METHOD OF CURING ABRASIVE BINDERS AND ABRASIVE ARTICLES PRODUCED THEREBY

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Application February 24, 1942, Serial No. 432,144

10 Claims. (Cl. 51—298)

1 The present invention relates to the art of manufacture of abrasive articles and the products resulting therefrom. It is most particularly applicable to the manufacture of abrasive articles of the coated abrasive type, although it has some application in the manufacture of abrasive wheels or like molded abrasives.

This invention is most particularly concerned with improvements in methods of curing the binder or adhesive employed with the abrasive grits, especially so as to secure new and improved characteristics, and also improvements in efficiency, in the resulting article.

Heretofore in the curing of adhesive or resinous binders in the manufacture of abrasive articles, e. g. coated abrasive articles or so-called sandpaper, it has been customary to pass a web of the coated abrasive, which includes the binder coat and layer of abrasive grits, through a drying oven, where the coated abrasive material is looped over racks, or is festooned. The temperature of these ovens has commonly varied with the nature of the adhesive employed. Where ordinary animal hide glue is employed, for example, a somewhat lower temperature has commonly been used than where certain heat convertible resins have been employed. Especially in the case of various heat convertible or heat-curable types of synthetic resins, where relatively high temperatures are desirable to adequately cure the same, a very real problem has presented itself in curing these resins satisfactorily while at the same time avoiding harmful overheating of the cloth or paper backings. So serious has been this problem that certain synthetic resins, otherwise showing promise of being suitable for abrasive binders, have been discarded as unsuitable because it was considered that they could not be cured to the necessary extent and still arrive at a marketable, commercially useful abrasive article.

Not many years ago, in the practice of making coated abrasive articles it was considered that the cloth or paper backing should never be heated above about 100° C. While it is now believed that this principle was not quite accurate, due to the fact that changes in paper and cloth backing are not due solely to instantaneous temperature but involve a time-temperature factor, it is still true that there is a rather practical limit in the amount of heating which paper and cloth backings can stand without causing a serious adverse effect on the strength and efficiency of the abrasive articles. If the temperature during curing is allowed to go above about 100° C., then the time at which a web of coated abrasive is allowed to remain at that temperature must be rather closely limited. Whereas it was not uncommon in practice of the prior art to keep a web of coated abrasive material at a temperature of around 90° C. for 48 hours or more, if the temperature is allowed to go up to, for example, 175° C. or higher, then the restriction of the time is a matter of minutes rather than hours. In practice it is rare to allow a cloth or paper backing to go above about 160° C. (i. e. 320).

Under these restrictions in curing, in accordance with the prior art, it will thus be seen why many potential binder materials were ruled out as unsatisfactory. Many cloth and paper backing materials were also regarded as unsatisfactory, and the range of choice of backing materials was very strictly curtailed. Even with certain binder materials which have been employed and suggested by various people, their use was at the expense of, or under the handicap of employing a binder which, on the basis of my work I am sure were insufficiently cured to bring out the best characteristics and the greatest efficiency in the resulting abrasive article.

I have developed a method of curing abrasive articles by which I am able to cure the binder to most any extent desired while keeping the backing relatively cool. I may, for example, heat the binder to temperatures of the order of 400°—500° F., or even higher, for a sufficient length of time to accomplish the desired cure, while at the same time keeping the backing well within the safe limits of heating for it, i. e. far lower in temperature than the resin. I accomplish this by supplanting oven heat (wholly or in part) by a source of radiant heat.

In accomplishing the results just set forth, I am also interested in another major consideration. In the curing of coated abrasives in accordance with prior art practice, where large ovens and many hours of curing time were employed and costly hot air circulating equipment was needed, the total cost for curing the abrasive material ran into a very large, almost astounding figure. According to the present invention I am able to replace the many hours of curing time heretofore required (subsequent to the elimination of solvent where used) by relatively few minutes of curing time, and in some instances even in times less than one minute. I am also able to replace large ovens and expensive hot air circulating equipment with a relatively cheap and relatively simple source of radiant energy. In so doing I avoid having large
amounts of abrasive material tied up for long periods of time in manufacture and I also provide a procedure for effecting a very substantial conservation of energy. Additionally I am able to operate my curing process so as to provide different cures in different portions or areas of the binder, as desired, and as more fully discussed hereinafter. This latter factor is quite important in controlling the nature and character, and the actual properties, of the finished abrasive article.

Accordingly, one of the objects of my invention is to provide a simple and greatly improved method of curing abrasive binders in the practical manufacture of abrasives. Another object is to obviate cumbersome curing methods and large amounts of air heating heat thereof employed. Another object is to produce abrasive articles of different and improved character, and abrasive articles having substantially improved performance efficiency by virtue of their method of production, by the virtue of the character of the abrasive article resulting therefrom. A further object is to effect the final cure of the resin or adhesive in a manner so as to avoid "stick marks" on the abrasive coated web, such as are difficult to avoid where the final cure is effected by festooning in an oven. A still further object is to maintain orientation during curing, that is, to avoid disorienting abrasive grits, such as tends to occur where the abrasive coated web comprising partially cured adhesive is wound on drums to effect the final cure. These and other objects and advantages will appear from the description taken as a whole.

Before describing various important characteristics of this invention, or advantages produced thereby, the invention will be quickly illustrated by reference to the accompanying drawings in which:

Fig. 1 is a schematic side elevational view of a section of coated abrasive material provided with a source of radiant energy;

Fig. 2 is a plan view of the apparatus and abrasive sheet of Fig. 1;

Fig. 3 is a schematic side elevational view showing an alternate system for curing an abrasive sheet;

Fig. 4 is a plan view of the apparatus and abrasive sheet shown in Fig. 3; and

Fig. 5 is an enlarged broken away sectional view of a coated abrasive sheet, illustrating radiant energy impinging on the bond and grits thereof.

Referring more in detail to the drawing, in the several figures of which like reference characters denote similar parts, in Fig. 1, A is an abrasive sheet which is being passed by suitable apparatus in the direction of the arrow under the radiant heat lamps B. Lamps B may be located, for example, about 10 inches, more or less, from the surface of the abrasive sheet, and the abrasive sheet may be passed at such a rate that it will be subjected to radiant energy for abrasive minutes, more or less, depending upon the particular adhesive or resin being cured and depending upon the spacing and intensity of the source of radiant heat.

It is to be understood that in Fig. 1, and also in the plan view shown in Fig. 2, only a portion of the radiant heat lamps are shown. Where the web of coated abrasive material is being passed, for example, at the rate of 20 feet per minute, and where it is desired for the resin or adhesive of the web to be exposed to the radiant heat energy for five minutes, for example, it will be obvious that the radiant heat lamps will extend over the width of the web of coated abrasive material and 100 feet along its length. An alternative to this procedure is to pass the web two or more times underneath or in proximity to the source of radiant energy.

Figs. 3 and 4 simply show another method of subjecting a web of coated abrasive material to a source of radiant energy. In these figures, instead of using radiant heat lamps, the source of radiant energy consists of heater elements C, joined in series and/or in parallel to a source of electrical energy, depending upon the number of such elements and the source of power available. The elements C are backed up by reflector D, which helps to conserve the energy and to concentrate the radiant heat on the surface E of the web of coated abrasive material A.

It is ordinarily desirable to have the elements C red hot during the curing treatment. The rays thus emitted from the elements C would include infra-red rays and, in fact, commonly consist largely of rays in the infra-red range. This is also usually true of the lamps B, shown in Figs. 1 and 2, which are of the type comprising built-in reflectors, which are readily available commercially.

In Fig. 5 a section of coated abrasive material has been shown in cross-section and of exaggerated size to illustrate the structure. This may be regarded as a section of the abrasive webs A or B shown in the other figures of the drawing. 10 is a cloth or paper backing material and 11 is a presize or impregnating coat. 12 is a resins (or adhesive binder coat, and the abrasive grits are designated as 13. Rays of radiant energy impinging on the surface of the coated abrasive article, and on the exposed surfaces of the binder layer 12, are illustrated by lines 14, which exemplify the fact that under certain circumstances the impingement of the rays of energy tends to be concentrated more at some points than others.

As illustrated in the drawing, as just described, particularly Figure 5, it will be quite readily seen that the radiant heat rays, while quite uniform in a general sense, often result in differential localized heating, resulting in differential localized curing. Where, for example, the abrasive grains or grits are relatively opaque to the incident rays of radiant energy, it will be seen that there is a tendency to increase the heating and curing around the surfaces of the abrasive grits over that at other points. This situation tends to be most pronounced, for example, where the abrasive grits are good absorbers of the incident heat rays (i.e., are relatively opaque and do not reflect radiant energy) and where also the resinous material is not so good an absorber of the energy of such rays. It will be also evident that that effect tends to be more pronounced in the case of so-called open-coat sandpaper than in the case so-called closed-coat sandpaper, the other circumstances being, for example, as just described. Even on abrasive grits which are of themselves not relatively so good as absorbers of infra-red rays or other radiant energy, their capacity for absorption of such energy can be improved greatly by pretreating them before application in abrasive manufacture. For example the abrasive grits could be treated with a thin coat of resin or adhesive having a very finely
divided filler or pigment contained therein, e.g. carbon black. They may be given a wash with some inorganic adhesive, such as aqueous sodium silicate, which may also, where desired, contain a suitable dull or relatively opaque pigment.

The energy absorbing characteristics of the adhesive or binder may also be controlled by the presence or absence of relatively opaque pigments or other heat or energy absorbing media. In fact, many resinous materials, even where quite translucent in a highly purified form, often have appreciably different powers of energy absorption when employed in relatively cheap and some dissimilar commercial form.

In general many fillers are available which are substantially cheaper per unit volume than resins or adhesives used as binders and hence may be freely used to any extent desired without increasing the cost of the binder materials as a whole, and in many cases they add to the strength and durability of the binder. In addition to carbon black, other examples of relatively opaque finely divided materials include iron oxides, slate dust, and many other products or by-products of commerce.

The above illustrates the various alternatives and modifications which are contemplated, but which are not regarded as essentials in the broad aspects of the present invention.

Where the adhesive or resinous binder coat, as a whole, is translucent enough to permit the passage of a substantial percentage of the incident energy rays, the cloth or paper backing or the like may be shielded from such rays by making the presize coat of suitable type. For example, the presize coat may be made up of any suitable adhesive, either similar to or different from the adhesive of the binder, containing a sufficient amount of carbon black or other absorber so as to inhibit or prevent transmission of such rays to the backing, or said presize or impregnating coat may contain a reflector such as flakes of aluminum bronze or other relatively cheap, commercially available reflectors of such type. The presize coating may also contain a combination of absorbers such as carbon black, red iron oxide pigment, etc., plus a reflector such as aluminum bronze flakes, so as to further control the curing at different points in the rest of the binder coat. However, when the binder coat itself is a good absorber for the incident radiant energy, as above pointed out, as where it is a good absorber either because of its own nature or because of the addition of carbon black or other finely divided, energy absorptive fillers, it will be clear that little or none of the incident rays will be transmitted to the backing, or to the interfacial surface of the presize coat and binder coat, and in such case the only heat transmitted to the portion of the binder coat adjacent the backing will be that transmitted largely by conduction. In such case, the binder coat is fully cured, as desired, near or adjacent to its exposed surface and is only partially cured at points remote from its exposed surface, i.e., adjacent to the paper, cloth or other backing. This is desirable in many types of abrasive articles, especially where the binder coat is of a heat-convertible resin, since it permits complete curing of the resin at its exposed surface, thus inhibiting gummage and clogging tendencies in the practical use of the abrasive article, as an abrasive belt, disc or in other form, and at the same time provides a union between the underlying portion of the abrasive binder and the backing or presize coat of more yieldable nature than the exposed surface of the binder coat, thus providing an abrasive article which will stand up better and resist tendencies to rupture where subjected to great shocks in usage. Particularly where the working face of the sheeted abrasive material is quite hot during use, the partially cured underlying binder material is more yieldable at elevated temperatures and thus the abrasive article as a whole is more durable and shock-resistant. It will be readily appreciated that where a coated abrasive article, for example in the form of a belt moving at high speed, is suddenly brought into contact with a relatively rigid material such as marble or glass, a tremendous shock is created due to the leverage of the abrasive grits on the backing and especially on the adhesive or resinous layers of the abrasive article, and the ability of the coated abrasive article to withstand such shocks can be greatly improved by the controlled curing of the adhesive or resinous coating, as above illustrated. During such abrading operations the points of the abrasive grits and exposed surface of the binder become quite hot and it is important that the exposed surface of the binder coat (or the exposed surface of the sizing coat) be cured to a sufficiently high degree so that it remains hard under those elevated temperatures. It is also highly desirable in many abrading operations for underlying portions of the adhesive or resinous material, at or adjacent to the backing, to be in such a state that they are softer and more yieldable at such temperatures. It will be evident that, since the underlying portions of the adhesive or resin are not exposed to abraded particles, the same high degree of curing is not necessary in reference to them in order to avoid clogging or gumming tendencies of the coated abrasive article during use.

The curing procedure of this invention leads to advantages and improvements in efficiency in virtually all types of commercial abrasive articles, particularly those involving the use of heatconvertible or heat-advancing resins or adhesives in the abrasive binders or sanding coats. While many of these can be adequately cured for commercial purposes by older type methods of curing, nevertheless their efficiency can be improved by the use of radiant heat curing as herein described. Where solvents are employed in the application of the binder or sizing coats, or both, it is often desirable to pass the web of coated abrasive material through an oven at a relatively low temperature, the abrasive web being festooned, in order to remove the solvent at relatively low temperature. Following this, the abrasive web, with the binder or adhesive layer thus dried or partially cured, may then be passed adjacent to radiant heat lamps, or other sources of radiant energy, to complete the curing of the binder to the degree desired. This accomplishes the various advantages hereinabove illustrated and also obviates the disadvantage of stick marks, due to festooning, which commonly occur where the complete curing operation is carried out in ovens.

Examples of adhesive or binder materials which can be cured to yield an improved and more efficient result are abrasive articles according to the procedure of this invention, as compared with oven curing, are straight phenol-formaldehyde resins of the Bakelite type, and other phenol aldehyde resins, novolac aldehyde resins and melamine aldehyde resins. Other examples include various glycerine phthalate or alkyd types of resins, for example alkyd resins.
which have been molecularly plasticized, e. g. the glycerol phthalate, glycol succinate resins. The only type of alkyl resins usable in the manufacture of cloth or paper backed abrasive articles. The present invention now makes various other specific alkyl resins usable in the manufacture of cloth or paper backed abrasive articles.

While hereinafore the web of coated abrasive material has been illustrated and described as being passed adjacent the source of radiant energy in the form of a flat web, this was for convenience of illustration only. For certain uses it is desirable and advantageous to have the length of the coated abrasive web in a curved, circular, or spiral form during radiant heat treatment, with the radiant heat lamps or other source of radiant energy correspondingly arranged in a curved, circular, or spiral form along the length of the coated abrasive web. Where the radiant heat lamps extend along a length of about 20 feet, as above mentioned by way of illustration, it will be evident that the circular or spiral arrangement may be conveniently arranged in a relatively small factory room. This tends to give a certain natural curvature to the finished coated abrasive material.

Various comparisons have been made between the performance efficiency of coated abrasive material made according to my present invention, as compared with coated abrasives made according to the standard prior art treatment. The standard treatment, used as a basis of comparison, was one where a web of coated abrasive material having a straight phenol aldehyde resin binder was first partially cured by fastening the same and passing it through an oven, the hottest point of which was approximately 150° F., the oven treatment lasting for approximately 12 hours. The web of coated abrasive material was then wound on drums, e. g. of two to four feet in diameter, and then cured for 48 hours at 160° C. (320° F.). An entirely similar web of coated abrasive material was similarly dried or precur ed in the same oven (where the highest temperature did not exceed about 150° F.) and the web of material, with the solvent thus eliminated, was passed adjacent a source of radiant heat, as illustrated in Figs. 1 and 2 of the drawing. A few days later, viz. about three or four days after, samples of each type of cured abrasive material were cut into sample belts and given a performance test. The performance test employed was to measure the grams of Carrara glass cut in 30 minutes, the grit size in both cases being No. 360. The performance test to which each sample was subjected was in all respects similar to the other. The coated abrasive material cured in accordance with the present invention showed a decided superiority in performance over that cured according to the prior art method just described, the increase in efficiency being in this case 76 percent. That is, the ratio of performance efficiency on the abrasive article produced according to the present invention, as compared with the prior art method, was 176/100.

The comparison in performance will vary somewhat with different sizes of grits, for a given binder, but is substantial over a wide range of grit sizes.

Various theories or explanations might be offered of this improvement in performance efficiency of the abrasive article of this invention. For example, it may be asserted that the increased strength of the backing is partly responsible for it. But the web of material being in roll form is important; that is, the protruding points of the abrasive grits are kept out of contact with other surfaces while the resin is “green,” i.e. the abrasive web is not wound into a roll until the binder has been given its final cure, thus avoiding such incidental disorientation of the previously oriented abrasive grits as tends to occur where the abrasive coated web is wound on a drum with the resin in “green” or partially cured state. But whatever the particular explanation, or combination of explanations, which should properly be applied, whether they are those above indicated and/or still others, the fact remains that a very substantial increase in performance efficiency of the resulting abrasive article was secured by following the procedure herein described.

The production of an abrasive article of the coated abrasive type which avoids festooning (and consequent stick marks) during the final cure, and which also employs a procedure which avoids mechanical pressure on the exposed abrasive grits which tends to cause disorientation, and which at the same time accomplishes the desired degree of cure of the adhesive material is regarded as one of the important accomplishments of this invention.

Hereinafore, in addition to straight radiant heat curing, I have described a combination of oven heating (to release any solvent employed and/or to effect a pre-cure) with a subsequent radiant heat treatment whereby the resin or adhesive binder is given its final cure. Another procedure also contemplated by me is to employ a combination of a high frequency electric field with radiant heat curing, with or without previous oven treatment. The high frequency alternating electric field may often be employed in advance of the radiant heat treatment. However it can sometimes be employed to advantage simultaneously with the radiant heat treatment; and, though this is less desirable in most instances, it will be clear that the high frequency alternating electric field treatment can be used subsequent to the radiant heat treatment. Suitable apparatus for setting up a high frequency electric field has long been well known and need not be illustrated in detail herein. It may for example consist of plates or bars, spaced about 18 inches apart, more or less, and having a voltage differential of 10,000 volts, more or less. Where bars are used instead of plates they may be longitudinally spaced, along the length of the web, a few inches to three or four feet or so. They may also be arranged so that the electro magnetic flux between the bars runs diagonally or even substantially longitudinally of the web of abrasive material, instead of primarily transversely.

Various heat-convertible resins have been mentioned hereinafore as composite or abrasive binders which may be treated according to the present invention with special advantages. These are not the only such materials which may be treated, but are merely illustrative. Within this class of materials the phenol-aldehydes have had the most outstanding commercial usage in
the past. However, despite the fact that they had extensive commercial usage as binders in the production of coated abrasive articles, it has been necessary to operate at virtually the maximum tolerable limit, of the paper or cloth backing, in temperatures and time of heating in order to give such phenol-aldehyde resin sufficient curing to make the resulting abrasive article satisfactory commercially. Even so, such phenol-aldehyde resins have not been cured so as to bring out the best in them in the resulting coated abrasive articles. One reason for this necessity of excessive deterioration of the backing. A signal achievement of the present invention is to provide for adequate curing of these phenol-aldehyde resins without overheating the backing; moreover such increased heating of the phenol-aldehyde resins may be accomplished while maintaining the cloth or paper or like backers at an even lower temperature than heretofore, i.e., while employing a lower degree of heating (viz. temperature-time exposure) than was customary and necessary according to prior art methods of manufacture.

While not essential in the operation of my process with various contemplated resins, yet nevertheless still further cooling of the backing may be accomplished by circulating relatively cool air or gases against the backing during the radiant heat treatment. Another method which may be employed to advantage is to pass the web of coated abrasive material with its cloth or paper or like backing in contact with a relatively cool metal plate, the opposite surface of which latter has a fin arrangement, if desired, to further increase the heat exchange effect. This feature is useful in most any case, but has more utility in the case of resins which cure relatively slowly and/or those which require unusually high temperatures, it being desired to inhibit or prevent any substantial decomposition of the backing due to any substantial time-temperature exposure within a harmful range.

The use or suggestion of a source of radiant energy for a number of heating purposes is of course not broadly new. Various phases of radiant energy transmission have long been understood. However, there is the additional consideration that the radiant energy source should preferably be directed more or less parallel to the plane of the coated abrasive article, as it has been pointed out and shown in the prior art, that the backing would not be heated fully as much, under the radiant heat treatment of the binder, as it would be under conditions of straight oven-curing of the binder. Furthermore, while the problem of stick marks caused by festooning has long been recognized in the coated abrasive art, and though certain suggested expedients have been offered in an effort to meet or partially solve this problem, no one to my knowledge has ever recognized the merits of the procedures herein defined for that purpose. In fact, no one heretofore has recognized any virtue or advantage of the improvements in the abrasive art, herein described.

One of the real problems in the prior art in the production of oriented coated abrasive articles has been to preserve the orientation after the abrasive grits have once been deposited in oriented position, e.g. in accordance with patents of James S. Smyser. This has been difficult due to the fact that the binder must have a substantial degree of fluidity or, at least, mobility, when the abrasive grits are deposited therein in oriented position, in order to secure suitable penetration and bonding thereof. It is then necessary to solidify or cure the binder, and this has been a relatively long procedure in accordance with prior art methods involving drying and subsequent curing of the abrasive in roll form. When the abrasive web is wound on a drum in only partially cured condition, a pressure is unavoidably exerted on the abrasive grits and this has a pronounced tendency to cause disorientation thereof in the resin binder or adhesive which is merely partially cured. Where the cure, particularly the final cure, is effected as herein described, however, i.e., without winding the web of coated abrasive material on a roll, and without causing any pressure to be exerted on the exposed ends of the abrasive grains, this tendency to disorient the abrasive grains is entirely eliminated.

While the present invention has been described and illustrated herein in accordance with various details and illustrative embodiments, both in respect to apparatus to be employed in the curing process and illustrative elements to be employed in the abrasive product itself, and various characteristics of the ultimate abrasive articles, it will be understood that this discussion is exemplary only and not limiting. All embodiments within the scope of the present application and the appended claims, which distinguish over the prior art, are comprehended.

What I claim is:

1. As a new article of manufacture, a granular coated web comprising a web backing material and granular particles adheringly attached thereto, said adhesive being substantially completely cured and relatively hard at and adjacent to the exposed surface of said adhesive, and being partially cured and softer and more yieldable at and adjacent to said backings.

2. As a new article of manufacture, a granular coated web comprising a web backing material and granular particles adheringly attached thereto, said adhesive having a substantially different degree of cure at and adjacent to its exposed surface and at and adjacent said backing material.

3. As a new manufacture, an abrasive article comprising abrasive grains and a bond of the heat-curable type for adhering said grains into a coherent mass or layer, said bond containing a finely divided material having a high coefficient of radiant energy absorptivity and being cured by radiant energy.

4. The method of manufacturing an abrasive article which comprises incorporating abrasive grains in an uncured or partially cured adhesive material, and then curing said adhesive in association with said grains by directing radiant energy against the abrasive article, said adhesive material while other portions of said abrasive article are relatively cool.

5. The method of manufacturing abrasive articles of the coated abrasive type which comprises coating a sheeted backing material with an adhesive coating, then depositing abrasive grits in said adhesive coating in oriented position, and then curing said adhesive coating by subjecting
its exposed, abrasive-coated surface to radiant heat rays, whereby the adhesive coating is cured while preserving the original orientation of said abrasive grits substantially undiminished, said backing material being maintained much cooler than said abrasive-coated surface during said curing step.

6. The method of making abrasive material of the coated abrasive type which comprises applying a layer or coating of liquid, heat-maturable adhesive containing a volatile vehicle to a web backing, applying a layer of abrasive grains to the adhesive coated web, then subjecting the resulting web to moderate heat to volatilize said vehicle and effect a pre-cure of said adhesive, and then effecting the final cure of said adhesive by passing said web in proximity to a source of infra-red rays, with the abrasive grain coated surface exposed to said rays and with said web backing shielded from said rays by said coating of adhesive, and thereby maintaining the said abrasive grain coated surface at a higher temperature than the ambient atmosphere, thereby to cure said adhesive while limiting substantially the heating of said backing.

7. The method of making abrasive articles which comprises adhesively combining abrasive grains with a mass or layer of heat-maturable adhesive, and curing said adhesive by subjecting the same to the combined effect of a high frequency electrical field and to rays of radiant energy.

8. As a new manufacture, an abrasive article of the coated abrasive type comprising a sheeted backing, a presize coat on said backing, a binder adhesive coating comprising a heat-curable synthetic resin overlying said presize coat, and abrasive grains embedded in said binder adhesive, said binder adhesive being cured by radiant heat including infra red rays directed against the surface thereof spaced away from said backing material, and said presize coat being of a character to serve as a barrier to the passage of radiant heat.

9. As a new article of manufacture, an abrasive article of the coated abrasive type comprising a sheet backing material and abrasive grains adhesively attached thereto by a heat-advancing resinous binder therefor, said adhesive binder being substantially completely cured and relatively hard at and adjacent to the exposed surface of said adhesive, and being partially cured and softer and more yieldable at and adjacent to said backing material.

10. As a new article of manufacture, a granular coated sheet comprising a sheet backing material and granular particles adhesively attached thereto by a heat-advancing resinous binder therefor, said adhesive binder having a substantially different degree of cure at and adjacent to its exposed surface than at and adjacent said backing material.

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