Feb. 15, 1938. R. C. BRYANT 2,108,645

MANUFACTURE OF FLEXIBLE ABRASIVE ARTICLES

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Fig. 8.

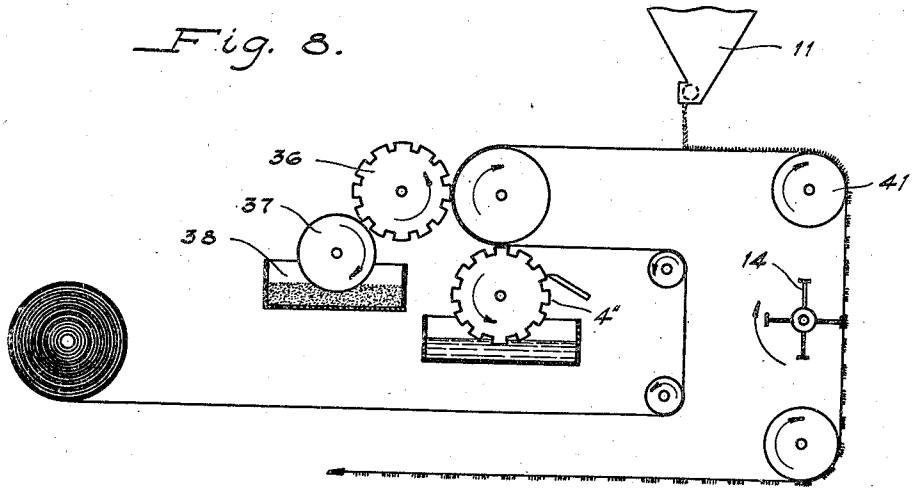


Fig. 9.

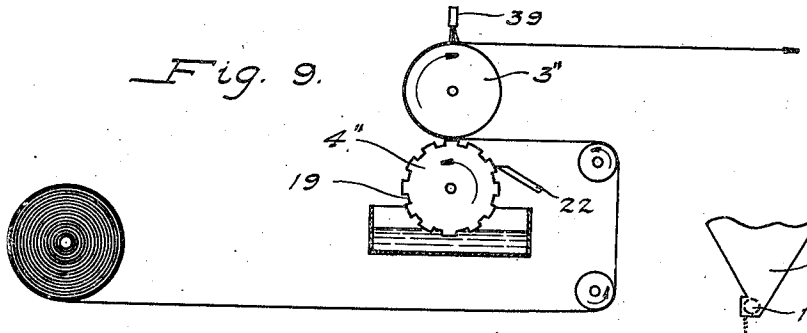
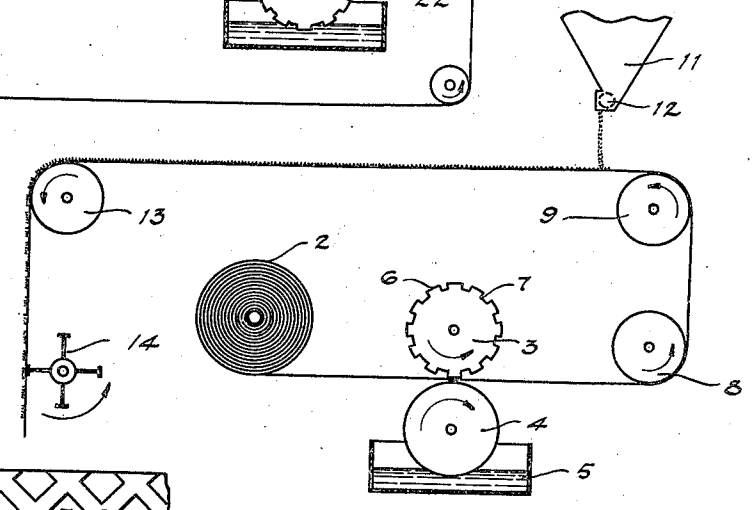


Fig. 1



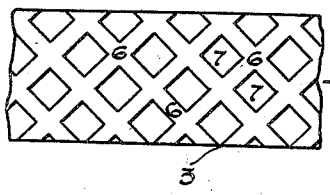


Fig. 1-A

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MANUFACTURE OF FLEXIBLE ABRASIVE ARTICLES

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Fig. 2.

