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SECTIONAL COATED ABRASIVE BELT AND PROCESS OF MAKING THE SAME

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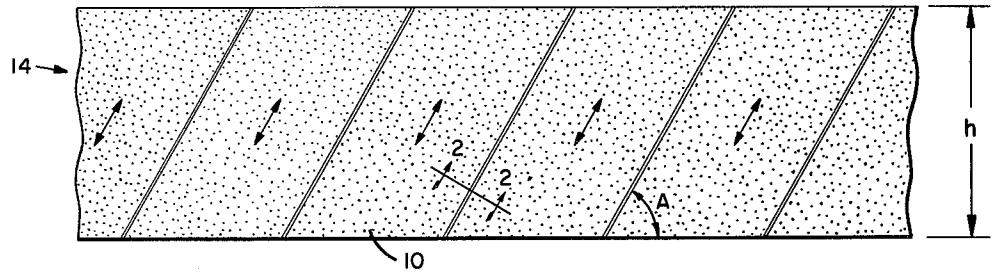


Fig. 1

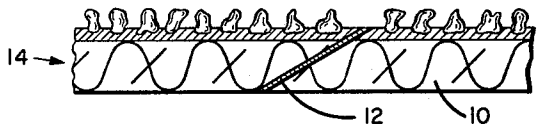


Fig. 2

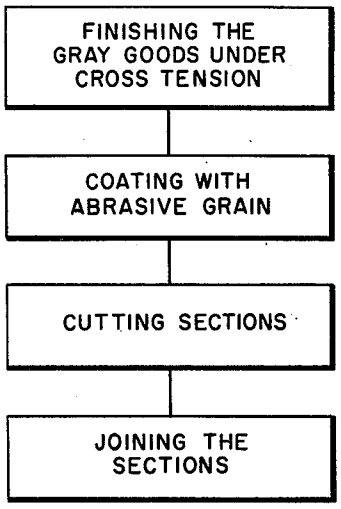


Fig. 3

INVENTOR.
EDWARD W. BRATTON
BY W. F. Doley
ATTORNEY

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SECTIONAL COATED ABRASIVE BELT AND PROCESS OF MAKING THE SAME

Edward W. Bratton, Kenmore, N.Y., assignor to The Carborundum Company, Niagara Falls, N.Y., a corporation of Delaware

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This invention relates to an improved coated abrasive belt, and more particularly, to an improved sectional coated abrasive belt having a width in excess of fifty inches.

In recent years, many applications have been developed that require the use of coated abrasive belts that have widths in excess of about 50 inches. The manufacture of such wide belts poses a serious problem to the coated abrasive industry. Existing equipment is not capable of coating backings that are wider than about 50 inches, and the cost of equipment that would be required to coat wider backings is prohibitive.

Many proposals have been made in the past to manufacture wide belts by splicing together sections of abrasive coated backing material. To make a belt that will operate smoothly, the joints between the sections must be at an angle to the direction of belt travel. To make the joint, the layer of abrasive is usually removed, and in some cases the abrasive is ground off both the bottom and top laps of two sections that are to be joined. Adhesive is then applied to the ends where the segments are to be joined, and the two ends are brought together in alignment between the platens of a press. The adhesive is then cured under pressure.

In making such joints, it is difficult to obtain perfect alignment of the laps, and it is not unusual to obtain a joint that has a greater thickness than the abrasive coated backing, so that the belt has a tendency to bump in use. This produces undesirable finishing and grinding results, and accelerates belt wear on and in the vicinity of the splice area.

To minimize the effects of variations in belt thickness, it is common to dispose the joints at an angle to the running direction of the belt. One common technique for making wide, sectional belts involves cutting a coated abrasive web into a series of parallelograms, and joining these parallelograms along their longer sides. The belt that is thus obtained has the warp threads of the sections disposed at an angle to the running direction of the belt. Usually this angle is in excess of 45°, so that the strength and stretch of the belt are determined in large part by the cross tensile strength and cross stretch, respectively, of the backing of which the sections are made. In most cases, when standard finished drills or jeans cloth is used, these characteristics fall considerably short of what industry desires and needs.

Recently, it has been proposed to form wide belts by joining trapezoidal, abrasive coated segments together so that their warp threads always extend in the running direction of the belt. While this produces a belt whose tensile strength and stretch characteristics are more susceptible of control, there are many places along the length of the belt where three segments come together in a joint, and it is very difficult to form these joints with the same thickness as the remainder of the belt. Furthermore, because of the large number of segments that must be joined together to make such a belt, labor costs are quite high.

One object of the present invention is to provide a coated abrasive belt having improved strength and low stretch characteristics in the fill direction.

Another object of the invention is to provide a wide, sectional coated abrasive belt having practical characteristics of stretch and strength in its running direction. A related object of the invention is to provide a practical process for making a belt of character described.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

In the drawings:

FIG. 1 is a fragmentary top plan view of a portion of a wide sectional belt that is made of abrasive coated sections of a cloth backing material that is finished under a minimum lengthwise tension, in accordance with one embodiment of this invention;

FIG. 2 is a fragmentary section, on an enlarged scale, taken on the line 2—2 of FIG. 1 looking in the direction of the arrows, and

FIG. 3 is a diagrammatic flow sheet depicting the steps that are involved in making a wide, sectional, abrasive coated belt in accordance with one embodiment of this invention.

The cloth, that is commonly used as backing for coated abrasive belts, usually has either a jeans or drills construction. It is normally prestretched, during finishing in the warp direction, by applying as much longitudinal tension as practical to minimize warp stretch. The longitudinal tension ordinarily decreases the cloth width and crowds a larger number of warp threads into every inch of width of the web, to increase the web strength per inch of width. This is satisfactory for ordinary abrasive belts where the running direction of the belt is the direction in which the warp threads extend. However, for sectional belts, in which the running direction of the belt is primarily the direction in which the cross threads extend, rather than the warp threads, this technique is extremely undesirable since it increases the stretchability of the cloth in the cross direction.

When sections of a cloth that has been finished in the usual way under high longitudinal tension in the warp direction, are made up into a wide sectional belt, with the cross threads extending more nearly in the running direction of the belt than the warp threads, the tensile strength of the belt in the running direction is low, and stretch is high. In fact, stretch is so high that the belt takeup on most grinding machines is exceeded unless minimum belt tension is maintained.

In accordance with this invention, a particular cloth construction, a sateen weave, is employed for the backing, and a minimum of tension is applied to the cloth in the warp direction during finishing. In some cases, we prefer to apply tension in the fill (cross) direction of the cloth during finishing, in order further to minimize stretch in the fill direction. This produces a backing for coated abrasive material that is ideally suited for cutting into sections that can be joined together to form a wide, sectional, abrasive coated belt, with the cross threads disposed in the running direction of the belt. The sateen weave cloth is preferably selected and finished so that it is characterized by having practically equivalent strength and stretch in both warp and cross (fill) directions.

The preferred cloth for the backing is a 5-harness sateen weave cotton coth. There are two types of sateens, warp sateens and filling sateens. Warp sateens are made with a larger number of threads in the warp than in the filling. Filling sateens are made with a larger number of threads in the filling than in the warp. Either type of sateen can be used, but the cloth is preferably selected and finished in such a way that the strength and stretch characteristics of the finished cloth are substantially equal in both directions.

One advantageous characteristic of sateen weave cloth is that it has a very smooth surface. Plain weave cloth has the maximum number of cross lacings possible, and there are therefore a large number of "knuckles" that

project outwardly from the cloth surface. Sateen weave cloth has a minimum number of cross lacings and relatively few projecting knuckles. The sateen weave cloth therefore resists wear better than twills and plain weaves. Moreover, all other things being equal, the tensile strength and resistance to stretch of sateen weave cloth theoretically are higher than those of any other weave, and thickness is at a minimum per unit weight.

The invention can be best understood by reference to a specific embodiment thereof. A roll of a 5-harness sateen weave cloth, having a weight of 1.12 yards/lbs. and a thread count of 96 x 60, 17's warp and 9.5 fill, and having a nominal width of 53", is scoured to remove soil, size, and to extract waxes and oils. After scouring, this cloth has a lengthwise stretch of 0.80 inch per five inch strip length, lengthwise tensile strength of 120 to 122 pounds per inch of width, cross stretch of 0.80 inch per five inch strip length, and cross tensile strength of 124 to 130 pounds per inch of width.

This roll of washed sateen, and four others of substantially similar characteristics, are filled with a phenolic resin filler modified with 15% to 20% by weight of ethyl cellulose. During filling, the cloth is subjected to a minimum of tension in the warp direction, in order to prevent overstretching of the cloth in the warp (lengthwise) direction. The cloth is then fed into an oven, to cure the filler. In the oven, the cloth is subjected to a minimum of warp tension, as necessary to cure to the desired width. The finished cloth has the characteristics tabulated in the following tables:

TABLE 1

Roll No.	Roll Weight, lbs./Sandpapermaker's ream	Filler, lbs./Sandpapermaker's ream	Percent Total Volatiles in Filled Cloth, by weight	Percent Non-Aqueous Volatiles in Cloth, by weight
1	25.6	7.2	6.69	3.02
2	27.0	8.1	6.98	2.98
3	27.6	8.9	6.59	3.20
4	27.7	7.8	6.40	3.03
5	26.1	7.4	6.75	3.02

corresponding physical characteristics of the drill cloth, after finishing but without heat treatment, are as follows:

TABLE 3

Drill Cloth Backing Finished With Warp Tension

Lengthwise Stretch, percent	Lengthwise Tensile, lbs./in. of width	Cross Stretch, percent	Cross Tensile, lbs./in. of width
0.35	200	1.4	50

The drills cloth gray goods has an initial width of about 42". Sufficient tension is applied in the warp direction during finishing to reduce the width of the cloth after the second dry to 36½". Similar finishing of 63" wide drills cloth yields a finished 51" wide web.

By way of contrast, according to this invention, the sateen cloth has an initial nominal width of 53", and is held out sufficiently during finishing so that the finished cloth has a width on the order of 50". Since some lengthwise tension must be applied to the sateen cloth in order to pull it through the dip trough, the squeeze rolls, and the oven for curing, there is some prestretching of the sateen cloth web in the warp direction. However, in contrast to the conventional finishing treatment of backing, the stretch is removed in both the cross direction and the warp direction. Even though the width of the sateen web is reduced during finishing, the use of minimum practical tension in the warp direction in effect prestretches the cloth in the cross direction, as well as the warp direction, so that the finished cloth has very little residual stretch. Tentering during curing is often helpful to finish to a desired width, but is not necessary. However, if a tenter-oven combination is available, it can be used. Substantially equivalent results are obtained by using the minimum warp stretch, that is practical, during finishing, and by using a tenter-oven combination to hold the cloth out, in the cross direction, during finishing.

As indicated in Table 2, the finished sateen backing material is approximately square in its properties, in that the cross-stretch and lengthwise stretch are of the same order of magnitude, as are the cross and lengthwise tensile strengths. Ordinary backing material, as exemplified by the standard finished drill cloth backing described above, has a cross stretch on the order of approximately four times its lengthwise stretch, and a lengthwise tensile strength that is approximately four times the cross tensile strength.

TABLE 2

Roll No.	After Heat Treatment for 6 Hours at 250° F.				Without Heat Treatment—Dry			
	Dry		Wet					
	Lengthwise Stretch, Percent	Lengthwise Tensile, lbs./in. of width	Lengthwise Stretch, Percent	Lengthwise Tensile, lbs./in. of width	Lengthwise Stretch, Percent	Lengthwise Tensile, lbs./in. of width	Cross Stretch, Percent	Cross Tensile, lbs./in. of width
1	.50	172	.68	179	1.51	170–174	1.59	140–141
2	.53	174	.72	183	1.53	168–175	1.66	134–163
3	.48	174	.63	182	1.48	170–177	1.56	123–126
4	.48	175	.66	186	1.47	170–172	1.71	147–148
5	.50	173	.67	180	1.52	168–173	1.59	147–148

[1] Approximate value.

By way of comparison, a drill cloth backing of the conventional type, 42" wide, having a thread count of 76 x 48 with 14's warp threads and 12's fill threads, and weighing 1.97 yards per pound, is dyed and dried, then finished with the same finishing materials described above, but with the conventional application of tension in the warp direction. The thickness of the drill cloth, before finishing, is about 0.012", as compared to 0.017" to 0.018" thickness for the sateen before finishing. The

The finished sateen cloth web is next coated with abrasive grain. It is then cut into sections **10** (FIG. 1) that have the shape of parallelograms whose longer alti-

tude *h* is equivalent to the width of the wide belt desired. The longer sides of the sections 10 are skived and joined with a resinous bond that is cured under heat and pressure between platens, to make an endless belt 14.

Preferably, the sections 10 are cut from the finished backing so that the angle A is between 75° and 80°, and preferably 78½°. The arrows in FIG. 1 indicate the direction of the warp threads in each section 10.

When the joint 12 between adjacent sections 10 is carefully made, the thickness of the belt 14 is uniform. In this respect, sateen cloth backings have additional advantage over other backings, since joints that are made with these backings characteristically have the same thickness as the backings from which they are made. This particular characteristic of sateen backings is difficult of explanation, since the joints are made after the sateen is coated with abrasive, when the backing is rigidified to some extent by the abrasive bond. However, it is recognized that sateen has a maximum compressibility potential, since basically it is a less stable weave in that the knuckles can shift. It is also recognized that sateen weave cloth is characterized by minimum thickness per unit weight, all other things being equal, as compared to other weaves, so that should any bumps exist, they would be smaller, proportionately, than would the case with a backing of the same weight but having a different construction.

Sateens are usually 5-harness fabrics with tape selvage, and are characterized by a high thread count. While it is preferred to use a 5-harness, tape selvage sateen fabric, since this is a standard industrial product, the invention contemplates the use of other types of sateens such as, for example, sateens having higher harness numbers, or wire selvage. Some typical sateen counts, that can be used in this invention, are 108 x 72; 104 x 64; 96 x 60, and 96 x 56. Both warp and filling sateens can be used. Ordinarily, warp sateens are preferred because they are the more conventional fabric structures and are less expensive.

While sateen is the preferred fabric, it is contemplated that other fabric constructions can be employed where the proper application of tension in the cross direction during finishing or filling can produce a cloth backing having a maximum stretch in the cross direction of about 10%, and minimum tensile strength in the warp direction of about 130 lbs./inch of width. Preferably, the corresponding properties in the other directions should be approximately equivalent. Sateen construction is preferred because of its advantages with respect to smoothness, strength, compressibility, and stretch. After coating, the coated material should have minimum strength of 150 lbs./inch of width, and maximum stretch of about 7%.

Cloth backings prepared in accordance with this invention are specifically intended for use in the manufacture of sectional belts. However, these backings also can be used to good advantage for ordinary abrasive coated belts, particularly where the characteristics of equal strength and stretch in the lengthwise and cross directions are important. While I prefer that, during finishing, the tension in the warp direction be the minimum practical amount, or that cross tension be applied by tentering, to take out as much of the cross stretch as is practicable, the cross tension and the lengthwise tension can be adjusted so as to regulate the amount of cross stretch with respect to lengthwise stretch, within the limits that are imposed by the cloth construction. For practical use, however, a coated abrasive belt should have in its running direction, a minimum tensile strength of about 130 lbs./inch of width, and a maximum stretch of about 10%. One great advantage of the present invention is that it permits the construction of sectional belts that have these requisite characteristics.

While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the limits of the appended claims.

I claim:

1. A process for making a sectional abrasive coated cloth belt in which the warp threads of the belt sections are disposed at an angle to the running direction of the belt, comprising finishing a cloth web under approximately minimum practical tension in the warp direction, coating the finished cloth web with abrasive, cutting the web into sections, and joining the sections together to form a sectional abrasive coated belt in which the warp threads of the sections are disposed at an angle to the running direction of the belt.

2. A process for making a sectional abrasive coated cloth belt, comprising finishing a sateen weave cloth web under approximately minimum practical tension in the warp direction, coating the finished cloth web with abrasive, cutting the web into sections, and joining the sections together to form a sectional abrasive coated belt in which the warp threads of the sections are disposed at an angle to the running direction of the belt.

3. A process for making a sectional abrasive coated cloth belt, comprising finishing a sateen weave cloth web under approximately minimum practical tension in the warp direction and under sufficient tension in the cross direction that the finished cloth has a maximum cross stretch of about 10%, coating the finished cloth web with abrasive, cutting the web into sections and joining the sections together to form a sectional abrasive coated belt in which the warp threads of the sections are disposed at an angle to the running direction of the belt.

4. A process for making a sectional abrasive coated belt, comprising finishing with a resin-base filling a 5-harness sateen weave cloth web under approximately minimum practical tension in the warp direction, coating the finished cloth web with abrasive, cutting the web into sections, and joining the sections together to form a sectional abrasive coated belt in which the warp threads of the sections are disposed at an angle to the running direction of the belt.

5. A process for making a sectional abrasive coated belt, comprising finishing with an ethyl cellulose-modified phenolic resin a sateen weave cloth web under approximately minimum practical tension in the warp direction and under sufficient tension in the cross direction that the finished cloth has a maximum cross stretch of about 10%, coating the finished cloth web with abrasive, cutting the web into sections, and joining the sections together to form a sectional abrasive coated belt in which the warp threads of the sections are disposed at an angle to the running direction of the belt.

6. A process for making a sectional abrasive coated belt, comprising finishing a sateen weave cloth web that has a minimum finished cross tensile strength of at least about 130 lbs./inch of width under approximately minimum practical tension in the warp direction and under sufficient tension in the cross direction that the finished cloth has a maximum cross stretch of about 10%, coating the finished cloth with abrasive, cutting the web into sections, and joining the sections together to form a sectional abrasive coated belt in which the warp threads of the sections are disposed at an angle to the running direction of the belt.

7. An abrasive coated belt comprising a cloth backing having a layer of abrasive grain bonded thereto, said backing being prestretched both in the cross direction and in the warp direction, and having substantially equal resi-

dual stretch in the directions of its cross and warp threads respectively.

8. An abrasive coated belt according to claim 7 in which the backing has substantialy equal tensile strength in the direction of the cross threads and warp threads thereof.

9. An abrasive coated belt comprising a cloth backing having a layer of abrasive grain bonded thereto, said backing being prestretched both in the cross direction and in the warp direction, and said belt having a minimum tensile strength in the running direction of the belt of about 130 lbs./in. of width.

10. An abrasive coated belt comprising a cloth backing having a layer of abrasive grain bonded thereto, said backing having minimum practical finishing prestretched in the warp direction and having substantially equal residual stretch and substantially equal tensil strength in the directions of its cross and warp threads respectively, and said belt having a minimum tensile strength in the running direction of the belt of about 130 lbs./in. of width.

11. An abrasive coated belt comprising a cloth backing having a layer of abrasive grain bonded thereto, said backing being prestretched both in the cross direction and in the warp direction, having substantially equal tension strength and residual stretch in the directions of its cross and warp threads respectively, and said belt having a minimum tensile strength in the running direction of the belt of about 130 lbs./in. of width.

12. A sectional coated abrasive belt comprising sections of abrasive coated sateen weave cloth that are each characterized by substantially equal residual stretch and substantially equal tensile strength in the cross direction and in the warp direction, and that are joined together with their warp threads disposed at an angle to the running direction of the belt, said belt having a maximum stretch in its running direction of about 10%.

13. A sectional coated abrasive belt comprising sections of abrasive coated sateen weave cloth that are prestretched both in the cross direction and in the warp direction of their threads, and that, coated, have a maximum stretch in the cross direction of about 7% and that are joined together with their warp threads disposed at an angle to the running direction of the belt, to provide a belt having a minimum tensile strength in the running direction of about 130 lbs./in. of width.

14. A sectional coated abrasive belt comprising sections of abrasive coated 5-harness sateen weave cloth that are resin finished and prestretched both in the cross direction and in the warp direction of their threads, and that have substantially equal residual stretch and substantially equal tensile strength in the cross and warp directions, and that are joined together with their warp threads disposed at an angle to the running direction of the belt, to provide a belt having a minimum tensile strength in the running direction of about 130 lbs./in. of width and maximum stretch in the running direction of about 10%.

References Cited in the file of this patent

UNITED STATES PATENTS

1,009,709	Furber	Nov. 21, 1911
1,194,494	Freeman	Aug. 15, 1916
1,806,208	MacKnight	May 19, 1931
2,059,583	Jackson et al.	Nov. 3, 1936
2,225,937	Williamson	Dec. 24, 1940
2,672,715	Walters	Mar. 23, 1954
2,723,438	Meier-Wenhorst et al.	Nov. 15, 1955
2,899,288	Barclay	Aug. 11, 1959

FOREIGN PATENTS

5,702 of 1889	Great Britain	Apr. 3, 1889