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COMPOSITE ABRASIVE SHEET

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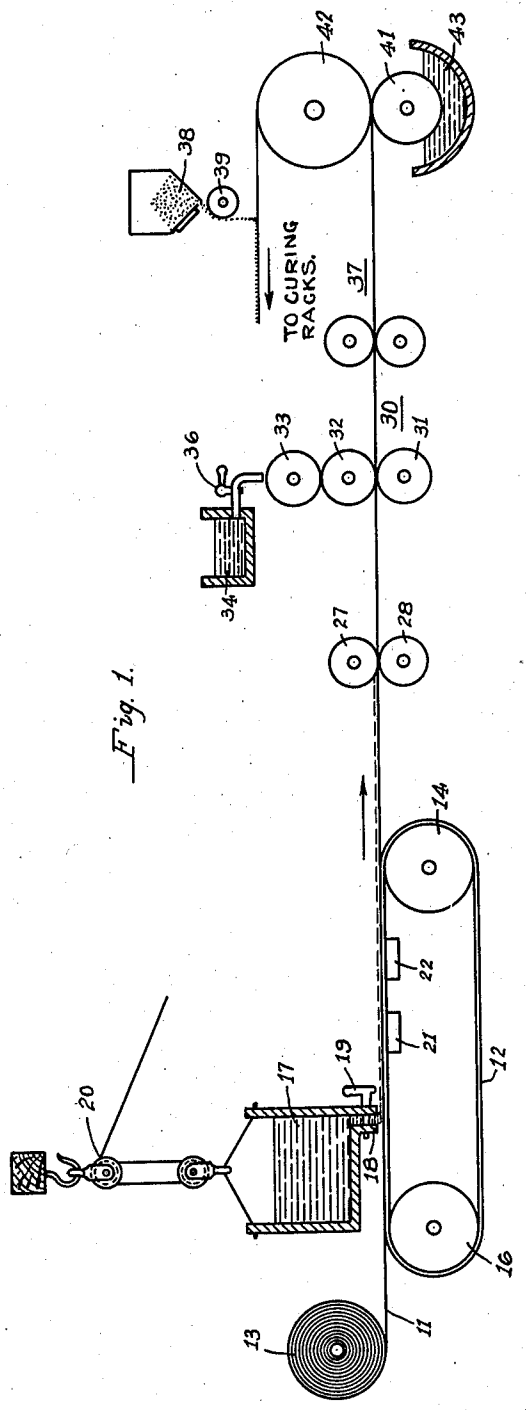


Fig. 1.

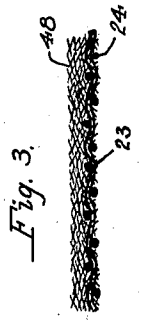


Fig. 3.



Fig. 4.

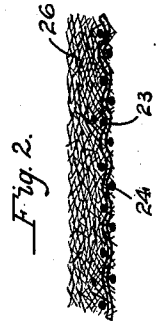


Fig. 2.

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COMPOSITE ABRASIVE SHEET

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4 Claims. (Cl. 51—185)

This invention relates to the manufacture of abrasive coated material and particularly to a simplified method of forming such material, and to an improved composite backing for sheet abrasive articles.

The conventional method of manufacturing a composite sheet or web abrasive material usually consists of adhesively securing a sheet of paper or the like to a cloth sheet in a face-to-face relation by means of glue, which is spread on the adjacent face surfaces to bind the cloth and the paper together. The abrasive granules are generally affixed to the outer surface of the paper or the cloth by an additional coating of adhesive or glue. It will be appreciated that the operations necessary to manufacture abrasive material in such a manner result in an expensive finished article. That is to say, an operation is necessary to combine the paper and the cloth into a composite sheet or web, such as gluing the surfaces thereof, and an additional gluing operation is required to coat the composite material so that the abrasive granules may be attached to a surface thereof.

It is therefore an object of the present invention to eliminate one or more of the customary operations in the manufacture of abrasive coated material by uniting the paper and the cloth without the use of an adhesive and, at the same time, provide an improved composite backing support for the abrasive sheet or article.

In many abrading operations, and particularly where an abrasive disk is used in connection with a power driven flexible supporting pad, it is desirable and in many cases necessary to provide the abrasive granules with a relatively rigid backing to prevent buckling of the abrasive sheet or disk. The abrasive disk is usually driven by means of a clamp member provided for securing the disk to the supporting pad near the center thereof and it is necessary to provide a relatively stiff disk in order that the driving force applied near the center will be properly transmitted to the periphery of the disk. Such an abrative article is usually formed by adhesively securing the granules to a fabric or cloth sheet and also gluing the abrasive coated cloth to a relatively stiff sheet of backing material. A backing material of this nature has been developed in the past by treating paper or pulp fibers with zinc chloride to form what has been known as vulcanized fiber or a hydrolyzed cellulose. The hydrated material thus formed and employed as a backing for a granular foundation has the characteristic of being flexible enough to follow the contour of an abrasive supporting pad over the irregular work surface, but is at the same time relatively stiff so that when the same is used as a backing for the abrasive foundation a desirable abrasive structure is provided. An abrasive disk, for instance, formed from such material will therefore be rigid enough to be operated in connection with a flexible power driven supporting pad without buckling. An unfortunate characteristic of the hydrated material of vulcanized fiber is that the yieldable characteristic thereof is substantially lost in a relatively short space of time. The tendency of the hydrolyzed cellulose or vulcanized fiber to become brittle probably results from the inability of known processes to remove all of the zinc chloride during the washing operations. The zinc chloride process is involved and the numerous operations necessary to properly treat, roll and wash the pulp fibers into a dense mass is expensive and uneconomical. It will be appreciated that the abrasive coated article provided with such a backing renders the composite granular support stiff but that certain limitations in the commercial application thereof prevent its complete utilization as a universal abrasive article. That is to say, the hydrolyzed cellulose or vulcanized fiber must be used within a compartively short period of time to prevent its deterioration as a result of becoming brittle.

It is therefore a further object of my invention to provide a relatively tough abrasive coated material with a comparatively stiff backing which will not become brittle as a result of age and which maintains a yieldable characteristic for an indefinite period.

In the accompanying drawing—

Figure 1 is a diagrammatic view of the composite web-forming apparatus, illustrating a method of uniting pulp fibers with an open woven fabric to form a composite web, including apparatus for stiffening and granular coating the composite web;

Figure 2 is an enlarged sectional view of the interlock between the pulp fibers and the fabric before consolidation thereof;

Figure 3 is an enlarged sectional view of the composite sheet material after the same has been compressed, dried and impregnated; and

Figure 4 is an enlarged sectional view of the finished granularly coated material.

Referring to the drawing, there is represented in Figure 1 apparatus for carrying out the present invention, or a method of making the improved abrasive coated material in a simplified manner. A web 11 of loose or open woven textile

fabric, such as knitted cotton or cheesecloth, is fed into a paper-making machine or onto a moving Fourdrinier wire 12 from a supply roll or reel 13. In the diagrammatically illustrated paper-making apparatus the Fourdrinier wire is supported in a horizontal manner and moved by a rotated pulley 14 and a rotatable cylinder or roll 16. Immediately after the fabric web 11 passes the roll 16 a layer or pulp fibers is deposited thereon from a reservoir 17 which is adapted to receive a supply of an aqueous suspension of pulp. A nozzle 18 or any other suitable distributing means is provided to spread a layer of pulp fibers in suspension evenly over the fabric web 11. A valve or gate 19 is arranged in the nozzle 18 to regulate the flow of pulp suspension to the web and the thickness of the pulp layer may to some extent be controlled thereby. It will be appreciated that the thickness of the pulp layer may be varied in any or all of numerous ways, for example by changing the speed of the moving Fourdrinier wire 12 and by controlling the flow of the pulp solution. As the web 11 is moved by the Fourdrinier wire 12, the liquid from the pulp suspension is drained through the open woven fabric and a portion of the pulp fibers is moved and intermingled with the fabric web and engages the woven strands of the textile web to provide an interlock between the fabric web and the adjacent pulp fibers. A plurality of suction boxes 21 and 22 may also be provided along the underside of the Fourdrinier wire 12 to remove the liquid of the pulp suspension downwardly and to further carry the pulp fibers into the porous weave of the fabric web 11. The fabric web carrying the layer of pulp is moved along by the endless foraminous conveyer 12 so that by the time the same is immediately above the cylinder 14 substantially all of the liquid has departed from the pulp fibers leaving a moist uncompressed layer thereof along the upper face of the fabric web with the contacting portion of the felted pulp fiber intermingled and interlocked with the woven fabric 11.

The penetration of the pulp fibers into the weave of the open woven fabric will to some extent depend upon the force by which the fibers are deposited on the fabric. It is important that sufficient penetration occur during the pulp layer formation period when the fibers are wet and in order that the fibers may be caused to properly intermingle with the strands of the fabric the height of the aqueous suspension of pulp may be maintained constantly at a high level in the reservoir 17 to increase the pressure at the nozzle 18. The reservoir may also be raised with respect to the Fourdrinier wire 12 by any well known means such as by a rope and pulley arrangement 20 whereby the pulp fiber will be brought into contact with the open woven fabric with greater force by reason of the increased velocity of the pulp solution falling a greater distance.

An enlarged section of the pulp fiber in the uncompressed state as carried by the fabric web in leaving the cylinder 14, is shown in Figure 2. The longitudinally extending strands 23 of the web are woven or knit with the transverse strands 24 to form a loose or open woven material in the nature of cheesecloth. The pulp fibers 26 greatly enlarged are shown above the woven fabric with a portion of the lowermost pulp fibers extending into the open weave of the fabric to interlock the pulp layer and the fabric web into a composite sheet.

After the fabric web 11 leaves the Fourdrinier wire or endless conveyer 12 the pulp layer carried thereby is compressed with the fabric and dried by the heated rolls or cylinders 27 and 28, which tend to further interlock the pulp fibers and the fabric.

The compressed composite web is then fed into a series of rolls indicated in general as 30 for the purpose of applying a filler or stiffener to the pulp layer. The pulp layer as hereinafter described becomes the backing for the abrasive granules attached to the fabric side of the composite web and it is necessary to provide the backing or the pulp with a relatively stiff characteristic. That is to say, the pulp must be formed into a relatively rigid state but which is, at the same time, yieldable enough to permit the abrasive web or sheet to be used in abrading operations over irregular surfaces. One method that may be employed in stiffening the pulp is by applying a suitable compound to the pulp fibers and this may be accomplished by spreading a liquid compound over the surface of the pulp by means of a roller 32 which carries a fluid layer of such a compound from the surface of a roll 33. The roll or cylinder 33 is coated with a supply of compound from the reservoir 34. A valve 36 is provided in the supply line to control the amount of compound that may be applied to the roll and hence to the pulp.

Any number of stiffening compounds may be used to stiffen the pulp, such as glue, sodium silicate, resin or latex, and applied thereto after the pulp has been felted on the fabric web. One compound that will provide the pulp with the characteristic of stiffness is an Alvar resin of the polyvinyl acetate acetal type which may be rendered solvent by acetone and applied to the pulp by means of the rolls 32 and 33. A resin of this type is thermoplastic and the impregnated pulp may then be further compressed by a series of pressure rolls indicated generally at 37 to form a relatively stiff backing for the fabric web 11. The amount of resin supplied to the pulp fibers may be controlled by the valve 36 and also by the speed of a traveling web 11. It will be appreciated that the unit volume of the resin as compared to the unit volume of the pulp fibers and the pressure to which the impregnated pulp is subjected will govern the density of a backing and, accordingly, the rigidity thereof. It may be desirable in forming abrasive material for use in some abrading operations to supply only a surface coating to the pulp and thus combine the pulp fibers along the upper surface of the composite web only to provide a more yieldable backing, and this may be accomplished by controlling the flow of liquid resin to the impregnating rolls by means of the valve 36, or by increasing the speed of the moving composite web through the rolls 31 and 32.

The stiffening compound may be applied to the pulp fibers by adding the same to the pulp solution contained in the reservoir 17. A resin may be applied to the pulp fibers in this manner by adding a dispersion of phenolic resin to the aqueous pulp solution contained in the reservoir 17. In this case the resin is mixed with the pulp fibers and carried to the pulp layer during the paper-making operation. This type of resin or binder is heat-hardenable and the pulp layer may be cured by any well known method of applying heat to the composite web. One method of stiffening the pulp fibers treated with phenolic resin may be accomplished by compressing the

composite web under a series of rolls such as indicated generally at 37, and the heat-hardenable resin may be cured later on simultaneously with the adhesive which is used to secure abrasive grain to the opposite surface of the composite web.

After the pulp layer has been properly cured to form a relatively stiff backing for the composite web, the fabric side of the composite web is coated with an adhesive such as glue by means of a plurality of rolls 41 and 42, which are so arranged that the roll 41 carries a coating of glue from the receptacle 43 to the outer surface of the fabric. Abrasive granules are then deposited on the adhesively coated fabric in any well known manner, such as spreading the grain over the surface from a hopper 38 and a roll 39. The abrasive coated composite web may then be moved to suitable racks to properly cure the granular securing glue.

An abrasive web, such as is shown in Figure 4, is therefore provided by the present method of preparing the composite web and coating the same with the abrasive grain. The enlarged grains 46, shown in Figure 4, are secured to the fabric face of the composite web by means of a glue coating 47 which is applied thereto by means of the roller 41. A tough foundation is thus provided for the abrasive grain by the textile fabric web 11, which is relatively tough in the initial state and becomes more so by the addition of the glue coating applied thereto. A relatively stiff backing is also provided for the fabric foundation by the pulp layer 48 which has been treated by a compound to bind the pulp fibers into a comparatively dense mass. The method of manufacturing the present abrasive coated material contemplates treatment of the elements of the composite web from the raw state with the definite objective of forming a relatively stiff abrasive article, and it is to be appreciated that the elements of an abrasive article formed in accordance with the present invention are assembled in a simplified manner. That is to say, the paper and the cloth elements are combined without the use of an adhesive and a separate mechanical process but are interlocked to each other by forming the paper on the cloth. The pulp or paper backing has been stiffened in a simple inexpensive manner to produce an efficient abrasive sheet which will not become brittle over an indefinite period of time.

I claim:

1. A composite abrasive article comprising a web of relatively loose woven textile fabric having a coating of pulp from suspension deposited on and intermingled with one surface thereof, a filler for said pulp adapted to stiffen said coating, a layer of abrasive granules arranged along the opposite surface of said fabric and affixed thereto by means of an adhesive carried by said fabric.

2. A composite abrasive article comprising a web of relatively loose woven textile fabric having a coating of pulp from suspension deposited thereon, and a portion thereof intermingled with one face of said fabric, a resinous compound for said pulp adapted to stiffen said coating, a layer of abrasive grains arranged along the opposite face of said fabric and attached thereto by an adhesive material.

3. A composite abrasive article comprising a web of relatively loose woven textile fabric having a layer of relatively stiff pulp arranged along one face of said fabric and interlocked therewith by having a portion of pulp fibers intermingled with and engaging the texture of said fabric, abrasive granules arranged along the opposite face of said fabric and glued thereto to provide a tough foundation for said granules.

4. A composite abrasive article comprising a web of relatively loose woven textile fabric having a sheet layer of relatively stiff pulp arranged along and laterally intermingled with one face of said fabric to bind the fabric and the pulp together, abrasive granules arranged along the opposite face of said fabric and adhesively secured thereto providing a tough foundation for said granules and a relatively stiff backing for said foundation.

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