Dec. 1, 1964 R. A. SUTPHIN 3,159,699

SKIRTED DIE

Filed Jan. 6, 1961

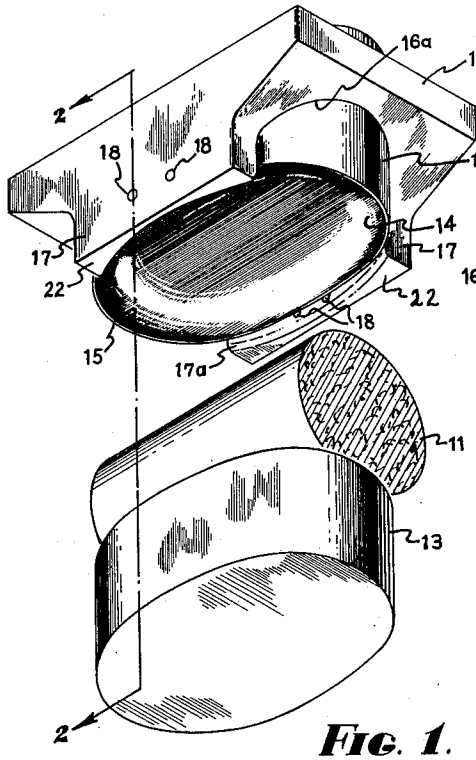


FIG. 1.

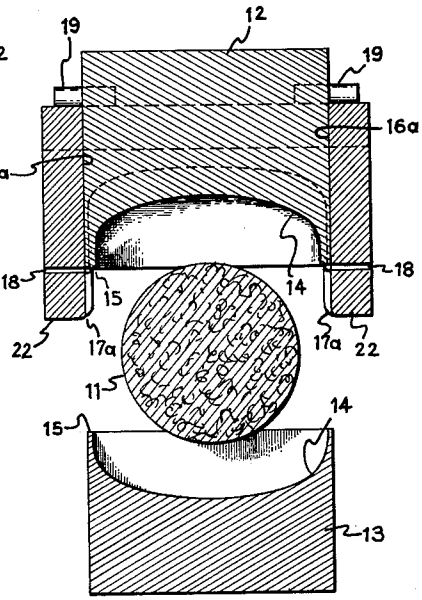


FIG. 2.

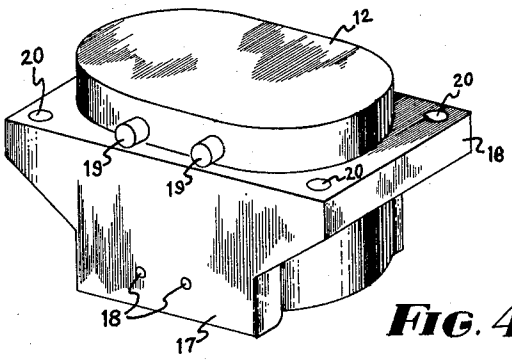


FIG. 4.

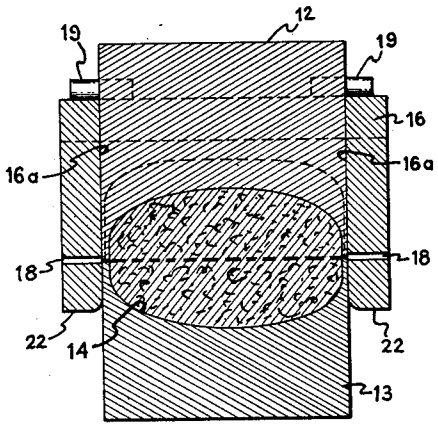


FIG. 3.

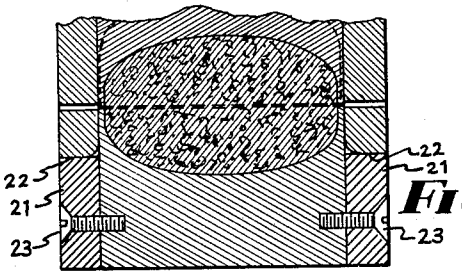


FIG. 5.

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SKIRTED DIE

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This invention relates to dies adapted to form plastic materials into articles having a "pin-die" shape and more particularly to dies adapted to stamp "pin-die" shaped bar soaps or detergents.

