ABRASIVE CLEANING AND HONING DEVICE AND METHOD OF HONING CONCRETE SURFACES

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ABSTRACT
A cleaning element (36) for a rotating disc cleaning pad 32 to hone a cement floor surface. Each cleaning element has a flat flexible abrasive surface (39) that is transversely positioned to the direction of motion to provide flex during cleaning of a cement floor surface.
ABRASIVE CLEANING AND HONING DEVICE AND METHOD OF HONING CONCRETE SURFACES

[0001] This application is a continuation-in-part of pending U.S. Ser. No. 10/851,393 filed on May 21, 2004.

TECHNICAL FIELD

[0002] The field of this invention relates to a cleaning and honing device for polished concrete surfaces.

BACKGROUND OF THE DISCLOSURE

[0003] Normal cleaning of concrete whether by a power wash, power sweep or scrub progressively deteriorates concrete by breaking apart smaller particles from the concrete surface, thereby making the concrete surface more porous and more susceptible to further deterioration.

[0004] Known cleaning brushes also progressively deteriorate concrete surfaces. The small bristles tend to undesirably add porosity to the concrete surface by poking into the holes that naturally occur in the concrete and breaking away the smaller particles of the concrete.

[0005] While concrete or cement is a very popular material for use in floors and construction materials because of its strength, durability and low costs, if the concrete or cement is left unfinished, the floor will inherently produce dust by the constant settling it undergoes whether by foot traffic or wheeled traffic and be susceptible to staining due to the porosity. One is then faced with a dilemma of cleaning a concrete floor with the disadvantage of the deterioration of its relatively smooth surface.

[0006] One way to achieve a better concrete surface look is to add a densifier such as sodium silicate to the concrete floor which closes the porosity of the floor. One then polishes the concrete with successive finer grit sand paper or polishing pads. This known process provides for a relatively attractive concrete polished surface. However this surface also needs maintenance when it gets dirty.

[0007] Previous attempts have been made to embed hardened abrasive particles such as silicone carbide a diamond particles into a substrate such as plastic for use on a power high speed machine. However, when such as abrasive device is used on the machine, the abrasive particles cause too much heat build up and has melted the plastic matrix. As more diamond particles are introduced in the plastic matrix, the more extensive and faster the heat build up occurs.

[0008] Previous attempts to embed hard diamond or other abrasive materials in the plastic matrix has resulted in affixing the diamond particles such that the diamond particle remains secured in the plastic even after the diamond edge has worn down and its abrasive cutting power has significantly degraded.

[0009] What is needed is a durable cleaning brush for mounting to a cleaning or buffing machine that is suitable for cleaning a polished cement floor. What is also needed is an expedient method to clean a polished concrete floor. What is also needed is a bristle that is durable and with a cross-sectional diameter larger than the cement floor pores in order to hone and smooth a concrete floor rather than degrade it during the cleaning process. What is also needed is a bristle that has a durable abrasive particle securely affixed to the bristle that is capable of honing a concrete surface.

SUMMARY OF THE DISCLOSURE

[0010] In accordance with one aspect of the invention, an abrasive cleaning device has a housing and a plurality of cleaning strips having a front abrasive face with a width and length. The cleaning strips are mounted to the housing such that the front abrasive face is aligned substantially transverse to the normal direction of motion of the housing. The cleaning strips include an abrasive material at the surface of the cleaning strips and secured to a substrate of the strips. The length of the face is substantially greater than the thickness of the strip to provide flexibility of the cleaning strips.

[0011] In accordance with another aspect of the invention, an abrasive cleaning device has a plurality of cleaning strips with one end mounted to the housing. The strip has a distal end with an abrasive material at the surface of a substrate and secured to the substrate. The length of the cleaning strips is substantially greater than its thickness to provide resilient flexibility. Preferably the substrate is made from a steel or plastic that provides the resilient flexibility to the bristle. Preferably, abrasive particles are secured to the strip such that when the strip wears it is exposing fresh abrasive particles at its working scrub surface. The distal working surface provides a flat edge to scrape away dirt and residue while the sharp abrasive particle cut and hone the cement surface. As the abrasive particles wear out, i.e. round down and lose its effectiveness, they eventually abrade away as the bristle shortens to expose new abrasive particles with sharp edges to the work surface.

