a balloon of three-dimensional shape in reflected light. The bombardment of the surface with a plurality of pellets operates to superpose one spheroidal design upon the other to give a mottled three-dimensional effect.

The impressions **32** made by the pellets **10** are of negligible depth thereby to produce a product having the desired surface smoothness but wherein the spheroidal balloon effect of three-dimensional shape is permanently retained in the surface.

Example 2

In the ramification illustrated in FIG. 3, the surface **40** of the work **42** is originally formed with a high polish prior to engagement by the resilient pellets in accordance with the practice of this invention. Upon engagement, the pellets provide spheroidal impressions **44** of the described three-dimensional effect on a highly polished background to give a very attractive and permanent appearance of depth and design to the surface. The points of impact can be spaced or they can be effected more frequently to give the superposed spheroidal effect on the polished background.

Example 3

In the ramification shown in FIG. 4, the work **50** is first treated with a sand blast, vapor blast, liquid blast or an air blast of fine abrasive to provide a continuous matte finish **42** on the surface of the work. Thereafter, the surface is processed in accordance with the practice of this invention to impact the matte surface with the spinning pellets **10** of resilient material. At the points of engagement, the pellets will impart the design **54** having the described three-dimensional effect with the spheroidal impressions having greater brightness and smoothness or else greater dullness than the matte surface, depending upon the use of a polishing agent in the one case and an abrasive agent in the other. Again, the points of impact can be spaced or preferably superposed to give a mottled appearance of three-dimensional balloons on the matte surface. In a reflected light, a very unique and interesting effect is secured.

Example 4

In the further ramification of the practice of this invention as shown in FIG. 5, after bombardment of the surface of the work **60** with the spinning pillets **10** to provide the described three-dimensional balloon effect, the surface is given an overall finish to polish the surface or to provide a matte finish on the surface as by conventional means, whereby the mottled or balloon effect underlies the overall surface effect to give a new and novel appearance differing from that secured by any other of the described ramifications.

Example 5

In the further ramification of the practice of this invention as shown in FIG. 6, the work **60** prior to bombardment with pellets consists of a base material of one color whose surface has a thin tight coating of different color such as that produced on the surface of metal by anodizing, blue tempering, flash plating or other conventional coating means. The surface of the work **60** is then bombarded with the spinning pellets **10** with less than complete coverage of the surface of the work to remove a portion of the colored surface coating and provide spheroidal impressions **44** of the described three-dimensional effect in the natural color of the base material on a background of the differently colored surface coating to give a very attractive and novel appearance of permanent nature on the surface of the work.

In the foregoing Examples 1–5, description is made of the various effects that are secured depending upon the pre-treatment or after-treatment of the surface bombarded by the resilient pellets, such as the unfinished surface of Example 1, the highly polished surface of Example 2, the matte surface of Example 3, the matte finish after bombardment in Example 4, or the treatment to effect the

bombardment of a surface having a film or coating of a contrasting color in Example 5, and in which the surface is turned through an angle of 90° to provide variable line effects, as illustrated in FIG. 6, and which will hereinafter be described. There are many more unique and attractive finishes that can be developed on the surface depending upon other factors which will hereinafter be described, such as:

(1) the size of the pellets;
(2) the material of which the pellets are formed;
(3) the linear speed of the pellets;
(4) the direction of spin of the pellets;
(5) the speed of rotation or spin of the pellets;
(6) the angle of impact between the pellets and the surface treated;
(7) the type of abrasive;
(8) coverage of the pellets.

(1) *The size of the pellets.*—The visual dimensions of the pattern that is left on the surface responsive to the impact by the spinning pellets will be found to be proportional to the dimensional characteristics of the pellets.

(2) *The material of which the pellets are formed.*—It has been found that the size of the pattern that is left by the spinning pellets upon impact with the surfaces will depend also on the degree of softness or hardness of the material making up at least the surface portion of the pellets. In general, it may be stated that the size of the pattern is indirectly proportional to the hardness of the pellets. In other words, with pellets of substantially the same dimension, the softer pellets will make the larger pattern while the harder pellets will give a smaller pattern. Thus many of the ramifications previously described with reference to paragraph (1), depending upon the dimensional characteristics of the pellets, can be achieved by proper selection of the pellets for softness or hardness, as the case may be, for producing large or small balloon patterns or the described various combinations thereof.

