

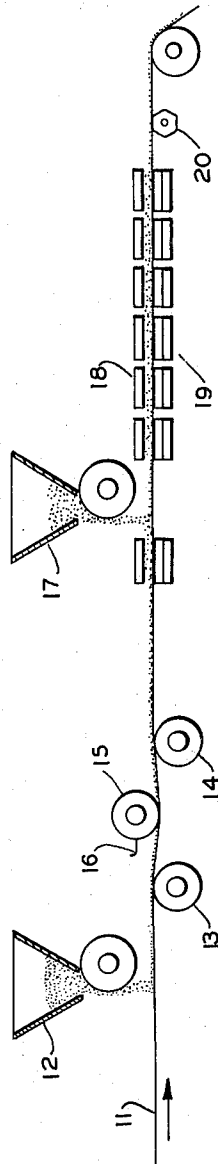
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MANUFACTURE OF COATED ABRASIVES

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## MANUFACTURE OF COATED ABRASIVES

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This invention relates to a new coated abrasive product and a method for making the same.

In particular, the invention relates to a method of manufacturing a coated abrasive and has as its object the production of a coated abrasive of superior cutting ability and durability.

More specifically, the coated abrasive produced by the method of our invention comprises a backing sheet having adhered to it a making coat of adhesive, a first gravity deposited layer of abrasive grain substantially redistributed, roughened and disoriented in said making coat, and a second layer of abrasive grain so oriented that the long axis of the individual grains tend to be perpendicular to the plane of the backing sheet. A further size coat of adhesive may be applied as is common practice in the art.

In producing the coated abrasive according to our invention, we apply a first gravity coat of abrasive grain to a properly prepared adhesive coated web. The web then passes through a set of rollers or other pressure applying device whereby the abrasive grain is rolled into and redistributed in the adhesive coat by a member traveling at a different surface speed and/or in a different direction, from the linear travel of the web. After the web passes this "rough-up" member, a coating of oriented abrasive grain is applied, preferably by electrostatic means.

Referring to the drawings, the single figure shows a schematic view of an apparatus suitable for carrying out our invention. The web backing 11, which may be any of the suitable paper, cloth, fibre, or combination backing well known to the coated abrasive art, after having been coated with an adhesive such as glue, or an uncured phenol-aldehyde, modified phenol-aldehyde or other coat-able resin of types and by methods well known in the prior art, is then subjected to a coating of abrasive grain from hopper 12. Following the grain coating, the web in being drawn through the apparatus from left to right by suitable conventional means as indicated by the arrows, passes over lower rolls 13 and 14 and under upper roll 15, spaced therebetween. Upper roll 15 is preferably of rubber or rubber coated, but may be of plastic, steel or other suitable material and is driven to produce slipping contact between the coated web and the roll. Although not essential, a collector means 16 may be employed to keep roll 15 free of adhesive and grain.

After the web passes the rolls 13, 14, 15 and while the adhesive maker coat is still fluid or tacky, a second hopper 17 applies a second coating of abrasive grain. In the zone of application of the grain from hopper 17 is applied an electrostatic field by means of charged electrodes comprising upper electrodes 18 and lower grounded electrodes 19. As is well known in the art, when a high voltage is applied across electrodes 18 and 19, an electrostatic field is produced between them which tends to align the abrasive particles in the field with their long axis parallel to the lines of force of the field. Thus the abrasive grains from hopper 17, acted upon by the electric field, are coated in an oriented state.

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Following the electrocoating zone a rotating beater 20 may be employed to vibrate the coated web to improve the overall bonding of the grain to the backing and dislodge loosely adhering grain. This beater bar, however, is not essential to the operation of our invention.

Instead of the downwardly propelled electrocoating device shown in the figure, we may use an electrocoating apparatus such as described and claimed in U.S. Patent 2,370,636 in which the abrasive particles are propelled upwardly to the adhesive coated web.

After passing the electrocoating zone and the optional beater bar, the coated abrasive web passes into ovens in which it is festooned for at least partial drying or curing as is well known in the art. Following the drying or curing operation a second coating of adhesive or size coat is applied to the abrasive side of the coated abrasive and the web passes to ovens for a final curing or drying step. The size coat, like the making coat may be any of the commonly used adhesives of the coated abrasive art.

The coated abrasive product resulting from the above described method is rougher and sharper and therefore faster cutting than a product utilizing the same grade of abrasive grain made by conventional coating methods of the prior art. Prior art methods of "roughening" the coat such as passing the coated web through nip rolls, although producing some beneficial results for certain uses, does not product the redistribution of the grain achieved in our invention wherein an open coating of grain is subjected to slipping pressure applying means, thereby producing a shearing force on the adhesive-grain coating in a direction parallel to the direction of travel of the web and an actual redistribution of the coating relative to the backing member. Although, in the past various methods have been employed for producing an abrasive having two separate applications of grain, and thus areas in which a double layer of abrasive results, these products, although rougher and sharper than conventional products and therefore faster cutting, are neither as fast cutting nor as durable as the coated abrasives produced by our invention.

In practicing our invention we may apply from about 20% to about 80% of the total abrasive by the gravity method from the first grain hopper. The total weight of grain to be applied in any given case depends largely upon the grade of the abrasive grain employed and may be varied between wide limits. The practical amounts of both abrasive and adhesive to be used in any given instance can be easily determined by one skilled in the art. The following example is given merely as illustrative of a practical embodiment and with respect to grain weight, and type of grain, adhesive weight and adhesive type does not represent critical materials or quantities. Variations in these matters and in the type and weight of backing materials are well within the scope of one skilled in the art. Along with variations in the types and quantities of materials used in carrying out our invention, variations in operating conditions such as speed of travel of the web, web tension, etc. will naturally occur to one skilled in the art, it being understood that an effective roughening of the gravity coat followed by a coating of oriented grain are the essential features of our invention. Although we have illustrated electrostatic orienting means for the abrasive grain, we may use any effective orienting means known to the art. For example, mechanical means such as a beater bar as shown at 20 in the drawing in addition to dislodging poorly adhered grain from the web, produce a certain amount of orientation and may even entirely replace the electrostatic orienting devices illustrated in the drawings when a sufficient degree of orientation is obtained by such methods.

Exemplary of a product of our invention is a fibre backed abrasive sheet to which 79 to 86#/ream of grit

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24 aluminum oxide abrasive grain is bonded by means of a waterproof adhesive maker coat, followed by a waterproof size coat. In coating the backing with grain, 35% of the grain was applied by gravity and then redistributed and rolled in by slipping pressure applying means such as illustrated in the drawing, the surface speed of the pressure member being from  $\frac{1}{4}$  to  $\frac{3}{4}$  the speed of the web, and 65% was applied in the presence of an electrostatic field of sufficient strength to produce substantial orientation of the second coating of grain. Where a distance of from  $\frac{1}{4}$  inch to  $1\frac{1}{2}$  inches separates the electrodes, we find that a potential of from 20 to 45 kilovolts, preferably alternating at standard frequencies, is satisfactory for producing grain orientation.

The above described coated abrasive product when compared to a conventional coated abrasive product utilizing the same adhesive and grain size and weights was found to be superior in length of cutting life and in rate of cut when employed in heavy duty grinding. Similarly the product was found to be superior to otherwise identical products made by (1) omitting the roughening step following the gravity coat, and (2) including the roughening step but omitting orientation of the second coating of grain.

Although the use of a rubber covered roll as the "rough-up" roll is particularly useful in our invention, a hard roll such as a steel roll, a roll having a patterned raised surface, a roll covered with card cloth, a rubber belt backed by a roll or other similar pressure applying means may be used in place of the rubber roll illustrated in the drawing.

It is understood that the particular apparatus described above is intended to be illustrative and not limitative of this invention, since it is obvious that the invention may be effected by apparatus arranged in many other different ways within the scope of the following claims.

We claim:

1. A method of making a coated abrasive sheet comprising the steps of: depositing a first open coating of abrasive grains upon a moving backing sheet having an adhesive coating thereon, embedding and redistributing said abrasive grains in said adhesive coating by pressure contact of a driven member whose surface is moving relative to the contacted abrasive and adhesive coating whereby a slipping contact effective to redistribute the abrasive grains in said adhesive coating is maintained between said member and said coating; and thereafter applying directly to said first open coating of abrasive grains and adhesive a second coating of abrasive grains, said second coating of grains being deposited with the long axis of the grains tending to be substantially perpendicular to the plane of the backing sheet.

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2. A method of making a coated abrasive comprising: applying a coating of abrasive grain to a moving adhesively coated backing, said grain being applied in an amount insufficient to completely cover the adhesively coated backing; applying pressure to the thus abrasively coated backing by means of a rotating roller in contact with said coating, the surface of said roller being in relative movement with respect to said coating whereby the abrasive grains are embedded and redistributed in said adhesive coating; and applying over said first coating a second coating of abrasive grain, said second coating of abrasive grain being oriented under the influence of an electrical field between charged electrodes positioned at opposite sides of said backing in the region of application of said second coating of abrasion grain.

3. A method of making a coated abrasive comprising: applying an open coating of abrasive grains to a web having an adhesive coating thereon, passing said adhesively coated web through a set of rollers, one of said set of rollers applying pressure to the abrasively coated side of said web, said one of said set of rollers producing a roughening action on said coating by being rotated about its axis whereby the surface of said roller is moving relative to the adhesive and grain coating on said web; and thereafter applying a second coating of abrasive grains to said adhesive coating, said second coating of grains being deposited with the long axis of the grains tending to be substantially perpendicular to the plane of the web.

4. A method of making a coated abrasive sheet comprising the steps of: firmly contacting a first open coating of abrasive grain in an adhesive coating on an adhesively coated moving sheet with a member the contacting surface of which is in motion and which surface is in motion relative to the moving sheet, said member acting to embed and redistribute the abrasive grains in said adhesive coat applying a second coating of abrasive grain directly on said first coating of abrasive grain and adhesive, said second coating of abrasive grain being applied with the long axis of the abrasive grains tending to be substantially perpendicular to said sheet; and thereafter applying a size coating of adhesive and hardening the adhesive layers.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |                |               |
|-----------|----------------|---------------|
| 1,357,944 | Behr           | Nov. 9, 1920  |
| 1,379,368 | Speer          | May 24, 1921  |
| 1,915,905 | Speer          | June 27, 1933 |
| 2,245,301 | Schacht        | June 10, 1941 |
| 2,371,605 | Carlton et al. | Mar. 20, 1945 |
| 2,819,178 | Haracz         | Jan. 7, 1958  |