[0012] In one embodiment, the abrasive material is formed by hard abrasive particles being embedded in the substrate that is a high temperature plastic matrix. In one embodiment, the housing is in the form of a rotatable pad made for rotation about a central point. The cleaning strips have their respective front faces substantially radially aligned with the center of the pad. In another embodiment, the housing is tubular and made for rotation about its major axis. The cleaning strips extend radially from the housing with the faces co-aligned with the major axis.

[0013] In accordance with another aspect of the invention, an abrasive bristle includes a plastic matrix, and an abrasive material embedded in only a distal end section of the bristle. A proximate mounting section of the bristle is devoid of the abrasive material. In another embodiment, the abrasive is coated on opposing ends. Preferably, the abrasive is brazed on the opposing ends.

[0014] In one embodiment, the distal end with the abrasive material extends toward the proximate mounting section with the abrasive ending at a point where the flexibility degrades a sufficient amount and the point being used as a wear indicator. In one embodiment, the abrasive material includes diamond particles. In one embodiment, the bristle includes abrasive material at opposing distal ends of the bristle element with a middle section being a mounting section to a support base. The middle section is devoid of the abrasive material. It is preferred that the abrasive material is embedded in the plastic matrix. It is also preferred that the plastic matrix is a high temperature plastic material.
[0015] In accordance with another aspect of the invention, a method of cleaning and honing a polished concrete surface includes moving a plurality of cleaning strips having a front abrasive face aligned substantially transverse to the direction of movement. The cleaning strips resiliently flex to accommodate high and low spots of the concrete surface. Preferably, the cleaning strip is in the form of a flexible plastic matrix with the abrasive face having a plurality of abrasive particles secured onto the cleaning strip across the face.

[0016] Preferably, the cleaning strips in cross-section have a major axis and a minor axis with the major axis positioned to be transverse to the normal motion of the housing. It is also preferred that the housing is a rotatable pad made for rotation about a central point. The cleaning strips have their respective major axis substantially radially aligned with the center of the pad. The minor axis is positioned to be transverse to the normal motion of the housing. In one embodiment, the abrasive material is diamond particles being brazed onto the substrate which can be steel.

[0017] According to another aspect of the invention, the flexible bristles with abrasive particles have a cross-sectional diameter substantially greater than the cement pores and preferably greater than \( \frac{3}{16} \) inch diameter to provide the bristles to glide over the pores and clean and hone the surface of the polished cement.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Reference now is made to the accompanying drawings in which:

[0019] FIG. 1 is a perspective view of a high speed burnishing brush with a cleaning device incorporating one embodiment of the invention;

[0020] FIG. 2 is an enlarged side elevational view of the cleaning device on the polished concrete floor;

[0021] FIG. 3 is an enlarged perspective view of one cleaning element made in accordance with another embodiment of the invention;

[0022] FIG. 4 is a cross sectional view taken along lines 4-4 shown in FIG. 3;

[0023] FIG. 5 is an enlarged perspective view of a further modified embodiment of a cleaning element;

[0024] FIG. 6 is a cross sectional view taken along lines 6-6 shown in FIG. 5;

[0025] FIG. 7 is an enlarged perspective view of an additional embodiment of a cleaning element;

[0026] FIG. 8 illustrates a method of attaching the bristle shown in FIG. 7 to a housing;

[0027] FIG. 9 is a bottom plan view of a disc pad incorporating wide blade shaped strips in accordance with an alternative embodiment of the invention;

[0028] FIG. 10 is a perspective view of a roller brush incorporating blades in accordance with an alternative embodiment of the invention;

[0029] FIG. 11 is a cross-section side elevational view of a steel bristle with diamond abrasive particles brazed thereon in use on a concrete floor; and

[0030] FIG. 12 is a view similar to FIG. 11 showing an embodiment with the abrasive particles only on the lower section of the front scrub face.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0031] Instead of washing and waxing as is often done with conventional floors, the maintenance of a polished concrete floor is accomplished by using an abrasive pad 32 used as shown in FIG. 1 on a conventional high speed machine (not shown) for honing the concrete surface. The machine is set at about 175 rpm's with a pad pressure of 60-300 psi. The cleaning by honing can also be done by a drum brush 34 as shown in FIG. 10 also mounted to a conventional drum machine (not shown).

[0032] The pad 32 is made from a plurality of cleaning elements called strips or bristles 36 which can be in the form of a round, square or rectangular bristle as shown in FIG. 2 which can be embedded with abrasive 38. The bristle 36 may be extruded from a high temperatures thermoplastic material mixed with abrasive particles 38. The abrasive particles 38 may be a hard particulate such as alumina silicate or small industrial diamond particles.

[0033] In one embodiment as shown in FIGS. 3 and 4, the bristle 36 has a distal end 40 with an abrasive flat front face 39 that engages the polished floor 10 with the hardened abrasive particles. The abrasive particles are sufficiently aggressive to scour any dirt or grime that exists on the concrete floor. The square bristles are at least \( \frac{3}{16} \) inch wide to be larger than the pores of most normal concrete floors. The bristle is also flexible to flex over high spots of the concrete floor to avoid scratching of the high spots of the concrete surface. While a square bristle is shown, rectangular or other shaped bristles are possible as long as they have a scrub face 39 over \( \frac{3}{16} \) inch wide. In this fashion, the concrete surface is honed and not abraded or scratched.

[0034] The bristle has its mounted end 42 embedded in the pad as shown in FIGS. 1 and 2 by being molded directly therein. The bristles are mounted such that the abrasive scrub face 39 is aligned transverse to the normal direction of motion of the pad at the face 39. For example, as shown in FIG. 9, the faces 39 are radially aligned about the center 41 of the pad when the pad rotates about its center 41. In this construction, all the bristles may be in working contact with the concrete surface simultaneously. The drum brush shown in FIG. 10 has the faces aligned along the width of the drum brush such that as the drum rotates in the indicated direction, the face 39 flushly encounters the concrete floor.

[0035] When diamond particles 38 are embedded as abrasive in the bristle, it is desirable that only the working distal end 40 is provided with the diamond particles 38 to contain costs of the relatively expensive diamond particles. As shown in FIGS. 3-6, two embodiments are shown each with diamond abrasive in proximity with the distal end 40 and the proximate mounting end 42 being devoid of such diamond particles. The embodiment shown in FIGS. 3 and 4 show a bristle with a layer of diamond particulates coated about the distal end. The diamond particulates are coated sufficiently thick and are secured strong enough to maintain its adhesion to the underlying bristle material. It should be noted that only the scrub surface 39 needs to be coated. As shown, opposing surface 43 is also coated in case there are machines
that rotate the pad in the opposite direction. The side walls 45 need not have any abrasive coating. FIG. 12 illustrates an embodiment where only the front scrub surface 39 has an abrasive coating and the side walls 45 and opposing surface 43 are free of an abrasive coating. The diamond abrasive coating is positioned only at the distal section of the front scrub surface 39.

[0036] FIGS. 5 and 6 show where the extruded bristle is made such that only the distal area 40 has the diamond particulate embedded therein with the remaining or proximate section 42 being devoid of diamond particulate. In this embodiment, the embedded diamonds extend completely through the interior of the bristle 36 as clearly illustrated in cross sectional view of FIG. 6. This embedded particulate has its advantages over the embodiment shown in FIGS. 3 and 4 as the bristle abrades through extended use, its outer surface at the distal end 40 no matter how worn always provides an outer abrasive surface 39 with diamond particulate 38 on a working surface.

[0037] For either embodiment, as the pad 32 is used, the distal end 40 abrades to provide a straight knife-like edge 41 on the concrete surface 12. As the diamond particles 39 wear down and their effectiveness becomes diminished, they eventually abrade off the bristle as the substrate material whether plastic or steel also wears down to provide a fresh diamond particles just above to replenish the effectiveness of the bristle for honing concrete surfaces.

[0038] Furthermore, the bristles 36 have a length that is sufficiently long compared to its thickness to provide resilient flexibility of the bristle as illustrated in FIG. 2 to flex. As the bristle is shortened through the extended wear and the bristle becomes to short and too stiff for proper use, the diamond particulate also becomes exhausted which provides for a sensory indicator that the bush is worn out.

[0039] In this fashion an abrasive bristle maintains its abrasive aggressiveness for a long term. The resilient flexibility of the bristle provides relief when the pad hits a high spot of the concrete floor and will not gouge or scratch at the high spot or open the pores at the high spot.