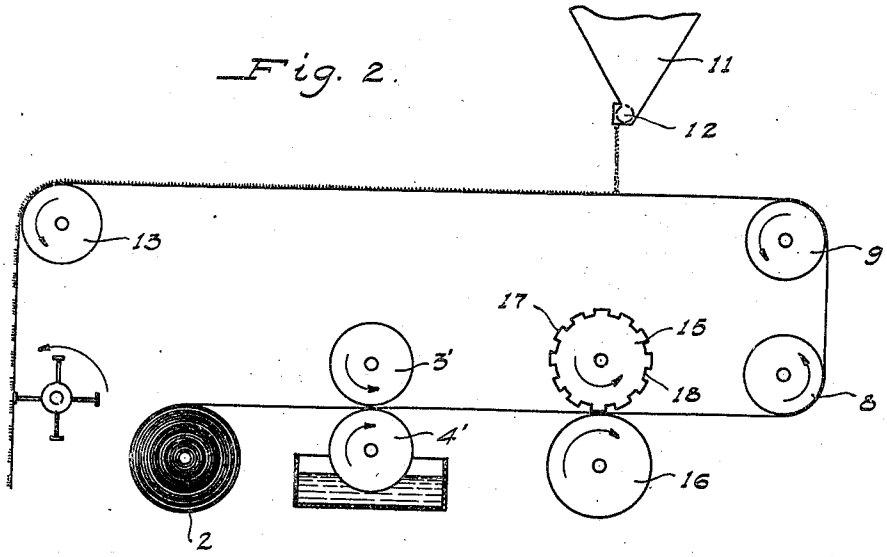
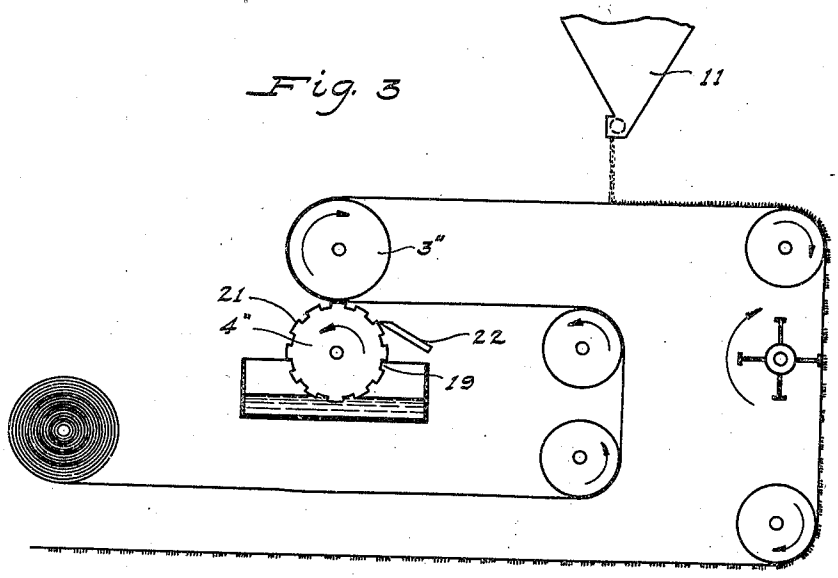


Fig. 3



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MANUFACTURE OF FLEXIBLE ABRASIVE ARTICLES

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Fig. 4.

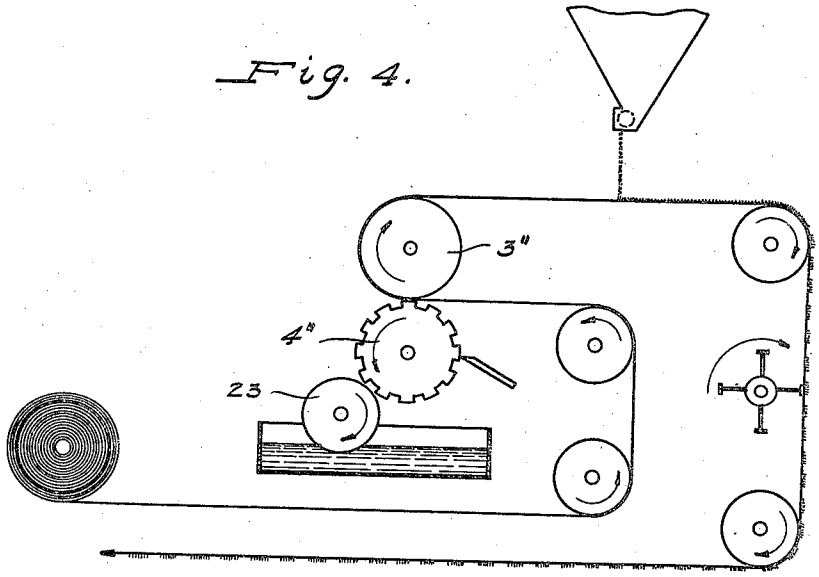
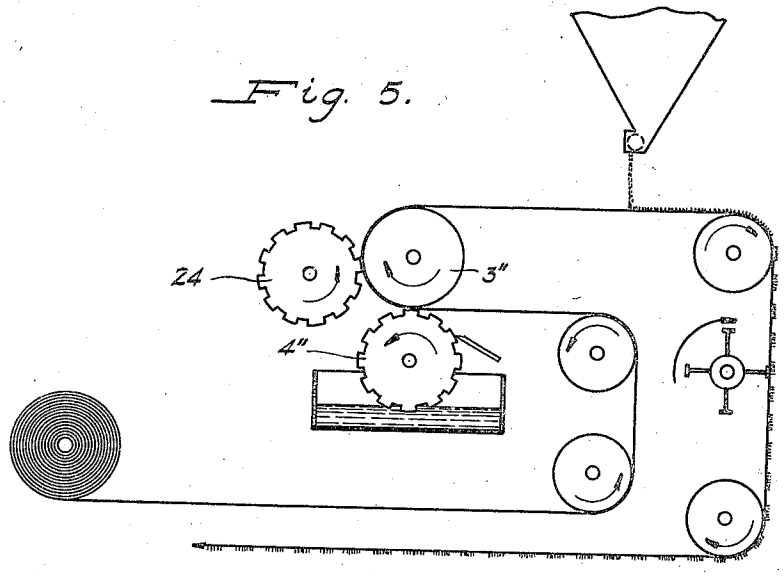


Fig. 5.



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MANUFACTURE OF FLEXIBLE ABRASIVE ARTICLES

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Fig. 6.