Articles, such as bar soaps, have been formed into "pin-die" shapes for many years. As used in the trade, an article having a "pin-die" shape is one which is adapted to be stamped by means of a die pair having peripheral surfaces or lands adapted to meet in substantial face-to-face contact, in contrast to die stamping by means of a box die, or a pin-box die, wherein the peripheral edges of the opposed surfaces which apply molding pressure to form the article are not brought into contact. In the most familiar embodiments of the latter forms of dies, one die half is telescoped within a passageway in a box portion, which passageway surrounds the other die half and provides the mold surfaces interconnecting the peripheral edges of the die halves. Thus, either the box die, or the pin-box die, stamps an article having ends and side panels with the surfaces thereof formed with a continuous flat band thereabout as a result of being molded to the shape of the box passageway between the peripheral edges of the die halves, whereas an article having a "pin-die" shape has no such band.

As normally performed, the process of stamping pin-die shaped bars is one wherein surplus material is extruded in all directions from the periphery of the bar, necessitating a trimming operation which is either performed manually or with a special automatic trimming mechanism built into or acting in conjunction with the die halves. If done manually, the trimming process is expensive and frequently leaves a rough ridge about the bar along the line at which the surplus material is separated. Automatic trimming, on the other hand, tends to produce a neater looking trim line but results in the deposit of the scrap surplus material surrounding the machinery and the die halves, compelling a continuous and difficult cleanup and scrap collection operation.

Many formulations of soap and/or detergent (hereinafter referred to jointly as soap), although desirable from a product performance standpoint, do not possess the degree of plasticity or reweldability conducive to good stamping operation. As now practiced, the stamping of such formulations into pin-die shaped bars frequently results in a product having a number of hairline cracks, substantially following the direction of crystal orientation, in the side or on the face panels of the bar. This type of defect is particularly prevalent where a plodder makes identical soap blanks for various shapes of bar soaps or where it is impractical to extrude blanks having a cross section approximating that of the finished bar.

These hairline cracks, which usually occur in two planes approximately perpendicular to each other and roughly at about an angle of 45° to the stamping direction as the soap blank is deformed in stamping, should not be confused with the type of cracks known in the industry as "dry cracks" or with another form called "wet cracks," both of which are controlled or caused by the process or equipment used prior to the stamp or by the physical characteristics of the soap itself. Hairline cracks of the nature intended to be corrected by this invention are serious quality defects since they not only detract from the appearance of the bar as it comes from the die, but also are

visible for a period of time as the bar is used by the consumer.

It is an object of the present invention to obviate the above difficulties.

Another object of the pesent invention is to provide for pin-die shaped soap products, a die which obviates the necessity of hand trimming of surplus material, which facilitates the collection of such surplus material, and which eliminates objectional hairline cracks in the side or on the face panels of the product.

Briefly stated, in accordance with one aspect of this invention, there is provided a die for stamping plastic material into an article, comprising mating die halves each having a cavity bounded by a narrow land, and a skirt member having portions thereof cotniguous to and parallel with the longitudinal lands of the die halves so as to prevent the lateral extrusion of the surplus plastic material.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the present invention, it is believed that the invention will be better understood from the following description of a preferred embodiment taken in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view showing a skirted die of this invention with a soap blank between the die halves;

FIGURE 2 is a section of the skirted die of FIGURE 1 taken along line 2—2 thereof;

FIGURE 3 is a section similar to that of FIGURE 2, taken at the time the skirted die has made a full impression on the soap blank;

FIGURE 4 is a perspective view from above showing the skirted die half of FIGURE 1; and

FIGURE 5 is a section similar to that of FIGURE 3, showing an embodiment utilizing means to prevent direct contact between the die halves.

Referring to FIGURE 1, an exemplary soap blank **11** is shown intermediate a pair of mating die halves, upper die half **12** and lower die half **13**, in a position to be stamped between the die halves **12** and **13** so as to be molded to the shape of the die cavities **14**. The soap blank **11** which is preferably milled soap, is taken as a freshly cut piece of a continuous extrusion of soap produced by a soap "plodder." At this time the soap blank **11** is in a warm and plastic condition and is best suited for the stamping operation since the blank **11** must be considerably deformed in order to be made to conform to the die cavities **14**. As in other stamping operations a stamp die liquor, such as a brine solution, is used as a lubricating and release agent, preferably by application of the liquor to the soap blank **11** before the placement thereof in position for the stamping operation. The specific liquor used and the method of its application, of course, are matters of choice and many variations thereof are well known in the art.

The continuously extruded long bar from the soap "plodder" has a "grain" structure of crystalline arrangement which has been oriented in the direction of the extrusion. Since the soap blank **11** is cut from the long bar, it, too, has a "grain" in the extrusion direction—in this case lengthwise of the blank **11**. Although it is possible that blanks **11** could be prepared with the "grain" running oppositely, i.e., transverse the long dimension, such is not usually the case. For this reason, as used herein the terms "length," or "longitudinal," or other words distinguishing one dimension or side from the other planar dimensions in terms of greater physical size, should be interpreted as meaning the dimension of the die or blank which parallels the "grain" of the soap. Similarly, the terms "width," "across," "lateral," and other like descriptive words are intended to refer to the dimension

of the die or blank which is transverse the direction of the "grain."

The soap blank **11** must, as in all similar stamping operations, be made to an optimum diameter for economy and best results for the size and shape of the bar being produced. This is a matter of experience once the dies have been prepared, and need not be discussed in detail herein. Along this same line, it is usual to cut the soap blank **11** longer than the die length by a finite amount to avoid what is termed a "water mark" in the industry. A "water mark" is the line of separation of two different or distinct shades of the color of the soap in a single bar and is usually found at each end of bars stamped from blanks shorter than the die length.

Each of the die halves, both upper die half **12** and lower die half **13**, have cavities **14** formed therein which follow the contours of the exterior surface of the portion of the bar intended to be molded thereby. The outer surfaces of the die halves of the exemplary apparatus parallel the direction of die motion, thus being vertical. These vertical surfaces are identical in shape and each is perpendicular to the plane of the die face within which the cavity **14** is formed and has a cross section with a periphery which parallels the peripheral edge of its respective cavity.

Although such is not shown in the figures, various designs or printed matter could be engraved upon, or placed in bas-relief on, the surface of the cavities **14** so as to decorate and/or, identify the source of the bar produced by the die. Such, of course, is a common practice and presently well known to those skilled in the art. Similarly other features well known in the industry could be incorporated in the die halves to promote production and ease of operation, for example, the use of ejectors to aid in the removal of the finished bar from the dies and the provision of passageways for the circulation of coolant through the die halves. While these features might operate to facilitate the stamping operation, they are not essential to the present invention and therefore not described in detail herein in order to set forth the best mode of carrying out the invention.

The cavities **14** are each surrounded by a continuous land **15** of relatively narrow width defined by the peripheral edge of the cavities **14** and the outer vertical surface of the die halves. Preferably, for the normal range of bar sizes the width of land **15** should be less than 1/16" in order to eliminate the necessity of trimming. When thus dimensioned and upon the application of sufficient pressure during the stamping operation, any surplus soap extruded from the dies will be "pinched off" between the opposed mating lands **15**, and the side panels and the ends of the bar will be clear of all such surplus. When stamping bars of milled soap which are of a size normally referred to as "regular" (i.e., having dimensions roughly in the range of 2" to 2¼" in width and 3" to 3½" in length) a force of from 8,000 to 10,000 pounds on the die plunger and a hold time of approximately 0.5 second is normally sufficient to obviate the necessity of a scrap trimming operation. In this range of pressures, it has been found that lands **15** which are narrower than 1/32" wear at a rapid rate and are highly susceptible to damage caused by the pressures involved in stamping and by other extraneous causes unless external stops, such as are illustrated in FIG. 5, are provided to prevent actual contact of the opposed lands. Lands **15**, however, which are wider than 1/16" do not satisfactorily "pinch off" the extruded scrap in the absence of considerably higher pressures than used in conjunction with a narrow land and/or a lengthy hold time for the die halves in the full impression positions. For these reasons, it is highly desirable for production dies to be made with lands **15** having a width of less than 1/16" to increase speed and decrease machine load, and if no external stops are used, to keep the width in the range of 1/32" to 1/16" for longer die life.

With respect to what has been termed a pinching off of the extruded scrap, it should be noted that in stamping regular size bars, if the die halves **12** and **13** (having lands **15** in the preferred range) are used with a force on the die plunger of about 8,000 pounds, the extrusion between the lands **15** will persist as a thin membranous sheet for approximately 4 seconds before becoming separated from the bar. It has been found, however, that despite this fact, a separation of the extrusion from the bar may be effected after the above-mentioned 0.5 second hold time. The mechanism of this separation is believed to be the fracture of the membranous sheet along the periphery of the bar, caused by tensile stresses developed in the sheet by bar expansive action following the cessation of bar compressions. The expansive action (due to internal pressures in the soap causing the bar to expand slightly in thickness when the die pressure is reduced) results in a slight movement of the bar relative to the membrane and the tensile failure of the latter. In any event, it will be seen that to "pinch off" the scrap extrusion, the opposed lands **15** do not have to be in direct contact and that the aforementioned possibility of external stops is practical in accomplishing the desired result. As used herein, terms such as "pinch off" should be interpreted as meaning separation as accomplished by either squeezing all of the extruded scrap from between the lands **15** accompanied by direct contact thereof or by the expansive action described above.

A skirt member **16** is adapted to receive one of the die halves in an aperture **16***a* extending through the skirt member **16**. Although the specific design of skirt member **16** is not important so long as the elements thereof combine to enclose upper die half **12** along its sides while leaving the die ends uncovered, the drawing shows the skirt member **16** as having a body with opposed depending portions or skirts **17** along the longitudinal edges of aperture **16***a*. The aperture **16***a* is sized and shaped to hold the die half snugly therein, preventing relative horizontal movement between the parts which could cause misalignment of die halves in the stamping operation. In the embodiment shown in the drawings, the skirt member **16** is applied to upper die half **12**, with the depending skirts **17** thereof extending downwardly a short distance past the land **15**. The inner surface of each of the skirts **17** generally follows the same contour as aperture **16***a*, engaging a substantial and continuous part of the outer longitudinal edge of the land **15** to which it is contiguous in a close sliding fit; however, the lowermost edge of the inner skirt surface is rounded or chamfered at **17***a* to provide a lead-in surface, the purpose of which will be more fully explained hereinafter. It should be noted that the body portion of skirt member **16** covers only a part of each end of the outer vertical surface of upper die half **12**, and as a consequence, no part of the skirt member **16** is adjacent to or depends past the end portions of land **15** of upper die half **12**.

As shown in FIGURE 5 the external stops mentioned above may be provided by a pair of laterally extending blocks **21** attached to the longitudinal sides of lower die half **13** by means such as machine screws **23**. Each of the block **21** has a horizontal cross section substantially like that of skirts **17** and is positioned so as to contact the lower surface **22** of the skirt **17** on the corresponding side of the die pair in use. The contact between surfaces **22** and the blocks **21** prevents the lands **15** from meeting in face-to-face contact to thus reduce wear and damage to these relatively fragile surfaces. The preferred range of separation of lands **15** caused by this stop means is from .005" down to approximately zero inches.

One or more exhaust ports or vents **18**, which extend through each of the skirts **17** at points aligned with the longitudinal sides of land **15**, permit the escape of stamp die liquor and air which may be entrapped during the stamping process. In the absence of such provision for

(A) a pair of mating die halves each having a cavity bounded by a continuous land, said lands being adapted to substantially contact one another in use, each of said die halves having in the plane of its land a first dimension and a second dimension which is normal to said first dimension,

(B) each said land comprising a pair of side portions extending substantially in the direction of said first dimension, and a pair of oppositely disposed end portions extending substantially in the direction of said second dimension, said side portions of each land being oppositely disposed to one another and separated by the second dimension of said cavity, each said end portion intervening corresponding ends of said side portions whereby said side and end portions alternate on said land, and

(C) means to block extrusion of surplus plastic material from said die outwardly over the side portions of said lands and to permit extrusion over the end portions thereof in directions generally aligned with said first dimension, said means comprising two spaced-apart and oppositely disposed surfaces contiguous to and substantially coextensive with the side portions of the lands of said die halves at least during the period of final deformation of said plastic material, one of said surfaces engaging one side portion and the second of said surfaces engaging the other side portion of the land of one die half, each of said surfaces simultaneously engaging the mating side portion of the other of said die halves thereby preventing egress of surplus plastic material in directions substantially aligned with said second dimension.

4. The die of claim 3 in which the width of said land is approximately less than 1/16".

5. The combination of claim 3 in which said means is provided with a multiplicity of exhaust passageways aligned generally in the plane of the lands of said die halves when said halves are in full impression position, at least one exhaust passageway extending through each said surface.

6. The combination of claim 5 in which said exhaust passageways have a diameter of about 0.0156" to about 0.020".

7. A die for stamping a blank of plastic material into a pin-die shaped article, said die having in combination:

(A) a pair of mating die halves each having a cavity bounded by a peripheral land, said lands being adapted to substantially contact one another in use, each of said die halves having co-planar of the land thereof a longitudinal dimension and a lateral dimension which is normal to said longitudinal dimension,

(B) said lands each having a pair of side portions substantially parallel to the said longitudinal dimension and a pair of end portions substantially parallel to the said lateral dimension, said side portions of each land being oppositely disposed to one another and separated by the lateral dimension of said cavity, each of the said end portions intervening corresponding ends of said side portions whereby said side and end portions alternate on said land, and

(C) means to block extrusion of surplus plastic material outwardly over the side portions of said lands and to simultaneously direct the extrusion of substantially all of said surplus material in directions generally aligned with said longitudinal dimension during stamping, said means comprising a pair of opposed skirts each of which has a length which is approximately the same as that of a said side portion, each skirt being maintained in engagement with substantially the entirety of the outer edge of a side portion of the land of one of the die halves, said opposed skirts extending beyond the land of one die half in the direction of the other die half and being adapted to telescope over the outer edges of the side portions of the land of the other die half in close sliding contact therewith, said skirts being separated from each other at their ends by the full length of each of said end portions of said one die half whereby oppositely disposed unblocked areas intervene the mating end portions of said die halves during the period of final deformation of said plastic material.

8. A die for stamping a blank of plastic material into a pin-die shaped article, said die having in combination:

(A) a pair of mating die halves each having a cavity bounded by a continuous land, said lands being adapted to substantially contact one another in use, each of said die halves having in the plane of its land a first dimension and a second dimension which is normal to said first dimension,

(B) each said land comprising a pair of side portions extending substantially in the direction of said first dimension, and a pair of oppositely disposed end portions extending substantially in the direction of said second dimension, said side portions of each land being oppositely disposed to one another and separated by the second dimension of said cavity, each said end portion intervening corresponding ends of said side portions whereby said side and end portions alternate on said land, and

(C) a skirted member in which one die half is held in fixed relationship, said skirted member comprising a body portion provided with an aperture for the reception of said one die half and engaged with said one die half at points removed from the land, and a pair of opposed depending skirts integral with and extending from the body portion, said skirts being in close engagement with and overlapping the outer edges of the side portions of the lands of the said one die half, said skirts being spaced apart at their ends by the full length of each of said end portions of the land of said one die half, said opposed depending skirts being adapted to engage in close sliding contact with the outer edges of the side portions of the mating land of the other said die half.

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the escape of liquor and air, the entrapped liquor or gas could prevent the soap from completely filling the die cavities in a lateral direction. It has been found that for best operation, the ports **18** should be sized to fall in the range of from .0156" to .020" in diameter.

As shown in FIGURES 2 through 5, several supporting pins **19** are driven into holes drilled into the outer vertical surface of upper die half **12** extending beyond the top of skirt member **16**. The locations of the pins are such that when the lowermost surfaces of the pins **19** contact the top surface of the skirt member **16**, the upper die half **12** is supported in correct vertical alignment with skirt member **16** and the exhaust ports **18** therein.

There are a multitude of ways in which the skirted die of this invention can be attached to a stamping machine. For example, an upper die plate could be mounted over the assembled upper die half **12** and skirt member **16** by being bolted to the skirt member **16** by means of the threaded holes **20** shown in FIGURE 4, thus forcing and retaining pins **19** of the die half **12** in contact with the skirt member **16**, and thereby eliminating relative vertical movement therebetween. Then the upper die plate could be fastened in some manner to an upper die platen which in turn is attached to the die plunger of the stamping machine. The lower die half **13** could be similarly attached by means of a lower die plate and a lower die platen to the die slide of the machine. Since such means are well known in the art and play no part in this invention they have been omitted from the drawing and from the detailed description of this invention in order to simplify the disclosure.

In the die "set-up" and in use, there is no need for the guide pins and guide bushings which are normally a part of the prior art dies for producing pin-die shaped articles. The skirt functions to provide both the preliminary alignment and the "running" guide needed during the stamping operation, in addition to the principal function hereinafter described. The die set-up is facilitated by mounting the parts of the die upon the stamping machine so that one or both parts are free to be adjusted in location, bringing the die parts together into a full impression position, and then tightening or fastening such parts securely to the machine while they are held in this position.

The function of the skirt in providing a "running" guide is important for good stamping operation since there is usually at least a slight amount of "play" between the die plunger and the die slide parts of a stamping machine. Such "play" is compensated for by the funneling effect of the rounded or chamfered interior edges (lead-in surfaces) of the skirt **17**, and by means thereof the lower die half **13** is deflected into registry with the interior surface of the skirt **17** as the dies move together in use, placing the die halves in perfect vertical alignment.

After the skirted die has been mounted upon the stamping machine, the stamping operation may be described as follows: A soap blank **11** of the proper size and plastic consistency and which has been treated with stamp die liquor is placed or fed between the die halves **12** and **13** when they are in the open position and the die halves are then brought together or into very close proximity under considerable force. As the opposed die halves approach each other, the intervening soap blank **11** is squeezed between the die cavities **14** of the die halves **12** and **13** and thus caused to be compressed in height and expanded in width. Upon continued relative movement as the die halves approach, the skirt **17** telescopes over lower die half **13** and further deformation of the soap blank **11** occurs until finally the deformed blank fills the volume intermediate the die halves at a point in time prior to the time at which the die halves reach the full impression position. During this initial deformation period, any stamp die liquor and/or air which may be entrapped between the dies are exhausted through ports **18**. Final deformation thereafter occurs until the die halves reach the full impression position, and it is during this phase that the principal function of skirts **17** comes into play —blocking further expansion of the deformed blank **11** in width and directing all surplus soap in a substantially longitudinal direction so as to be extruded from the die ends. Lateral extrusion is effectively prevented by the close fit of the upper die half **12** in the aperture **16***a* of skirt member **16** and of the lower die half **13** with the inner surfaces of skirts **17** and by the skirt material itself closing egress from between the die halves. Of course, an extremely small amount of soap will enter the ports **18** but such is insignificant in its effect upon the bar quality when ports of the preferred size (i.e., in the .0156" to .020" diameter range) are used. Along this same line it has been noted that during continuous operation of the skirted die of this invention, an extrusion of soap into ports of the preferred size does not prevent the escape of air and die liquor therethrough in subsequent stampings since the die is, in effect, self-cleaning in this respect.

As the opposed lands **15** are brought contiguous to one another at the conclusion of the final deformation of the blank **11**, the pressure exerted upon any soap which lies between the lands causes substantially all of such soap to be extruded as scrap along with the other surplus soap or to be forced into the bar being formed. In any event, at the full impression position of the cycle or shortly thereafter, the severing of the scrap from the formed bar is accomplished by the pinching off mechanisms previously described, and the extruded scrap at each end falls into scrap receiving devices (not shown) adapted to receive such material. Subsequently, the die halves may be moved to an open position and the stamped bar removed by hand or by rotation of the die halves or by other well known means so as to prepare the dies for the next stamping operation.

While previously dies for pin-die shaped articles frequently produced products having hairline cracks in the side and face panels (the longitudinal sides and the top and bottom of the bar shown), the skirted die of this invention produces articles having no such quality defect. It is believed that the extrusion of all the scrap in the direction of the grain of the soap blank, caused by the provision of blocking means (the skirts of the described embodiment) to prevent lateral scrap extrusion, is the factor which eliminates such hairline cracks. Furthermore, the skirted die of this invention permits a clean separation of scrap from product without auxiliary trimming devices and provides for the concentration of such scrap at a few points so as to simplify collection thereof.

Many modifications of the above invention may be used and it is not intended to hereby limit it to the particular embodiment shown or described. For example, the die pair could be arranged to have the skirt member inverted and mounted on the lower die half or the die halves could possibly be operated in a horizontal plane. The terms used in describing the invention are used in their descriptive sense and not as terms of limitation, it being intended that all equivalents thereof be included within the scope of the appended claims.

What is claimed is:

1. In the process of die stamping crystalline oriented plastic material into a pin-die shaped article, the steps which comprise placing an oversize blank of said crystalline oriented plastic material between mating die halves, deforming said blank by means of said die halves until scrap extrusion occurs and directing the extrusion of substantially all of the scrap from between the die halves in the direction of crystalline orientation of said blank.

2. The process of claim 1 in which said plastic material is milled and plodded soap.

3. A die for stamping a blank of plastic material into a pin-die shaped article, said die having in combination: