

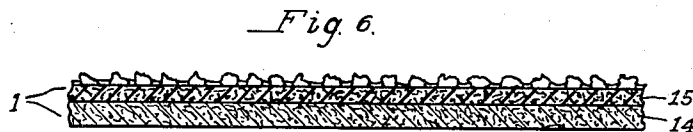
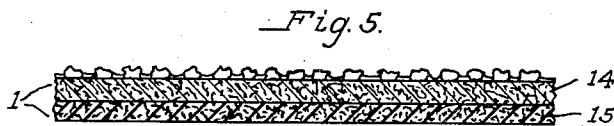
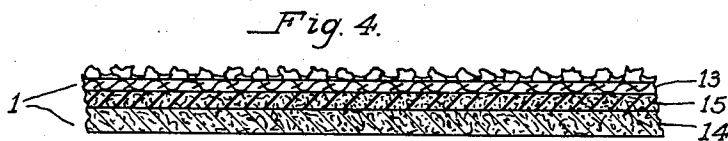
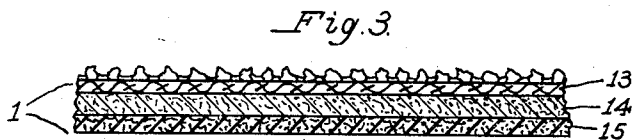
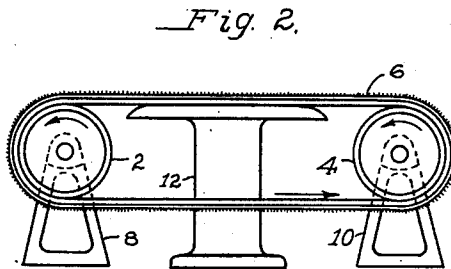
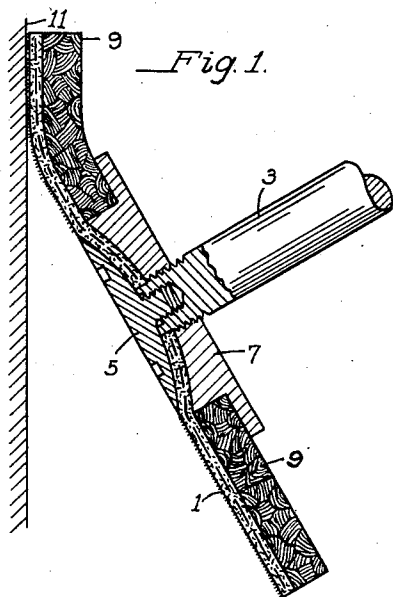
May 25, 1943.

H. P. KIRCHNER

2,320,139

FLEXIBLE ABRASIVE ARTICLE

Filed Jan. 23, 1941



INVENTOR.
HENRY P. KIRCHNER

BY

ReBerner
ATTORNEY.

UNITED STATES PATENT OFFICE

2,320,139

FLEXIBLE ABRASIVE ARTICLE

Henry P. Kirchner, Niagara Falls, N. Y., assignor
to Carborundum Company, Niagara Falls, N. Y.,
a corporation of Delaware

Application January 23, 1941, Serial No. 375,689

10 Claims. (Cl. 51-195)

This invention relates to abrasive articles having a flexible backing, such as abrasive discs for use in surfacing metals or abrasive belts for finishing table tops. One of the objects of the invention is to decrease the cost of abrasive articles of the kind referred to.

This application relates to the same subject matter as U. S. application Serial No. 245,465, filed December 13, 1938.

Although the invention is adapted to a number of embodiments, a principal field of application is to be found in the manufacture of abrasive discs for surfacing metals such as the panels of automobile bodies and the like according to the method described in U. S. Patent No. 1,558,714. This field of application of the invention is mentioned by way of illustration and not with the intention of limiting the field of usefulness of the invention.

