BUTT JOINT FOR FLEXIBLE ABRASIVE SHEET MATERIAL

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3,402,514 BUTT JOINT FOR FLEXIBLE ABRASIVE SHEET MATERIAL

William L. Johnson, Hanover, Mass., assignor to Abrasive Products, Inc., South Braintree, Mass., a corporation of Massachusetts

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This invention relates to jointing the ends of flexible abrasive coated sheet material as in the fabrication of belts, bands, cones and other endless abrasive sheet products. Products of this invention have butt joints or splices as distinguished from lap joints, although the joints may, and preferably do run, at an angle between 30 and 80° with respect to the edges of the endless material.

While the art has heretofore recognized the advantages, when butt joining abrasive sheet material, of not increasing the thickness of the composite sheet at the joint, lest bumping and juggling of the composite while it runs between the work-piece and a platens, drum or back-up roll adversely affect the abrasive finishing, it has sought to do this by relying either entirely upon the compressibility of the backing material or upon the actual removal of a portion of the backing material in order to accommodate a joint material applied to the composite. (See U.S. Patents Nos. 2,391,731, 3,154,897 and 2,733,181.)

The procedure of destroying and removing a part of fibrous backing structures was admittedly developed because of the unreliability of relying upon compression alone to attain the desired unincreased thickness at the joint, particularly where the backing material was relatively incompressible or not sufficiently compressible to accept the entire thickness of the applied joining material.

The removal method, while attaining the desired unincreased thickness, does have the disadvantage inherent in excising any portion of the backing fiber, namely, of weakening the backing structure to the extent of any such removal and increasing the likelihood of tearing at the joint.

It is thus an object of this invention to provide a butt joint of reliable maximum thickness not exceeding the thickness of the composite abrasive material on each side of the joint but without weakening the composite by any removal, abrasion or disruption of any portion of the fibrous backing structure. Structures of the present invention thus constitute a radical departure from previous joints.

The present invention is based upon an appreciation of the fact that, whereas it has heretofore been considered essential to retain the coated abrasive face of the sheet as intact as possible at the joint, in fact interruption of cutting during the passage of the joint across the work is not disadvantageous so far as good finishing is concerned because the grit side of the joint remains smooth, unbumped and in or below the plane of the cutting surface of the grit on each side of the joint.

It has further been found that a depression of sufficient depth to accommodate a strong flush reinforced cross-binding insert of more than sufficient tenacity to maintain the joint intact for the life of the product, can be made without reaching the plane of the fibrous backing material, thus leaving the backing structure intact.

Because of the smoothness, flush nature, durability and strength of the insert after the product is finished, no defects in sanded products are discernible because of the presence of the joint which has improved strength due to the disrupted integrity of the backing and maximum thickness no greater than those provided when the backing structure is partially disrupted or removed.

A joint of this invention is shown in cross-section in the accompanying drawing, the elements of which will be referred to in connection with the following description of products of this invention.

EXAMPLE 1

A length of conventional woven cloth backed abrasive sheet material having a total thickness of .032 inch trimmed at its ends so that the straight ends, when brought into abutting relation, made a belt joint extending across the material at a 45° angle. The thickness of the filled cloth backing (cotton drill having a thread count of 76 per inch in the warp and 48 per inch in the fill) was approximately .012 inch leaving a combined making coat and sizing (phenol aldehyde) and grit thickness of approximately .020 inch. Each end of the strip was then presented to a diamond grinding wheel to grind off the abrasive grit to a depth of about .006 to .007 inch for a distance of about .94 inch extending back from each end edge.

An insert was prepared as follows:

A sheet of woven fiberglass reinforcement made from monofilament glass roving and having a thickness of about 10 mils and a transient compressibility without loss of tensile strength of about 500% was placed between two sheets of nylong-phenol-aldehyde film, each of approximately 3 mil thickness (sold by Chrysler Corporation as C-6) and compressed in a flat lamination press at a temperature not exceeding 350° F. and running from 25 seconds at 340° F. up to 75 seconds at 325° F. with a pressure of 500 pounds. This operation compressed the glass and film composite to a thickness of about 7 mils, encapsulating the fibers between the overlying polymeric layers.

The ends to be joined of the abrasive sheet were placed in abutting relation in a jig with the ends about .94 inch apart. A piece of the glass reinforcement compressed and encapsulated between the compressed polymeric film was cut on the bias at a 45° angle to give a width of about .04 inches so that it would just fit into the depression made on each side of the joint by the previous grinding operation. On the back side, the two marginal edge portions of the cloth backing were overlapped with a narrow strip of the same film in 3 mil thickness. The entire joint was then pressed between Teflon coated anvils with the top anvil being at 385° F. and the bottom anvil at 350° F. for about ten seconds, being a period long enough to flow the polymeric film between the butt ends and compress the composite polymeric film and glass reinforcement into a pliable matrix, H-shaped in cross-section, adherent to the fibrous backing ends and having a thickness no greater than the thickness of the stock. This left the upper element of the H-shaped joint flush with the cutting plane of the abrasive grit on each side of the joint, seated in the ground-away depression, and adherent to the bottom of the depression; and left the lower parallel element of the H-shaped structure compressed and merged into the plane of the composite belt stock.

The temperature and the time the film was left between the anvils was not enough to completely polymerize but was sufficient to completely thermo-stabilize the synthetic polymeric bonding material so that even if subsequent temperatures exceeding 375° F. were encountered in operation, the result would be a further hardening rather than any softening of the matrix material which remained heat resistant up to a localized operating temperature as high as 450° F.

In a reinforced H-shaped joint of this character, the joint will not break open on either side nor crease nor hinge even when severely folded or twisted. Its pliability is excellent because of the fact that the matrix of bonding material is not completely polymerized and does not become brittle as the result of application of a high operating temperature.
EXAMPLE 2

The same procedure was followed as in Example 1 except that the backing material was constituted of 130 pound per ream cylinder paper having a thickness of 10 mils, having an animal hide glue making coat, an abrasive layer and an overlying phenol-aldehyde sizing coat, totaling 20 mils in thickness.

Structures resulting from fabrication in accordance with Examples 1 and 2 hereof are illustrated in the accompanying drawing wherein 10 designates the fibrous backing material, 12 indicates an adhesive coat bonding a layer 14 of abrasive grit to the backing. 16 indicates the pre-formed insert which is placed in the depression formed by partial or whole removal of the abrasive grit and adhesive on the grit side of the composite, 18 indicates the film which by heat and pressure has been partially compressed, partially impregnated into the back side of the fibrous sheet 10, and 20 illustrates the joining leg to complete the matrix of H-shape cross-section. 22 shows the compressed woven glass roving reinforcement encapsulated in the insert 16.

While as described the element 18 is unreinforced, it can, of desired be reinforced, provided the compressibility of the backing will accommodate its combined matrix-reinforcement thickness. In such case very fine plastic or metal or glass filaments may be used, since the main joint strength is provided by the upper element 16.

The above nylon modified resin has been found to be particularly efficacious by reason of its temperature stability and anti-frictional qualities, but it is contemplated that equivalent qualities may be present in other nylon or otherwise modified co-polymeric resins, the essential nature of this invention not residing in any particular chemical nature of the synthetic polymeric resin so long as it attains the physical requirements for producing a matrix of the type procured with the use of the above nylon modified phenolic resin.

What is claimed is:
1. A butt joint for flexible abrasive grit-coated sheet material comprising:

4. two abutting straight end edges of a composite structure, including a fibrous backing bearing a layer of abrasive grit adhesively adherent to at least the upper face thereof.

portions of said composite, marginally adjoining said straight edges on said abrasive grit upper face, being recessed to a depth short of said fibrous backing, and

a pliable substantially thermostable matrix, H-shaped in cross-section, of synthetic polymeric bonding material embracing said composite end edges with one of its pair of parallel elements seated in said upper face recess, and the other of its parallel elements adhered on its inner side to the other under face of said backing,

said matrix having its upper surface substantially flush with the cutting plane of said abrasive grit layer on each side of said joint,

and a layer of woven glass roving compressed and encapsulated within, and being substantially co-extensive with, the upper parallel element of said matrix.

2. A butt joint as claimed in claim 1, wherein the other of said parallel elements is thinner than the element seated in said upper recess and is compressibly merged into the plane of said composite, whereby said matrix is no thicker than the maximum thickness of the said composite structure on each side of said joint.

3. A butt joint as claimed in claim 1, wherein said matrix comprises a nylon-phenol-aldehyde polymer.

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OTHELL M. SIMPSON, Primary Examiner.