This invention relates to a method of strongly attaching a bar or cake of solid detergent to a synthetic sponge and relates also to sponges combined with detergent bars or cakes so effectively that they are not separated during washing use, even when the detergent has been substantially completely consumed.

In the past, attempts have been made to combine soaps with sponges. In those efforts directed to cementing soap to the surface of the soap, it has been found that adhesion becomes unsatisfactory when the bar is wetted and under ordinary washing conditions the soap and sponge are soon separated. The present invention solves this problem and provides an improved and practicable method, readily adapted to trouble-free automatic operation for economically making the combined products. The novel products made have been found to have the ability to adhere together during use, even when repeatedly subjected to solutions of alkaline detergent materials in warm water and the compressive, tensing and shearing forces accompanying washing actions.

In accordance with the present invention a process for attaching detergent material to synthetic sponge comprises applying to a bar or cake of solid detergent material selected from the group consisting of water soluble soaps of higher fatty acids, water soluble synthetic organic detergents and mixtures thereof, a water insoluble adhesive, a water impermeable barrier, held to the detergent material by the adhesive, additional water insoluble adhesive and synthetic sponge, the additional adhesive holding the water impermeable barrier to the synthetic sponge, pressfing the sponge against the detergent bar and maintaining it in position, pressed against the bar, for a sufficiently long time to hold the water impermeable barrier tightly against the detergent with the adhesive covering and adhering to substantially all the contiguous water impermeable barrier and detergent bar surface. Also in accord with this invention a combination synthetic sponge and detergent cake comprises a cake of detergent material selected from the group consisting of solid water soluble soaps of higher fatty acids, water soluble synthetic organic detergents and mixtures thereof, a water impermeable barrier held to the detergent by a water insoluble adhesive and a synthetic sponge fastened to the water impermeable barrier.

The invention, its various objects and advantages will be apparent from the following description, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic representation of a process for attaching detergent material to synthetic sponge;
FIG. 2 is a perspective view of an improved detergent bar of this invention;
FIG. 3 is a vertical section taken along plane 3–3; FIG. 4 is a perspective view of another detergent bar made in accordance with the present invention; and FIG. 5 is a perspective view of an invented detergent bar, inverted for better illustration, after consumption of substantially all the detergent in normal handwashing usage.

In the embodiment of the invented process illustrated in FIG. 1, a soap, synthetic detergent or combination soap—synthetic detergent composition, at a temperature of 80°–140° F., preferably 90°–110° F., and of moisture content between 5 and 20% is plodded to continuous bar form 11 in a vacuum soap plodder 13. Endless belt 15 supports the plodder bar to and from cutter 17 which divides the bar into blanks 19 of size and shape suitable for pressing. At soap press 21, comprising vertically rotating spider 23 containing die boxes 25 blanks are pressed to cake (or bar) shape desired by dies 27 and 29. Die 27 has a projection 31 on the face thereof to form a depression in a face of each of pressed detergent cakes 33, of size to match the sponges 35 and barrier films 37 to be inserted in the depressions and fastened firmly to the detergent. The pressed cakes 33 are then conveyed to an automatic machine 39 of the type frequently employed for labeling bottles and jars, where the detergent cakes are indexed with "assembled" sponge-barrier units 41 and are fastened to them. A further explanation of the action of the "labeler" 39 will be given later.

Paralleling the detergent cakes moving to the labeler are pre-indexed sponge-barrier units. These are shown as rectangular flat-faced pieces of cross-sectional area equal to that of the detergent cake depression and covering a major proportion of a face of the cake. The sponge-barrier combined units are formed by applying a barrier film to a strip of sponge and fastened to the combined sponge and barrier. It covers the pressure sensitive adhesive and later acts to support and index the sponges to be applied to detergent cakes, but it is readily stripped from the barrier film when desired, without tearing.

The continuous strip of cemented sponge, barrier and backing is fed to a cutter 59 which cuts the sponge and barrier film, to shape them to fit the depression molded in the detergent cake, but does not cut the paper backing 57. Stripper, 61, which may be associated with cutter 59, then removes the unwanted pieces of sponge and barrier and the strip of pre-cut sponges is fed to the "labeler" 39. This machine strips the backing 57 from the sponges and presses indexed sponges against the detergent recesses, discharging the combination of sponge and detergent 63. The pressure sensitive adhesive holding them together sufficiently strongly to prevent detachment in the next operation.

The combination sponge-detergent is immediately sent to a wrapping station where an automatic machine 65 compresses the sponge, and holds it against the detergent face while a wrapper 67 or other confining packing is placed about it and fastened in place. Thus, the wrapper aids in improving the seal of the pressure sensitive adhesive between sponge and detergent and the resilient sponge holds the wrapper tight to improve its appearance. After wrapping, the wrapped cakes are packed in cases, preferably by an automatic packing machine, represented by numeral 69. The cases are so dimensioned that they, too, act to compress the sponges and thereby hold the pressure sensitive adhesive in close relationship with detergent and barrier film so as to maintain and even improve the seal between them during storage. Although the described procedure and apparatuses lend themselves to accurately fitting the synthetic sponge in the depression 75, it is sometimes advantageous to allow a tolerance or clearance between the sides of the sponge and the sides of the depression to facilitate placement of the
sponge without accidentally impinging the barrier (and its adhesive coating) against the raised face of the detergent cake. After placement of the sponge the presence of the clearance space is disadvantageous because it interrupts the continuity of the cake surface, making it less attractive and also allowing water to more readily penetrate to the edge of the interface between detergent and pressure sensitive adhesive. In Fig. 1 a second press 73 is shown before the wrapping machine to press the sponge tightly against the detergent cake and to deform the detergent enough to close the clearance between sponge and detergent. In this press design may be present the detergent and sponge in combination with suitable modification, decorative, identifying or advertising material may be printed on the sponge, although pre-printed sponges may also find use.

The novel product of the process described is illustrated in greater detail in FIGS. 2 and 3. A cake of detergent 33 contains a depression 75 into which is cemented a synthetic sponge 35 cemented to a barrier film 37. The product of FIG. 4 is similar but can be made without pressing operations, the pluddled detergent bar being extruded in the shape illustrated, preassembled sponge, barrier and pressure sensitive adhesive strip being cemented in place and then released, allowing replacing of the air by wash water. The primed numerals identify elements corresponding to those numerals in FIGS. 2 and 3. In FIG. 5 a thin sliver 77 of soap is shown still adherent to thin plastic barrier film 37 which is still held to sponge 35. The sliver 77 is all that is left of a cake of FIGS. 2 and 3 after normal hardwashing or bath use. By intentionally flexing the sponge and barrier and applying force, the barrier can be separated from the sponge, if so desired, but in normal careful use they will remain attached. After consumption of the detergent the pressure sensitive adhesive coated barrier will remain clean looking and will not pick up dirt, when wet. It will serve to hold the sponge together and will help to prevent its disintegration during use. Still, the adhesive will allow the sponge to be easily adhered to dry surfaces, such as walls or sinks.

The sponge which may be combined with the detergent cake is substantially water insoluble and resilient. It is preferably very light in weight, much less than the density of water, and contains an interconnected cellular network the cells being filled with gas, usually air. With this structure the sponge is able to take up moisture throughout its body, when it is collapsed by pressure, expelling the air, and then released, allowing replacing of the air by wash water. Such continuous compression and expansion of the sponge face facilitates the mixing of air and detergent solution in films and promotes the development of a copious foam. The small interconnecting cells of the sponge are substantially uniform in size to the eye and generally range from 0.005 to 0.100 inch. The material of which the sponge is made should be dimensionally stable and little affected by the presence of moist or dry conditions, insofar as expansion and contraction are concerned. Such a sponge will not tend to warp or distort during use due to alternate moistening and drying of the detergent cake and will not tend to pull away from the surface of the detergent. It is also desirable for the material of the sponge, itself, to be relatively non-absorbent, to promote faster draining and more rapid drying of the product. Among suitable sponge materials are the various synthetic products, especially those based on substances commonly referred to as plastics. Natural animal sponges do not have the properties or structure to be suitable in the invented combination article. Ordinarily cellulosic sponges may not be used because their dimensional instability and capillary action make them less suitable than other synthetics. In the group of satisfactory materials which may be made into sponges useful in this invention there may be mentioned those made by foaming rubber, either natural or synthetic, as well as sponges made by foaming resilient plastics such as polyethylene, polyesters, polystyrene chlorides and acetates and other compounds of similar properties. The most satisfactory of these plastic sponges found to date are those made from polyurethane, preferably of the polyester type for harder and medium sponges and of the polyether type for those desired to be softer. These sponges are of good color, high resiliency, low water absorption, and acceptable for use in the so-called cosmetic usage where it contributes an excellent massage action on the skin without irritation. These polyurethane sponges do not lose their desirable tactile properties when wet. As with most plastics the polyurethanes are available in a wide variety of colors which contribute toward the esthetically pleasing effect, with suitable marking, decora-
Between detergent and sponge is a barrier, usually in thin film form. This barrier should be thin enough to be resilient and flexible so that it will not easily be pried loose from the detergent and sponge to which it is fastened. The barriers that have been found to be most useful are those made from synthetic organic plastics, usually in thickness of from 0.25 to 5 mils, preferably about 1 mil.

The plastics used are impermeable or substantially impermeable to water and prevent transmission of moisture through to the adhesive bonding detergent and barrier, thus preventing or inhibiting the weakening action of water. Water on such a barrier may contact the edges of adhesive layer under the barrier, this will not usually sufficiently weaken the bond to cause the separation of barrier film from detergent. It has been found that layers of water insoluble adhesives alone will not perform the function of a thin continuous plastic film, apparently because the adhesives, even though carefully applied, do contain perforations through which water may penetrate to loosen the detergent-barrier bond. This fault is accentuated when thin adhesive layers are used. Although sheet plastics also sometimes contain minute openings, usually these are few enough and small enough so that very thin films are substantially impermeable to water.

Among the useful barrier films, the most preferred is poly (ethylene terephthalate), known as Mylar. Other polyesters, such as those of alpha,omega-glycols and symmetrical aromatic dicarboxylic acids; vinlyliden chloride-vinyl chloride copolymer (Saran); polymeric amides, such as the polymers of hexamethylene diamine and adipic or sebacic acid (Nylon 66 and Nylon 610); plasticized polyvinyl chloride (Tygon, Geon); rubbers, both natural and synthetic, such as neoprene, butyl rubber, polyisoprene, and GR-S; and phenolics, e.g., phenol formaldehyde, Versamid, synthetic polyamides (nylon type). Of course the choice of adhesive will be somewhat dependent on the nature of the synthetic sponge and the barrier used and should usually be selected for the greatest degree of adhesion under the conditions of use. Also, if the detergent is alkaline reacting, e.g., soap, the cement should be resistant thereto so that it is not hydrolyzed or otherwise adversely affected in use. Nitrile rubber, epoxy resin and polysobutylene adhesive on the invented products retain their adhesive powers, even in strong soap solutions.

Although it is usually preferred to employ an adhesive, the sponge and barrier film may be sealed together by other means, too. Thus, fusion or heat sealing is sometimes applicable. The sponge may have its surface fused or molded to form a continuous film or skin on the surface to be joined to the detergent. Even staples or other holding devices could be used if unobtrusive and unobjectionable in use and if the barrier was resealed or otherwise kept water impermeable.

While the fastening of barrier film to sponge may be effected by various means and the selection of an adhesive is not extremely critical, the problem of sealing a material to a detergent is more difficult of solution. It has been found, after extensive experimentation that many water insoluble adhesives that are capable of adhering to dry soap and other detergent materials are easily removed when the detergent becomes wet or moist. The provision of a barrier between sponge and soap mitigates this adverse effect but it is still highly preferable to employ certain types of adhesives for best adhesions. It has been found that the non-resilient and inflexible adhesives, such as epoxy resins, phenol and formaldehyde derivatives, proteinaceous glues and so forth leave an objectionable hard, sometimes crystal-like deposit on the barrier after the detergent has been consumed. This rough surface is esthetically undesirable. The coating of rigid cement also stiffens the barrier, decreasing its flexibility and its ability to distort slightly when pressed, rather than to be torn away from the detergent. This lack of flexibility causes the sponge to part from the soap before the soap is substantially consumed, decreasing the utility of the product. It is therefore desirable to employ the flexible and resilient adhesives, such as those commonly referred to as being pressure-sensitive. These remain resilient almost permanently and adhere to the soap or detergent, even when repeatedly immersed in water. If loosened, the pressure-sensitive adhesive can be rejoined to the detergent when dry by slight manual pressure. In this respect it is noted that for best adhesion the bar should be hard and dry to the touch when the sponge-barrier is first put in place. Usually the moisture content of such a barrier will be 5–20%. With bars containing a major proportion of soap a moisture content less than 5% will cause difficult plodding and above 20% will usually be unduly soft.

Among the pressure sensitive adhesives, that found best is one based on butyl rubber (polysobutylene). Such compositions, available from Richards, Parents & Murray, New York, N.Y., can be applied to a roll or piece of polyurethane sponge which has been covered on one face with barrier film. The applied adhesive, usually about equal in thickness to the Mylar films described earlier, is coated with non-adherent backing and may be stored until needed for application to the detergent, such application preferably being effected by automatic machines as the Tuck Labeler made by Technical Tape Corporation, New Rochelle, N.Y.

Like other pressure sensitive adhesives those based substantially on polysobutylene are usually composed of a plasticized high molecular weight elastomer, the plasticizer in this case being a low molecular weight fraction of the same material, polysobutylene. Other elastomers such as the rubbers and organic polymers described
earlier may also be plasticized to form pressure sensitive products, according to known methods. Usually the plasticizer used will be a suitable hard resin dissolved in an oil, the resin and oil producing a tackiness and the resin generating adhesive strength. Still other types of pressure sensitive adhesives are known and may be employed, e.g. those based on a polyester of caster oil and maleic ester.

In applying the pressure sensitive adhesive to the barrier film before sealing to the detergent core should be taken that it covers all the film, so as not to leave any portions thereof uncoated. This decreases the efficiency of removing the adhesion of sponge to detergent. Furthermore, the pressure exerted in fastening the sponge to the detergent should be enough to press all the pressure sensitive adhesive into contact with the detergent surface.

As was said previously, the sponge units, less detergent, may first be assembled, then stored and applied to detergent when desired, either as individual pieces or as a length which is subsequently cut with the detergent bar, as by a machine like that represented by numeral 17. Thus the manufacturing processes are simplified and made more flexible and may be carried out using presently available equipment to a substantial extent. This also enables the consumer to obtain the full benefit of the combination article for a greater period, in effect, increases the useful life of the product. Some of these benefits are outlined here.

The synthetic sponge, being lighter than water, increases the buoyancy of the product and causes even piled soaps and detergents to float. The sponge also reduces the solvent rest for the detergent, facilitating drainage and decreasing smearing or sloughing of detergent gel. This is especially important in the cases of synthetic detergent bars and soap—synthetic detergent bars, which are usually more soluble than desirable. The sponge rest also increases the sliding friction of the detergent, preventing slipping off inclined washstand surfaces and giving the user a better grip.

The sponge aids in producing a copious lather and acts as a wash cloth, helping to clean the skin. Because the surface properties of the sponges can be readily regulated in production, firm or soft washing surfaces can be made, as desired. The sponges can be molded, pressed out or printed with permanent decorative material, advertising, trade names or instructions for use. Finally, all these advantages over ordinary soaps are attainable with only a small increase in production costs, if the products are made by the claimed processes. In some instances, where pressing is omitted (being now unnecessary because the sponge may be preprinted with trade name and decoration) the cost of the sponge bar may be even less than the cost of an equivalent sized detergent bar.

The above invention has been described with respect to illustrations of preferred embodiments thereof. It is not limited to such methods and articles only, the scope of the invention being as recited in the claims.

What is claimed is:

1. A process for attaching detergent material to synthetic sponge which comprises applying to a bar or cake of solid detergent material selected from the group consisting of water soluble soaps of higher fatty acids, water soluble synthetic organic detergents and mixtures thereof, a water insoluble adhesive, a water impermeable barrier, held to the detergent material by the adhesive, additional water impermeable adhesive and synthetic sponge, the additional adhesive holding the water impermeable barrier to the synthetic sponge, pressing the sponge against the detergent bar and maintaining it in position pressed against the bar, for a sufficiently long time to hold the water impermeable barrier tightly against the detergent with the adhesive covering and adhering to substantially all the contiguous water impermeable barrier and detergent bar surface, so that, during washing, water will not be able to contact the detergent under the sponge and will not be able to contact the adhesive holding detergent to impermeable barrier, except around the peripheral portions thereof.

2. A process according to claim 1 in which the synthetic sponge, water insoluble adhesive and water impermeable film are applied to the solid detergent material together.

3. A process for attaching detergent material to synthetic sponge which comprises pressing against a bar or cake of solid detergent material selected from the group consisting of water soluble soaps of higher fatty acids, water soluble synthetic organic detergents and mixtures thereof, a synthetic sponge having fastened to it with water insoluble adhesive one side of a water impermeable film which is coated on the other side with a resilient, water insoluble, pressure sensitive adhesive, so that the pressure sensitive adhesive holds the film to the detergent, applying to the connected detergent bar and sponge a restricting cover while holding the sponge against the detergent, which cover will hold the sponge against the detergent for a sufficiently long time to hold the pressure sensitive adhesive covering and adhering to substantially all the contiguous water impermeable film and detergent bar surface, so that, during washing, water will not be able to contact the detergent under the film and will not be able to contact the adhesive holding the detergent to the film except around peripheral portions thereof.

4. A process according to claim 3 in which the detergent is pressed to shape suitable for fastening to a synthetic sponge, a plurality of film coatings thereof, cemented on one side to the sponge and on the other side covered with a pressure sensitive adhesive, are serially held to a strip of backing material, the pressed detergent cakes and strip of sponges are fed together to a joining station, the backing is stripped from the sponges and they are consecutively indexed with the detergent bars, pressure sensitive adhesive facing the bars, are pressed against the detergent bars and the detergent bars with sponges attached are wrapped.

5. A process according to claim 4 in which the detergent bar contains a soap of higher fatty acid, the adhesives are alkali resistant, the detergent bar is puddled and pressed at a moisture content of 5 to 20% and temperature from 80–140°F. to cake form having a cavity for insertion of a sponge, the sponge with pressure sensitive adhesive on the attached film is placed in the cavity and pressed against the detergent cake and the cake with sponge attached is re-pressed to force detergent at the cavity edges against the sides of the sponge.

6. A process for attaching detergent material to synthetic sponge which comprises plodding a continuous bar of solid detergent material selected from the group consisting of water soluble soaps of higher fatty acids, water soluble synthetic detergents and mixtures thereof, applying to the continuous bar of detergent a water insoluble adhesive, a water impermeable barrier, held to the detergent by the adhesive, a synthetic sponge and means for holding the sponge to the bar, pressing the sponge, barrier and adhesive against the detergent bar to hold the barrier against the detergent with the adhesive covering and adhering to substantially all the contiguous barrier and detergent bar surface and then cutting the bar of detergent material and attaching sponge and barrier to lengths.

7. A process according to claim 1 in which the synthetic sponge and attached water impermeable barrier coated with water impermeable pressure sensitive adhesive are pre-assembled and subsequently applied to the solid detergent material together before being cut to length.

References Cited in the file of this patent

UNITED STATES PATENTS

717,256 Nilsson Dec. 30, 1902
2,365,920 Vaughan Dec. 26, 1944
2,420,734 Churchill May 20, 1947
2,731,777 Wollersheim Jan. 24, 1956