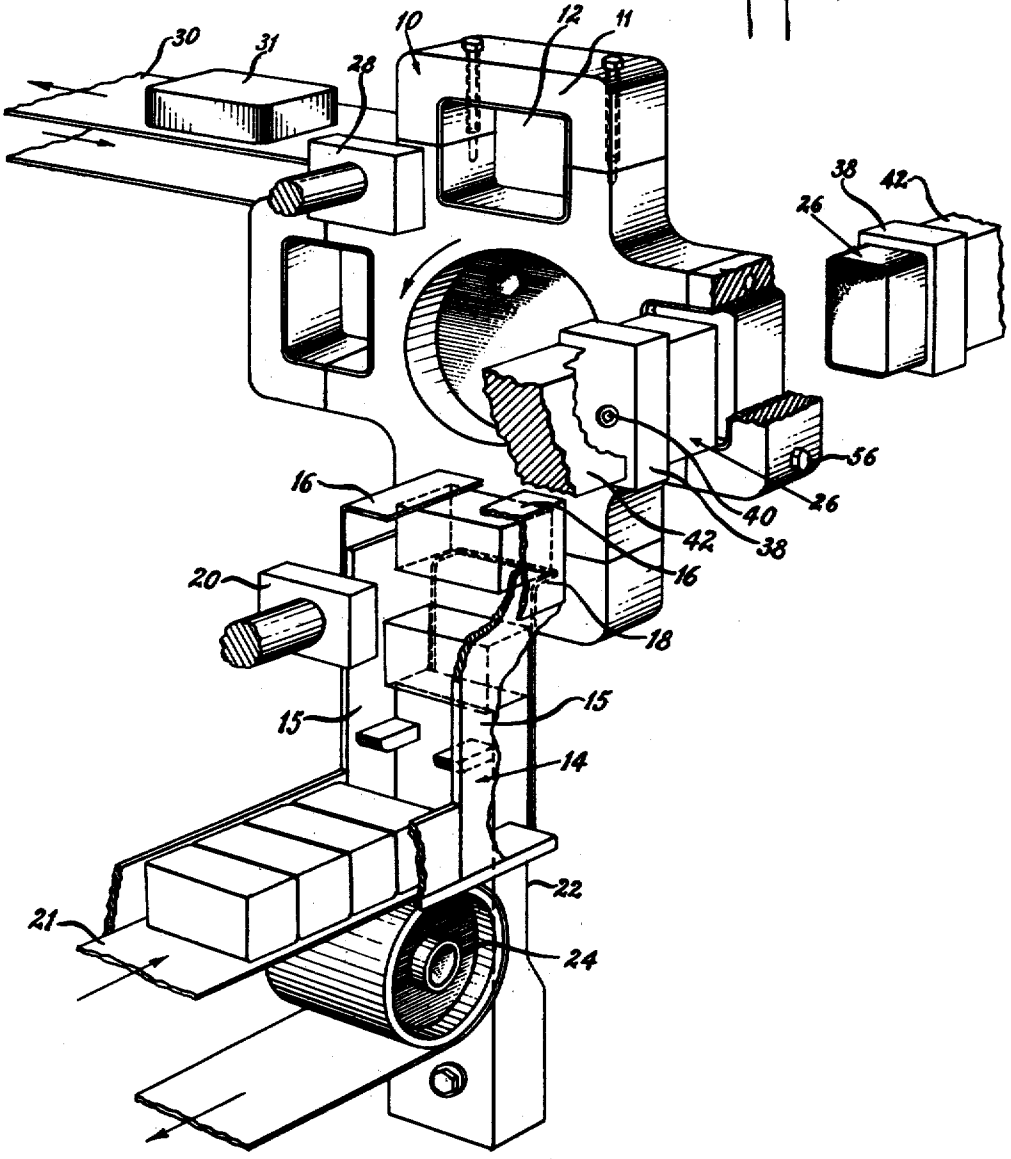
Dec. 27, 1960 W. W. SWEET ET AL 2,965,946

APPARATUS AND PROCESS FOR PRESSING DETERGENT BARS AND CAKES

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Fig. 1.



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Filed Oct. 2, 1958 2 Sheets-Sheet 2

Fig. 2.

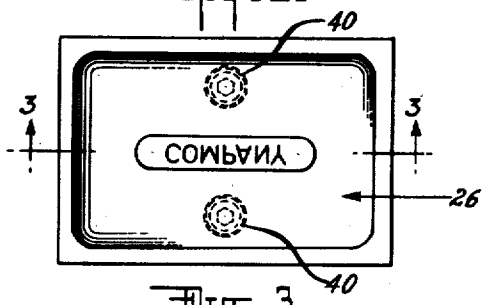


Fig. 3.

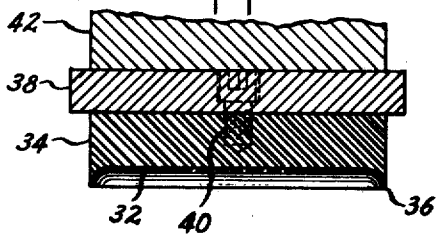


Fig. 6.

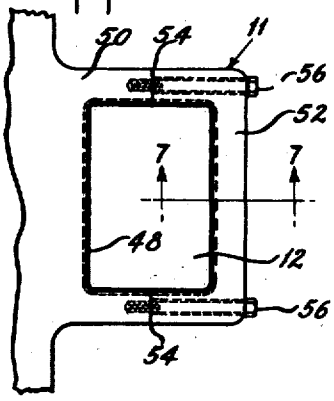


Fig. 7.

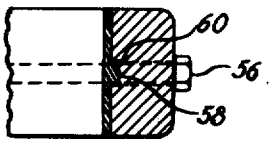


Fig. 4.

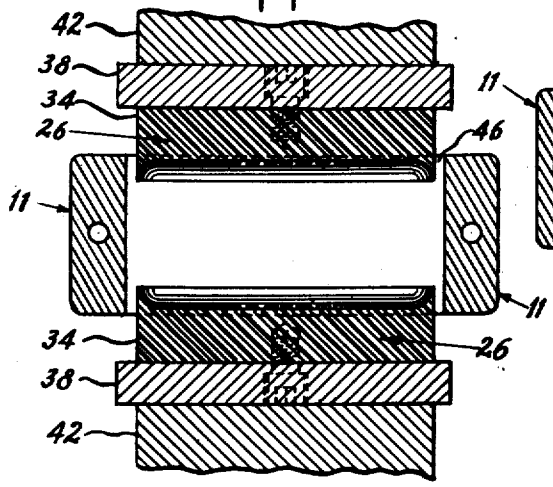
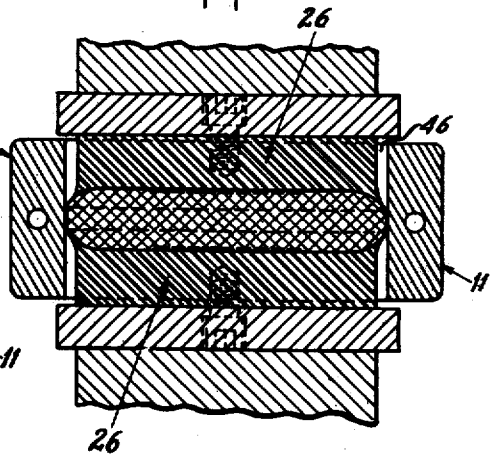


Fig. 5.



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APPARATUS AND PROCESS FOR PRESSING DETERGENT BARS AND CAKES

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19 Claims. (Cl. 25—7)

The present invention relates to an apparatus and process for pressing detergent materials into the forms of bars and cakes and has particular reference to die members and die boxes, formed partially or wholly of plastic materials.

One form of apparatus which has been used for pressing detergent materials into the forms of bars and cakes comprises a die set, including a pair of companion die members and a die box, mounted in operative relationship on a stamping or pressing machine.

The die sets of such apparatus have been wholly formed of various kinds of metals and alloys, e.g., steel, iron, copper, aluminum, bronze, Monel metal, etc. Dies and die boxes made of these metals, although widely used in the detergent industry, have certain inherent limitations, disadvantages and drawbacks which limit their usefulness and desirability for commercial detergent pressing operations.

The construction of metal die members, for example, necessitates painstaking and time consuming hand shaping and machining operations. When a metal die member wears out or is broken it is difficult to replace it with an exact duplicate replacement die since the replacement die must also be shaped individually by hand.

A disadvantage inherent in die sets made of metals is the fact that a certain amount of detergent material escapes from between the working faces of the die members during pressing and flows into the clearance space between the dies and the interior walls of the die box, producing a so-called fin or flash.

In time some of the detergent flash builds up on the faces of the dies and mars the surfaces of subsequently pressed cakes. The cleaning of the dies and the die box to remove this fin or flash necessitates shutting down the apparatus and requires considerable handling of equipment which results in increased labor and production costs and, if cakes of soap or detergent had been produced by the dies upon which flashing was deposited, that production would have to be scrapped. Had the manufacturer of this marred product not been noticed, and the soap been shipped, bars put on sale would be unsightly to the consumer and would probably create an unfavorable impression about the quality of the detergent itself. This might very well lead to a loss of customers for the product, as well as damage to the manufacturer's valuable reputation for selling only products of the highest quality.

Difficulties similar to those described in the preceding paragraph are also encountered when the detergent or soap being pressed is attracted to the material of the die and a portion adheres to the die during pressing. This behavior is not usually as frequent or as detrimental as the deposition of flashing on the die. It occurs most often when the die has a rough or figured working surface and when the material being pressed is soft and lacks cohesion. It has been observed that metal has an affinity for detergents (including soaps), sometimes causing severe die-marking when detergent adheres to it.

It has now been discovered that the disadvantages and limitations heretofore encountered in pressing detergent materials with metal die sets may be overcome or substantially minimized by pressing the detergent in a die set formed of organic plastic materials. This improvement is especially notable when the dies are used to press softer, tackier detergents, which tend to adhere to metal dies. The novel plastic die members and die boxes of this invention are rugged and long wearing and may be mounted quickly for operation in conventional pressing machines. The dies and boxes are extremely simple in character and are capable of being produced rapidly and economically by methods and machines that are commercially feasible and highly efficient in operation.

The plastic materials which are useful for the manufacture of dies for pressing detergents are organic polymers of high molecular weight. The particular plastic employed in making novel die members and die boxes, or the working surfaces thereof, may be selected from a relatively large number of suitable materials, including both the so-called natural and synthetic high molecular weight polymers. Examples of the natural polymers include esters and ethers of cellulose, e.g., cellulose nitrate (Pyralin), cellulose acetate (Plastacele), cellulose propionate (Tenite), ethyl cellulose (Ethocel), etc.; condensation products of formaldehyde, glyoxal, and epoxides with proteinic materials such as casein, soya bean protein, zein, etc.; condensation products of natural ester gums with dibasic acids such as maleic, fumaric, phthalic acids, etc., with or without interaction with synthetic resin formers such as styrene, methylmethacrylate, etc.

Representative examples of synthetic plastic materials include both condensation polymers and addition polymers. Suitable condensation polymers are polyamides, e.g., copolymer amides of adipic acid with sebacic acid and hexamethylenediamine (nylon 10001), etc.; polyesters, e.g., polyglycolterphthalate (Dacron), etc.; copolyester polyamides, e.g., copolymers of adipic acid and hexamethylenediamine with ethylene glycol, etc., condensation products of formaldehyde or epoxides with urea, melamine, phenols, or suitable admixtures thereof, e.g., poly condensation products of dimethylol phenol with an excess of formaldehyde (Bakelite), dimethylolmelamine (Melmac), etc.; polymers containing silicon obtained by interaction of bi-functional alkyl or aryl silanes with each other and with glycols or diamines, e.g., polyphenolsiloxane (silicones), etc.; condensation products of alkyl dihalides with sodium sulfide and oxidation products of dimercaptans, e.g., polyhexamethylene disulfide (Thiokol); etc.

Examples of suitable addition polymers include polymers of vinyl and vinylidene derivatives and of higher substituted alkylenes, e.g., polyethylene (Polythene), which may be either low, medium or high density, polypropylene, random or isotactic, mixed polymers of ethylene and propylene, other polymers of lower alkylenes of up to four carbon atoms to the monomer, polyvinyl chloride (Geon), polyvinylidene chloride (Saran), polyvinyl acetate (Vinylite), polystyrene (Styron), polytetrafluoroethylene (Teflon), polytrifluoromonochloroethylene (Kel-F), etc.; polymers of derivatives of acrylic and substituted acrylic acids, e.g., polymethylmethacrylate (Lucite), polyacrylonitrile (Orlon), etc.; polymers of allyl compounds, e.g., polyallyl chloride, polyallyl esters; copolymers of vinyl chloride and acrylonitrile (Igelite, Dynel, etc.); polymers containing urethane groups, e.g., addition products of phenylene diisocyanate with glycols (Desmodur); polymers of ethylene oxide and other epoxides, e.g., polyoxyethylene (Carbowax); polymerization products of dienes such as butadiene, isoprene, chloroprene, e.g., polybutyldiene (Perbunan), polyisoprene (rubber), polychloroprene (neoprene); etc.

The polymerization products mentioned may be used alone or in suitable admixtures in the novel plastic die members and die boxes of the present invention. If de-

sired, adjuvant materials may be incorporated with the polymerization products, e.g., plasticizers, fillers, coloring materials and the like. The employment of suitable plasticizers and other regulants allows adjustment of characteristics of the plastic so as better to suit it for the particular application desired. For example, polyvinyl chloride of a variety of hardnesses and flexibility may be made by the addition of different amounts and types of plasticizers. Similarly, the degree of polymerization of the various plastics may be controlled and fillers also may be employed to regulate the properties of the dies and die boxes or their working surfaces. The die members should be of a plastic which is of sufficient strength to press out the detergent being processed and it is highly preferred that it be flexible enough, in the design employed, to expand against the die box interior during pressing so as to close off the clearance space between die and die box at the leading edge portions of the die, thereby preventing flashing of the detergent. Such a plastic should also be sufficiently resilient to return quickly to its initial shape when the pressing force is released, allowing opening of the clearance space to permit an inrush of air to break the vacuum between the die working surface and the cake of pressed detergent. The quick contraction of the die to its original shape also avoids the possibility of the die edges being torn by contact with the die box upon reentry. In typical high-speed presses the die enters the die box about once a second and before reentry the die must have become small enough to clear the die box, allowance also being made for slight variations of die to die box alignment.

In order to indicate more fully the advantages and capabilities of the novel detergent pressing apparatus, reference is made to the following description taken in conjunction with the accompanying drawings which, by way of illustration, show a preferred embodiment of the invention. Other embodiments of the invention employing the same or equivalent principles may be used and structural changes may be made as desired without departing from the present invention and the purview of the appended claims. In the drawings similar reference characters are used to designate corresponding parts in each of the several figures.