In the case of abrasive discs used for surfacing metal bodies, the service required of the disc is severe. Vulcanized fiber has been favored for use as a backing material for the abrasive sheets because such backings stood up particularly well in comparison with backings made of most other commercially available materials. Although vulcanized fiber has many valuable properties as a backing for abrasive particles, such as its toughness for example, it is an expensive material to use in the thicknesses that are required for strong abrasive discs.

In accordance with the present invention, a layer of strong thick paper, such as kraft paper, is substituted for a portion of the vulcanized fiber. The improved disc is therefore in the general form of a triple layer in which the abrasive particles are bonded to a cloth support which in turn is strongly attached to a double layer composed of consecutive layers of kraft paper or the like and of vulcanized fiber or similar material. The invention is illustrated by means of the accompanying drawing in which:

Figure 1 is a partial section of a form of apparatus that has been employed in the use of the improved disc, the disc being shown in a typical position obtained in actual use;

Figure 2 is a side elevation of a sanding belt made in accordance with the invention;

Figure 3 is a partial transverse section of one of the improved discs;

Figure 4 is a similar section of a modification of the disc illustrated in Figure 3; and

Figures 5 and 6 are sections similar to that shown in Figures 3 and 4 of modified backings in which the cloth is omitted.

Referring to the drawing in more detail, one of the improved discs 1 made in accordance with the present invention is attached to a rotatable shaft 3 through pressure applied to the central portion of the disc by screwing the cap 5 onto the terminal portion of the shaft 3 so that the disc is squeezed against the backing element 7. The outer or working portion of the disc is yieldably supported by means of a pad 9 which is suitably attached to the backing element 7 and thereby to the shaft 3 to which the element 7 is fastened.

During the operation of the disc the shaft 3 is rotated by means not shown in the drawing and the abrasive-coated outer surface of the disc 1 is pressed against the workpiece 11 which is to be surfaced. In order to use the type of disc shown in Figure 1 of the drawing efficiently, it is necessary to apply them to the workpiece with considerable force and consequently the disc with its supporting pad 9 is subjected to rather severe stresses, both by reason of the pressure that is applied by the operator and by reason of the torque which is transmitted through the shaft 3 and which acts against the drag of the abrasive particles on the workpiece.

Heretofore, discs for use in this type of work have commonly been made using glue as the adhesive for attaching the abrasive particles to a backing of vulcanized fibre or of hydrated cellulose as described and claimed in a patent to Herbert R. Stratford, No. 1,684,748. Such discs have been very successful and millions have been made and used. Their average abrading life on a standard test is about 9 minutes during which they remove an amount of steel of the order of 140 grams. When heat hardenable synthetic resins are used as binders a disc of this character has a much longer abrasive life and removes a much larger amount of steel.

In Figure 2 there is shown a form of machine which is commonly employed in using endless abrasive belts. The machine comprises a driven pulley 2 which is caused to rotate by a source of power not shown in the drawing and a second pulley 4 which is driven by means of the abrasive belt 6. The pulleys are mounted on shafts carried in suitable bearings supported by the standards 8 and 10, respectively. A table 12 is usually provided to form a support for the belt at the part where the work is applied to the belt.

The backing sheets for the abrasive particles in the discs or belts described above can, in accordance with the present disclosure, be made of a triple sheet material such as is indicated in Figures 3 and 4. In the case of the backing

shown in Figure 3 the abrasive particles are attached by means of a suitable adhesive to a cloth support 13, which in turn is attached to a double layer composed of kraft paper 14 attached to the vulcanized fibre 15. The backing shown in Figure 4 is similar to that shown in Figure 3, except that the positions of the layers 14 and 15 are reversed. In the modifications shown in Figures 5 and 6, the abrasive particles are coated directly onto a paper and fibre backing without the use of a layer of cloth adjacent to the abrasive particles.

One way of making the type of sheet, illustrated in Figure 3, is to take a roll of kraft paper whose thickness is about 0.007 inch and a roll of vulcanized fibre of thickness about 0.005 inch and wind the paper and vulcanized fibre in such a manner that adjacent surfaces of the two layers are coated with liquid adhesive such as glue and then wound on a third roll with the paper and vulcanized fibre united by the adhesive into a single sheet in which the thickness of the combined layer is a little more than twice that of the layer of vulcanized fibre. After the adhesive has dried and hardened the resultant double layer is then similarly united with a layer of print cloth which is attached to the outside surface of the paper layer to form a triple layer such as the support for the abrasive particles shown in Figure 3. The print cloth surface is then wet with liquid adhesive by moving the sheet in contact with the upper surface of a roll whose lower surface moves through liquid glue. Abrasive particles are dropped on the coated cloth and the adhesive is dried to form a three-layer support with abrasive particles strongly attached to the outer cloth surface. A sizing layer can be subsequently coated on the abrasive particles to complete the abrasive sheet.

The abrasive sheet shown in Figure 4 can be made in a manner similar to that disclosed for the abrasive sheet illustrated in Figure 3.

A number of advantages result from the use of the three-ply combination, whose manufacture has just been described, in place of the two-ply backing previously used where the vulcanized fibre is the sole support for the abrasive-coated cloth. First the chemical treatment given vulcanized fibre results in a low folding-endurance, so that the substitution of a paper, with a relatively high folding-endurance, for part of the vulcanized fibre in the combination, increases the folding-endurance of the abrasive sheet combination materially.

Folding-endurance in various paper sheets is measured by subjecting a strip of the paper to be tested to a standard tension, e. g., 1 kilogram weight per centimeter width, while the strip is oscillated back and forth in contact with an edge of rectangular section. The number of oscillations which the strip can withstand before rupture is a measure of the folding-endurance.

In a combination as in Figure 3 where a thinner vulcanized fibre and kraft paper are used in place of thicker vulcanized fibre alone, there is a material reduction in cost due to the reduction in weight of vulcanized fibre used and due to the introduction of kraft paper which costs only a small fraction of the cost of vulcanized fibre. Further, since the abrasive sheet combination of Figure 3 uses a thin layer of vulcanized fibre plus a layer of strong kraft paper with a strengthening adhesive layer between the layers, it is stronger than the vulcanized fibre alone and therefore permits the use of a cheaper print

cloth without too much reduction in strength. This is best illustrated by the following table:

	Backing with no adhesive coating	Weight in pounds for 330 sq. ft. of backing	Strength in lbs. per in.	
			Lengthwise	Transverse
5	Backing previously used—Bottom—.010" vulcanized fibre. Top—heavy cloth drill 2.12 yds. per lb., cloth 39" wide.	57	300	160
10	Backing of Fig. 3—Bottom—.005" vulcanized fibre. Middle—.007" kraft paper. Top—Light print cloth 5.4 yds. per lb. cloth 39" wide.	45	261	143

This table illustrates that although my new combination backing is 12 pounds lighter for the area given (330 sq. ft.) and uses a much cheaper cloth and much less of the expensive vulcanized fibre, the strength of the combination is not materially reduced.

In place of the vulcanized fibre used in these new abrasive sheet combinations, other equivalent papers, made from fibres highly hydrated by chemical means or prolonged mechanical treatment, may be used. As examples, parchment paper illustrates a cellulosic product which has been highly hydrated by the action of sulfuric acid on the fibres; a similar product can be made by hydrating pulp fibres by prolonged mechanical beating, i. e., the pulp has been beaten on the order of 8 to 40 hours, this beating usually being carried out under light beater roll pressure to prevent excessive cutting of the pulp fibres while developing the hydrated condition. In place of the kraft paper other papers, containing fibres which have not been highly hydrated by chemical means or prolonged mechanical treatment, may be used. The customary beating to break up the pulp and to develop a slight degree of hydration (consistent with proper behavior of the pulp on the paper machine) is sufficient for the purpose of the present invention. The thickness of the papers may vary, but it is preferable that the cheaper, not highly hydrated, paper should be as thick or thicker than the more expensive paper.

Thus considerable variation is possible in the components of the backing without departing from the invention which is defined within the compass of the following claims.

I claim:

1. A flexible abrasive sheet comprising a layer of abrasive particles adhesively secured to a composite backing formed successively of a layer of cloth, a layer of kraft paper in which the cellulosic fibres are relatively slightly hydrated, and a base layer composed of compressed cellulosic fibres that have been highly hydrated, the layer of paper being substantially thicker than the layer of highly hydrated cellulosic fibres and the successive layers being united by means of hardened adhesive.

2. An abrasive disc for the surfacing of metal surfaces such as automobile bodies, said disc having a backing for the abrasive particles composed successively of a layer of light print cloth attached to the abrasive particles, a layer of strong kraft paper about a hundredth of an inch thick adhesively attached to the cloth layer, and a layer of vulcanized fibre substantially thinner

than the kraft paper and adhesively attached thereto.

3. An abrasive disc for the surfacing of metal surfaces such as automobile bodies, said disc having a backing for the abrasive particles composed successively of a layer of light print cloth adhesively attached to the abrasive particles, a layer of strong kraft paper adhesively attached to the cloth layer, and a layer of vulcanized fibre substantially thinner than the kraft paper and adhesively attached thereto, said backing having a longitudinal tensile strength in excess of 200 pounds per inch and a transverse strength in excess of 100 pounds per inch.

4. A flexible abrasive article comprising a layer of abrasive particles adhesively secured to a composite backing composed successively of a layer of cloth, a layer of paper in which the cellulosic fibres are relatively slightly hydrated, and a layer of compressed cellulosic fibres that have been highly hydrated, the successive layers of the backing being strongly united by means of hardened adhesive.

5. A flexible abrasive article comprising a layer of abrasive particles adhesively secured to a composite backing formed of a layer of cloth, a layer of paper in which the cellulosic fibres are relatively slightly hydrated, and a layer of compressed cellulosic fibres that have been highly hydrated, the thickness of the layer of slightly hydrated paper constituting a substantial proportion of the combined thickness of paper and highly hydrated fibres.

6. A flexible abrasive article comprising a layer of abrasive particles adhesively secured to a composite backing composed of a layer of cloth, a layer of highly hydrated cellulosic fibres, and

a layer of paper in which the cellulosic fibres are relatively slightly hydrated, the layers being united by means of hardened adhesive.

7. A flexible abrasive article comprising a layer of abrasive particles adhesively secured to a composite backing composed of a layer of highly hydrated cellulosic fibres and a layer of relatively slightly hydrated cellulosic fibres, the two layers having thicknesses of the same order of magnitude.

8. A flexible abrasive article in which the abrasive particles are attached by means of hardened adhesive to a backing composed of a layer of cloth, a layer of vulcanized fibre, and a layer of cheap, strong paper, the layers being united by means of hardened adhesive.

9. A flexible abrasive article comprising a layer of abrasive particles secured to a composite backing composed successively of a layer of cloth, a layer of compressed cellulosic fibres that have been highly hydrated, and a basic layer of strong paper in which the cellulosic fibres are relatively slightly hydrated, the last-mentioned layer being substantially thicker than the intermediate layer and the successive layers being united by means of hardened adhesive.

10. An abrasive disc for the surfacing of metal surfaces such as automobile bodies, said disc having a backing for the abrasive particles composed successively of a layer of light cloth attached to the abrasive particles, a layer of vulcanized fibre attached to the cloth layer, and a layer of strong kraft paper adhesively attached to the vulcanized fibre, the paper layer being substantially thicker than the layer of vulcanized fibre.

HENRY P. KIRCHNER.