[0040] In this manner, the bush by having a bristle with a relatively wide, flat, and resilient flexible abrasive face 39 does not cause excessive deterioration or scratching of the concrete floor. In fact, it honors the concrete floor to maintain its smoothness. Secondly, by only having diamond particulate at the distal section 40, there is less waste of diamond particulate and increases the structural and heat integrity of the plastic matrix. By placing the diamonds only on the front scrub face, the plastic matrix is able to withstand higher heat outputs produced by the diamond abrasive. By placing the diamond bristles in a rotating pad construction as shown in FIGS. 1, 2, 8 and 9, all the diamond scrub faces can be in operating contact with a concrete surface simultaneously thereby increasing the work output of the brush pad 32. In addition, a sensory wear indicator is provided when the diamond particulate is totally abraded.

[0041] A further embodiment is shown in FIGS. 7 and 8 which provides for a double ended bristle 46 that has two opposing distal ends 48 each with diamond particulate either coated or embedded in the same fashion as described in the embodiments shown and described for FIG. 3-6.

[0042] In this bristle, both distal ends 48 are positioned to be operable against the floor surface 10. The mid-section 50 is mounted to the brush substrate by extending through holes 52 and being stapled in place by staple 54. Other molding techniques may also embed the mid-section 50 in the brush with the two distal ends 48 extending outward. It should be noted that the bristle provides for two cleaning sections with opposing abrasive faces 39. When the bristle is mounted into the pad, both faces 39 face the same direction. The operation of the brush bristles 46 is identical with the previous described embodiments.

[0043] While square cross-sectional bristles 36 have been shown and described, wide blade bristles 36 as shown in FIG. 9 can be used with pad 32. Bristles 36 have a cross-section with a major and minor axis with the major axis being radially aligned about the center of rotation 41 and transverse to the normal motion of pad 32. The blade shaped bristles 36 while shown in four staggered sections can have a variety of configurations on pad 32. The bristles 36 may also have an elliptical or oblong cross-sectional shape with the major axis in the same position as shown. Other applications may have the minor axis aligned to be transverse to the normal motion of the housing. A bristle with a circular cross-section is also usable for honing the concrete surface if the diameter exceeds ½".

[0044] While a plastic matrix has been shown and described, the substrate may be made from steel such as steel wire or wire strips 36 as shown in FIG. 11 with diamond particles 38 brazed or electroplated thereon.

[0045] Another embodiment is shown in FIG. 10 with drum 34 mounting wide blades 36 about its periphery to provide scrub faces 39 to operate in similar fashion as described before. The brush may also be used as an aggressive abrader. For this use, narrower bristles may also be used.

[0046] In all the shown embodiments, the wear of the substrate allows for the sacrifice of the diamond particles. Preferably, the diamond particles are sacrificed or fall off of the bristle before the diamond edge becomes sufficiently rounded. If the diamond edge becomes rounded, a ball bearing effect undesirably occurs where the diamond glides over the surface but does not cut, abrade or polish. By sacrificing the diamonds before hand, the bristle is assured to cut and hone as it wears down and becomes shorter.

[0047] In this fashion the use of diamond abrasive bristles becomes cost effective and provides for easy maintenance of a polished concrete or cement floor surface and provide honing of the floor during cleaning maintenance.

[0048] Other variations and modifications are possible without departing from the scope and spirit of the present invention as defined by the appended claims.

1. An abrasive cleaning device for cleaning and honing a concrete surface comprising:
   a rotatable disc shaped housing for rotation about a central axis;
   a plurality of cleaning strips having a front abrasive face with a width and length extending downward from said disc shaped housing;
said cleaning strips mounted to said housing such that the front abrasive face is aligned substantially transverse to the normal rotatable direction of motion of said housing;
said cleaning strips having a substrate and an abrasive material at the surface of said cleaning strips and secured to said substrate; and
the length of said cleaning strips being substantially greater than its thickness to provide flexibility of said cleaning strips to allow some strips to flex over high spots in said concrete surface.

2. An abrasive cleaning device as defined in claim 1 further comprising:
said abrasive material being hard abrasive particles being embodied in said substrate; and
said substrate being a plastic matrix.

3. An abrasive cleaning device as defined in claim 1 further comprising:
said plastic matrix being a high temperature plastic.

4. An abrasive cleaning device as defined in claim 1 further comprising:
said cleaning strips having its front abrasive faces substantially radially aligned with the center of said pad and transverse to the normal rotational motion of said housing.

5. An abrasive cleaning device as defined in claim 3 further comprising:
said abrasive material embedded only in a distal end section of said bristle; and
a proximate mounting section being devoid of said abrasive material.

6. An abrasive cleaning device as defined in claim 1 further comprising:
said abrasive material being only on a distal end of said front abrasive face with said proximate end and said other faces being devoid of said abrasive material.

7. An abrasive bristle comprising:
a plastic matrix,
an abrasive material embedded in a distal end section of said bristle; and
a proximate mounting section of said bristle being devoid of said abrasive material.

8. An abrasive bristle as defined in claim 7 further comprising:
said distal end with said abrasive extending toward said proximate mounting section with said abrasive ending at a point where said flexibility degrades a sufficient amount and said point being used as a wear indicator.

9. An abrasive bristle as defined in claim 8 further comprising:
said abrasive material being only on a distal end of a front abrasive face with said proximate end and other faces being devoid of said abrasive material.

10. An abrasive bristle as defined in claim 7 further comprising:
said abrasive material comprising diamond particles.

11. An abrasive bristle element comprising:
a plastic matrix; and
an abrasive material at opposing distal ends of said bristle element;
said middle section being a mounting section to a support base;
said middle section being free of said abrasive material.

12. An abrasive bristle element as defined in claim 11 further comprising:
said abrasive material being embedded in said matrix;

13. An abrasive bristle element as defined in claim 11 further comprising:
said abrasive material being coated on said opposing ends.

14. An abrasive bristle element as defined in claim 13 further comprising:
said abrasive material having a brazed connection on said opposing ends.

15. An abrasive cleaning device as defined in claim 14 further comprising:
said front abrasive faces being substantially flat and said abrasive material being coated on only said front abrasive faces with said other faces being devoid of abrasive material.

16. An abrasive cleaning device as defined in claim 15 further comprising:
said cleaning strips in cross-section having a major axis and a minor axis with said major axis positioned to be transverse to the normal motion of said housing.

17. An abrasive cleaning device for cleaning and honing concrete surfaces comprising:
a disc shaped housing for rotation about a center axis;
a plurality of cleaning strips having a substrate with a mounting end mounted to said housing and a distal end with abrasive particles at the surface of said substrate and secured to said substrate for honing concrete surfaces and releasable from said distal end as said abrasive particles rounds out to provide exposure of another abrasive particle for honing said concrete surface;

the length of said cleaning strips being substantially greater than its thickness to provide flexibility of said cleaning strips; and
said cleaning strips in cross-section having a major axis and a minor axis with one of said axes positioned to be transverse to the normal motion of said housing.

18. An abrasive cleaning device as defined in claim 17 further comprising:
said major axis being positioned transversely to the normal motion of said housing.

19. An abrasive cleaning device as defined in claim 18 further comprising:
said abrasive material at the surface of only the front abrasive face with other faces being devoid of abrasive material; and
said front abrasive faces being substantially flat.
20. An abrasive cleaning device as defined in claim 19 further comprising:
said abrasive material comprising diamond particles having a brazed connection with said substrate.

21. An abrasive cleaning device as defined in claim 18 further comprising:
said cleaning strips having a major and minor axis greater than \( \frac{1}{8} \) inch such that it is larger than the diameter of cement pores.

22. An abrasive cleaning device for a concrete surface comprising:
a brush with a plurality of resiliently flexible bristles having a major and minor axis larger than the pores of said concrete;
said brush having a scrub working surface with abrasive particles affixed thereto;
said brush having a flat edge at its distal end to scrape away dirt and residue; and
said brush providing a replenished scrub working surface as worn abrasive particles abrade from the scrub working surface and as the scrub working surface abrades away for honing the concrete surface.

23. An abrasive cleaning device as defined in claim 22 further comprising:
said scrub working surface being substantially flat and substantially transverse to the normal direction of motion of said cleaning device.

24. An abrasive cleaning device as defined in claim 23 further comprising:
said abrasive particles affixed only at said scrub working surface with other faces of said bristles being devoid of abrasive particles.

25. A method of claiming a polished concrete surface comprising:
moving a plurality of cleaning strips having a front abrasive face aligned substantially transverse to the direction of movement; and
said cleaning strips flexing to accommodate high and low spots of the concrete surface.

26. A method as defined in claim 25 further comprising:
said cleaning strip being a flexible substrate with said abrasive face having a plurality of abrasive particle secured thereon across said face.

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