In the drawing:

Fig. 1 is a perspective view, with parts broken away for greater clarity, of apparatus embodying features of the invention;

Fig. 2 is a front view of a plastic die member;

Fig. 3 is a sectional view of the die member shown in Fig. 2, along line 3—3, looking in the direction of the arrows;

Fig. 4 is a sectional view of a novel plastic die set, including a pair of plastic die members and a die box, showing the relative position of the parts before the die members are brought towards one another during the pressing stroke;

Fig. 5 is a sectional view similar to Fig. 4 showing the relative position of the parts and a pressed detergent cake upon completion of the pressing stroke;

Fig. 6 is a fragmentary view of a die box spider showing a die box, a receiving cavity and a plastic liner; and

Fig. 7 is an enlarged fragmentary view of the die box and liner shown in Fig. 6, along line 7—7, looking in the direction of the arrows.

Referring to the drawings, the invention as therein illustrated, is embodied in apparatus including die members and a die box formed of plastic materials designed for pressing detergent bars of generally rectangular shape. Any other bar shapes, e.g., round, oval, square, circular, etc., may be pressed within a die set of corresponding design. Plastic die sets capable of pressing bars of various shapes are equivalent to the plastic die set illustrated and are contemplated within the scope of the present invention.

Looking first at Fig. 1, apparatus for pressing detergent material into the forms of bars and cakes is depicted. The reference character **10** designates a die box spider which is cruciform in shape and which is adapted to rotate counter clockwise (as shown on the drawing) about an axis perpendicular to lines through the middle of each pair of opposite arms of the spider and at the point of intersection. There is a die box **11**, having a rectangular receiving cavity **12** located in each arm, the direction of the cavity being parallel to the axis of rotation of the spider. Means (not shown in the figure) are provided for rotating the spider through 360° in 90° increments.

A guide box **14**, having lateral walls **15** spaced apart by a distance approximately equal to the length of a receiving cavity, is located adjacent the spider. The upper part of the guide box is closed off by a pair of stops **16**. A shoulder **18** is located at a distance below said stops approximately equal to the width of a receiving cavity. The stops, shoulder and lateral walls of the guide box together form a port of approximately the same cross section as a receiving cavity. The port is extended a short distance from the guide box in the direction of the spider. The guide box is so located that said port is in horizontal alignment with each receiving cavity successively as the cavities are rotated into the lowermost position of the spider after each 90° rotation of said spider. A horizontally reciprocating bottom pusher **20** is positioned in alignment with said port and is adapted for reciprocable motion in and out of the guide box.

A vertical pusher **22**, adapted to reciprocate vertically in the guide box, is provided. A conveyor feed belt **21** mounted upon rollers **24**, one of which (not shown) is driven by positive means, has its forward end positioned in the guide box **14**. Pusher **22** is adapted to reciprocate from a position below the forward end of the conveyor belt, to a position in alignment with the shoulder.

Adjacent the spider and at a position 90° forward from the lowermost point thereof there is a pair of companion plastic die members **26** of approximately the same cross section adapted for horizontal reciprocation into each of the cavities **12** successively upon registry of the spider.

A horizontal reciprocating top pusher **28** is located adjacent the spider in horizontal alignment with a receiving cavity at the uppermost position of the spider. Pusher **28** is adapted to reciprocate through each of said cavities successively upon registry of the spider. A take-off belt **30** is located below the uppermost cavity on the side of the spider opposite the top pusher and conveys pressed detergent cakes **31** (one shown) to a wrapping station or the like.

Looking next at Figs. 2 and 3, a plastic die member **26** is shown in the form of a block having a body portion provided with a depressed working surface or face **32**. The peripheral portion of the depressed face curves outwardly and joins side walls **34** of the block to terminate in a flexible thin feather edge **36**. If desired, trademarks, tradenames and the like may be embossed on or engraved in working face **32** for marking the pressed bar.

The die member **26** is secured to a mounting plate **38** in any convenient manner as by machine screws **40**. The plate **38** is secured to a shaft **42** attached to a detergent press.

Looking next at Figs. 4 and 5, there is shown a plastic die set comprising a die box **11** and a pair of relatively movable plastic die members **26**. As illustrated in the drawing the die box is made larger in size than the die member to provide a clearance space **46** which allows for passage of the die members in and out of the box. The size of the clearance space has been exaggerated in the drawing for purpose of clarity of description.

In Fig. 4 the die members are shown in the position in which they appear near the beginning of the pressing stroke. Figure 5 shows the position of the die members at the end of the pressing stroke.

Looking next at Figs. 6 and 7, a die box **11** having a

plastic liner 48 within a receiving cavity 12 is shown. Die box 11 comprises two portions 50 and 52 joined to one another at 54 and held by any convenient means, e.g., by machine screws 56. As shown more clearly in Fig. 7, that surface of die box 11 which defines cavity 12 is provided with a groove or notch 58, i.e., the notch extends about the perimeter of cavity 12 in box 11. The outer surface of plastic liner 48 is provided with an integrally formed perimetrically extending ridge 60. To assemble the parts it is only necessary to remove portion 52 from portion 50 of the die box, insert liner 48, replace die box portion 52, and insert and tighten screws 56. Ridge 60 of liner 48 fits securely within notch 58 and maintains the liner in fixed position.