(3) *The linear speed of the pellets.*—The dimensional characteristics of the pattern can also be varied by reference to the linear speed of the pellets that are thrown onto the surface of the work for introducing the new and novel appearance. It has been found that the dimensional characteristics of the pattern are proportional to the linear speed of the pellets, that the higher the linear speed, the larger the apperance of the impressions that appear to be formed on the surface, and vice versa.

(4) *The direction of spin of the pellets.*—The description heretofore has to do with the effect secured when the pattern appears to be formed with lines that run in a direction substantially perpendicular to the axis about which the pellets are spinning.

This angular arrangement of lines, depending upon the angles, markedly increases the number of designs capable of being secured, each of which gives a myriad of effects depending upon the angle or direction from which the surfaces are being viewed. Any single pattern will give a different appearance from a different angle such that by merely turning the surface, many different designs can be observed from any one surface treatment.

(5) *Speed of rotation of the pellets.*—The number of lines that appear to be formed in the pattern can be varied by reference to the speed of rotation of the pellets. The higher the speed, the denser the lines, and vice versa. Thus by variation of the speed, the line effects can be varied to again provide further means for modification of the appearance.

(6) *The angle of impact between the pellets and the surface treated.*—It has been found that the angle of impact materially affects the appearance of the pattern that is formed in the surface of the work.

(7) *The type of abrasive.*—The type of abrasive is influential on the type of line that appears to be formed.

A hard abrasive of large particle size will produce lines of greater prominence and width whereas a fine and soft abrasive will produce fine shadows, etc.

(8) *The coverage of the pellets.*—This concept has to do with the amount of coverage that is secured, depending upon the dimensional characteristics of the pellets, the time of exposure to the pellets, and the density of the pellets thrown onto the work.

It will be apparent from the foregoing that I have provided a simple and efficient means for producing surface effects of novel design and appearance in the surfaces of metal, plastics, glass, rubber, wood and the like structural or decorative materials. It will be apparent that the effect secured is permanently inscribed in the surface without destroying surface smoothness and that the new and novel finish can be achieved in a low cost and efficient manner either on a batch principle or in a continuous operation.

It will be understood that other changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In the method of producing a decorative finish onto surfaces of a work comprising projecting rounded pellets of a resilient material in laterally spaced apart relation onto the surface of the work with a movement having a linear component and a rotational component, simultaneously providing a pulverulent particulate abrasive material at the point of impact of the pellets with the surface of the work whereby a pattern corresponding to the area of the pellets in engagement with the surface of the work is inscribed in the surface, providing relative movement between the work and the source from which the pellets are projected onto the surface of the work in a direction substantially perpendicular to the linear direction of the pellets projected onto the work surface and at a rate which will cause engagement between the pellets and spaced portions of the work surface whereby the patterns inscribed on the surface of the work are spaced one from the other in the work surface.

2. The method as claimed in claim 1 in which the pulverulent particulate abrasive material is present as a continuous coating on the surface of the work.

3. The method as claimed in claim 1 in which the pulverulent particulate abrasive material is introduced with pellets thrown linearly onto the surface of the work.

4. The method as claimed in claim 1 in which the pulverulent particulate abrasive material is embodied in the pellets of resilient material thrown onto the surface of the work.

5. The method as claimed in claim 1 in which the surface of the work is polished prior to being impacted by the pellets.

6. The method as claimed in claim 1 in which the surface of the work has a matte finish before being impacted by the pellets.

References Cited by the Examiner

UNITED STATES PATENTS

2,331,974	10/1944	Haff et al.	41—17
2,584,031	1/1952	Lander	51—319
2,618,109	11/1952	Miller	51—319
2,742,724	4/1956	Fleiss	41—17
3,090,166	5/1963	Straub	51—9
3,098,324	7/1963	Straub	51—9

LESTER M. SWINGLE, *Primary Examiner.*

JOHN C. CHRISTIE, J. SPENCER OVERHOLSER, *Examiners.*

L. J. SHECHTER, *Assistant Examiner.*