Sept. 17, 1968 A. MORA 3,401,490

PROCESS FOR MANUFACTURING RESILIENTLY YIELDING BASES PROVIDED WITH ABRASIVE SURFACES AND PRODUCT THUS OBTAINED

Filed March 24, 1965

FIG. 1

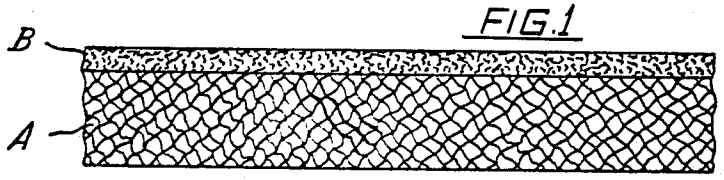


FIG. 2

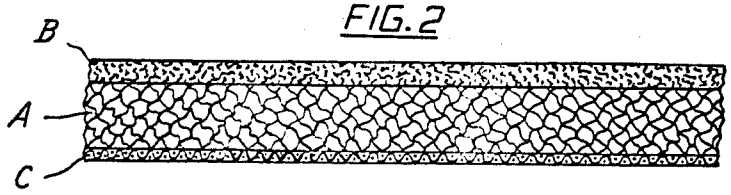


FIG. 3

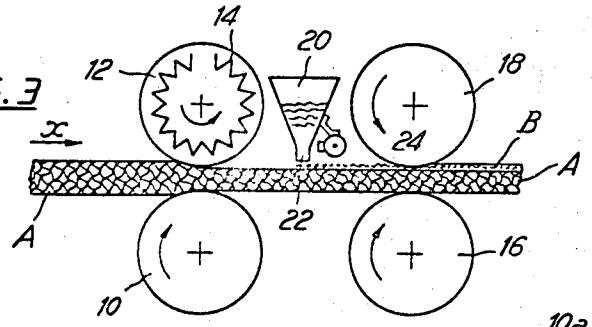


FIG. 4

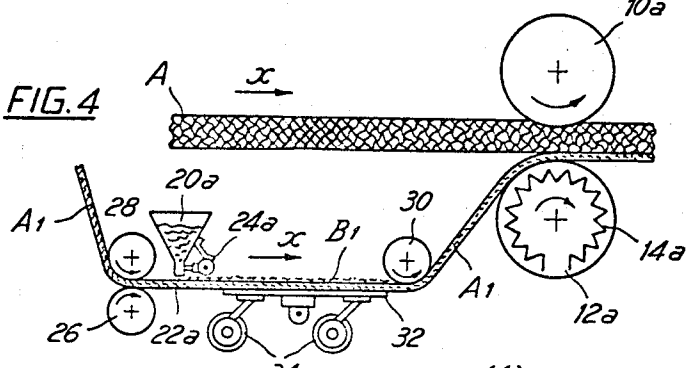
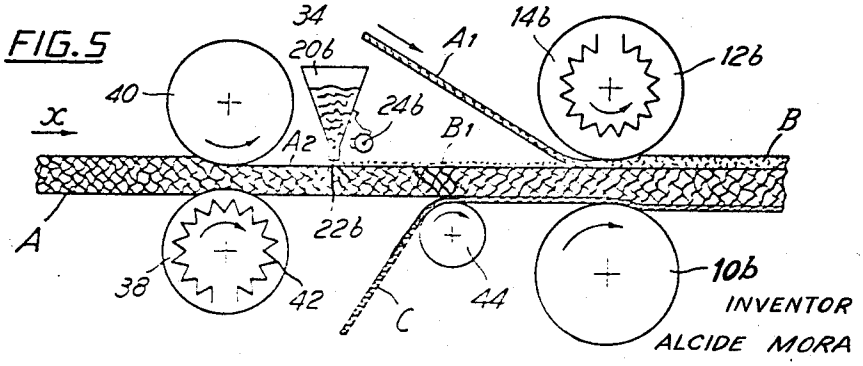


FIG. 5



INVENTOR
ALCIDE MORA

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Alcide Mora, Via Genova 5,
Varedo, Milan, Italy

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ABSTRACT OF THE DISCLOSURE

A method for forming an abrasive article wherein a resiliently yielding open cellular meltable base is passed under a heated roll to melt the surface of the base to a desired depth, and then abrasive particles are distributed over the melted surface and partially embedded therein, so that upon cooling the particles are held in said surface.