Each of the companion die members 26 is preferably formed wholly of highly polymeric plastic although only the working surfaces thereof, those contacting the detergent to be pressed, or the edge portions of those surfaces, are necessarily of such material. Within the broader area of this invention are contemplated detergent pressing apparatuses in which the die members are of metal alloy or other hard base material covered with a layer or coating of plastic of suitable thickness.

Among the preferable harder plastics that have been used successfully in making die members may be mentioned the condensation polyamides of adipic acid with sebacic acid and hexamethylenediamine, e.g., nylon 10001. The nylons have been found to release exceptionally well from detergents being pressed. Such ease of parting and low degree of adherence minimize fouling of dies and allow more continuous production with only infrequent shutdowns.

Nylon 10001 has a modulus of elasticity of about 400,000, a compressive strength of about 13,000, a compressive strength at 1% deformation of about 4,900 and a flexural strength of about 14,600, all in pounds per square inch. Also suitable are other nylons and other hard plastics having a modulus of elasticity between about 5×10^4 and 5×10^5 pounds per square inch combined with a compressive strength between about 10,000 and 35,000 pounds per square inch and a flexural strength between about 8,000 and 20,000, preferably between about 10,000 and 15,000 pounds per square inch. Such plastics are rigid enough to press out very firm soaps or detergent compositions and are strong enough to withstand breakage under compressive forces to which they are subjected, but are sufficiently flexible to allow the expansion of the forward portion of the die member outwardly against the die box during pressing. It is preferred to construct the die member with a depressed working face, or what is in effect the same thing, a thin raised edge, to aid expansion of the leading edge to the die box during pressing, effectively preventing flashing of detergent. However, the die periphery may also be undercut to facilitate this expansion.

Among the so-called softer plastics that have been useful for pressing detergents and soaps into cake form, those made from polymers of lower alkylenes are found particularly suitable. The low density or conventional polyethylenes are presently preferred embodiments of these softer plastics which are also useful for the manufacture of detergent pressing dies and die working surfaces. As with other die plastics, the lower polyalkylenes may be utilized in the construction of die boxes. The die boxes may be resilient enough to deform slightly to conform with the die shape during pressing to prevent flashing.

Although many polyethylenes are softer than the nylons, their compressive and flexural strengths being unmeasurable by the conventional methods because specimens of these materials fail to break under the test conditions, nevertheless they make excellent die mmbers. The modulus of elasticity of a typical soft or low modulus polyethylene is about 19,000 pounds per square inch, well below the lower limit of the range defining the hard plastics previously discussed. Other soft plastics, such as plasticized polyvinyl chloride (Geon) have been used to press out soap bars. However, the polyalkylenes, particularly polyethylene, allow a much quicker die release, from the detergent material being shaped, than do many other plastics, apparently because if disaffinity or non-adherence between the polyalkylene material and the detergent.

The higher density and medium density polyethylenes are also useful in manufacturing soap and detergent cakes. As is evident, dies made from these materials will usually have properties between those of soft polyethylene and nylon and sometimes might even be made as hard as or harder than nylon 1001. Their modulus of elasticity, compressive strength and flexural strength should not exceed the upper limits already given for the harder plastics. One of the suitable harder polyethylenes now being manufactured has a molulus of elasticity of 150,000, a compressive strength of 2,450 and a flexural strength of 1,400, all in pounds per square inch.

It will be clear to one skilled in the art of manufacturing detergent bars that it is preferable to utilize the softer plastic dies in shaping the more plastic soaps and detergent compositions, rather than in the pressing of those which are more resistant to alteration of shape. The plasticity of the detergents can often be increased by heating or by the addition of moisture or plasticizer but such changes of formulation are usually to be avoided, if the only purpose thereof is to allow the blank to be pressed more readily. Rather, it is preferable to employ a die of properties which suit it for use with the detergent composition being shaped. The softer polyethylene dies have been used for pressing the ordinary fatty acid soaps and various combination soap-synthetic detergent bars. To minimize distortion and flow of these plastics during pressing it is advisable to have the blank of soap being pressed of a size and shape that corresponds closely to that of the desired finished product.

The softer polyalkylene plastics referred to above are often described by their melt indexes and densities. Within the relatively limited classes of these polymers, such properties are helpful in defining the nature of the particular plastic. Usually, as the density increases the stiffness (modulus of elasticity) of the polyalkylene increases too, and the flex life decreases. With the same molecular weight distribution (weight average molecular weight/number average molecular weight) and constant density, a higher melt index indicates a decrease in tensile strength. If only molecular weight distribution is increased tensile strength also increases. Soap and detergent bars may be pressed with polyethylenes having melt indexes above 0.25 and densities above 0.914. Molecular weight distribution usually ranges from 5 to 40 and weight average molecular weights are from 25,000 to 1,000,000. A polyethylene made by Canadian Industries Limited, their No. 220G, was found to be very satisfactory. This material has a melt index of 2.0 and a density of 0.919. Other resins, including the same manufacturer's Nos. 204–E–07 and 1200H, were also useful but their 01500A, having a density of 0.912 and a melt index of 150, was considered too soft for most commercial applications. Although the properties given above will indicate to one skilled in the art which of the specified types of plastics are of greatest utility in the apparatus and process of this invention, the ultimate test of suitability will be an actual production run on the particular detergent being stamped. The given properties (melt index, molecular weight, molecular weight distribution, density, modulus of elasticity) are exemplary of useful soft and medium modulus polyethylenes. Other polyalkylenes, even other polyethylenes, of equivalent satisfactory pressing characteristics may be used even if of test properties outside the ranges given.

Die members formed wholly or partially of the plastic materials described may be used in conjunction with die

boxes of metals or metal alloys. However, in a preferred embodiment of the invention, the die boxes are formed wholly of said plastic materials (usually the harder types) or are formed at least partially of plastic materials. Thus, metallic die boxes having receiving cavities lined or covered with a coating layer of plastic material of a suitable thickness, applied, for example, as illustrated in Figs. 6 and 7, can be used.

The operation of the detergent pressing apparatus of this invention is simple and now will be described with respect to the die pressing of a milled detergent blank comprising the sodium soaps of mixed higher fatty acids. The apparatus employed in the pressing operation to be described includes a liner for the die box cavity and a pair of companion plastic die members, each made of a plastic material comprising the condensation polyamides of adipic acid with sebacic acid and hexamethylenediamine (nylon 10001). For convenience the apparatus is being described with respect to a specific nylon but it will be understood that the description also applies to apparatuses and processes using other suitable plastics, as taught by this specification.

Blanks of the milled detergent having a length of about 3½" and a width of 2" are fed into the guide box 14 by the moving conveyor belt 21. Vertical pusher 22 raises one of said blanks to the top of the guide box where the same is held by the lateral pressure of the walls 15 of the guide box. Bottom pusher 20 pushes the blank into the port of the guide box where it is held by the shoulder 18. In the next upward stroke of vertical pusher 22 a second blank is raised to the top of the guide box and the next forward stroke of the bottom pusher 20 pushes said second blank into the port thereby pushing the first blank from the guide box into a receiving cavity 12 at the lowermost position of the spider. The spider then is rotated 90° and the detergent is in position for being pressed between dies 26.

The dies 26 are brought forcibly towards one another with sufficient pressure, e.g., about 250 pounds per square inch to form and press the blank into a cake of detergent having the shape of the cavity defined by the dies and the die box. While the blank is being pressed into shape the detergent forces the feathered resilient edges 36 of the dies 26 outwardly against liner 48 of the die box 11. Since the feathered resilient edges are held firmly against the liner none of the detergent can flow into and collect in clearance space 46.

The dies then are withdrawn and the spider again is rotated 90° carrying the pressed cake into the uppermost position. Top pusher 28 then ejects said cake from the cavity whence it falls onto the take-off conveyor 30.

A lubricating material, e.g., mineral oil, carbitol, acetic acid, glycerine, salt solutions, pulverized solids, etc., may be used, if desired, in pressing detergent materials with the apparatus of this invention. If a lubricant is used it may be applied most advantageously to the blanks while the same are being carried to the guide box by conveyor belt 21. Only a minor amount of lubricant need be used, i.e., only about one or two drops need be applied to every fifth or sixth detergent blank.

The detergent pressing apparatus, including die sets of suitable plastics described herein, is adapted for pressing bars and cakes of soaps or synthetic detergents of various compositions employed in the art. It is a particular feature of the invention that blanks and bars comprising synthetic detergents, with or without fatty acid soaps in admixture therewith, can often be pressed without sticking to the die and die box, although these materials are frequently, strongly adherent to metal parts.

The plastic die sets of the present invention may be produced readily and easily by well-known commercial manufacturing processes. The die members may be made, for example, by transfer molding, compression molding, jet molding, heatronic molding, cold molding, plunger molding, injection molding, etc. Details of the method and equipment employed in molding need not be considered here. Inasmuch as great numbers of similar die members can be made in such manner it is a relatively simple matter, when a plastic die member becomes unusable, to replace the same with another member which is an exact duplicate of the first. Furthermore, a great saving in labor costs is realized since the construction of an accurate plastic die duplicate, unlike the manufacture of metal dies, does not necessitate painstaking and time consuming hand shaping operations.

Plastic dies afford still further savings since the costs for producing and maintaining such dies are much lower than for metal dies. For example, based on a year's operation the costs for producing and maintaining plastic dies made of nylon 10001 for about twenty-five to thirty-five detergent presses is approximately one-third to about one-fourth as much as the cost of producing and maintaining Monel metal dies of comparable size and shape.

Moreover, lubricants used during the pressing operation do not cause poisoning of detergents which are pressed within plastic die sets as they do detergents pressed within metal die sets. The use of a lubricant generally is considered desirable to help prevent pieces of detergent from adhering to and building up on the dies and marring the surfaces of subsequently pressed cakes.

