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A. A. WINSTON
COMPOSITE SCOURING PAD

3,103,031

Filed June 14, 1961

2 Sheets-Sheet 1

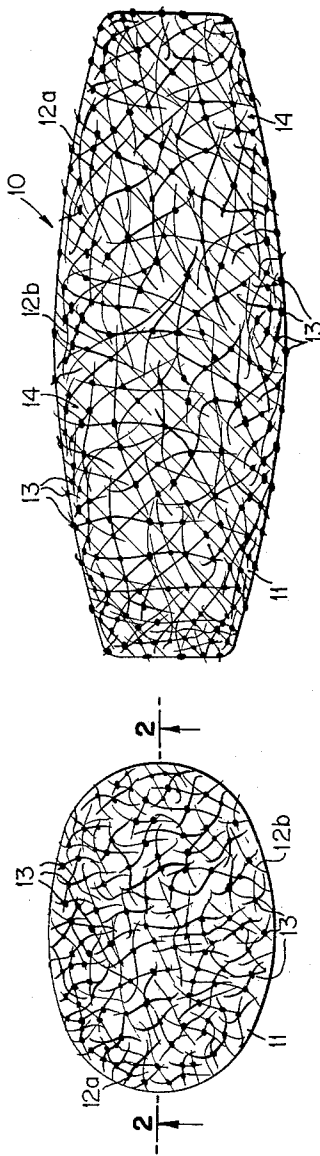


FIG. 1

FIG. 2

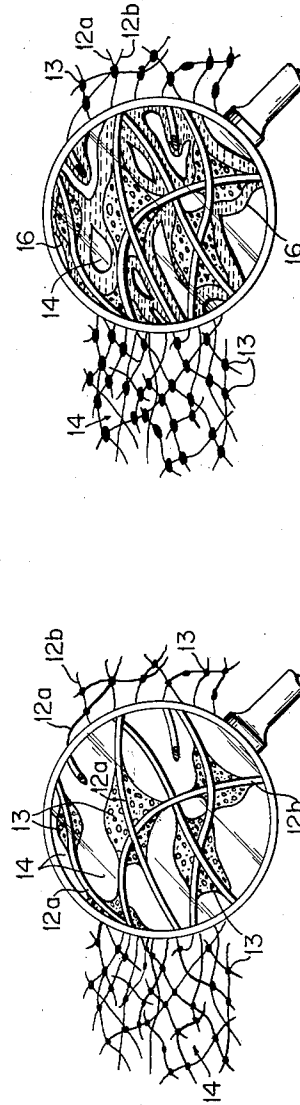


FIG. 3

FIG. 4

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2 Sheets-Sheet 2

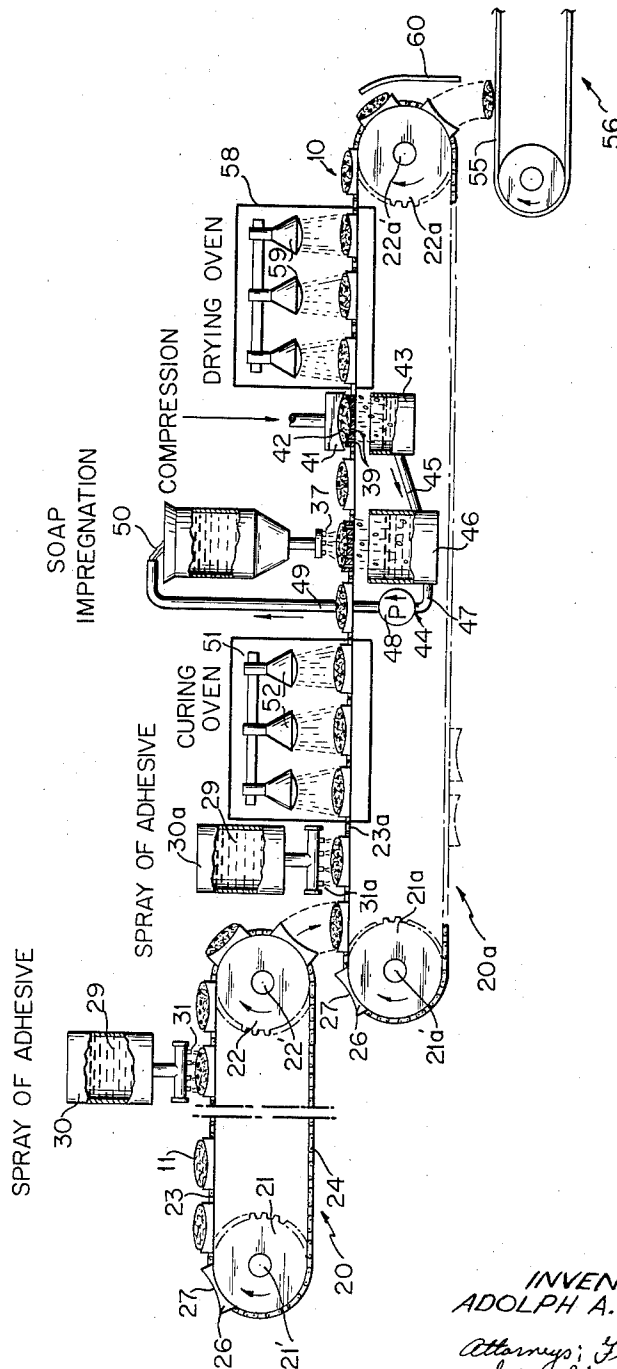


FIG. 5

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3,103,031

COMPOSITE SCOURING PAD

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This invention relates to scouring devices of the type used in the home and in various industrial areas. More particularly, the invention is concerned with the production of a fibrous scouring article capable of replacing soap and/or detergent-impregnated metal wool pads. The term "detergent" as it is employed in the specification and accompanying claims is intended to cover synthetic detergents, soaps and other saponaceous material of varying degrees of surface activity commonly employed in the cleansing art.

Metal wool (for example, so-called steel wool) has gained wide acceptance for scouring household articles, such as pots and pans. Scouring and polishing pads made of steel wool strands which have been matted or felted together, or intertwined or interwoven into a mass of filaments, are also employed in the industrial field for the removal of old waxes preparatory to reapplication of wax.

Such metal wool pads are noted for their abrasive characteristics and rely upon the relative hardness of the metal for their scouring action. However, metal wool pads suffer from a number of undesirable characteristics. Metal wool itself is harsh and unpleasant to the touch. Moreover, the metal wool can break or "splinter" and result in slivers of metal entering the skin of the user or being left as a residue on the scoured structure, e.g., a floor, in which event an uneconomic cleanup period is required after scouring.

It has, therefore, long been a desire in the trade to find a replacement for metal wool scouring pads which replacement exhibits none of the undesirable characteristics which are inherent in the use of a metal scouring article. Among classes of materials which have been suggested as replacements for metal wool are natural organic fibers, such as entangled filaments of cotton, jute, sisal, wool or the like. Moreover, synthetic organic fibers, such as nylon and other polyesters, have also been suggested as useful substitutes for metal wool. Both the natural and synthetic organic materials possess one superior characteristic over metal wool in that they have no tendency to rust. Certain of the synthetic fibers are particularly adaptable for utilization in scouring pads, since such compositions are relatively stable at those temperatures likely to be encountered in household and industrial uses of scouring pads. Such synthetics are also resistant to corrosive action of other organic chemicals and are flexible, durable, and compare favorably in cost with metal wool.

Still another advantage of certain synthetic organic materials such as nylon, polypropylene, vinyl chlorides, rayon acetates, is that they may be formed into monofilaments which monofilaments can be felted into porous, open mats or batts of unusually high loft, springiness and compressibility. Such low density or high voids volume batts lend themselves ideally to a property which is desired in the cleansing art, namely, the ability to absorb water in substantial quantities rapidly and transmit foreign substances of an undesirable character from the working surface whereby such batts can be rinsed free of this matter upon removal from the soiled surface.

More recently, batts of relatively short, interlaced synthetic organic fibers exhibiting a high degree of loft, flexibility and toughness have become commercially available. For example, the Curlator Corporation, of Rochester, New York, manufacturers of so-called "Rando-Webber" machines for forming non-woven fibrous

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materials, have made possible the production of high-loft structures on a commercial scale. United States Patent No. 2,890,497, issued June 16, 1959, to Curlator Corporation on an application filed in the names of Langdon et al., discloses a machine admirably suited for use in preparing high-loft batts of synthetic organic fibers.

However, in order to impart advantageous scouring characteristics to such batts which may be classified as either high-loft or low-loft structures, it has been necessary to add finely divided abrasive particles to the batt structures. Suitable abrasive mineral grits are silicon carbide, tungsten carbide and flint fines. Several methods of incorporating abrasive particles in fibers which are interlaced or felted into batt structures suitable for use in scouring pad manufacture are known. One such method is to extrude synthetic filaments of organic material from a molten plastic mass and, while the filaments are still plastic immediately after their extrusion, to propel particles of abrasive matter against them. In this manner abrasive grits are forced against the plastic filaments, impinge thereagainst and adhere thereto. When the filaments cool to a setting temperature, the particles of abrasive remain imbedded in the filaments and protrude therefrom in position to be utilized for their abrasive characteristics. Such a method is exemplified by U.S. Patent No. 2,375,585 to Rimer, issued May 8, 1945. U.S. Patent No. 2,334,572 to Melton et al., issued November 16, 1943, discloses a similar method in which a dry, gaseous suspension of abrasive particles and separated fibers are mixed and the resulting material collected in the form of a loosely felted abrasive web. Still another patent which shows a similar method is U.S. Patent No. 2,413,551 to Englund, issued December 31, 1946.

Unfortunately, such abrasive materials mar, scuff, scarify or otherwise detract from the overall appearance of the utensil or working surface being scoured or otherwise cleaned depending upon the relative hardness of the working surface subjected to the abrading action of such materials. To be sure, a detergent incorporated into a batt having the abrasive thereon serves to lubricate the region between the working surface of the pot, pan, floor or other area being cleaned as well as the surface of the cleansing article itself whereby the tendency for the relatively hard, finely-divided abrasive particles to gouge or otherwise destroy the finish of the working surface is minimized. This finding has been disclosed and claimed in U.S. patent application Serial No. 35,626, filed June 13, 1960; however, such scouring or cleansing of relatively soft utensils such as copper-clad articles and plastic composition tiles still leaves them scarified to an undesirable extent.