This invention relates to a method of forming, on a cellular resiliently yielding base, abrasive surfaces of the desired grain size; this invention also concerns the abrasive article or product obtained by said method and the apparatus performing said method.

For certain industrial work and home uses it is necessary to polish, smooth or clean metal surfaces using abrasives also in the presence of suitable liquids acting as lubricants, detergents and coolers to remove and rub away from the surface being worked the material removed and the abrasive detached from the base. This work is usually carried out by using an abrasive secured by means of binders on a paper or fabric base. These known products have serious drawbacks due to the difficulty of assuring a firm connection and anchorage of the abrasive grains to the base. Even using a very good quality binder the anchorage of the abrasive is precarious and risky because the abrasive base is deformed in use to conform it to the surface being worked. As a consequence, there is a loss of abrasive which still retains very good abrasive qualities.

The above drawbacks are further aggravated when the abrasive product must be used in the presence of detergent, lubricant, solvent or even cooling liquids, the use of special binders being needed in such a case.

An object of this invention is to provide an abrasive product which is resistant to mechanical stresses, flexible and resiliently yielding so as to enable it to uniformly follow even irregular or discontinuous surfaces. Another object of the invention is to provide an abrasive product which can be used in the presence of liquids of any kind even if they have a high temperature without losing its abrasive properties and also performing on the abrasive, during the work, a cleaning and detersive action to remove the rubbed off material from the surface. Moreover, it makes it possible to work easily irregular, uneven or sunken surfaces.

The method according to the invention in which a base of a resiliently yielding cellular material holds the abrasive, comprises superficially melting said cellular base, applying and incorporating the powdered abrasive material, in the melted layer.

For the purpose of assuring the superficial stratification of the abrasive material, the latter is arranged and spread in the structure of a covering also having a cellular structure which is melted so that the abrasive material is held and incorporated into said melted material and fixedly secured to the base.

The abrasive product obtained by the above set forth method comprises a base including at least one member of a resiliently yielding cellular material one face of which incorporates an abrasive layer.

This concept in practice can originate numerous embodiments all of which fall within the scope of the invention, e.g. said abrasive product could be suitably reinforced, for instance, with a fabric when flexible and limitedly stretchable products are desired; or said reinforcement could be constituted by stiff materials such as wood, metals, resins and the like so as to form rigid supports which hold the abrasive by the aid of an intermediate resilient layer depending on the requirements imposed by the type of use of the produce made according to the method under consideration.

The invention will now be disclosed in the following description with the aid of the accompanying drawing which makes reference to some embodiments according to this method wherein:

FIGURES 1 and 2 diagrammatically show, on an enlarged scale, the sectional views of two embodiments of the product obtained using the method according to the invention;

FIGURES 3, 4 and 5 diagrammatically show in elevation some embodiments of the apparatus suitable to carry out said method.

Turning to FIGURE 1, the article according to the invention comprises a cellular base A, one face of which holds abrasive material B; base A in the case illustrated, is a resiliently yielding cellular material, for example, a foamed polyurethane resin, preferably of an open-cell type, with cells of small size as hereinafter set forth.

Abrasive layer B comprises powders such as powdered emery, boron carbide or, in general, silicates used, in a known way, as abrasives. Said powder will be of a desired grain size, depending on the required use and is incorporated and secured, as hereinafter set forth, to one or both of the faces of base A to constitute an abrasive layer of a desired thickness.

Turning now to the modification shown in FIGURE 2, the abrasive product is like that of FIGURE 1, however, cellular base A has at its face opposite abrasive layer B, a reinforced member C formed, for instance, by a fabric. The reinforcing member can be of a flexible but limitedly stretchable type, or of a rigid type, and in this latter case, it may be made of a metal, resin or the like so that abrasive layer B is held by a resilient cushion formed by base A. In both cases this is very useful when the product according to the invention is used on polishing, smoothing or glossing machine tools and the like.

The product above set forth is obtained using the apparatus shown in FIGURE 3 which has a first pair of rollers **10**, **12** of which the upper is provided with a heater **14** formed, for instance, by a thermo-electric resistance that heats said roller to a suitable temperature. In combination with the pair of rollers **10**, **12**, a second pair of cylinders **16**, **18** is provided which act as calendering rollers exerting on the material being worked a pressing and levelling action; moreover, said pair gives a feeding motion to said material and to said end, a part of the rollers under consideration is kinematically connected to respective power means to impart the desired speed to the material. Between rollers **12** and **18** a hopper **20** containing powdered abrasive material is arranged, which hopper at its bottom has a nozzle **22** combined with a dispensing member **24** which regulates the supply of abrasive so that the latter be placed on the cellular base A as a uniform and regular layer.

Depending on the features of this apparatus, the method according to the invention is carried out as follows: cellular base A in the form of a continuous band is fed through a pair of feed rollers, not shown, between the pair of rollers **10** and **12** when said material comes into contact with heated roller **12** it melts superficially to a desired depth depending on the feeding speed and heating temperature. Before this melted layer solidifies the abrasive

material is spread and deposited on this melted layer as the abrasive flows out from nozzle **22** in the desired amount so that said material penetrates for a certain depth into the layer wherein it is retained. The action of penetration of the abrasive material into the melted layer can be increased by means of vibrations imparted to base A and said abrasive is pressed into the melted layer by passing base A between the next pair of rollers **16, 18** thereby resulting in a base A provided with an abrasive layer B. This layer, when cooled, has substantially the same features of the material of cellular base A, which has a certain natural resilience which allows the abrasive material to project more or less from the melted surface during the use of the abrasive product.

The apparatus illustrated in FIGURE 4 is a modification intended to obtain an abrasive product layer B of which can have a notable thickness in which the powdered abrasive is evenly distributed. Also said modified apparatus has a pair of rollers **10***a*, **12***a*, the latter of which is provided with heating means **14***a* which in the case illustrated, is placed underneath for the reasons which will now be set forth. The method according to this modification, uses in combination with the cellular base A, a layer A_1 of cellular material of an aperture thickness to form a covering which covers and holds the abrasive powder applied on and incorporated into base A. Sheet A_1 constituting a top member is carried to pass through a pair of driving rollers **26, 28** and conveying along a straight path defined, besides by said pair of rollers, also by an idle roller **30**. In this straight path a hopper **20***a* is arranged that comprises a dispensing nozzle **22***a* and a table **32**, combined with a vibrator **34**, is provided underneath sheet A_1 for the purposes which will be now set forth. Downstream idle roller **30**, two rollers **10***a*, **12***a* are placed between which both elements A and A_1 are passed. The covering A_1 after having left the pair of rollers **26, 28** receives, while running past the dispensing nozzle **22***a* during its forward movement in the direction of arrow *x*, a certain amount of powdered abrasive which forms a layer of a given thickness. During said forward motion, covering A_1 with the abrasive passes on abrasive is caused to penetrate into the cellular structure of said cover to fill thus all or substantially all the cells of its structure. The covering A_1, as already stated, is caused to pass on heated roller **12***a* and is pressed against the lower face of cellular base A. During this movement, the covering, due to its limited thickness is fully melted and, together with the abrasive material, is caused to adhere to and penetrate into the cellular surface of base A, as already stated in connection with the previous case illustrated in FIGURE 3.

The abrasive product obtained according to this variation, has all the yielding and resilient properties, furthermore the abrasive can be made to project from the melted layer when said product is used in that, during this operation, a certain pressure is exerted on base A causing the latter to be resiliently deformed and, accordingly, causing the abrasive grains to be projected out, however said grains are held by the melted mass.

Turning now to FIGURE 5, the apparatus shown in this figure is also equipped with a pair of rollers **10***b*, **12***b* one of which is provided with heating members **14***b* and a hopper **20***b* to contain the abrasive material. Also this modification of the method comprises the use of a covering A_1 applied on the cellular base A. According to this variation, upstream the abrasive hopper **20***b* a pair of rollers **38, 40** is provided, the former being provided with a heat source **42** in like manner to roller **12** previously considered. Roller **38** cooperates with the lower face of cellular base A and is heated to a temperature adapted to melt superficially the face of said cellular base A for a limited thickness. Downstream the pair of rollers **38–40**, a roller **44** is provided to apply against the melted face of base A a reinforcing sheet C, such as a fabric which is then caused to adhere to the under face of cellular base A. On the other face of cellular base A, a layer of abrasive powder is placed as already stated, said abrasive powder being supplied through a dispensing nozzle **22***b* to constitute a layer of a substantially even thickness.

On said abrasive layer B_1 the cellular covering A_1 is then placed so that said abrasive layer B_1 is sandwiched between said cellular base A and covering A_1. The latter, upon contact with heated roller **12***b* and due to its limited thickness, is fully melted, pressed and made to adhere to the underside of cellular base A to incorporate abrasive layer B_1. The latter may be previously incorporated into covering A_1 by means of vibrations (as already explained) or by means of a pneumatic action exerted on the upper face of said element.

Modifications and variations can be made on the above method; for example, roller **10** in FIGURE 3 could be provided with heating means to melt the other face of the cellular base A and apply to the latter the reinforcing member C. In the case of the apparatus of FIGURE 5, the abrasive material can be simultaneously applied on the melted surface of cellular base A and covering A_1. The cellular structures of elements A and A_1 can be of any kind having the most suitable features according to the characteristics of use of the desired abrasive product. Preferably, the cellular structure of the covering A_1 can be less dense than cellular base A; the covering A_1 material can just as well advantageously have a melting point lower than that of the material of the cellular base A, especially if it is considered that said covering must be fully melted and made to adhere to the face of cellular back A. Other modifications and variations may be devised depending on the intended use of the abrasive product obtained using the method of the invention; for example, the quality of the abrasive and the grain size thereof can vary accordingly to the need. The same is true for the thicknesses used for the materials constituting cellular base A and covering A_1; by way of example, the ratio between the thicknesses of covering A_1 and the cellular base A can vary from 1:4 to 1:30; e.g. the thickness of celluar base A can vary from 5 to 30 mm. while the thickness of covering A_1 can vary from 0.2 to 10 mm. The physical characteristics of the material of the covering A_1 can be different from those of the material from which cellular base A is made; e.g. the covering can have a greater hardness and consistency.

The above and other variations do not depart from the spirit and scope of the invention whose protection extends also the apparatus carrying out the method according to the invention.

What I claim is:

1. A method for preparing an abrasive article comprising passing a foamed polyurethane base under a heated pressure roll, controlling the temperature and speed of said roll to melt the top surface of said base to a uniform predetermined depth and form a superficially melted surface at said depth, discharging powdered abrasive onto said melted surface of said base, and embedding particles of said abrasive in said surface, and cooling said abrasive coated base to set said abrasive in said surface.

2. A method as set forth in claim **1** which includes the step of rolling said base after said abrasive has been discharged thereon to embed the same in the melted surface.

3. A method for preparing an abrasive article comprising discharging powdered abrasive onto the top of a relatively thin layer of a foamed polyurethane, passing said layer with powdered abrasive thereon across a heated roll to completely melt said layer, and pressing said melted layer with abrasive therein against a surface of a base layer of a foamed polyurethane base material to cause said melted layer to adhere to said surface.

4. A method as set forth in claim **3** including the step of passing the opposite face of said base material across a heated roll to melt the surface thereof, and pressing into

contact with said melted opposite face a fabric sheet to cause said sheet to adhere to said opposite face.

5. A method as set forth in claim 4 wherein said layer having powdered abrasive therein and said fabric are pressed sequentially to said base layer.

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DONALD J. ARNOLD, *Primary Examiner.*