Experience has shown that lubricants, when used in pressing detergents within metal die sets, in addition to promoting the corrosion of the metal equipment, also react with the metal to form chemical compounds which poison the detergent. Such poisoning promotes spotty discoloration and hastens the development of rancidity within the detergent. Furthermore, undesirable degradation of the perfume materials incorporated in the detergent often results.

Bars and cakes of detergent pressed within the plastic die sets of the present invention do not become poisoned because the lubricants are inert with respect to the plastic materials. Furthermore, the pressed cakes do not show signs of perfume degradation or rancidity development nor do they become spotted or discolored even after having been stored for long periods of time

By using the apparatus of the present invention it is possible to press large numbers of detergent bars and cakes of uniform size and shape having a smooth finish and a high sheen.

Certain of the plastic materials hereinbefore described are subject to seizing and galling when separate pieces of the same are brought together under frictional or pressure contact. Therefore, the plastic materials employed in forming the die sets of this invention preferably are selected so that the plastic material used in forming the die members will not seize and/or gall with the plastic material used in forming the die box.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood, of course, that many modifications and changes and substitutions may be made therein without departing from the true scope of the invention as defined in the appended claims.

What is claimed is:

1. Apparatus for pressing detergent materials into cake form comprising a relatively movable companion die member and a die box, said die member having a working surface, the peripheral portion of which is of plastic material which is a polymer of high molecular weight capable of being resiliently deformed in the pressing of detergent material, in such manner that the peripheral portion of the die member working surface is forced outwardly against the die box during pressing.

2. Apparatus for pressing detergent materials into cake form comprising a relatively movable companion die member and a die box, said die member having a working surface, the peripheral portion of which is a high molecular weight polymer of lower alkylene, capable of being

resiliently deformed in the pressing of detergent material, in such manner that the peripheral portion of the die member working surface is forced outwardly against the die box during pressing.

3. Apparatus for pressing detergent materials into cake form comprising a relatively movable companion die member and a die box, said die member having a working surface, the peripheral portion of which is a high molecular weight polymer of ethylene, capable of being resiliently deformed in the pressing of detergent material, in such manner that the peripheral portion of the die member working surface is forced outwardly against the die box during pressing.

4. Apparatus for pressing detergent materials into cake form comprising a relatively movable companion die member and a die box, said die member having a working surface, the periphery of which terminates in a thin raised edge portion capable of being resiliently deformed in the pressing of detergent material, in such a manner that the detergent forces the thin raised edge portion of the die member working surface outwardly against the die box during pressing, thereby decreasing flashing of the detergent, the said thin raised edge portion of the die member being made of plastic material which is a polymer of high molecular weight.

5. Apparatus for pressing detergent materials into the form of bars and cakes comprising a pair of relatively movable companion die members and a die box, each of said die members having a depressed working surface the periphery of which terminates in a thin edge portion, said edge portion and all other portions of said die members and die box which come in contact with the detergent material during pressing being formed of a plastic material which is a polymer of high molecular weight and which is capable of being resiliently deformed in such manner that the detergent material forces the edge portions of the working surfaces of the die members outwardly against the die box during pressing.

6. Apparatus as set forth in claim 5 in which each of said die members and said die box are formed of said plastic material.

7. Apparatus as set forth in claim 5 in which said die members are formed of and said die box is lined with said plastic material.

8. Apparatus as set forth in claim 5 in which the working surfaces and peripheral edge portions thereof of said die members are formed of and said die box is lined with said plastic material.

9. Apparatus for pressing detergent materials into cake form comprising a relatively movable companion die member and a die box, said die member having a working surface, the periphery of which terminates in a thin raised edge portion of polyethylene capable of being resiliently deformed in the pressing of detergent material, in such a manner that the detergent forces the thin raised edge portion of the die member working surface outwardly against the die box during pressing, thereby decreasing flashing of the detergent.

10. Apparatus for pressing detergent materials into cake form comprising two relatively movable companion die members and a die box, each of the said die members having a working surface, the periphery of which terminates in a thin raised edge portion capable of being resiliently deformed in the pressing of detergent material, in such a manner that the detergent forces the thin raised edge portion of the die member working surface outwardly against the die box during pressing, thereby decreasing flashing of the detergent, the aforesaid die member working surfaces and thin raised edge portions thereof being of a plastic material which is a polymer of high molecular weight characterized by having a modulus of elasticity between about 5×10^4 and 5×10^6 pounds per square inch combined with a compressive strength between about 10,000 and 35,000 pounds per square inch and a flexural strength between 8,000 and 20,000 pounds per square inch and possessing high resistance to fatigue and being inert to the action of the detergent materials being pressed.

11. Apparatus as set forth in claim 10 in which the die member working surface is of a condensation polyamide of adipic and sebacic acid and hexamethylene diamine characterized by having a modulus of elasticity between about 5×10^4 and 5×10^6 pounds per square inch combined with a compressive strength between about 10,000 and 35,000 pounds per square inch of a flexural strength between about 8,000 and 20,000 pounds per square inch.

12. Apparatus for pressing detergent materials into cake form comprising two relatively movable companion die members and a die box, each of the said die members having a working surface, the periphery of which terminates in a thin raised edge portion capable of being resiliently deformed in the pressing of detergent material, in such a manner that the detergent forces the thin raised edge portion of the die member working surface outwardly against the die box during pressing, thereby decreasing flashing of the detergent, the aforesaid die members, including working surface and peripheral thin raised edge portion, being made of a polymer of high molecular weight which is a condensation polyamide of adipic and sebacic acids with hexamethylene diamine characterized by having a modulus of elasticity of about 400,000 pounds per square inch a compressive strength of about 10,000 pounds per square inch and a flexural strength of about 14,600 pounds per square inch.

13. A process for pressing detergent materials into cake form which comprises introducing a blank of detergent material into a receiving cavity of a die box, maintaining the blank in said cavity while pressing it between a pair of oppositely positioned companion die members, each of which die members has a working surface, the peripheral portion of which is of plastic material which is a polymer of high molecular weight, to press said blank into the form of a cake having the shape of the cavity defined by the die members and die box, the aforesaid peripheral portions of the die members being capable of being resiliently deformed in the pressing operation in such a manner that the detergent forces them outwardly against the die box, thereby decreasing flashing of the detergent, and then removing the pressed detergent bar from the die box and die members.

14. A process for pressing detergent materials into cake form which comprises introducing a blank of at least one detergent material selected from the group consisting of soaps and synthetic detergents into a receiving cavity of a die box, maintaining the blank in said cavity while pressing the same between a pair of oppositely positioned companion die members, each of which die members has a working surface, the periphery of which terminates in a thin raised edge portion, to press said blank into the form of a cake having the shape of the cavity defined by the die members and a die box, the aforesaid thin raised edge portion being capable of being resiliently deformed in the pressing operation in such a manner that the detergent forces the said portion of the die member working surface outwardly against the die box, thereby decreasing flashing of the detergent, and then removing the pressed detergent bar from the die box and die members without removing the working surface of plastic material from the die members, the said plastic material comprising a polymer of high molecular weight which is a condensation polyamide of adipic and sebacic acids with hexamethylene diamine characterized by having a modulus of elasticity between about 5×10^4 and 5×10^6 pounds per square inch combined with a compressive strength between about 10,000 and 35,000 pounds per square inch and a flexural strength between 8,000 and 20,000 pounds per square inch and possessing high resistance to fatigue and being inert to the action of the detergent materials being pressed.

15. Apparatus for pressing detergent materials into cake form which comprises a pair of relatively movable companion die members and a die box, said die members having working surfaces of polyethylene.

16. Apparatus for pressing detergent materials into cake form which comprises a pair of relatively movable companion die members and a die box, said die members having working surfaces of a plastic material which is a polymer of high molecular weight comprising a condensation polyamide of adipic and sebacic acids with hexamethylene diamine characterized by having a modulus of elasticity between about 5×10^4 and 5×10^6 pounds per square inch combined with a compressive strength between about 10,000 and 35,000 pounds per square inch and a flexural strength between 8,000 and 20,000 pounds per square inch and possessing high resistance to fatigue and being inert to the action of the detergent materials being pressed.

17. The apparatus of claim 16 in which the die member working surfaces are of a plastic material which is a polymer of high molecular weight comprising a condensation polyamide of adipic and sebacic acids with hexamethylene diamine characterized by having a modulus of elasticity of about 400,000 pounds per square inch, a compressive strength of about 10,000 pounds per square inch and a flexural strength of about 14,600 pounds per square inch.

18. A process for pressing detergent materials into cake form which comprises introducing a blank of at least one detergent material selected from the group consisting of soaps and synthetic detergents into a receiving

cavity of a die box, maintaining the blank in said cavity while pressing the same between a pair of oppositely positioned companion die members, each of which has a working surface of plastic material, to press said blank into the form of a cake having the shape of the cavity defined by the die members and die box, and removing the pressed detergent cake from the die box and die members without removing the plastic working surface from the die members, the said plastic material comprising a condensation polyamide of adipic and sebacic acids with hexamethylene diamine characterized by having a modulus of elasticity between about 5×10^4 and 5×10^6 pounds per square inch combined with a compressive strength between about 10,000 and 35,000 pounds per square inch and a flexural strength between 8,000 and 20,000 pounds per square inch and possessing high resistance to fatigue and being inert to the action of the detergent materials being pressed.

19. A process as set forth in claim 18 in which the plastic material of the die member working surface comprises a condensation polyamide of adipic and sebacic acids with hexamethylene diamine characterized by having a modulus of elasticity of about 400,000 pounds per square inch, a compressive strength of about 10,000 pounds per square inch and a flexural strength of about 14,600 pounds per square inch.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,965,946 December 27, 1960

Warren William Sweet et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, lines 51 and 52, for "manufacturer" read -- manufacture --; column 2, line 36, for "etc.," read -- etc.; --; column 5, line 35, for "strength" read -- stress --; line 72, for "mmbers" read -- members --; column 6, line 6, for "if" read -- of --; line 14, for "nylon 1001" read -- nylon 10001 --.

Signed and sealed this 27th day of February 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents