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2,194,472

PRODUCTION OF ABRASIVE MATERIALS

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Fig. 1.

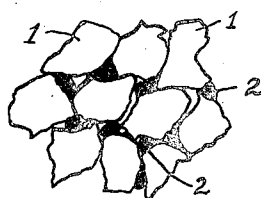


Fig. 2.

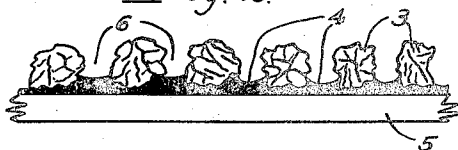
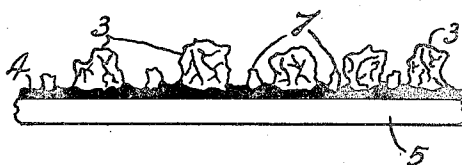


Fig. 3.



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PRODUCTION OF ABRASIVE MATERIALS

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6 Claims. (Cl. 51—185)

This invention relates to the production of improved abrasive coated materials and more particularly to the production of flexible abrasive materials such as abrasive coated paper and cloth, belts, discs, and the like.

A difficulty encountered in the use of abrasive coated materials lies in the fact that the spaces between the grains soon become clogged with material removed from the work which covers the cutting edges and renders them ineffective before the cutting ability of the grain has been entirely utilized. It has been proposed to remedy this defect by spreading out the grains to a greater extent on the backing, resulting in the production of the so-called "open-coat" abrasive fabric. This is effective in the case of the coarse grits but with fine grits the small amount of work done by each grain and the greater reduction in the number of cutting grains necessary to provide the open spaces makes the method less valuable than in the case of the coarser grain.

It is an object of this invention to provide a coated abrasive article having the large clearance spaces and high cutting rate characteristic of large grit "open-coat" fabric and the ability to produce fine finishes characteristic of fine grit abrasive coated fabric.

It is also an object of the invention to provide a coated abrasive article which has a high initial cutting rate which is maintained throughout the life of the article by removal of dulled edges and their replacement by sharp edges.

The invention contemplates the production of an abrasive article comprising a suitable backing and a coating of abrasive grains held thereon by a suitable adhesive, a substantial proportion of the coating of abrasive grains being in the form of aggregates, each of which includes a plurality of abrasive grains. The aggregates may be formed and placed on the backing as such. The aggregates may be used in uniform grit sizes or in combinations of grit sizes, or in combination with individual grains. To provide the desired cutting rate it is preferable that the aggregates have clearance spaces around them or spaces in which no abrasive grains exist or in which only a layer of individual abrasive grains, one grain thick, is interspersed.

In the drawing, Figure 1 is a diagrammatic sectional view of an abrasive aggregate according to the present invention. Figure 2 is a diagrammatic representation of a section of a coated abrasive utilizing the abrasive aggregates of the present invention. Figure 3 is a diagrammatic representation of a section of a coated abrasive

showing a modification of the present invention.

The aggregate coated abrasive material of the present invention may be produced in various ways; for example, by producing a granular mass of aggregates and then applying them to a suitable backing in the manner in which abrasive grains are applied to a backing in coating it with abrasive material.

In preparing the aggregates according to the first mentioned method, abrasive grains are bonded into aggregates containing from 2 to 30 or more abrasive grains. These aggregates are then suitably screened to provide aggregate particles of a reasonably uniform size. The aggregates may be formed in advance with any of the binders ordinarily used in the production of bonded or flexible abrasive products and the binder for attaching the aggregates to the backing may be any binder ordinarily used, or suitable for use, in the manufacture of abrasive coated materials. For example, aggregates formed with a ceramic binder may be attached to a paper backing by means of glue, or, the binder for the aggregates and for the backing may be the same. For example, abrasive grains may be mixed with glue and after hardening, broken up into aggregates which may then be attached to a suitable backing by means of a glue film.

Various resins are also of value in the production of the aggregates and in applying them to the backing. For example, aggregates may be produced by mixing abrasive grains with a solution of a heat-hardenable phenol resin in the "A" stage in a suitable solvent such as alcohol or acetone. The mixture of abrasive grains and resin solution may be then allowed to dry by evaporation of the solvent. Or, the mixture may be compressed and the resulting shape dried, by application of heat if necessary. In either case the formed mass is then broken up and screened to obtain aggregates of a suitable range of sizes.

The aggregates thus formed each consist of a plurality of abrasive grains bonded together with interstitial binder which depends in amount upon the ratio of binder to abrasive grain in the original mix. The number of grains in the aggregates will depend upon the degree of crushing and the method of separation of the aggregates into various sizes. An aggregate of this nature is illustrated in Fig. 1 of the accompanying drawing, which shows in section, an aggregate consisting of grains 1 of abrasive material bonded together by interstitial binder 2 which cements the grains together at points of contact and holds them in a rigid mass.

The invention will now be further described with reference to specific examples but it is to be understood that the invention is not thereby limited but includes the production of a coat of
 5 abrasive aggregates on a suitable backing by means of any binder or combination of binders, or any combination of steps.

Example 1

10 280 grit silicon carbide abrasive grain is mixed with a solution of "A" stage phenol formaldehyde resin in acetone in a proportion to supply 2% of resin based on the abrasive grain. The mixture is dried in an oven overnight at a temperature of
 15 150° F. and the temperature is then raised to 250° F. and held at that temperature for one half hour. The resulting mass is then cooled, broken up, and screened through a 150 mesh screen and onto a 220 mesh screen. Upon examination of the
 20 fraction thus separated it is found that the aggregates consist of from 2 to 4 abrasive grains each. These aggregates are then attached to a paper backing by an oil varnish of the character commonly used in the manufacture of waterproof
 25 sandpaper. The coated abrasive material thus produced is found to have an exceptionally long abrading life, to cut faster than an article made from abrasive grain of a corresponding grit size, and to produce the finish characteristic of 280
 30 mesh silicon carbide.

Example 2

50 grit silicon carbide is mixed with 2% of glue in the form of a very thin glue solution.
 35 The mixture is then spread out in a pan and allowed to dry, crushed, and then screened through a 22 mesh screen and onto a 28 mesh screen. The fraction of aggregates thus separated is applied to 100 lb. cylinder paper by coating the
 40 paper with a 33% glue solution, sprinkling on the aggregates and then applying a sizing coating consisting of a 20% solution of glue.

Example 3

45 Rubber bonded aggregates may be made from the following ingredients:

	Percent
Smoked sheet -----	8
Sulphur -----	4
50 Abrasive grain -----	88

The smoked sheet is made plastic on the customary roll mill and the sulphur and grain then worked into the plastic mass to form a homogeneous mixture. The mixture is then vulcanized under proper conditions of pressure and temperature to produce a mass that may be crushed to form rubber bonded aggregates. These aggregates may be attached to a backing by any
 55 of the adhesives mentioned above, for example, glue, resin, or rubber.
 60

Example 4

Ceramic aggregates are made by mixing 5% clay bond with 95% abrasive grain with suitable
 65 additions of liquid to cause the mixture to have the right consistency. The mass is then baked to vitrify the bond at 1250° C. After cooling sufficiently, the vitrified mass is broken up to produce aggregates containing a plurality of abrasive grains. The aggregates produced in this
 70 manner may be attached to the backing by an adhesive whose base is glue, resin or rubber, or any other adhesive suitable for attaching abrasive grains to a backing.
 75 For certain purposes it may be desirable to

intersperse the abrasive aggregates on the backing with a layer of single grains, one grain thick. This assists in anchoring the aggregates on the foundation and makes possible the use of the material for producing a fine finish when the aggregates have been worn down to the same level as the individual grains.

Preferably, however, the aggregates should be applied to the backing with spaces between them substantially in the nature of coarse grit open-coat paper whereby clearance spaces exist between adjacent grains to assist the cutting action of the grain and to provide for the removal of the material cut from the work from the cutting points of the abrasive aggregates. This arrangement is illustrated in Fig. 2, wherein a backing 5 carries a layer of aggregates 3 which are embedded in a film of adhesive 4 and separated from each other to provide clearance spaces 6 between adjacent aggregates.

As stated above it may be desirable to have individual grains interspersed in the layer of abrasive aggregates. This may be done by applying the individual grains to the backing with the aggregates in admixture therewith, or the individual grains may be applied to the paper before or after the aggregates are applied. This construction is shown in Fig. 3 in which the backing 5 has attached to it by means of adhesive 4, a coating of abrasive material consisting of aggregates 3 interspersed with individual granules 7.

In connection with the present invention it has been found that abrasive coated products made with abrasive aggregates instead of an even layer of individual abrasive grains are exceptionally fast cutting, long lived and at the same time produce finishes characteristic of the grit size employed in making the aggregates. By suitably proportioning the amount of bond used in preparing the aggregates in comparison with the binder used to attach the aggregates to the backing it is possible to vary within a considerable range the abrading life of the article, it being generally true that if the relative amount of bond used to form the aggregates is reduced the abrading life is correspondingly shortened but the cutting rate is increased. The invention also permits the production of abrasive coated materials having a considerable range of properties without sacrifice of the finish developed when the articles are used. It is an improvement over the method heretofore employed in which it was impossible to vary either the cutting rate or the life of the article when the quality of the finish had been determined.

Previously it has been customary to employ a number of different grit sizes in working up an article in order to get the benefit of the relatively fast cutting rate of coarse grits in the initial stages and then developing the finish with the slow cutting fine grit in a later operation in order to produce the desired fine finish. By the use of the improved article of this invention this necessity for a change in grit size is removed and the finishing operation can be conducted with the speed heretofore obtained with coarse grit, while a finish characteristic of fine grits is simultaneously developed. The invention may be applied to a variety of backing materials such as paper, cloth, fiber, or wood which may or may not be flexible, and the term "coated abrasive article" means any article consisting of a backing coated with a comparatively thin layer of abrasive aggregates. In carrying out the

invention, various kinds of abrasive grains, as well as different types of bond for the aggregates and binders for attaching the aggregates to the backing may be employed. It is possible to em-

5 employ one type of bond for the abrasive grain, including ceramic as well as organic bonds, and another type of binder for attaching the aggregates to the backing. In this way it is possible to obtain abrasive action in coated abrasive materials not heretofore possible, since this inven-
10 tion makes possible the use of binders which could not be used in producing coated abrasive materials; for example, ceramic bonds. Generally, the invention makes possible the combina-
15 tion of the binder in the aggregate which will produce the desired cutting action and the use of a binder for the backing which possesses great adhesion to the backing, but which may or may not possess great tenacity in holding single
20 grains in place, since the rough, relatively porous surface of the aggregates renders them much easier to retain on the backing than individual grains.

Other modifications of the invention include
25 the addition of fillers to either the bond used for forming the aggregates or in the binder used for attaching the aggregates to the backing. It is possible also to vary the cutting action of the aggregates by incorporating in them friable non-abrasive particles which break out easily to constantly expose fresh cutting edges to the work. These may be incorporated in the mix for making the aggregates before attachment to the backing.

I claim:

1. An abrasive article comprising a backing and a coating of abrasive grain held on said backing by an adhesive binder, the said abrasive grain comprising a substantial proportion of bonded abrasive aggregates, said aggregates being porous, angular, and unflattened and comprising a plurality of single abrasive grains bound together with a minor proportion of bond, the bond of said abrasive aggregates being of a kind and in an amount such that the abrasive grains in the aggregates are held together less tenaciously than said aggregates are held on said backing by said binder.
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2. An abrasive article comprising a backing and a coating of abrasive grain held on said backing by an adhesive binder, the said abrasive grain consisting of a substantial proportion of bonded aggregates interspersed with single grains, said aggregates being porous, granular and unflattened and comprising a plurality of single abrasive grains bound together with a minor proportion of bond, the bond of said abrasive aggregates being of a kind and in an amount such that the abrasive grains in the aggregates are
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held together less tenaciously than said aggregates are held on said backing by said binder.

3. An abrasive article comprising a backing and a coating of abrasive grain held on said backing by an adhesive binder, the said abrasive grain comprising a substantial proportion of bonded abrasive aggregates, said aggregates being porous, angular, and unflattened and comprising a plurality of single abrasive grains bound together with a minor proportion of a resin bond, the bond of said abrasive aggregates being of a kind and in an amount such that the abrasive grains in the aggregates are held together less tenaciously than said aggregates are held on said backing by said binder.
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4. An abrasive article comprising a backing and a coating of abrasive grain held on said backing by an adhesive binder, the said abrasive grain comprising a substantial proportion of bonded abrasive aggregates, said aggregates being porous, angular, and unflattened and comprising a plurality of single abrasive grains bound together with a minor proportion of a ceramic bond, the bond of said abrasive aggregates being of a kind and in an amount such that the abrasive grains in the aggregates are held together less tenaciously than said aggregates are held on said backing by said binder.
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5. An abrasive article comprising a backing and a coating of abrasive grain held on said backing by an adhesive binder, the said abrasive grain comprising a substantial proportion of bonded abrasive aggregates, said aggregates being porous, angular, and unflattened and comprising a plurality of single abrasive grains bound together with a minor proportion of a rubber bond, the bond of said abrasive aggregates being of a kind and in an amount such that the abrasive grains in the aggregates are held together less tenaciously than said aggregates are held on said backing by said binder.
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6. An abrasive article comprising a backing and a coating of abrasive grain adhesively held on said backing by a resinous adhesive, the said abrasive grain comprising a substantial proportion of bonded abrasive aggregates, said aggregates being porous, angular, and unflattened and comprising a plurality of single abrasive grains bound together with a minor proportion of bond, the bond of said abrasive aggregates being of a kind and in an amount such that the abrasive grains in the aggregates are held together less tenaciously than said aggregates are held on said backing by said adhesive, whereby there may be obtained during use of the abrasive article a breaking down of said aggregates to provide fresh cutting surfaces.
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