

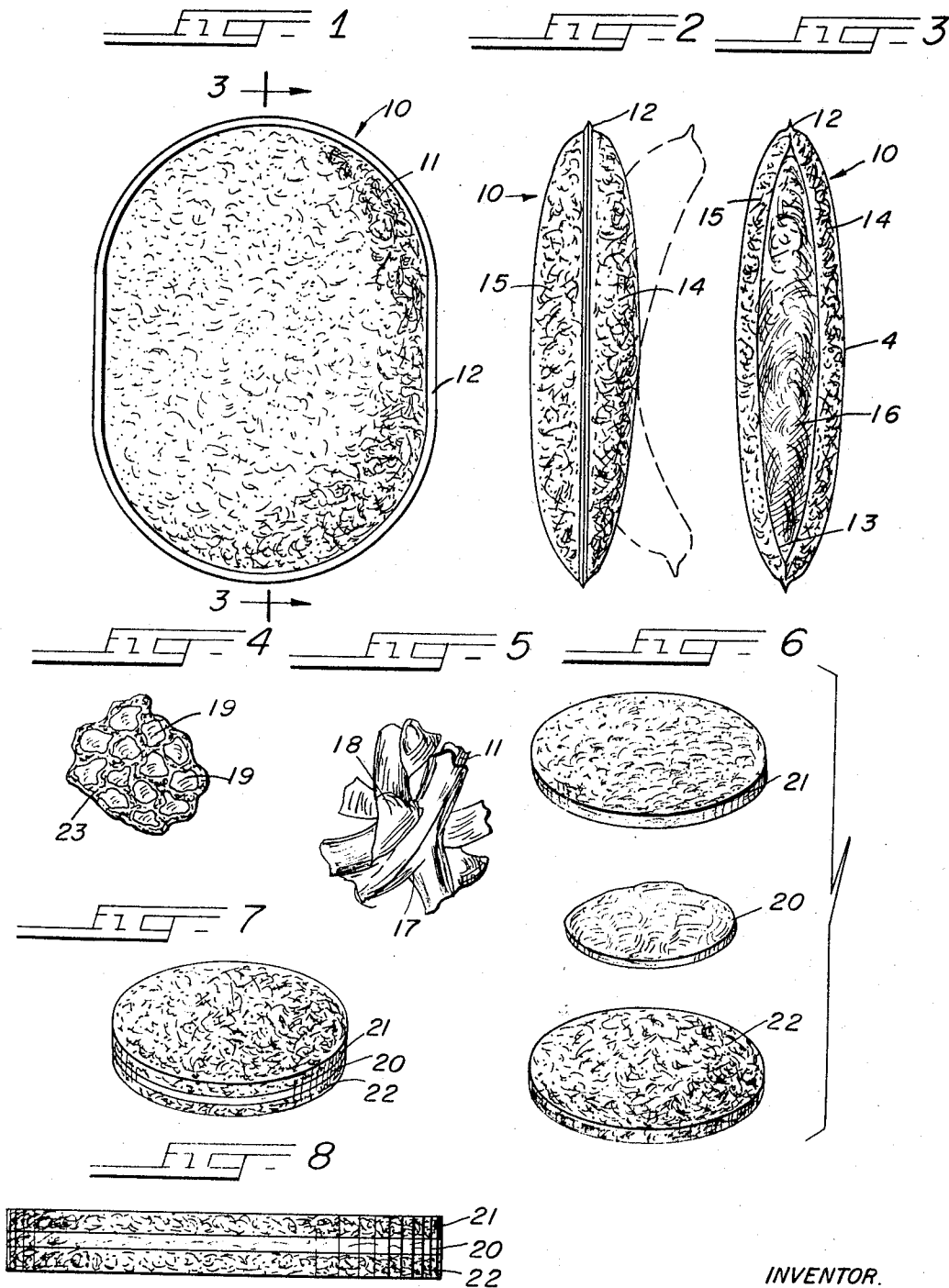
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SCOURING PAD

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SCOURING PAD

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ABSTRACT OF THE DISCLOSURE

Scouring and cleaning pads in the form of a flexible porous pouch with the matrix of the pouch being substantially filled with macroscopic particles of a cleansing material such as soap, the particles of cleansing material being substantially encapsulated by a flexible elastomer so as to provide a controlled release of the cleansing material when the pads are used in the presence of water.

This invention relates to cleansing devices in the form of a pad and more particularly to a novel and improved scouring pad of the type which is ordinarily used for cleansing kitchen utensils and similar articles.

Over the years, a number of scouring pads have been manufactured for removing accumulations of dirt, grease, charred food and the like from various surfaces. The most conventional and popular scouring device is the highly abrasive steel wool pads. Although steel wool pads are suitable for certain limited uses, they do possess numerous disadvantages. Such a pad, while it possesses suitable abrasive qualities, usually rapidly deteriorates by virtue of rust and physical disintegration. Soap impregnated steel wool pads likewise have a very short life, the soap is readily used up and there is the further disadvantage in any steel wool scouring device that splinters of steel wool may enter the user's hands. Additionally, there is always the attendant problem of rusting which occurs with any steel wool product used in the presence of water.

The present invention therefore takes as its principal object the solution of these prior art problems and the provision of a new and improved scouring pad.

Another object of the invention is to provide a scouring pad which has greatly lengthened useful life.

Still another object of the invention is to provide a flexible scouring and cleansing pad in which the soap or detergent used as the cleansing agent will not readily dissipate from the pad.

Still a further object of this invention is to provide a scouring pad which will not rust and which is fully resistant to the action of commonly used solvents, detergents and hot water.

Another object of this invention is to provide a scouring pad which is resilient; which will readily conform to contours and to irregularly-shaped objects.

These and other objects and features of the invention will become more apparent from a consideration of the following description.

FIGURE 1 is a front elevational view of a preferred embodiment of the present invention.

FIGURE 2 is a side elevational view of the scouring pad as shown in FIGURE 1.

FIGURE 3 is a sectional view taken along the line 3-3 in FIGURE 1.

FIGURE 4 shows the improved soap formulation of this invention.

FIGURE 5 is a greatly enlarged and in part sectional view of the fibrous abrasive article of this invention.

FIGURE 6 is an exploded view of another embodiment of this invention.

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FIGURE 7 is a perspective view of the article of FIGURE 6.

FIGURE 8 is a side view showing the article of FIGURE 7.

In its preferred embodiment, the present invention contemplates an improved scouring pad comprising a sealed envelope or pouch of a lofty non-woven web of a fibrous material which fibrous envelope fully surrounds and encloses a matrix 13 which is substantially filled with a cleansing composition such as a soap, detergent, or soap-detergent mixture 16 with the cleansing composition being encapsulated by a flexible adhesive material.

Referring to FIGS. 1, 2 and 3, the fibrous envelope or pouch 10 consists of layers 14 and 15 of a lofty, open, non-woven web of fibers 11 with these layers being completely sealed together at 12 to form the pouch or envelope 10.

The fibers 11, as shown in detail in FIGURE 5, which may be utilized in our invention include the synthetic fibers such as nylon and Dacron, and the common types of commercial animal hair such as hog hair, horse hair and cattle hair. I prefer to use nylon of varying diameters.

Referring to FIGS. 1, 2, 3, and 5, it will be seen that the fibers 11 are randomly disposed throughout the web layers 14 and 15 and that they are firmly bonded at points where they cross and contact one another by a binder material 17, which is shown in more detail in FIG. 5. Abrasive materials 18 are bonded to the fibers by means of the binder 17. Since one of the objects of this invention is to produce a scouring pad which has a very high degree of resiliency and is able to be used in the scouring and cleaning of sharply irregular surfaces or of surfaces of sharp contour, it is preferred to use a binder material which can be best characterized as being soft and rubbery-like in nature. In fact, I prefer to use binder materials which have a Knoop hardness number of 6 or less with binders having a Knoop hardness number of about 1 and even less, giving very excellent results.

In forming the fiber web the initial step involves the formation of the open web in a layer of the desired thickness. This operation could be accomplished manually, but preferably is carried on mechanically on a garnett machine or other well-known fiber pad forming machine, such as, for example, a Curlator Rand-O-Webber. When using a garnett machine, it is preferred to use a Lapper (manufactured by Proctor and Schwartz) in conjunction with the garnett machine to give additional randomness to the non-woven web. With such equipment, the length of the fibers employed should ordinarily be about one-half to four inches and I prefer to employ fibers of from one and one-half to two inches. Preferably, the fibers should have a three dimensional curvature impressed upon them by curling or crimping which may be accomplished by mechanical means or by chemical curling processes, all of which are well-known in the art. The crimped or curled surface produces in the final product loft or openness of web.

After the fiber web has been formed as described above, a binder is applied to the web fiber which is plasticized and serves to unite the web. Although the fibers 11 can be bonded together at points where they cross and contact one another by the binder material 17, preferably the binder is applied to the web in such a manner that it will form a continuous film along the fibers. For example, a plasticized elastomer binder when sprayed or applied to the web of fibers is found to form a continuous film about the fibers, serving not only to unite the fibers, but to encase them throughout their length. The binder utilized can be an elastomer such as a natural rubber or latex, a synthetic elastomer latex, or a reclaimed rubber dispersion. Some specific examples are natural

rubber, butadienestyrene dispersions, neoprene dispersions, polyvinyl chloride, vinyl latex, etc.

Where the scouring pad of this invention is to be used under severe conditions, for example, usage for extended periods of time in solutions of strong detergents at temperatures exceeding about 140° F., or for use under conditions where extremely high tensile strength is required, I prefer to bond the fibers 11 of the web with an epoxy resin binder which has been chemically modified by certain polyesters and polyamides. Such binders, according to the Knoop hardness test, are just as soft or perhaps even softer than the soft vulcanized rubber elastomers as set forth above. These chemically modified epoxy resins have a tensile strength which is substantially greater than the soft or vulcanized rubber elastomer set forth above and an even higher tensile strength when compared with the harder and more rigid binders, such as the phenol-aldehyde resins. These harder and more rigid binders may also be used in my invention where tensile strength and flexibility are not essential requirements.

These modified epoxy resins binders can be described as the combination of an epoxy resin, polyester and polyamide. The epoxy resins which may be employed are the reaction product of epichlorohydrin with a dihydric phenol. Bisphenol A[bis(4-hydroxyphenyl) dimethylmethane] is preferred. The reaction is carried out in the presence of a caustic such as sodium hydroxide with the epichlorohydrin being employed in excess. The epoxy resins suitable for use in this invention may be characterized as having an epoxide equivalent of from 170 to 200; a viscosity at 25° C. in centipoises of 3000 to 20,000; an average molecular weight of about twice the epoxide equivalent and are usually in a liquid condition at room temperature.

The polyamide component of the binder can be characterized as the condensation polymer of dimerized (and trimerized) vegetable oils, unsaturated fatty acids, and aryl or alkyl polyamines. The polyamides are amber colored thermoplastic resins with molecular weights ranging from about 3,000 to about 10,000 and melting points ranging up to about 190° C. The polyamides having lower molecular weights, up to about 6,000, and lower melting points are used in this binder. It is preferred to use the polyamides in which a higher amine such as Deta is used in preference to ethylenediamine. It is also preferred to use the polyamides having higher amine values such as those having amine values ranging from about 290-450, with those polyamides having amine values ranging from 350-400 giving excellent results. The polyamides used can be further identified as having a viscosity (Gardner-Holdt) of from about 200-1,000 cps. at 25° C. Versamid 140 (available from General Mills) and D.E.H. 14 (available from Dow Chemical Co.) are two examples of polyamides which perform exceptionally well in the binder composition.

The polyamide component serves to cure the epoxy resin and to flexibilize the resin. Depending upon the amount of polyester, the weight ratio of polyamide to epoxy resin in the binder of this invention is ordinarily from about 0.5/1 to about 1/1.

The polyesters useful in the binder composition are the long chain polyesters having chain lengths of at least 14 members. The chains may be terminated either with carboxy or alcoholic hydroxyl groups depending on the ratio of reactants employed in the synthesis. Excellent results have been obtained with a polyester identified as PL-5 available from General Resin Corporation and comprising the reaction product of approximately 3 mols of phthalic acid, 7 mols of adipic acid and 12 mols of dipropylene glycol. The weight ratio of polyester to epoxy resin is about 0.25/1 to about 1/1.

In preparing the binder, the epoxy resin, polyamide and polyester are mixed together and thinned with a suitable solvent for ease in applying the binder to the fibrous web.

The solvent is volatile; methylene chloride has proved to be an excellent solvent for this purpose.

The continuous film of binder about the fibers 11 provides a means for uniting the abrasive grains 18 about and along the length of the fibers so as to form a protective armour sheath about the fibers. Such abrasive materials may include all the well-known abrasives such as for example, silicon carbide, aluminum oxide, garnett, flint, emery, and pumice in varying grit sizes.

The binder and abrasive grains may be applied to the non-woven web in a number of well-known ways. In one method, a binder slurry can be formulated with the dispersion of the abrasive grain in the slurry. The slurry containing the grain can then be applied to the fibrous web, either by spraying, dipping, or roller-coating. In another method, the grain and binder can be supplied in separate operations, the grain being applied by gravity, rolling in, or by electrostatic deposition. If desired, a second coating of binder can be applied for better reinforcing, and this may also be accomplished by spraying, roller-coating, or dipping. Thereafter, the binder and abrasive coated fibrous web may be dried and cured at appropriate temperatures depending upon the nature of the binder material employed.

After the non-woven fibrous web has been coated with binder and abrasive material, it may then be processed to cause the binder to bond the fibers together and to firmly unite the granules to the fibers. Temperatures employed in the curing process may be in the range of about 275° F. to 375° F. for a period up to about 10 minutes, depending again upon the specific binder employed.

Following the curing of the non-woven fibrous web, the sections 14 and 15 of the fibrous envelope may be die-cut or stamped in any suitable dimension.

The scouring pad 10 has exceptional durability and even when utilized in connection with hot water and strong detergents, such abrasive impregnated webs will outlast conventional steel wool scouring structures by many times. It has been found that to impregnate the fibrous web with soap as is done in conventional steel wool scouring pads would be entirely unsatisfactory. Experiments have shown that when such a fibrous web is impregnated with soap in a conventional manner, the soap is soon dissipated. The open nature of the web also contributes to the rapid dissipation of the soap when the soap is impregnated on the web itself and this only serves to further reduce the utility of these very durable webs as scouring pads. The problem of rapid soap dissipation can be overcome by encapsulating the soap, detergent or a soap-detergent mixture with a flexible adhesive material. Encapsulation of the cleansing ingredient serves not only to dramatically extend the life of the cleansing ingredient, but when compared to the use of a simple pellet of pure soap, it actually permits the scouring pad to more readily conform to sharply irregular and sharply contoured objects which are being cleaned and scoured. As is shown in FIG. 3 and in greater detail in FIG. 4, the matrix 13 of the fibrous envelope is provided with a pellet 16 of encapsulated cleansing material, which may be soap, synthetic detergent or a soap-detergent mixture. The pellet 16 of encapsulated cleansing material consists of macroscopic particles of cleansing material 19 which have been substantially encapsulated or encased by a flexible or elastomeric adhesive 23. The encapsulating film of adhesive or elastomer 23 provides a continuous film about the macroscopic pieces of cleansing material. It is preferred that the particles of cleansing compound 19 have a minimum particles size of 1/8 by 1/8 inch. The adhesive or elastomer utilized to encapsulate the particles of cleansing material must be flexible so that the encapsulated cleansing compound particles when placed within the matrix 13 of pad 10 will not substantially reduce the flexibility of the pad. The encapsulating adhesive or elastomer should

also be resistant to commonly used solvents such as turpentine, xylene etc. and resistant to the commonly used soap and detergent solutions. Another requirement of the adhesive utilized is that it be one which will not completely inhibit transfer of water to the encapsulated cleansing compound. Encapsulation of the cleansing compound 19 by a film which would completely block any water from reaching the cleansing compound would be unsatisfactory. Therefore, the encapsulating adhesive or elastomer utilized in my invention can best be described as a water-permeable material which permits a controlled release of the water-cleansing compound solution to the surface of the object being cleaned.

A number of adhesives or elastomers can be used to encapsulate the macroscopic particles of cleansing compound. The urethane resins have provided highly successful results. Other examples of suitable materials include the plasticized polyvinyl chlorides such as Geon 576 and the more flexible acrylics such as Rhom and Haas Rho-plex B-15, a flexible acrylic emulsion.

As used in this application, the term "soap" ordinarily refers to the water-soluble ammonium, metallic, organic base salts of various fatty acids, which are chiefly lauric, oleic, stearic and palmitic acids. My invention also contemplates the use of anionic type synthetic detergents in place of or in combination with soap. The anionic type synthetic suitable for us in this invention can be described as those detergents having pronounced cleansing power and including in their molecular structure an alkyl radical containing from 6 to 18 carbon atoms and a sulfonic acid or sulfuric acid ester radical. Either organic base, ammonium, sodium or potassium salts of the anionic type detergents can be used. The main types of detergents falling within this category are alkyl-aryl sulfonates, such as sodium or potassium dodecylbenzene sulfonate, sodium or potassium octadecylbenzene sulfonate, and sodium or potassium octyl-naphthalene sulfonate; the alkyl sulfates, such as sodium or potassium salts or dodecyl, hexadecyl, and octadecyl sulfates; the sulfonated fatty acid amides, such as sodium or potassium salts of the oleic acid amide of methyl taurine; and the sulfonated monoglycerides such as the mono-coconut oil fatty acid esters of 1,2-hydroxy propane-3-sodium sulfonate.

As to the non-ionic types of synthetic detergents suitable for use in my invention, these may be described as those detergents which do not ionize, but owe their water-solubility to un-ionized polar groups such as hydroxyl or ether linkages. The basic types of detergents falling within this category are the polyoxyethylene ethers of the higher fatty alcohols and alkyl phenols; the polyethylene glycols of fatty acids; fatty alkylol amide condensation products; polymers of ethylene and propylene oxides; compounds formed by the addition of propylene oxide to ethylene diamine, followed by the addition of ethylene oxides; fatty acid ethylene oxide condensation products; condensation products of ethylene oxide in a fatty acid ester of a polyhydric alcohol or sugar; and the detergents prepared by heating together a higher fatty acid with a diethanolamine.

The selection of the particular soap, detergent or soap-detergent combination is dependent to some extent on the amount of foaming required. Additionally, I have found that with some of the cleansing compounds tested, the release of the compound was too rapid. For example, I find that a cleansing compound consisting entirely of tallow chips, although having reduced foam properties, was released very slowly and the encapsulated tallow chip particles were retained over a very long period of time. On the other hand, for example, a dried potassium-cocoa soap, although having very good foam characteristics was not as good as the all-tallow chip cleansing compound as far as retention characteristics are concerned. In general, for most cleansing operations I prefer to use pellets of

soap or a soap synthetic detergent mixture over the all synthetic detergent pellet.

In forming the cleansing pellet 16, the soap, synthetic detergent, or soap-synthetic detergent mixture is prepared and the cleansing compound is then formed into macroscopic particles having a minimum size of about $\frac{1}{8}$ x $\frac{1}{8}$ inch, either by extruding or crushing. Following the formation of the cleansing compound, it is mixed with a suitable flexible adhesive or elastomer in the ratio of about 25 to 75 parts of cleansing compound to about 75 to 25 parts of elastomer. It should be understood that ratios of cleansing compound to elastomer outside the ranges set out above will provide somewhat satisfactory results although we have found that using lesser amounts of adhesive than set forth above usually results in incomplete encapsulation of the cleansing compound and consequently the cleansing compound is used up in a more rapid manner. On the other hand, utilizing more elastomer than set out above results in a "water proofing" of the cleansing compound and does not ordinarily provide enough cleansing compound for most scouring operations.

The flexible elastomeric adhesive and cleansing compound of proper particle size are intimately blended together. Following blending the mixture can be poured in suitable molds and cured at temperatures ranging from 150° F. to 220° F. The molding operation is necessary when a shaped pellet 16 such as that shown in FIG. 3 is desired. The mixture of elastomeric adhesive and cleansing can also be formed into sheets and thereafter die cut to suitable sizes.

Specific examples illustrating our invention are set out as follows:

EXAMPLE I

Formation of fibrous web

Crimped nylon fibers of lengths of about $1\frac{1}{2}$ " (15 denier) weighing about 3.0 to 3.6 ounces per square yard and $\frac{1}{4}$ " thick were formed into a web on a Rand-O-Webber machine. One side of the web was then sprayed with approximately 15 to 20 ounces per square yard of a binder slurry including abrasive grain, the slurry having the following formulation:

	Parts
Geon 576 vinyl latex:	
(A plasticized film forming polyvinyl chloride latex made by the B. F. Goodrich Co.)	100.0
Aerotex M3 resin:	
(A melamine-formaldehyde resin available from American Cyanamide Co.)	34.0
Aerotex Accelerator AS:	
(Hardener for the Aerotex M3 resin—American Cyanamide)	13.0
Silicon carbide (500 mesh)	155.0
Triton X-100	
(A stabilizing and dispersing agent—Rohm and Haas)	0.4
Carbon black	3.0

It was found that the binder slurry penetrated approximately 75–80% of the web. Following the spraying, the web was run through a forced air-drying oven at 250° F. for approximately 30 seconds to set the binder. The partially coated web was then turned over and sprayed on the opposite side with the same formulation as set forth above in the amount of 15–20 ounces per square yard. The coated product was then conveyed to a curing oven and set at 325° F. for a period of approximately 6 minutes. The cured binder material utilized in this Example had a Knoop hardness number of 1. In the above spraying operation, a Binks No. 42 spray nozzle was used to spray on the binder slurry, and the conveyor speed was 16 feet per minute with curing oven conveyor speed set at 18 feet per minute.

Following is a listing of additional formulations which

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have been prepared and used as binders according to the above procedure:

(1)		Parts
Geon 576 vinyl latex	155.0	5
Silicon carbide (550 mesh)	155.0	
Water	5.0	
Triton X-100	0.2	
Carbon black	3.0	
(2)		10
Geon 576 vinyl latex	50.0	
Geon 351 vinyl latex (an unplasticized polyvinyl resin—B. F. Goodrich Company)	25.0	
Hycar 1552 latex (A butadiene-acrylonitrile copolymer—The Goodyear Co.)	25.0	15
Aerotex M3 resin	40.0	
Aerotex AS hardener	2.0	
(3)		20
Hycar 1571; Hycar 1572; Hycar 1552 ¹	100.0	
Aerotex M3 resin	40.0	
Aerotex AS hardener	2.0	
Water	10.0	

¹ 100 parts of any one of these copolymers.

Following is a formulation which is a copolymer of an epoxy resin, polyester and polyamide and which has been prepared and used as a binder:

		Parts
Epi-Rez 510 (An epoxy resin having a viscosity from 10,000 to 16,000 cps., a specific gravity of 1.15–1.17 at 25° C., an epoxide equivalent of from 185–200, being the reaction product of 2 mols of epichlorohydrin with 1 mol of bisphenol A and Available from Jones Dabney)	100	
DEH-14 (A polyamide curing agent and flexibilizer having an amine value of 350–400; a viscosity of 200–600 cps. at 75° C. (Gardner-Holdt) and available from Dow Chemical Company)	100	
PL-5 (A completely polymerized long chain polyester being the reaction of approximately 3 mols of phthalic acid with 7 mols of adipic acid and 12 mols of dipropylene glycol. It has an acid value of 28–32 and is available from General Resin Corporation)	75	
Silicon carbide (No. 500 mesh)	310	45
Methylene chloride (solvent)	120	

The above binder slurry penetrated approximately 75% of the web. Following spraying, the web was run through a forced air drying oven at 325° F. for approximately 5 minutes to set the binder. The partially coated web was then turned over and sprayed on the opposite side with the same formulation as set forth above, again in the amount of 15 to 20 ounces per square yard. The coated product was cured at about 375° F. for a period of approximately 7 minutes. The cured binder material had a Knoop hardness number of approximately 0.67.

EXAMPLE II

A series of cleansing compounds were prepared according to the following formulations:

(1)		Percent
Tallow chips	100	
(2)		65
Tallow soap	80	
Coco soap	20	
(3)		70
Tallow soap	70	
Coco soap	30	70
(4)		100
Dried potassium coco soap	100	
(5)		100
Sodium dodecylbenzene sulfonate flakes	100	75

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(6)

Sodium coco soap	60.35
Potassium coco soap	6.70
Water	8.25
Micro Silica 4A (magnesium silicate)	18.70
Snow White Silex (titanium dioxide)	6.00

(7)

Igepon	10.86
Sodium coco soap	49.49
Water	8.25
Micro Silica 4A	18.70
Snow White Silex	6.00

Each of the above formulations were formed into macroscopic particles having a size of about $\frac{3}{8} \times \frac{3}{16}$ inch.

EXAMPLE III

A series of elastomeric adhesives were prepared according to the following formulae:

(1)

		Parts
Bostik 7070	10	
Boscodur #1	1.5	

(2)

Rhoptex B-15	9
Polyvinyl alcohol	1

(3)

Geon 351	10
Diocetyl phthalate	3.5

Approximately 32 pounds of any one of the cleansing compounds prepared according to Example II were blended with a mixture of 10 pounds of the Bostik 7070 resin (a two-part polyurethane adhesive made by B. B. Chemical Co.) and one and one-half pounds of the Boscodur curing agent. The soap adhesive combination was intimately mixed and poured into a suitable mold and cured at 220° F. for approximately 10 minutes. The encapsulated pellet of soap obtained was then sandwiched between two layers of a fibrous pad prepared in accordance with the method described in Example I. The two layers of non-woven fibrous webbing were heat-sealed along the edge at 12 and a scouring pad as shown in FIGURES 1–3 was obtained.

In FIGS. 6, 7 and 8 of the drawing there is illustrated another embodiment of the present invention. A layer 20 of encapsulated cleansing compound is sandwiched between two layers 21 and 22 of an abrasive containing non-woven fibrous web. In preparing this scouring pad, the encapsulated cleansing compound may be knife-coated on one side of a layer of fibrous web and then both web layers are pressed together and cured. The elastomeric adhesive serves not only to encapsulate the cleansing compound but also serves to bond layers 21 and 22 together. Although the scouring pad shown in FIGS. 6–8 is highly flexible and has a long use life, where heavy duty scouring is desired, the scouring pad shown in FIGS. 1–3 is superior since the fibrous web fully surrounds the encapsulated cleansing compound and serves to protect the encapsulated cleansing compound pellet 16.

It will be appreciated that this invention is susceptible of various modifications to provide other cleaning and scouring pads falling within the scope of this invention. The abrasive containing fibrous web layers 14, 15, 21 and 22 may be replaced by other materials such as the various sponges: cellulose sponge, foam rubber or the foamed plastics such as the flexible polyurethanes. In the device illustrated in FIGS. 1–3, for example, the layer 15 may consist of a sponge material with layer 14 consisting of an abrasive containing fibrous web. In such a modification advantage can be made of the abrasive action of layer 14 and the moisture retentive properties of sponge layer 15.

I claim:

1. A cleaning and scouring device comprising a pouch formed of a web of non-woven fibers interlaced randomly and in crossing contact with one another, the fibers being bonded at points where they cross and contact one another by a resilient binder having a Knoop hardness number of about 6 or less, said binder being a copolymer of an epoxy resin, polyamide and a long chain polyester, an abrasive material bonded to said fibers by said binder, the matrix of said pouch being substantially filled by a pellet of cleansing material, said pellet including macroscopic particles of a cleansing material substantially encapsulated by a flexible adhesive resistant to soap and detergent solutions to form a water-permeable membrane about said cleansing material thereby permitting a controlled release of a solution of said cleansing material from said pellet.

2. The device of claim 1 wherein said non-woven fibers are nylon and wherein said binder has a Knoop hardness number of about 1 or less.

3. The scouring device of claim 2 wherein the ratio of cleansing material to adhesive is from about 25 to 75 parts of cleansing material to about 75 to 25 parts of adhesive.

4. A cleaning and scouring device comprising a flexible porous pouch with the matrix of said pouch being

substantially filled with macroscopic particles of a cleansing material encapsulated by a flexible adhesive being resistant to soap and detergent solutions and, said adhesive forming a water-permeable membrane about said cleansing material permitting a controlled release of a solution of the cleansing material.

5. The device of claim 4 wherein said cleansing material is in the form of macroscopic particles having a minimum size of about $\frac{1}{8}$ x $\frac{1}{8}$ inch and wherein the ratio of adhesive to cleansing material is from about 75:25 to about 25:75.

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