July 20, 1937. C. W. FOSS 2,087,318

ABRASIVE DEVICE

Filed July 8, 1936

Fig. 1.

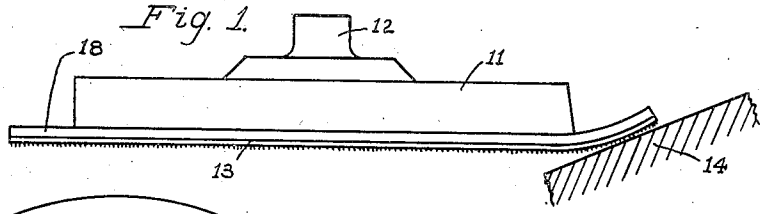


Fig. 2.

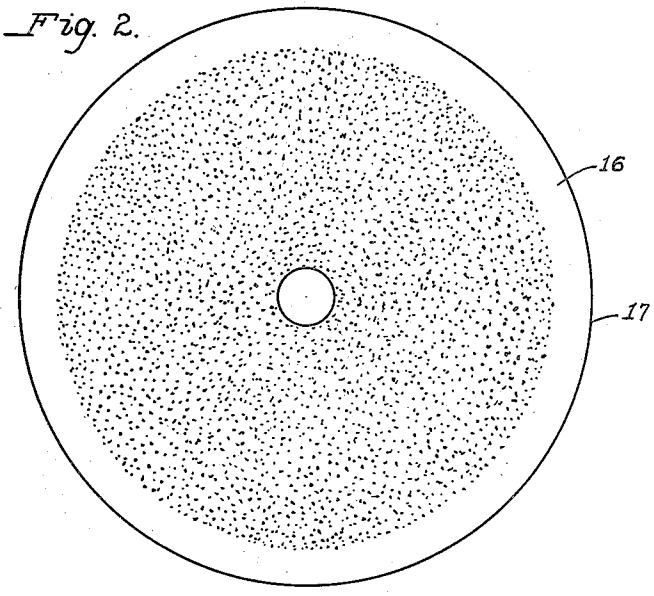


Fig. 3.

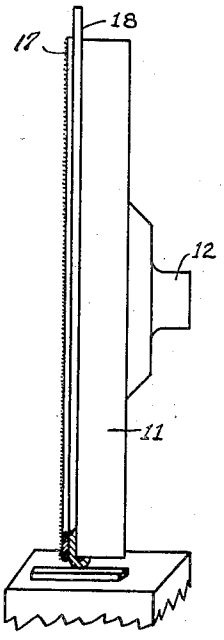
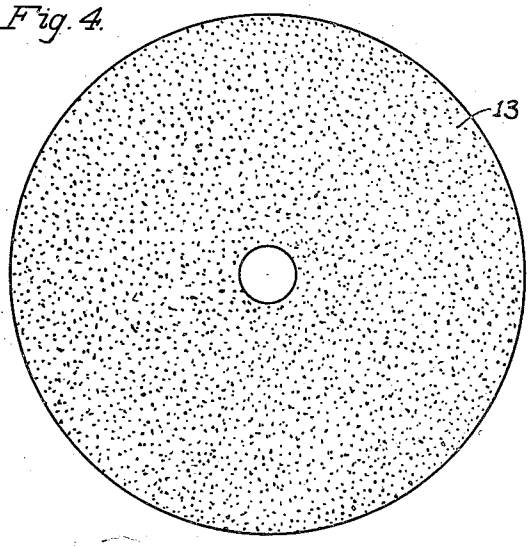


Fig. 4.



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2,087,318

UNITED STATES PATENT OFFICE

2,087,318

ABRASIVE DEVICE

Carl W. Foss, Niagara Falls, N. Y., assignor, by mesne assignments, to The Carborundum Company, Niagara Falls, N. Y., a corporation of Delaware

Application July 8, 1936, Serial No. 89,566

6 Claims. (Cl. 51—195)

The present invention relates to abrasive structures, preferably in sheet form, and more particularly to the treatment of material for the purpose of forming or attaining composite structures from which well known forms of sheet abrasives may be shaped such as what are commonly known as abrasive discs.

The conventional practice of abrading irregular surfaces such as automobile bodies includes the use of an abrasive disc combined with a flexible supporting pad of a diameter complementary to that of the disc. Such an assembly is usually driven by means of a flexible shaft so that the abrasive may be manually moved over the surface of the work under treatment. The rotating flexible pad provides a support for the abrasive disc and also permits the disc attached to the center thereof to flex laterally and follow the contour of an irregular work surface. By reason of the flexible nature of the arrangement only a relatively small portion of the disc, namely the peripheral surface thereof, is brought into contact with the work surface. The useful portion of the revolving disc is therefore a comparatively narrow annulus varying in width from the peripheral edge towards the center of the disc in accordance with the flexibility of the combined assembly and the pressure applied by the operator. The general type of such disc is approximately nine inches in diameter and the annulus or useful portion varies from ¼ inch to 1½ inches as measured radially inward from the peripheral edge. After the abrasive particles carried by this portion of the disc become dull or worn away the disc is no longer useful and must be discarded in favor of a new disc.

It is therefore an object of the present invention to provide a disc and supporting pad combination with such structural characteristics as will permit a greater portion of the abrasive surface of the disc to be utilized than has been heretofore possible.

A more specific object of the invention is the provision of a supporting pad with a diameter appreciably less than that of the disc and combining an abrasive disc therewith of such a brittle character as to shear or cut away uniformly at the periphery when operated with the edge thereof engaging a work surface.

A still further object of the invention is to provide an abrasive disc with a composite backing that is relatively rigid as compared to previous discs of this general type so that grinding pressure will be obtained by the peripheral portion thereof when the same is associated with a supporting pad of an appreciably smaller size.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and the following description wherein an exemplary embodiment of the invention is disclosed.

Figure 1 is a view in side elevation of an abrasive disc and supporting pad.

Figure 2 is a view of an abrasive disc showing the relatively narrow annulus of the face with the abrasive particles removed as a result of engagement of that portion of the disc with a work surface.

Figure 3 is a side plan view of the assembly showing the manner by which the worn annulus of the disc may be sheared.

Figure 4 is a face view of the abrasive disc shown in Figure 2 after the worn edge has been removed.

Referring to the drawing there is represented in Figure 1 a flexible supporting pad 11 of a smaller diameter than that of the conventional type of abrasive support. That is to say, the present invention contemplates a smaller disk-like pad than that heretofore employed as exemplified in U. S. Patents Nos. 1,686,898 and 1,686,938 hereinafter referred to or if the old type of flexible pad is employed the diameter of the abrasive disc is such that an inch or more of the abrasive extends beyond the periphery of the pad. A pad of such dimension as compared to the diameter of the disc and otherwise similar to pads of the prior art may be rotated in the usual manner by attaching the hub 12 to an appropriately driven flexible shaft (not shown) so that the abrasive disc 13 attached at its center and supported in front of the pad 11 may be moved over a work surface such as represented at 14.

After the disc 13 has been used a portion of the abrasive particles becomes dull or is entirely removed from the face of the disc as illustrated in Figure 2 by the annulus 16. The differential in size of the yieldable pad 11 as compared to that of the disc 13 is provided for the purpose of permitting the worn annular portion thereof to be sheared by forcing the edge 17 of the rotating disc into engagement with the work surface as indicated in Figure 3.

In carrying out a grinding operation with such an assembly wherein the abrasive disc is materially larger than the supporting pad it is necessary to provide the disc with structural characteristics which will cause the portion 18 of the

disc extending beyond the pad to maintain grinding contact with the work surface when lateral pressure is applied by the operator. The backing for the abrasive particles must therefore be more rigid than any of the structures of the prior art, particularly more so than those disclosed in Patents Nos. 1,686,898 and 1,686,938 issued respectively to Richard P. Carlton and Herbert R. Stratford, since the supplementary backing or pad does not extend to support the entire disc. In addition to rigidity the backing must also be yieldable enough to permit the abrasive particles to follow irregularities in the work surface.

In the fabrication of abrasive sheet material from which discs of such characteristics may be shaped a sheet of fabric, for example, textile cloth known as Ohio Falls preshrunk drill weighing about 2.5 pounds per running yard and approximately 28 inches wide is treated by applying a liquid, heat-hardenable resin such as a phenol aldehyde condensation product to one face thereof in the ratio 10 pounds of liquid to a (480 sheet 9 x 11) ream of cloth. After the fabric has been so treated the volatile liquids of the resin may be driven off by heating the material for a period of two hours at a temperature which will not cure the resin to any appreciable extent and preferably in a range between 165° to 170° F.

Abrasive particles are adhesively attached to one face of the fabric as hereinafter described and in order that a matrix will be provided to stiffen and strengthen the threads of the cloth and insure uniform shearing of the fibers of the cloth while the fabric is being cut down it is essential that the cloth be supported by a highly rigid reinforcement such as filling the interstices or voids between the threads of the cloth and the fibers thereof with some relatively inflexible material. It is for this purpose that the opposite face of the fabric is then treated with a quantity of the above indicated resin sufficient to fulfill the above requirements and preferably in the amount of 8 pounds per ream. After the application of the second coating the fabric may be permitted to dry or it may be festooned and dried by heating at a temperature which will not materially cure the resin and specifically between 165° and 170° F.

Any tough ductile material such as fish paper may be employed as a base for the fabric and hydrated cellulosic material or vulcanized fiber has been found to be satisfactory for this purpose. A sheet of such material having a thickness of substantially .010 inch and a width complementary to that of the fabric is coated with a phenol aldehyde condensation product resin in the ratio of approximately 6 pounds per ream. After one face of the fiber is thus coated the fabric or cloth as above treated may be united therewith by rolling the two sheets at room temperature to adhesively join the same. As a result of the rolling operation a portion of the resin with which the fiber has been coated is absorbed by the fabric to further fill the fibers and interstices thereof.

Preparatory to applying the abrasive particles the fabric face of composited material, formed in accordance with the hereinabove described method, should be coated with sufficient resin to affix a layer of abrasive grain thereto. The cloth face of a ream of the composite sheet may be treated with 22 pounds of a resin derived from mixing a liquid phenol aldehyde condensation product with a powdered "A" stage heat-hardenable phenolic resin. Various proportions of the liquid and solid resins may be combined and 100 pounds of the powder mixed with 500 pounds of liquid has been found to provide a suitable adhesive for the abrasive particles and further fill the fibers or threads of the fabric. Thereafter 95 pounds of abrasive particles, as for example fused alumina, is spread uniformly over the fabric face of a ream of the composite material. A sizing coat of the same mixture of resin is then applied in an amount to properly affix the abrasive particles to the fabric and 18 pounds of such a resin per ream has been found to fulfill these requirements.

Thereafter the material should be festooned and dried for a period of 10 hours at approximately 125° F. and 7 hours at a temperature of 185° F. after which the same may be rolled to impart a small curvature to the composite sheet material. The resin of the rolled sheet is then cured at a temperature of 250° F. for a period of 16 hours. It will be apparent however that time and temperature required to properly cure the resin may be varied in accordance with the particular resin employed. These latter temperatures cure all of the resin which has been employed in connection with the fabric including the coats employed to adhesively join the fabric and the fiber, together with the grain securing applications.

Discs such as illustrated in Figure 1 may then be cut from the sheet material comprising a layer of abrasive particles which are supported by a composite backing consisting of a fabric sheet coated with a resin to such an extent that the cloth is brittle and a fiber sheet of tough ductile cellulosic material to render the structure rigid and only slightly flexible so that if the same is bent beyond the flexure incident to the grinding operation or beyond the elastic limit thereof cracks develop in the cloth as distinguished from previous cloth combinations wherein the bond stretches or bends to maintain the continuity under considerably more flexure.

A disc formed in accordance with the hereinabove method may therefore be operated in connection with a supporting pad having a smaller diameter than the abrasive. The rigid character of the composite backing imparts sufficient stability to the disc to maintain grinding by the face adjacent the periphery under pressure of the operator. The disc may be used in such a manner until the abrasive particles are dull or flaked away to form a relatively barren portion as indicated by the annulus in Figure 2. The assembly being free for movement by reason of the flexible shaft may then be positioned in such a manner that the edge 17 of the disc is brought into engagement with a protuberance in the work surface as illustrated in Figure 3 when the fabric is sheared uniformly to reduce the diameter of the disc. Such operation of the disc does not always cause the fiber sheet to be sheared since it is tough and ductile. It appears that the fiber first curls towards the supporting pad in a manner such as indicated in Figure 3. Continued engagement of the edge of the rotating disc with a projection in the work surface causes the curled fiber to be abraded or worn so that the diameter is substantially equal to that of the sheared fabric at the end of the cutting operation.

Although certain steps have been described as illustrative of a method of carrying out the in-

vention it will be apparent that modifications may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. A flexible abrasive article comprising a composite backing consisting of a cellulosic sheet, a fabric sheet adhesively attached to one face of said cellulosic sheet, and a heat-hardened resin intermingled with the fibers of said fabric in a quantity sufficient to provide the same with a relatively brittle characteristic and a layer of abrasive particles adhesively attached to the face of said fabric.

2. A flexible abrasive article comprising a composite backing consisting of a hydrated cellulose sheet, a fabric sheet adhesively attached to one face of said cellulose sheet, and a heat-hardened resin filling the interstices of said fabric sheet in a quantity sufficient to provide the fabric component of said backing with a relatively rigid brittle characteristic and a layer of abrasive particles adhesively attached to the face of said fabric.

3. A flexible abrasive article comprising a composite backing consisting of a vulcanized fiber sheet, a fabric sheet adhesively attached to one face of said fiber sheet, and a heat-hardened resin intermingled with the threads of said fabric and filling the interstices thereof in a quantity sufficient to provide the fabric with a shearable characteristic and a layer of abrasive particles attached to the fabric face of said backing.

4. A flexible abrasive comprising a composite backing consisting of a vulcanized fiber disc, a textile fabric disc adhesively attached to one face of said fiber disc, a heat-hardened phenol aldehyde condensation product resin surrounding the threads and filling the voids of said textile fabric to reinforce the fabric and render the same brittle whereby the same will shear uniformly when the peripheral edge thereof is applied to the work surface and a layer of abrasive particles attached to the fabric face of said backing.

5. A grinding device comprising the combination of a flexible disc-like supporting pad, with a flexible abrasive disc of a larger diameter than that of said pad having a composite backing consisting of a vulcanized fiber disc combined with a brittle fabric disc carrying abrasive particles whereby the abrasive disc will maintain itself beyond the periphery of said pad to provide grinding by the portion of the disc extending beyond said pad and the fabric component of such portion may be sheared when the edge thereof is applied to the work surface.

6. A grinding device comprising the combination of a flexible disc-like supporting pad with a flexible abrasive disc, the said abrasive disc being of materially greater diameter than that of said pad and having a composite backing, consisting of a cellulosic sheet characterized by toughness, flexibility, and high resistance to buckling combined with a brittle fabric sheet carrying abrasive particles whereby the said abrasive disc will be self-supporting beyond the periphery of said pad to provide grinding by that portion of the disc extending beyond said pad and whereby the fabric component of such portion may be sheared when the edge thereof is applied to a work surface.

CARL W. FOSS.

DISCLAIMER

2,087,318.—*Carl W. Foss*, Niagara Falls, N. Y. ABRASIVE DEVICE. Patent dated July 20, 1937. Disclaimer filed May 22, 1942, by the assignee, *The Carborundum Company*.

Hereby disclaims the subject matter of claims 1, 2, 3, and 4 of said Letters Patent.

[*Official Gazette June 16, 1942.*]

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