It is an object of the present invention to provide a cleansing and scouring article which offers the desirable scouring action of metallic wools and thereby alleviates the tendency toward unsightly marring of the working surface being cleansed or scoured, which scouring action is provided in a utensil or other suitable scouring implement having none of the disadvantages of metal wool scouring articles alluded to hereinabove.

In accordance with the present invention this object is achieved by felting a plurality of short length plastic fibers with a plurality of relatively short length metal wool filaments into an open batt having a high voids volume of at least 50%, whereafter the felted mass of plastic and metallic filaments are permanently united through the intermediation of a suitable binder composition. The present invention is founded upon the discovery that when a suitably open porous batt is produced, preferably one having a voids volume of at least 60% and typically in the neighborhood of 60-80%, a most unique cleansing

and scouring effect is achieved through the cooperation of the aggregated plastic and metallic filaments or fibers. It appears that the yielding support lent by the batt of plastic fibers to the metallic filaments in the batt permits gentle yet effective frictional engagement between the relatively hard cutting edges of the filaments so that ease of travel of the batt as a scouring implement is achieved while efficiently removing soil, carbonaceous deposits, and other cooking residues and matter. The composite cleansing article of the present invention permits the ingress and egress of a detergent composition which may be incorporated in the batt preparatory to its use or during its use whereby suitable lubricity is offered between the working surface of the metallic filaments and the surface being cleaned. By virtue of the yielding support offered to the metallic filaments in their short length form by the binders aggregating these filaments together, unsightly mars, scars or other scarifications of the working surface such as contributed by abrasive grits like tungsten carbide is avoided and instead the surface being cleansed is capable of assuming a polished, glossy surface, mirror-like in appearance.

In order to assure uniformity of the felted batt of metallic filaments and plastic fibers, it has been found that these filaments should be of sufficiently short length to permit their being felted under the influence of a fluid such as air or a compatible liquid such as glycerine petroleum oil or water so that the filaments and fibers can be randomly oriented in all directions with respect to one another and intertwined in preparation for application of binder material.

Felting is preferably carried out by air in a Curlator type "Rando-Webber" machine whereby the short length fibers are distributed to a three dimensional fluffy felt, although it is also within the spirit of the present invention that glycerine, an oil, or some other fluid including water may provide a liquid suspension for the composite of metallic filaments and plastic fibers. The choice of felting operation will be dependent to some extent upon the relative densities and dimensions of the plastic fibers and metallic filaments. As the density difference between these two types of filaments increases their amenability to a uniform distribution decreases and, accordingly, the appropriate felting technique to be employed should compensate for the tendency of filaments and fibers of different densities to stratify or otherwise segregate during the felting operation. For relatively light weight materials such as aluminum "wool," air felting appears to offer the most preferred method of treatment since the short length of such metallic filament as well as its relatively low density in comparison with other heavier metals permits more effective air felting of such filaments in respect of plastic fibers such as nylon and the like. On the other hand, in the case of short length steel filaments, preferably stainless steel filaments, air felting may also be practiced provided care is taken to insure uniform initial distribution of the batt or mass of filaments in a suitable mixing or tumbling vessel for a period of time which assures the maximum relocation of the metallic filaments with respect to the plastic fibers. For many applications, however, it may be preferred to employ a liquid felting as distinguished from an air felting procedure wherein the plastic filaments and the metallic filaments are suspended in a compatible liquid material, agitated therein, dispersed with respect to one another, and thereafter deposited in a batt of suitable voids volume such as may be produced by the rapid withdrawal of the suspended liquid from the dispersion of filaments and fibers therein.

As indicated previously, the length and cross-sectional dimension of the filaments will have a bearing upon the ease which may be employed to felt the mass. Preferably, both the plastic fibers and the metallic filaments should have a length not exceeding 3" and typically the length will range between 1/2" and 1 1/2", with the fibers and filaments having a ratio of length to cross-sectional dimen-

sion of between 50:1 and 2000:1, typically 500:1. Generally, the length to width ratio of the metallic filaments will be smaller than the corresponding ratio of the plastic filaments in view of the amenability of the latter to air felting as well as liquid felting procedures. On the other hand, in many applications it will be found desirable to employ metallic filaments having lengths as great as 4", although for most applications the filament length will be less than 3". The length of the metallic filaments will be dependent upon the desirability of having as great a surface contact of looped strands in the vicinity of the working surface to be cleaned. It is preferred to have the metallic filaments not only uniformly felted whereby they may be intertwined and in contact at spaced points with one another as well as with the plastic filaments so that metallic loops or convolutions will be exposed on the surface of the batt preparatory to application of the resin for binding the plastic filaments. By so locating the metallic filaments they will be at least temporarily locked in place in an area proximate the working surface of the batt, some of the metallic filaments being united by the binder composition to the plastic filaments while other portions of the metallic filament may be simply interwoven but not bound to the plastic filament or matrix for receiving same. The extent therefore to which the spaced point-to-point contact is achieved by felting the metallic filament and plastic fibers will be dependent upon the extent to which the binder composition is sprayed or otherwise applied to the felted filaments. Preferably, a preponderance of the binder composition is sprayed onto the felted batt of such filaments so as to assure at least one and preferably two or more bonds between the metallic and plastic filaments so intertwined whereby a minimum of free metallic filaments is assured. Indeed, by reason of "wetting" of the felted mass of filaments and fibers with binder, the volume thereof will be substantially reduced from a voids volume of 70-90% to about 60 to 80% through such wetting action, the level of binder used being usually in excess of the level by weight of plastic fibers present in the batt.

The binder preferably is of an irreversible thermosetting, rigid, inflexible nature so as to assure a permanent union between the various filaments at their spaced points of contact. Among those binders which have been found suitable for use for the purposes of the present scouring article are synthetic resins, e.g., phenolaldehyde resins, butylated urea aldehyde resins, epoxy resins and polyester resins, and modified natural or synthetic rubber, such as latex compositions which have been blended with a filler so that they do not become pasty at high temperatures. Among commercial sources of adhesive binders which are suitable for use are Shell Chemical Company's Epon 828 which is a liquid epoxy resin, and Hycar Latex 1561, a butadiene-acrylonitrile copolymer latex marketed by B. F. Goodrich Company.

The metallic filaments which are preferably employed in accordance with the present invention are of the type which do not rust, corrode, oxidize or otherwise change their appearance, strength and ductility upon flexing or being wetted in the batt. Hence, such metal "wools" as stainless steel and aluminum are preferred, although any carbon steel may be employed which is capable of being formed into a metal wool of elongated strands and subsequently subdivided into the short length filaments of the present invention.

Preferably soap or other detergent material is incorporated in the fibrous batt similar to those produced in accordance with methods of the prior art, but having a volume of void spaces within the batt which comprises a large portion, e.g., 75% of the total volume of the batt. In any except the most compacted of those fibrous batts which are well known in the art, there are voids between adjacent fibers of the batt. Such voids provide repositories for detergent globules and serve as locations where

detergent materials can be stored until contacted with water or other solvent to free their cleansing action.

It has been found particularly advantageous for a network of intercommunicating voids to be formed in the batt, in which case quantities of detergent matter impregnated in the batt may successively be utilized according to the location of the detergent with relation to the surface of the pad which is contacted with the solvent. Thus, if such a pad is contacted with water on one working surface, the water will activate the cleansing action of detergent near that working surface immediately. In further uses of the pad more and more detergent nearer the center of the pad will be dissolved and activated and, if opposed surfaces of the pad are used to contact work, the last detergent to be used will be that at the center of the pad. This results in effective control of the use of the detergent within the pad.

A scouring pad according to the present invention which has optimum cleansing characteristics is one in which, of the total volume occupied by the pad, the concentration of fibers is sufficient to present an abrasive area to the work being scoured so that any surfaces of the work will be contacted by a sufficient quantity of abrasive matter to effect efficient scouring of that surface without unreasonable effort. Likewise, the percentage of the total volume of the batt occupied by void spaces within the batt should be large, both to enable relatively large quantities of detergent to be retained within a batt, and to permit a unique coaction between the batt fibers, detergent and solvent applied to the batt.

Because of the high voids volume of the composite batt which is impregnated with soap or other detergent to produce an abrasive scouring article according to this invention, an ample supply of detergent may be retained in the batt without completely filling the voids with globules of detergent. As located in the voids, the detergent globules tend to cluster around the batt fibers and extend only partially into the voids. It has been found especially efficient for the detergent to be present in such quantities that it occupies approximately one-third of the voids volume, or 30% of the total volume of the batt.

When water or other solvent is directed into contact with a wettable, high-loft batt which has been impregnated with detergent so that some 30% of its volume is occupied therewith, a highly advantageous coaction takes place. The wettable fibers quickly transmit the solvent to the detergent within the batt. Because of the high voids volume and because the detergent does not fill the voids, the wettable fibers transmit the solvent to detergent stored in inner recesses of the batt. Upon application of the batt to the working surface the detergent solutions form an interface between the loops or convolutions of the metallic filaments stationed in the batt whereby a gentle frictional engagement between the "soil" of the work surface and the batt is provided.

As is well known, a batt or wettable synthetic fibers and a high voids volume will be elastic and resilient, i.e., it will tend to reassume its initial form after it has been compressed and the compression released. Compression of a detergent-impregnated batt according to the present invention after solvent, e.g., water, has been applied makes use of the elastic property of the batt to foam the detergent while the latter is still in the batt. The detergent is then brought to the surface of the batt in an activated state ready for immediate utilization of its cleansing properties. The scouring article is thus extremely effective in use and, upon being wetted, is brought to a condition of usefulness with great speed. As stated hereinbefore, this new and exceptionally useful article is obtained through the coaction of an open, resilient batt formed from wettable fibers and having high voids volume, metallic filaments stationed and intertwined with the fibers at least at surface portions of the batt, and detergent globules impregnated in the batt and occupying

at least about 20% of the total volume of the batt, but not completely filling the voids thereof.

Thus, a detergent incorporated within a fibrous abrasive batt, as outlined hereinbefore, effects a dual function: it cleans articles with which it comes in contact and it lubricates the working surface of metallic filaments which are intertwined and bonded at spaced points to plastic fibers of the batt.

Detergents with which a batt having the scouring characteristics outlined hereinbefore may be impregnated, may be selected from any natural or synthetic detergent which is non-toxic, non-irritating, not rapidly soluble and has a melting point substantially above room temperature. The detergent should be non-toxic and non-irritating, of course, so that if any detergent film remains on a pot, pan or other article after a scouring operation, that detergent film will be neither poisonous nor irritating when inverted with food in a subsequent use of the article. In addition, it should be non-irritating so that the hands of the user are not affected adversely during and after a scouring action employing the pad. Excessive solubility is not a desirable characteristic because such a detergent might be completely used up in the course of one scouring action, making the pad uneconomical to use. If the detergent has a melting point at or below room temperature, it is likely to melt in transit or on the retailer's shelf and thus flow from the batt.

Furthermore, a detergent which can be advantageously utilized as the impregnant of a scouring pad according to the present invention is one which is physically and chemically compatible with other detergents with which it is likely to come into contact. It is common, for example, for a scouring pad to be used during or immediately after a dishwashing operation, in which case the detergent in the scouring pad should be compatible with detergents normally used as dishwashing compositions. Consequently, since most dishwashing compositions that are now employed include anionic synthetic detergents, use of a soap or cationic detergent in the pad will not be compatible with the dishwashing detergent and will act adversely on the foam of the dishwashing detergent and destroy a large part of its cleansing power. It is, therefore, preferred that a non-ionic, anionic or amphoteric synthetic detergent be incorporated into the batt to form the present scouring pad.

It is also important to select a detergent which will have a proper amount of lubricity to provide a thin film over and around metallic filament particles stationed on the fibers of the batt by means of adhesive binder. Excessive lubricating properties, however, make the detergent unsatisfactory since the film of detergent can act to so enervate the abrasive qualities of the particles stationed on the fibers as to render their effect almost nugatory.

Among those anionic synthetic detergents which have been found effective as impregnants are alkylaryl sulfonates and lauryl sulfate. A composition commercially available is a sodium salt of alkylaryl sulfonates marketed by Stepan Chemical Company under the trademark DS-60. Another commercial source of alkylaryl sulfonates is Ultra-wet 60-K, produced by Altantic Refining Company.

Among the non-ionic synthetic detergents which are suitable for use in the present scouring pad are ethoxylated alcohols, acids, phenols, and esters which contain OH groups, in addition to amines, amides, ethoxylated amines and ethoxylated amides. Also desirable are condensation products of an alkylolamine and a member of the group consisting of higher fatty acids and their triglycerides, esters, amides and anhydrides. Among such compositions commercially available is a lauryl diethanol amide made by Stepan Chemical Company under the trademark P616.

As is well known, certain synthetic detergents, when used together, exhibit synergistic effects which result

in markedly superior cleansing action. Thus, a detergent composition which has been found particularly advantageous for use in a scouring pad of the present invention is one which is composed of about four parts of the sodium salt of alkylaryl sulfonates and about one part of a highly active lauryl diethanol amide.

It should be noted, however, that a wide variety of natural and synthetic detergent materials will be found suitable for use in the present invention, and such materials will readily be determinable by those skilled in the art. Those compositions which have been named hereinbefore as being most advantageous for such use have been selected on the basis of their compatibility with materials with which they may come in contact in the course of household uses. In particular industrial uses it may well be that these detergents will be found more advantageous because they are compatible with other substances with which they are brought in contact in that particular use. Therefore, the selection of a detergent is governed to a large extent by the use to which the batt incorporating it is to be put, the degree of lubricity required, and the cleansing action which must necessarily be obtained.

These and other objects, features and advantages of the present invention will become more apparent when taken in connection with the following detailed description of a preferred embodiment of the invention and the illustration of that embodiment in the accompanying drawings, which form a part thereof, and in which:

FIG. 1 is a plan view with parts broken away showing a preferred embodiment of the present invention;

FIG. 2 is an enlarged vertical sectional view along line 2—2 of FIG. 1;

FIG. 3 is a sectional view showing in detail a random arrangement of fibers with adhesive binder and metallic filaments positioned thereon, detergent being absent from the voids between fibers.

FIG. 4 is a view of the structure in FIG. 3, the voids between fibers being partially filled with detergent as shown; and

FIG. 5 is a diagrammatic, elevational view of a preferred process of manufacturing a pad according to the invention.

Referring now to the drawings, and in particular to FIGS. 1 to 4, an abrasive, impregnated scouring pad 10 according to this invention comprises a batt 11 formed from an interlaced mass of synthetic, non-metallic fibers 12a and metallic filaments 12b. As best seen in FIGS. 3 and 4, fibers 12a and 12b are disposed throughout the batt 11 in a random, three-dimensional arrangement. The fibers 12a and 12b are of various lengths, according to the equipment used to produce the batt, but are preferably from one-quarter to two inches long. It is of importance that the individual fibers be fixed to other fibers which cross and contact them so as to maintain the unity and shape of the batt 11. To maintain such unity a quantity of an adhesive binder is sprayed on or otherwise applied to the batt of loose fibers. In FIGS. 3 and 4 the binder is seen to be globules 13, which encase at least two fibers at points where they contact or are immediately adjacent each other.

As stated, one method of applying adhesive binder to the batt 11 is to spray the binder on the batt. Such spray is directed on at least one surface of the batt, which surface is to be brought into contact with a piece of work, such as a pot or pan. Preferably, such a surface has a large portion of the total surface area of the batt. It has been found particularly desirable to apply the binder to opposed surfaces of the batt, so that fibers near the surfaces adhere to each other and are thus held in a fixed relationship at their points of contact whereby convolutions of metallic filaments and the free ends of these filaments are brought into working relationship to the soil on the surface to be cleaned.

In accordance with the preferred embodiment illus-

trated, the adhered fibers of the batt are not matted or compressed prior to the application of binder thereto. In their illustrated form a batt 11 is formed with a large proportion of the total volume thereof composed of voids which extend between the fibers to form a network of communicating spaces. Prior to the application of soap or other detergent to the batt the void volume of the batt is relatively high, e.g., in the neighborhood of 75%. This void volume is maintained by the adhesive, which gives permanence to the shape of the batt when the fibers which compose the batt are merely loosely arranged together, the large percentage of void volume tending to make the batt resilient and elastic so that it will return to its original shape after such normal compression as is encountered in household and industrial uses.

It is in these voids between the fibers that detergent is preferably incorporated. In FIG. 4 the voids 14 are shown as being partially filled with detergent, which is in the form of clusters 16 which adhere to individual fibers 12a and b and project from the fibers into the voids. Such a structure as that illustrated in FIG. 4 might be typically found in a central portion of a scouring pad according to the present invention, it being desired to store a large part of the detergent incorporated in a batt in such a central portion so that the detergent will not easily be completely washed from the pad when the pad is subjected to a stream of water or is immersed therein. Unfilled portions of the voids are still sufficient to enable the voids to form an intercommunicating, open network so that water entering the pad may flow into the pad, aided by the inherent wettability of the fibers of the pad, and thus penetrate into inner portions of the pad. By this means it has been found possible to control the release of the detergent from the pad and thereby give in part long life to the pad.

A preferred method of producing soap-impregnated scouring pads according to the present invention is illustrated diagrammatically in FIG. 5. As shown therein, an endless belt 20 is propelled by spaced pairs of sprocket wheels 21 and 22 around which it is trained to form upper and lower horizontal flights 23 and 24, respectively. Sprocket wheels 21 and 22, mounted on axles 21' and 22', respectively, for rotation therewith, are spaced longitudinally as shown. Each sprocket wheel illustrated in FIG. 5 is one of a pair of such wheels, the other sprocket wheel of the pair being spaced axially from and mounted on the same axle as the wheel illustrated.

Endless belt 20 itself is formed from chain members which carry a plurality of links 26 between them, such links having a plurality of spaced concave depressions 27 formed therein along their lengths. These concave depressions 27 are so shaped that, when links 26 are in the horizontal, upper belt flight 23, the depressions 27 are disposed upwardly and are of such dimensions as to be adapted to retain a fibrous batt 11 therein. In its respective concave depression 27 each batt 11 is moved at a uniform speed throughout the steps of the method, and a continuous operation for producing a detergent-impregnated scouring pad of the invention is thereby provided.

As seen in FIG. 5, a batt 11, which has been positioned in its depression 27 by means of an automatically operated hopper or by a human agency, is carried to a first location at which it is subjected to a spray of liquid adhesive binder. A spray of the binder mix is maintained in a tank 30 or other container and is directed on an upwardly facing surface of the batt 11 by means of nozzles 31.

After the binder spraying station has been passed by a batt in its depression 27, the batt is inverted. As illustrated, such inversion may be effected by providing a guide member 25 in spaced relation to sprocket wheel 22 so that, as the belt 20 engages and moves around sprocket wheels 22, batts 11 will be held against their

links 26 until they have been inverted, in which position they are positioned in identical links 26 carried by endless belt 20a.

Endless belt 20a is similar in construction to endless belt 20, being trained over and around sprocket wheels 21a and 22a rotated by axles 21a' and 22a', respectively, to form upper flight 23a and lower flight 24a. Links 26 carried by belt 20a have concave depressions 27 which are of the same shape and are propelled in the same manner as they are by endless belt 20.

In a concave depression 27 of a link 26 of upper belt flight 23a, the batt 11, which has had an adhesive binder applied to that surface which is now its lower surface, is moved to a location where its upper surface is sprayed with the same binder mix 29. Spraying is accomplished by means of nozzles 31a supplied with binder mix from a tank 30a. After such spraying the batt 11, which has now been sprayed with binder 29 on opposed surfaces, is moved to a drying chamber 51, where radiant heaters 52 are provided to furnish heat to bind the adhesive, abrasive mix 29 to the fibers 12a and 12b. Such bonding firmly stations the metallic filaments 12b and the plastic fibers 12a at points where they cross and contact one another.