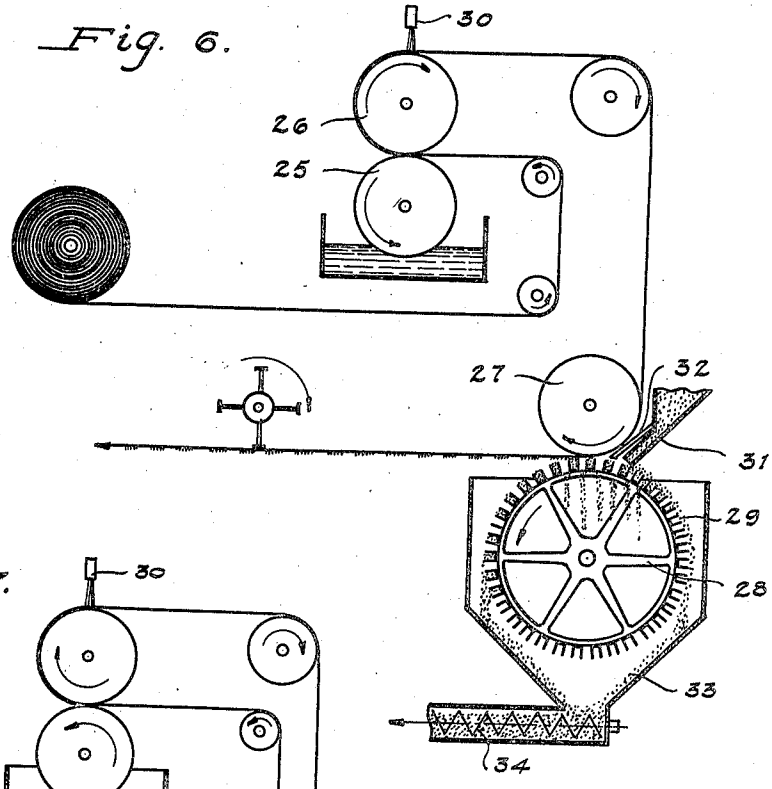
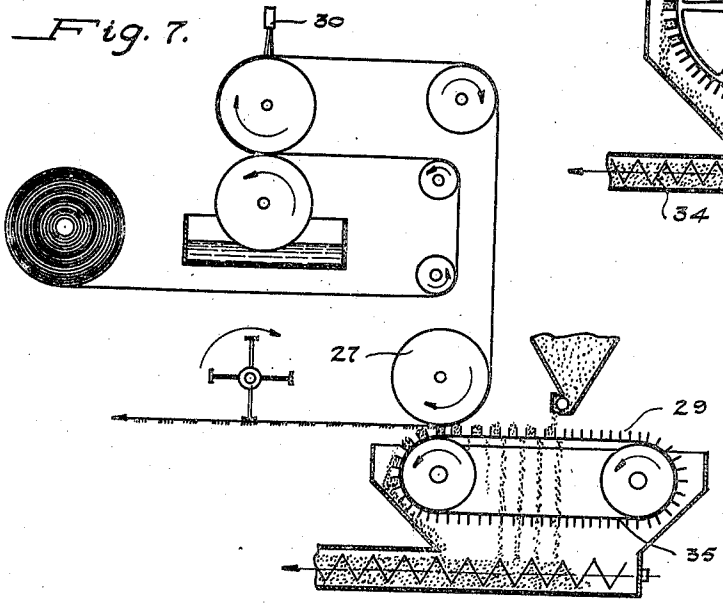


Fig. 7.



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UNITED STATES PATENT OFFICE

2,108,645

MANUFACTURE OF FLEXIBLE ABRASIVE ARTICLES

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Application March 18, 1933, Serial No. 661,629

3 Claims. (Cl. 91—68)

This invention relates to the manufacture of flexible abrasive articles with intermittent or discontinuous coatings and relates particularly to improved methods of producing such flexible abrasive articles with intermittent coatings of more definite pattern and of more uniform character than is provided by present commercial practice.

The article which it is desired to produce by my improved methods should be distinguished from "open-coated" abrasive articles in which abrasive grain is distributed on an adhesively coated backing in such a manner that the spaces between the abrasive granules are comparatively large as compared with the ordinary close-coated abrasive fabric. In my improved flexible abrasive articles there are areas of coated abrasive with interspersed areas which are slightly coated with abrasive or which are substantially uncoated with abrasive grain. As compared with the ordinary open-coated flexible abrasive articles the more densely coated abrasive areas of my improved article are more resistant to the shearing stresses exerted by the work than are the individually supported abrasive granules of the ordinary open-coated abrasive fabric. The interspersed open areas in my improved abrasive fabric are useful in preventing the accumulation of debris in the denser abrasive areas of the abrasive fabric. As compared with open-coated abrasive fabric the type of abrasive fabric to which this invention relates may be called intermittently or discontinuously coated abrasive fabric.

According to the present invention, the open-coated effect is obtained by a change in the method of putting the adhesive on a travelling fabric, in contrast to the methods which have been previously employed for an analogous purpose, such as changing the amount of grain projected on the travelling fabric per unit time or changing the speed of the travelling fabric.

As an example of a type of method which has been used to form intermittently coated abrasive fabric, an adhesively coated sheet of fabric has been passed under a hopper from which abrasive granules fall in a thin sheet, while a perforated mask permits abrasive granules to fall on certain portions only of the travelling sheet. With such apparatus, the tendency is to form heaps of multi-layered abrasive under the perforations in the mask. Thick coatings of sizing are needed to hold the upper layers of abrasive. The abrasive article thus formed is stiff and does not have the flexibility desirable in intermittently coated abrasive fabric.

My improved method of manufacture of intermittently coated abrasive fabric is illustrated by the accompanying drawings in which:

Figure 1 shows in elevation apparatus for providing fabric with an intermittent coating of adhesive and a subsequent coating of abrasive;

Figure 1A is a fragmentary view showing a portion of the peripheral surface of the embossed or engraved roll in Figure 1;

Figure 2 shows a modification of the apparatus shown in Figure 1, in which modification the fabric is first given a uniform coating of adhesive which is subsequently made discontinuous;

Figure 3 shows a modification of the apparatus indicated in Figure 1 differing from the latter in that the liuqid adhesive is transported to the fabric by means of an engraved or embossed roll instead of a smooth roll;

Figure 4 shows coating apparatus differing from that indicated in Figure 3 in that the engraved roll is supplied with adhesive from a smooth roll which contacts with the main supply of adhesive;

Figure 5 shows coating apparatus differing from that indicated in Figure 3 by the use of a supplementary roll which impresses a second adhesive pattern on the fabric;

Figure 6 shows in elevation apparatus for printing adhesively coated fabric with a pattern formed of abrasive grain;

Figure 7 differs from Figure 6 in the substitution of a belt for carrying abrasive grain into contact with the fabric;

Figure 8 illustrates apparatus differing from that of Figure 3 by the addition of supplementary means to prevent coating of certain portions of the fabric with abrasive grain; and

Figure 9 illustrates a method of applying a controlled quantity of adhesive to a sheet in a pattern which is later smoothed out into a coating of substantially uniform thickness by means of a brush.

Referring to the drawings in detail, the roll 2 in Figure 1 contains a supply of paper or cloth to be coated. The material to be coated is referred to generally in this application as fabric. The fabric is drawn between a pair of rotating rolls 3 and 4. The rotating roll 4 has a smooth surface which receives a film of liquid adhesive from a supply 5. The roll 3 is provided with a pattern, depressed portions of which are shown at 7 in Fig. 1. As the fabric passes between the rolls 3 and 4, liquid adhesive is transferred to the lower side of the fabric but not in a uniform coating. The outer portions 6 of the roll 3 press

out the adhesive from those portions of the fabric surface which lie opposite to said outer portions 6 of the roll 3. Portions of the fabric surface which come opposite depression 7 (as they pass between the rolls 3 and 4) will receive adhesive from the smooth surface of the roll 4. The fabric receives, therefore, areas of liquid adhesive whose outlines correspond to those of the depressions 7 indicated in Figure 1A. The areas corresponding to the continuous areas 6 (indicated in Figure 1A) have only a small thickness of liquid adhesive on account of the pressure exerted by the projections 6 during the coating interval. After passing between the rolls 3 and 4 the coated side of the fabric is brought above the uncoated side by means of the rolls 8 and 9 so that abrasive grain can be dropped on it from a hopper 11. A rotating member 12 positioned at the outlet of the hopper releases the grain in a falling sheet which impacts on the travelling fabric. The coated fabric is brought into a vertical plane as it passes the roll 13. Grain that has fallen on the areas thickly coated with adhesive is largely retained, while grain that has fallen on the areas which are very thinly coated with adhesive falls off to a large extent, this action being assisted by the beater 14 which helps to remove the granules which are more lightly held. The intermittent character of the abrasive coating thus obtained is indicated in the portion of the fabric that has passed the roll 13 in a downward direction in Fig. 1. The fabric then passes to a drier in which the liquid adhesive is hardened. A sizing coating of adhesive can be given subsequently to reinforce the attachment of the abrasive grain to the fabric.

The apparatus shown in Figure 2 is similar to that shown in Figure 1 except that the fabric receives a coating of liquid adhesive on its passage between smooth rolls 3' and 4' the latter of which dips in the lowest part of its travel into a vessel containing liquid adhesive. The travelling fabric thus receives a comparatively uniform coating of adhesive on its lower side. This coating of adhesive is shortly thereafter made non-uniform by the passage of the fabric between the smooth roll 16 and the embossed or engraved roll 15. In the abrasive-coated article finally obtained, the intermittent coating depends on the character of raised surface of the roll 15. The raised portions 17 of this roll produce bare spots on the flexible abrasive article and the depressions 18 on the other hand produce abrasive-covered areas.

The apparatus shown in Figure 3 is similar to that shown in Figure 1 except that the lower roll of the pattern-forming pair is engraved instead of the upper roll. The depressions 19 produce abrasive-coated areas in the resultant product and the raised portions 21 produce bare spaces in the resultant product. The fabric is printed with a glue pattern in a manner somewhat analogous to the process used in engraved printing. In the latter process however, the paper surface receives no ink outside of the printed letters. In the applicant's process liquid adhesive is squeezed from some portions of the surface of the fabric on to other portions. A scraper 22 can be used to regulate the thickness of the coating of adhesive more particularly on the raised portions of the engraved roll.

The apparatus illustrated in Figure 4 differs from that illustrated in Figure 3 in that the roll which transports liquid adhesive to the fabric does not dip into a container which holds a supply of liquid adhesive. The smooth roll 23 takes adhesive from the container during its rotation and transfers it to the engraved roll 4'' which in turn transmits adhesive to the fabric.

The apparatus illustrated in Figure 5 is similar to that illustrated in Figure 3 as far as the impression of the primary adhesive pattern is concerned. An additional roll 24 having a second pattern is used to press adhesive from other areas on the fabric. For example, the engraved roll 4'' which dips in the liquid adhesive is provided with parallel raised portions while the roll 24 is provided with other parallel raised portions which cut across the primary adhesive pattern which has just been formed and form a secondary adhesive pattern.

In the apparatus shown in Figure 6, the travelling fabric receives a coating of adhesive on one side from the rotating roll 25 acting in conjunction with the dry counter or calender roll 26. The adhesive coating thus received by the fabric is comparatively uniform in thickness. This uniformity is enhanced by the action of the brush 30. The fabric then passes between a smooth roll 27 and a rotating member 28 which carries a series of pockets 29. As these pockets near their uppermost positions they are supplied with abrasive from a hopper 31. The heaps of abrasive grain received from the hopper into the pockets are reduced to the desired extent by means of a scraper 32. The abrasive grain in the pocket which has just been levelled comes next into contact with the fabric under the center of the roll 27. The fabric thus becomes intermittently coated in accordance with the distribution of pockets on the rotating member 28. The abrasive-coated fabric then passes on to the drier where the adhesive is hardened. As the pocket 29 continues its rotation from its highest position it is cleared of abrasive by the action of gravity. The falling grain is received in a container 33 and is removed by a rotating screw member 34 or by a travelling belt and retained for further use.

The apparatus illustrated in Figure 7 is similar to that illustrated in Figure 6 except that a travelling belt 35 takes the place of the rotating member 28. With the apparatus shown in Figure 7 it is possible to fill the pockets 29 to a higher level with abrasive since the belt travels horizontally from the hopper to the contact with the roll 27.

The apparatus illustrated in Fig. 8 is similar to that illustrated in Figure 3 except that further provision is made to prevent abrasive grain from sticking to portions of the fabric which it is desired to keep free from grain. This further provision is to be found in the engraved roll 36 and the smooth roll 37 which last-mentioned roll transports talcum powder from a container 38 to the raised portions of the roll 36. The roll 36 is provided with a pattern of raised parts and depressions which correspond closely to those on the roll 4''. The driving apparatus for the roll 36 is timed so that talcum is deposited on those portions of the fabric from which adhesive has been pressed by the roll 4''. When the adhesively coated fabric comes under the hopper 11 the grain which falls on the talcum coated areas is easily removed after it passes the roll 41 by gravity and the action of the beater 14.

My improved intermittently coated abrasive fabric has many advantages. The need for flexible abrasive fabric is shown by the attempts which have been made to produce flexible abrasive fabric by bending it successively over rods

or bars of small diameter. This procedure breaks the binder along a series of parallel lines. These flexing operations weaken the adhesive layer and often cause peeling. This is especially the case with heavy abrasive materials such as floor-sanding abrasive fabric. With my improved intermittently coated abrasive fabric it not necessary to resort to these flexing operations if suitable patterns are used on the embossed rolls which I have disclosed and if the thickness and viscosity of the adhesive coating are properly regulated.

Instead of square or rectangular abrasive areas I can use diamond-shaped abrasive areas which have the general form of a rhombus, the long diagonal of the rhombus making an angle of 25°–30° with a side of the rhombus. Abrasive fabric having abrasive areas of this type is naturally flexible along the bare channels that separate the abrasive areas.

Any suitable driving means may be used for rotating the various rolls and the fabric in contact therewith. A series of electric motors whose speed can be changed in unison or individually is desirable for this purpose. Some of the rolls whose purpose is to change the direction of the fabric can be mounted to turn freely around their supporting shafts while the latter are mounted in slots in a resilient manner so that lateral motion of the shafts is possible. In this manner sudden strains in the fabric are reduced. Suction drums are used in contact with the fabric where they are necessary for facilitating continuous regular movement of the fabric. In the case of the opposed rolls, such as 3 and 4, either roll can be the driving member while the other roll is mounted to rotate freely on its supporting shaft or both rolls can be rotated in opposite directions by synchronous driving means.

The apparatus indicated in Figure 9 may be used to control the quantity of adhesive which is applied to a given area of fabric. This quantity is varied, for example, by varying the depth and the area of the recesses 19. Adhesive is scraped from the raised portions of the roll 4'' by means of the scraper 22. The use of this scraper is however optional. The fabric is printed with the adhesive pattern of controlled thickness as it passes between the rolls 4'' and 3''. The fabric with its intermittent coating of adhesive is subjected shortly thereafter to the action of a brush 39 which smooths out the adhesive coating so that it becomes substantially uniform in thickness. This uniform coating of adhesive can then be given a coating of abrasive which is held to the fabric by means of a more uniform coating of adhesive than is ordinarily obtainable. The importance of this result lies in the fact that customers frequently request abrasive fabric of a grade similar to that which they have purchased on a previous occasion. By using similar paper an adhesive together with an engraved (or embossed) roll of the same character that was used in producing the preferred product, duplication of this desired product is made possible.

Again by giving the embossed roll (4'' in Figure 3 or in Figure 9) a pattern with a small "mesh", that is, a pattern with small depressed areas, I am able to obtain an adhesive pattern of correspondingly small adhesive areas on the fabric. The "dots" of adhesive retain one or more coarse abrasive grains such as 16 grit, the area of the adhesive being only large enough to retain a very small number of granules. The raised portions of the engraved roll can be made of such dimensions that the distances between the little islands of abrasive are large or small. In this way I am able to make abrasive sheets having a controlled open coating. Such sheets have superior abrasive qualities since they do not become clogged so readily with the debris which results from abrasive operations.

The rolls having irregular surfaces can be made by various methods such as engraving, embossing, knurling, attaching strips of various materials to the surface of the roll or any other feasible means by which a patterned roll can be constructed. I do not wish to limit myself to any particular material in the construction of the roll.

The shape of the adhesive patches can be controlled by varying the shapes, sizes and depths of the depressions in the engraved or embossed roll. For example, one side of the pocket may be deeper than the other. The pockets may differ among themselves in depth and contour, so that the patches of adhesive on the fabric can be made to vary among themselves according to a predetermined pattern.

In the manufacture of abrasive disks by a method involving the apparatus described above only the portions which are to be cut out need to be coated with adhesive, thus effecting economy in the adhesive and abrasive used.

While my improved apparatus can be embodied in various ways my invention is described within the compass of the following claims.

I claim:

1. The method of manufacturing intermittently coated abrasive fabric which comprises giving one surface of the fabric a substantially uniform coating of adhesive, then squeezing the adhesive from portions of said surface which it is desired to have free from abrasive, then projecting abrasive grain onto the surface thus intermittently coated with adhesive, and thereafter hardening the adhesive.

2. The method of manufacturing intermittently coated abrasive fabric which comprises applying a thin coating of liquid adhesive to one face of a fabric, then after a short interval pressing out the adhesive from certain areas in a pattern which is indefinitely repeated on the surface of the fabric, dropping finely divided abrasive on the unevenly coated adhesive surface, and removing abrasive particles from the less adhesive portions of the surface thus treated.

3. The method of manufacturing intermittently coated abrasive fabric which comprises applying a thin coating of liquid adhesive to one face of a fabric, then after a short interval pressing out adhesive along a plurality of series of parallel strips, said strips extending across the fabric and the strips of one series intersecting the strips of any other series, then dropping finely divided abrasive on the unevenly coated adhesive surface, and removing abrasive particles from the less adhesive portions of the surface thus treated.

4. The steps in the method of making a flexible abrasive coated article having distributed abrasive and non-abrasive areas which comprise applying adhesive to one side of a fabric and simultaneously impressing the opposite side of said fabric with localized pressures to form a patterned adhesive coating, and distributing abrasive granules on the patterned side of the fabric.

5. The steps in the method of making a flexible abrasive coated article having regularly distributed abrasive and non-abrasive areas which comprise applying adhesive to one side of a fabric

and simultaneously impressing the opposite side of the fabric with localized pressures applied toward the areas which are to be non-abrasive, and distributing abrasive granules on the patterned side of the fabric.

6. The steps in the method of making a flexible abrasive coated article having distributed abrasive and non-abrasive areas, which steps comprise passing a web so that the surface elements of one side of the web contact successively with a source of adhesive supply on a rotating cylinder and subjecting the web to localized pressures produced by an engraved cylinder that presses partly of the web against the adhesives coated cylinder and which leave said side of the web coated with a pattern of adhesive in substantially the same fluid condition as the adhesive supplied, distributing abrasive particles over the side of the web that has the adhesive pattern, hardening the adhesive, and removing abrasive from the portions of the web which have been subjected to localized pressures and to which the abrasive particles are consequently not strongly attached.

7. The steps in the method of making flexible articles intermittently coated with abrasive grains which comprise applying adhesive to the surface of the fabric to be coated with abrasive grains, pressing the adhesive away from predetermined portions of said surface by localized pressure applied to the surface of the fabric opposite to that which is to be coated with abrasive grain at points corresponding to those at which the abrasive coating is to be interrupted, and distributing abrasive particles on the side of the fabric that has been intermittently coated with adhesive.

8. In the method of making flexible articles intermittently coated with binder and attached abrasive particles and produced by the formation of an adhesive pattern on a traveling web with subsequent distribution of abrasive particles on the same side of the web followed by removal of excess abrasive and the hardening of the adhesive, the step of pressing the adhesive away from predetermined portions of said surface by localized pressure applied to the surface of the fabric opposite to that which is to be coated with abrasive grain at points corresponding to those at which the abrasive coating is to be interrupted.

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