July 27, 1948. W. B. SUMMERS ET AL 2,445,807

JOINT FOR ABRASIVE BELTS OR BANDS

Filed June 18, 1947

Fig. 1.

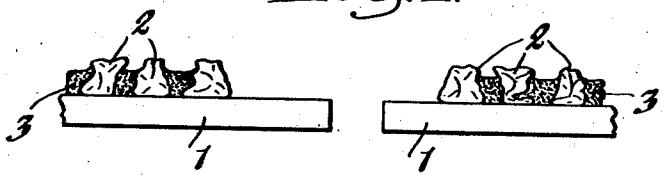


Fig. 2.

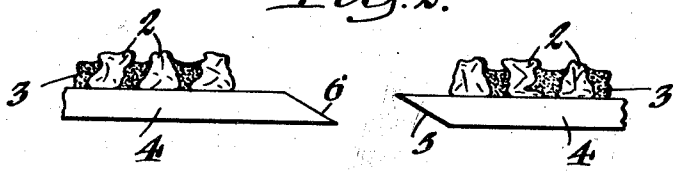


Fig. 3.

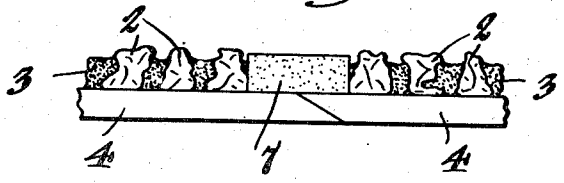


Fig. 4.

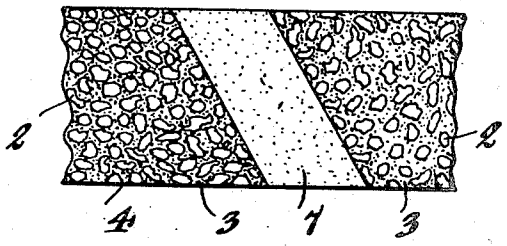
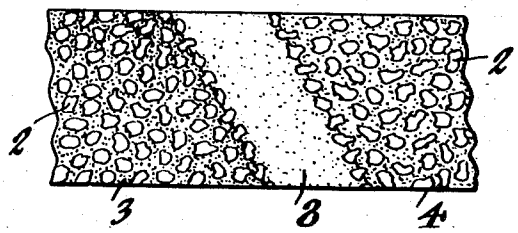


Fig. 5.



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JOINT FOR ABRASIVE BELTS OR BANDS

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Application June 18, 1947, Serial No. 755,358

16 Claims. (Cl. 51—188)

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This invention relates to improved joints for abrasive belts or bands.

In making abrasive belts it is customary to cut a strip of suitable dimensions from a web of abrasive coated material comprising a backing such as paper or cloth having a layer of abrasive grains attached to one side by an adhesive. The ends of the strip are then joined to form the endless belt or band. In making the splice which joins the ends of the strip the abrasive grain is usually removed from at least one end, a suitable adhesive is applied to the surface from which the grain has been removed, and the other end is lapped over the adhesive coated surface, pressed thereon, and the liquid adhesive is then solidified. Another method which is sometimes used is to butt the two ends together and apply a strip of suitable material such as cloth carrying a layer of adhesive on one side to the back of the strip and thus fasten the two ends together. Abrasive belts made by either of these methods have the objection that they are thicker at the joint or splice than they are in the rest of the belt and when the workpiece comes in contact with this joint there is a bump which is likely to mar the workpiece. Such a bump also puts an undue strain on the joint and as a result the joints frequently fail prematurely.

Another method of making belt joints consists in removing substantially all of the abrasive grain from both ends of the strip, applying the liquid adhesive to that end which is to be inside the belt, and assembling as described above. In making such joints one or both of the ends which are to be overlapped may be tapered as by grinding to form complementary surfaces which theoretically should provide a joint of the same thickness as the backing in the other part of the belt. Actually it is impossible as a practical matter to make joints by this method which are identical in thickness to the other parts of the backing because of the difficulty in getting the two ends exactly lined up and because the cement occupies same space. The tapered or beveled ends are also employed where the abrasive grain is left on that end which is to form the outer surface but the same difficulty is there experienced in getting joints which are identical in thickness with that of the rest of the belt.

Where the abrasive grain is removed from both ends of the strip that portion of the backing which forms the joint is left exposed and is subject to wear because the workpiece is very likely to rub over the denuded backing. Except for this difficulty joints of that type would be the most

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satisfactory of those now known because of the fact that it is possible to assemble the joint under pressure and to make a joint which is free from the objectionable bump.

We have discovered a method of making a joint of the type where the abrasive grain is removed from both ends of the strip from which the belt is made which overcomes the difficulties previously experienced. Briefly stated, our invention comprises the step of applying over the outer surface of the belt at the joint, and preferably extending a slight distance into the abrasive grain on each side of the joint, a hard tough layer containing a lubricant which reduces the coefficient of friction of the layer to such a point that it does not wear or become heated in use. In the absence of a lubricant the protective layer gets unduly warm because of the friction between it and the workpiece and the heat thus generated has a deleterious effect on the cement which is used to attach the two ends of the strip and form the joint or splice.

It is therefore an object of our invention to provide an improvement in abrasive belt joints or splices. Another object is to provide a belt in which the joint will be sufficiently strong and wear-resistant so that it does not fail before the abrasive portion of the belt is worn out. Still another object of the invention is to provide an abrasive belt comprising a joint which is of such character that it does not bump and yet is strong enough to withstand the stresses to which it is subjected in use throughout the life of the abrasive portion of the belt.

Understanding of our invention will be facilitated by reference to the drawing wherein:

Fig. 1 is a side elevation, greatly enlarged, of the two ends of a strip of abrasive coated material prepared for assembly in accordance with one modification of our invention;

Fig. 2 is similar to Fig. 1 but shows the modification wherein the ends of the backing are tapered;

Fig. 3 is an enlarged side elevation of a joint made from the strip prepared as illustrated in Fig. 2;

Fig. 4 is a top plan view of a completed belt joint made in accordance with one modification of the invention; and

Fig. 5 is a similar top plan view of a belt joint made according to a second modification of the invention.

In carrying out our invention we first provide a strip of abrasive coated material comprising a backing such as a drill cloth or a 130 lb. rope cylinder paper to one side of which a layer of abrasive

grains is attached by an adhesive such as glue, a suitable varnish, or a synthetic resin. As is well known in the art, abrasive belts are made from numerous types of coated abrasive material and it is therefore unnecessary to provide a detailed description of the method of making such material. Our invention is well suited for use in making belts from any of the usual forms of abrasive coated material.

Having provided a strip of the abrasive coated material of suitable length and width in accordance with usual practice, we remove the abrasive grains from both ends of the strip over an area which is substantially equal at both ends. We then apply an adhesive to one of the areas from which the grain has been removed, lap the other end over the adhesive coated surface, apply a suspension of a finely powdered solid lubricant such as graphite, talc, mica or molybdenite in a liquid which is convertible to a tough hard solid and harden both the cement and the liquid carrying the lubricant. We usually prefer to complete the joint by hardening the cement which attaches the two ends before we apply the liquid carrying the lubricant although the hardening of the two liquids may be completed in one treatment.

Referring to the drawings, Fig. 1 shows the two ends of a suitable strip consisting of a backing 1 having a layer of abrasive grains 2 attached to one surface by an adhesive 3. The abrasive grain and adhesive have been removed from a portion of each end of the strip as is shown in the drawings.

In Fig. 2 a backing 4 having the coating of abrasive grains and adhesive is tapered on each end in a complementary fashion, the abrasive grains being removed from a portion of each end. The angle of the taper 5 is substantially the same as that of the taper 6 so that when the adhesive is applied to surface 5 or 6 or to both surfaces and the ends are butted the thickness of the backing at the joint will be closely the same as that of the other part of the backing 4. At the same time denuded portions are provided above that part of the backing which forms the joint.

In Fig. 3 we have shown a side elevation of an assembled joint made from the strip illustrated in Fig. 2 after the ends have been butted and held together by the cement 8 and the protective layer 7 of hard tough material carrying the lubricant has been applied.

Fig. 4 shows a top plan view of the belt assembled, as for example in accordance with Fig. 3. In this figure the protective layer 7 extends only up to the abrasive grains. Fig. 5 is similar but shows a joint wherein the protective layer 7 has been applied over an area sufficient to carry it slightly into the abrasive coated portion of each.

We will now illustrate our invention by reference to specific examples, it being understood that the examples are not limitative.

Example I

A strip of abrasive coated cloth comprising a backing of drill cloth carrying a coating of 60 grit fused alumina abrasive grain attached to one side by hide glue was cut from a web. Each end was cut in such a way as to form an angle of 45° between the end and the side, the cuts on the two ends being complementary so that when the ends were butted a continuous joint was formed.

The abrasive grain and glue were removed from a strip ¾ inch wide at each end along a line parallel to the end and a solution of hide glue in water was applied to the upper side of one end and the lower side of the other end. The two ends were then overlapped, clamped together and the joint was allowed to dry until the glue had set.

A coating material to be applied over the exposed outer surface of the joint was then prepared by first soaking 25 parts by weight of a high grade hide glue in 75 parts by weight of water for 30 minutes and then heating to 140–150° F. and stirring until the glue solution was smooth. 25 parts by weight of finely powdered graphite were then stirred into the 100 parts by weight of glue solution while the solution was held at a temperature of 140–150° F. until the mixture was smooth and free from lumps.

A uniform heavy coating of this mixture was then brushed over the top of the splice where the grain had been removed and after the coating had been dried for 24 hours the splices were flexed over a standard belt flexer along the direction of the splice; that is to say, at an angle of 45° with the edge of the belt.

The belt thus prepared was used for smoothing steel and it was found that this belt was usable until the abrasive portion of the belt had worn out. Belts made without the protective coating and also belts made with a coating of glue but without graphite failed at the joint long before the abrasive portion of the belt was worn out.

Example II

A belt was made up exactly according to the procedure of Example I except that the coating which was applied over the exposed outer surface of the joint consisted of a glue of Example I without any graphite mixed with it and that finely powdered graphite was sprinkled over the glue surface while it was still moist and adhesive. The joint thus formed was found to be fully as satisfactory as that made according to Example I.

Example III

A strip of waterproof abrasive cloth made on a backing of drill cloth which had been impregnated with a resin to waterproof it and prevent stretch and then provided with a coating of 120 grit silicon carbide abrasive grains attached by a heat-hardened phenolic resin was cut with the end forming a 45° angle as described in Example I. The abrasive grain and the resin adhesive holding the grain to the backing were removed from a strip approximately ¾ inch wide from each end of the strip and a joint was made according to the invention described and claimed in United States Patent No. 2,350,861. Specifically, the end which became the inner side of the belt was ground to a taper with an abrasive wheel and the under side of the other end of the strip was coated with a plasticized urea-formaldehyde condensation product made of the following composition:

	Parts
Aqueous solution of urea-formaldehyde resin containing 60% solids	100
Sorbitol phthalate	10
Acid catalyst	10
Water	100

The catalyst consisted of an aqueous solution of ammonium thiocyanate and thiourea.

The solution was prepared by mixing together the sorbitol phthalate and catalyst, mixing this with the solution of urea resin and finally diluting with water. The surfaces to be joined were roughened with 50 grit fused alumina abrasive paper and a coating of the adhesive was applied

to each surface by a brush. These surfaces were then dried for a half hour at room temperatures and a second coat was applied and dried for one hour. The two ends were then assembled with the adhesive surfaces in contact and with the ends aligned to make the belt even and the joint thus formed was hot pressed at 225° F. under a pressure of 2000 pounds per square inch for two minutes.

The outer surface of the joint thus formed was then coated with a suspension of finely powdered graphite in the same cement that was used to form the joint in the proportion of 3 parts of the graphite to 97 parts of the solids content of the cement. Two coats of the cement containing the graphite were brushed onto the joint to completely cover the abrasive-free surface and also to extend approximately ⅛ inch over into the abrasive coated surface on each side of the joint. After drying, the cement containing the graphite was hot pressed to heat-harden the urea resin whereupon a very smooth and slippery surface was provided over the joint.

The belt thus made was mounted on a belt sanding machine provided with means for applying water to the workpiece and was tested in this wet operation. It was found that the joint was still satisfactory when the abrasive portion of the belt had become worn out. On belts made similarly except that no protective layer was applied in the one case and a protective layer of the resin without the graphite was applied in a second case the joint failed long before the abrasive portion of the belt had become useless.

Example IV

A belt was made as described in Example III except that the protective layer was formed by mixing pulverized talc with a liquid heat-hardenable phenol-formaldehyde condensation product which was heat-treated until it had become converted to the infusible insoluble condition.

Example V

A belt was made according to the method and using the compositions described in Example I except that mica dust was substituted for the graphite.

As is shown by the examples, our invention may be practiced in various embodiments and with various modifications. We have found that the exact amount of lubricant is not critical so long as sufficient is provided to reduce the friction of the protective layer to the point where it does not become heated when the belt is used and yet is not included in proportions sufficient to substantially reduce the hardness and toughness of the other component of the protective layer such as the glue or the synthetic resin.

As is shown by the examples, the invention is adapted to the production of abrasive belt joints made from different types of coated abrasive materials. It may also be used where the belts are made from various types of backing common in the art such as suitable cylinder paper or a combination of paper with cloth as well as with the drill cloth described in the specific claims.

Other modifications and embodiments of the invention may be practiced without departing

from the spirit of the invention, the scope of which is defined in the appended claims.

We claim:

1. In a method of making an abrasive belt the steps which comprise providing a strip of abrasive coated sheet material comprising a backing and a layer of abrasive grains attached to one side thereof by an adhesive, removing the abrasive grains from each end of the strip over an area which is substantially the same, applying an adhesive to one of the said areas, overlapping the ends of the strip, applying a finely divided lubricant and a liquid which is convertible to a hard tough solid to that portion of the outer surface of the article which is substantially devoid of abrasive grains, and hardening the cement and the said liquid.

2. A method as claimed in claim 1 wherein the lubricant is powdered graphite.

3. A method as claimed in claim 1 wherein the liquid applied to the outer surface comprises a suspension of powdered graphite in a solution of glue.

4. A method as claimed in claim 1 wherein the liquid applied to the outer surface comprises a suspension of powdered graphite in a heat-hardenable liquid resinous material.

5. A method as claimed in claim 4 wherein the heat-hardenable liquid resinous material is a urea-formaldehyde condensation product.

6. A method as claimed in claim 4 wherein the heat-hardenable liquid resinous material is a phenol-formaldehyde condensation product.

7. A method as claimed in claim 1 wherein the liquid is applied to the outer surface and the lubricant is applied over the top of the liquid surface.

8. A method as claimed in claim 1 wherein the cement is first hardened and the liquid containing the lubricant is applied and hardened thereafter.

9. An abrasive belt comprising a strip of abrasive coated sheet material provided with portions of substantially equal areas at each end which are substantially devoid of abrasive grains cemented together with the abrasive coated portion forming the outside of the belt, and a layer of hard tough material comprising a solid lubricant over that portion of the outer surface of the belt which is substantially devoid of abrasive grains.

10. An article as claimed in claim 9 wherein the hard tough material is glue.

11. An article as claimed in claim 10 wherein the lubricant is graphite.

12. An article as claimed in claim 9 wherein the hard tough material is a heat-hardened urea-formaldehyde condensation product.

13. An article as claimed in claim 12 wherein the lubricant is graphite.

14. An article as claimed in claim 9 wherein the hard tough material is a heat-hardened phenol-formaldehyde resin.

15. An article as claimed in claim 14 wherein the lubricant is graphite.

16. An article as claimed in claim 9 wherein the lubricant is graphite.

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