Having been moved from the drying chamber 51, a batt 11 is preferably subjected to a spray of soap or other detergent 35 contained in a tank 36, the spray of detergent being directed on the upper surface of the batt by means of nozzles 37, which may direct a spray of considerable force against that surface of the batt 11. It is desirable that the detergent solution which is applied to the batt 11 in liquid state be forced through and permeate even the central portion of the batt 11. Excess detergent solution does not remain in the concave depression 27 in link 26, but is drained from the depression by means of orifices 39, which extend from the surface of the concave depression 27 through the body of the link 26 to under-surface 40 of link 26. The structure of an individual link 26 is illustrated in FIG. 5, where orifices 39 are shown in the form of relatively narrow, cylindrical drainage tubes which are parallel to each other and extend at substantially right angles to the bottom 40 of link 26. It will be apparent, of course, that the precise structure of the link 26, depression 27 and drainage outlets 39 will not be limited to the precise form illustrated in FIG. 5, but that such modifications may be made in the form thereof as will occur to one skilled in the art, provided that these members still serve the same functions which they accomplish in the preferred, illustrated embodiment.

After passing the detergent-application station, an impregnated batt 11 is then subjected to compression by means of a ram 41 having a concave surface 42 adapted to cooperate with the upper surface of the batt 11. At the compression station ram 41 is moved downwardly against batt 11 in its concave depression 27, and by compressing the batt, squeezes therefrom a quantity of the liquid detergent solution with which the batt has been impregnated. Such detergent solution, which is viscous and does not flow easily, is thereby forced from the batt through ducts 39 and past the bottom 40 of link 26 into a recovery chamber 43. Chamber 43 is part of a recirculation system 44 which includes a conduit 45 through which liquid in recovery chamber 43 flows to a further recovery chamber 46, which is positioned to receive excess liquid detergent discharged from ducts 39 upon the initial application of detergent solution to the batt 11. Liquid detergent from one or more receiving chambers 43 and one or more further receiving chambers 46 is directed by conduit 47 to a pump 48 which forces the recovered detergent solution in a generally vertical direction through pipe 49 and from spout 50 back to storage tank 36. It is, of course, a requisite of the illustrated recovery system 44 that the detergent remain in substantially liquid form in order to permit it to flow to the pump 48 and thence back into storage tank 36. Heating means may therefore be required to assure a liquid condition of the detergent in the course

of its travel through the recovery system 44, if the detergent is of such a nature that it rapidly congeals and solidifies if exposed to atmospheric temperatures. Likewise, heating means of a conventional type may be utilized in conjunction with storage tank 36 in order to maintain liquid the detergent therein.

Compression of the batt 11 at the compression station serves the function of removing a quantity of detergent solution from the network of voids of the batt. Heavy impregnation of the batt 11 with detergent so that the detergent substantially fills the entire network of voids is undesirable because, when the detergent solution is later solidified, the batt loses several of its advantageous characteristics. Thus, when unimpregnated, the batt is a high-loft structure, flexible, elastic, and resilient. These qualities, together with the wettability of the plastic fibers 12a make the scouring article quick-foaming and exceptionally useful. A flexible pad also is capable of entering crevices where food particles or the like may be lodged and can scour uneven or irregular surfaces by conforming to those surfaces. Complete detergent impregnation stiffens the batt and renders it at least initially unflexible, in which condition the batt will remain until a sufficient quantity of detergent at the surfaces thereof has gone into solution under the application of water or other solvent. Consequently, compression of the batt by a ram 41 removes excess detergent from the batt.

After the batt 11 has been squeezed at the compression station, it next passes through another drying chamber, indicated generally by reference numeral 58, in which the detergent solution in the network of voids of the batt is solidified. As illustrated, radiant heaters 59 are provided to furnish the heat required to solidify the liquid detergent. From the chamber 58 the batt 11 is further carried by its link 26 between sprocket wheels 22a and is discharged as the endless belt 20a is trained around the sprocket wheels and is thereby inverted to form lower flight 24a. Batts 11, now finished scouring articles, are held by guide member 60 and pass to upper flight 55 of a second conveyor belt 56, which flight conveys them to inspection and packaging stations.

A number of the various acids can be added to the detergent compositions to make a product more effective, for example, in removing oxides and sulfides from copper and brass articles. Alternatively, high caustic levels can be introduced into the detergent system to make the product more effective in working with carbonized greases and fats. Typical of the materials in the first category of acids are sulfamic, oxalic, phosphoric, and tartaric. A typical material in the second class (that is the alkali system) is sodium hydroxide. Also combinations of these additives may be made to modify the cleaning properties of the detergent-impregnated articles. The level of such active additives will vary in accordance with the cleaning problem required; for instance, where the working surface is copper, the level of acidic components employed will be relatively high in comparison with the level of detergent required, whereas in the removal of highly greasy and oily-type soils, the level of detergency must be high to emulsify these greases and oils.

Although impregnation of a liquid detergent composition is one of the preferred methods of incorporating a lubricating medium into the batt of matted interwoven plastic fibers and metallic filaments, other methods of providing such a detergent composition may be practiced such as the deposition of a layer or individual strips of the detergent in paste form at spaced points along one surface of the batt whereafter the batt may in turn be laminated to another batt or a paper backing sheet through the intermediation of a suitable adhesive. In this application of the detergent paste it should preferably be located centrally of the batt, that is, in the inner regions of the matted plastic fibers and metallic filaments whereby the open spongiform structure will be permitted to absorb quantities of moisture for dissolving

quantities of the detergent paste and then meter the paste deposit through the spongiform mass of fibers and filaments to the working surface of the batt.

It should be understood therefore that the term "batt" as employed herein and in the accompanying claims is intended to describe a mass of matted, randomly arranged metallic and non-metallic fibers resulting in a web-like structure. This batt may be arranged in various shapes and forms. Thus, although the drawings show a preferred form of article, a pad-like and oval in shape, the pad may be rectangular or round. The thickness of the batt can be varied depending upon the intended period of use of the structure and the degree of impregnation of the detergent composition therein. By virtue of the ability to form the batt prior to or after application of an adhesive binder, the batt may be folded upon itself leaving a void space in between two plies thereof whereby a pocket may be formed for the hand of the user. Although the invention has been described primarily in terms of a batt having a single ply, it is within the spirit of this invention that two or more such plies may be laminated together, which plies may be impregnated with foamed detergent separately or have the detergent deposited at spaced locales on the plies prior to or after lamination with one or more of the detergent-type compositions described herein; in this way a multi-purpose article may be provided. Likewise, the abrasive composition in such single ply or laminated structures may be varied in accordance with the uses intended, providing two different abrading and cleansing surfaces (rough and fine) for finishing applications.

Another composite structure employing the batt of the present invention may be made by laminating this batt or pad to a sponge of either natural or synthetic origin. Typical of these sponges are the articles now manufactured from polyurethane, nylon, and cellulose acetate. Such sponges serve to remove water films remaining on surfaces after the detergent-impregnated batt has completed the scouring and cleansing action.

In general articles such as hereinbefore described can be used in cleaning hard surfaces such as metallic, plastic, ceramic and glass, but are not considered desirable for softer surfaces such as painted and varnished surfaces.

The invention will now be more fully understood by reference to the accompanying example for manufacture of specific batts:

Example

Fine steel wool manufactured from low carbon steel wool wire and having a maximum cross-sectional dimension of 0.002" was cut into filaments 1"-3" in length. 15 denier nylon staple was cut into fibers 1" to 1½" in length. Three parts by weight of these steel wool filaments and one part by weight of the nylon fibers were felted together in a Rando-Webber apparatus of the type referred to hereinabove to produce a batt ½" thick having a voids volume of 80% and a three dimensional structure wherein the metal filaments and plastic fibers are randomly intermingled with some of the fibers and filaments extending the full ½" dimension of the batt. A binder comprising 16 parts melamine-formaldehyde and one part polyvinyl acetate (dry basis) in a 50% water base was sprayed onto one face of the batt at a level of 1.6 parts resin by weight to one part by weight of plastic fibers. As a result of the spray impinging the surface of the batt and the "wetting" which takes place upon such spray the voids volume of the batt was reduced to 70%. The batt with the binder sprayed thereon was then passed to a drying oven wherein the binder was cured at an air

temperature of 300° F. for ten minutes under infrared lamps placed 3' above the batt. The batt was then removed from the curing oven and turned over to permit spraying of binder on its unexposed face, whereafter the curing process was repeated. During this curing operation the water base of the resin evaporates and the binder sets to fix the filaments and fibers at their spaced points of contact with one another in a three dimensional structure having an open, lofty, springy character and having exposed loops of metal filaments on the surface of the batt for scouring soiled working surfaces.

In lieu of nylon staple 16 denier cellulose acetate filaments 1 to 1½" in length could be employed in which case it is preferred to employ 1.6 parts by weight polyvinyl chloride for each part of cellulose acetate filaments present in the batt. Also, one-half of the cellulose acetate filaments may be replaced with 22 denier polypropylene filaments 2" in length. Further, in lieu of the polyvinyl acetate-melamine-formaldehyde binder, a mixture of 10% polyvinyl acetate, 20% phenol-formaldehyde and 70% polyacrylic latex may be employed. The latter binder composition being sprayed onto a batt at the level of 2.1 parts by weight binder for each part by weight of nylon filaments.

While the present invention has been described with particular reference to specific example, it is not to be limited thereby, but reference is to be had to the appended claims for a definition of its scope.

What is claimed is:

1. An article of manufacture suitable for use as a scouring pad, comprising a lofty low-density, non-woven, three-dimensional batt composed of a plurality of elongated flexible tough organic plastic fibers and a plurality of elongated metallic filaments which are interlaced and disposed in random arrangement to form a network of intercommunicating voids extending throughout the batt and occupying at least 50% of the total volume of said batt, said network spacing each of said fibers and said filaments from others of said fibers and said filaments except at locations where said fibers and said filaments cross and contact one another, and an adhesive composition disposed at said locations and bonding said fibers and said filaments together thereat to unite said batt into an integral resilient structure throughout its dimensions.

2. An article of manufacture according to claim 1 wherein a majority of said fibers and filaments have lengths less than 2".

3. An article of manufacture according to claim 2 wherein the majority of said fibers and filaments range in length from ½ to 1½" and wherein said fibers and filaments have a ratio of length to cross-sectional dimension of between 50:1 and 2000:1.

4. An article of manufacture according to claim 3 wherein said batt has a voids volume between about 60-80%.

5. An article of manufacture according to claim 4 in which the batt is impregnated with a dried detergent composition surrounding said fibers and filaments.

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