Aug. 18, 1964 F. L. EICHNER ETAL 3,144,974

MANUFACTURE OF FOOD CONTAINER AND THE LIKE FROM ALUMINUM FOIL OR OTHER THIN METALLIC MATERIAL

Filed July 10, 1959

2 Sheets-Sheet 1

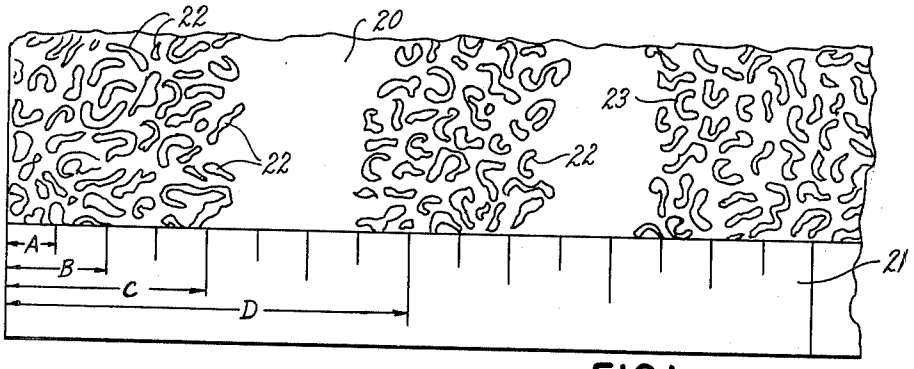


FIG.1

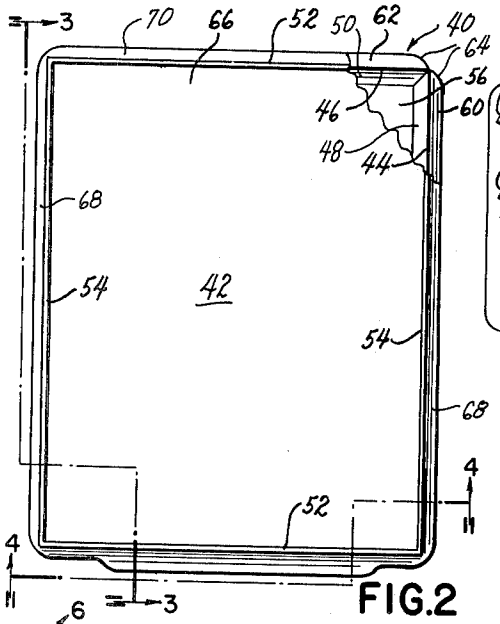


FIG.2

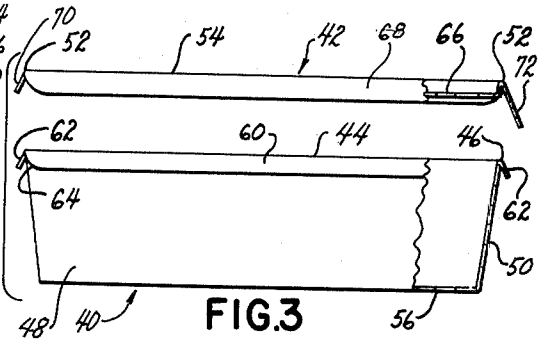


FIG.3

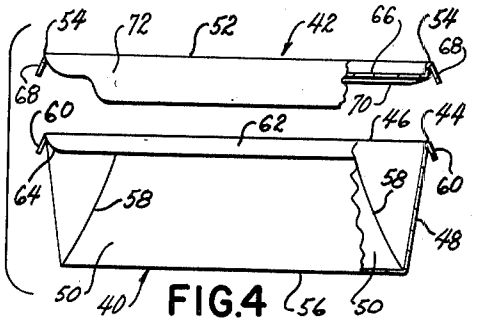


FIG.4

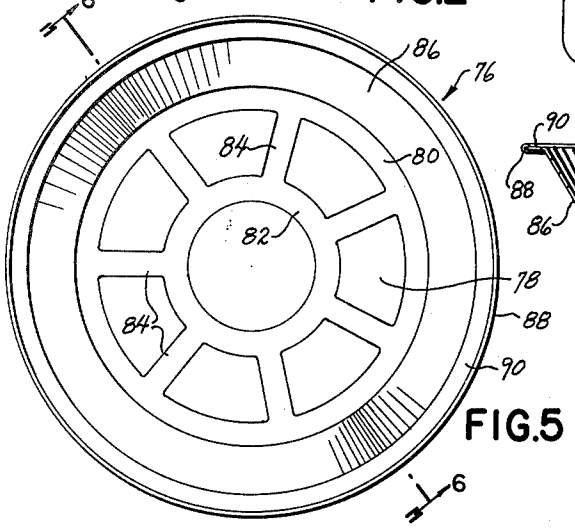


FIG.5

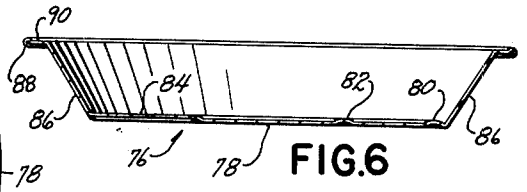


FIG.6

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MANUFACTURE OF FOOD CONTAINER AND THE LIKE FROM ALUMINUM FOIL OR OTHER THIN METALLIC MATERIAL

Filed July 10, 1959 2 Sheets-Sheet 2

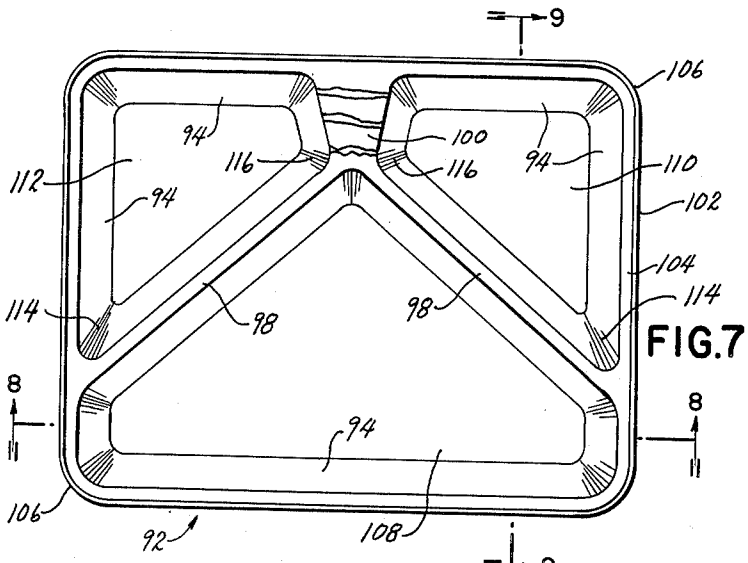


FIG.7

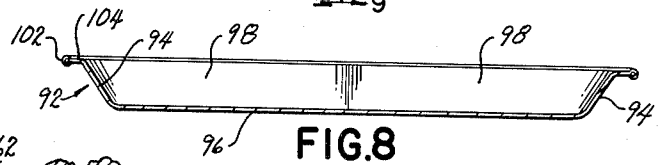


FIG.8

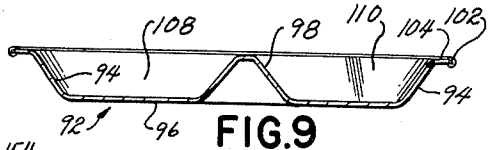


FIG.9

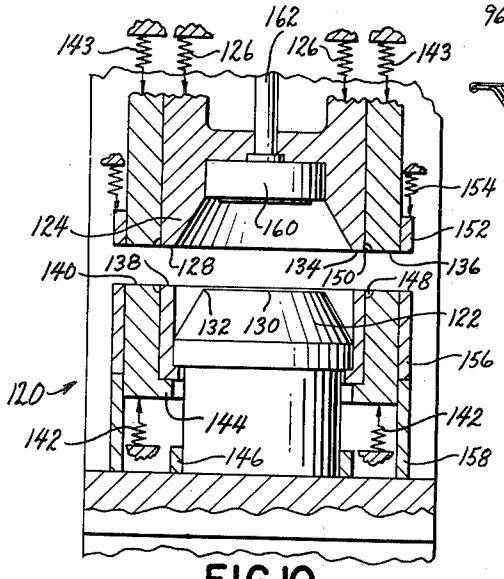


FIG.10



FIG.11

FIG.14

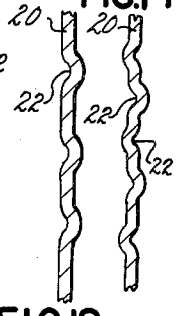


FIG.12

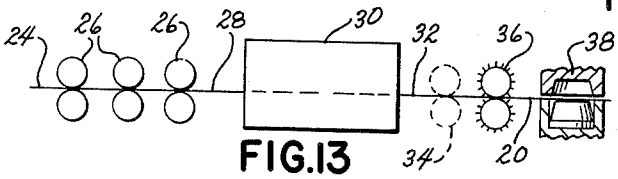


FIG.13

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3,144,974

MANUFACTURE OF FOOD CONTAINER AND THE LIKE FROM ALUMINUM FOIL OR OTHER THIN METALLIC MATERIAL

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Filed July 10, 1959, Ser. No. 826,191
4 Claims. (Cl. 229—3.5)

This invention relates to the manufacture of food containers from aluminum or aluminum alloy foil or foil-like sheets.

For the sake of brevity, the words "thin sheet material" are intended to refer to sheet material having an unembossed thickness in the order of from 0.0015 to 0.006 inch in thickness, and the word "aluminum" as herein used is intended to include not only aluminum alone but also the proper aluminum alloys usable in this art.

Aluminum foil or foil-like material, as now manufactured, has been provided with a smooth shining and reflective surface. It has been the universal practice to retain this texture or surface in the manufacture of containers and receptacles in an effort to present attractiveness to such containers. Such practice has inherently introduced certain unnoticed problems and disadvantages in the forming and drawing of the receptacles, which this invention overcomes in a simple and efficient manner.

Many of the unnoticed problems present in the prior practice are removed by the present invention with the retention of equal or superior attractiveness in the product, and with the production of a superior product.

According to this invention the thin sheet material preferably is simultaneously embossed and work hardened by an omni-directional or 360° stretch embossing pattern which not only retains the attractiveness of the prior smooth shining foil, but also introduces further unexpected results with the elimination of previously unnoticed problems and disadvantages inherently present in such previous practice.

The omni-directional stretch embossing pattern now preferred has a plurality of closely formed, irregularly curved, narrow or hair-like undulations adjacent each other, some of which are irregular C-shaped patterns, and in which the prevailing length of the undulations is in the order of from $\frac{1}{32}$ to $\frac{3}{32}$ inch in length, and the height is in the order of from 0.001 to 0.005 inch.

Containers manufactured from aluminum thin sheet material having the omni-directional stretch embossing pattern of this invention are surprisingly attractive, and eliminate many problems and disadvantages which have been previously unnoticed.

For example, die drawing operations are greatly improved. The smooth shining thin sheet material previously used is incompressible and varies as much as 10% in thickness throughout a run of material. Drawing dies for thin sheet material of this kind are oftentimes provided with surrounding pressing plates which must maintain an evenly distributed frictional drag on the sheet material as the drawing dies pull the material into the desired container form. The thin sheet material is pulled, rather than drawn, as the dies move toward each other, particularly in the formation of slanting wall containers. Since the prior smooth thin sheet material is smooth and incompressible by the die surrounding pressure plates, the 10% thickness variation in the sheet material and local variations within the sheet material can cause the pressure plates to produce an uneven frictional drag around the dies with consequent uneven pull and formation of the container. On the other hand the embossed thin sheet material, as used in this invention, has a spongy reaction (due to the foil-like thinness of the sheet) as it passes

through the pressing plates, which enables the pressing plates to produce an evenly distributed frictional drag around the dies to produce a superior container.

During many of the forming and drawing operations of the containers herein described, bends and corners are produced which require the thin sheet material locally to elongate differentially with respect to the surrounding sheet material. The thin sheet material of the previous practice is very limited in its capacity locally so to elongate differentially because of its smooth and thin construction. This provides only a limited amount of material in the thin sheet to produce this local elongation. With the embossed sheet used in this invention, the elongation is predistributed in a manner so there is always at least one, or more, undulation present which provides sufficient elongation by the straightening of the undulation rather than by an undue local stretching of the thin sheet of the prior practice, which previously was likely to produce a rupture or weak wall. Hence the forming or drawing procedures are greatly improved by this invention.

The temper and hardness necessary for successful forming and drawing operations are more easily, effectively and cheaply obtained by the practice of this invention. The methods of hardening the thin smooth sheet material of prior practice have been expensive or unsatisfactory as compared to the practice of this invention. For example, the prior smooth thin aluminum sheet of prior practice has been work hardened by passing the material through a selected number of rolls, then has been annealed substantially to dead softness, and then again passed through a number of rolls presumably to produce the desired thickness and hardness, which desired hardness usually is a fraction of "full hardness," which for example, is half hardness. However, thin aluminum sheet so work hardened has very poor stretch characteristics, and hence is poor forming or drawing material. Another more satisfactory, but more critical and expensive, prior method of tempering has been to pass the material through a number of rolls to produce the desired thickness and usually a full hardness, and thereafter to soften the material to the desired fractional hardness in an annealing furnace. However this is a very critical and relatively expensive procedure, as the annealing furnace treatment requires a very narrow and critical temperature band to produce the desired fractional hardness. According to this invention, the desired fractional hardness is obtained by smooth rolling to an intermediate thickness and annealing substantially to dead softness, or any easily controlled softness, and then usually by smooth rolling to the desired thickness, and by embossing in rolls to produce the desired fractional hardness. Such work hardened sheet has good stretch characteristics due to the embossing pattern which is superior to the prior first described rolling, annealing and rolling process, and is also much cheaper and less critical than the second described prior, more expensive process of rolling to full hardness and fractional annealing above described.

Lubrication during the forming or drawing operations is improved by the practice of this invention. The lubricant which is usually provided for these operations is more efficiently carried to the operating zone of the forming or drawing press, since the lubricant is efficiently carried in the valleys or interspaces of the undulations without the loss of lubricant in transportation as is frequent in the prior smooth sheet construction.

The smooth shining surfaces of the prior receptacles, which sometimes present an attractive appearance, actually often accentuate surface imperfections or misalignments, because the reflections from these smooth surfaces cause the imperfections and misalignments to stand out or be magnified in an unattractive manner. This is avoided by the practice of this invention.

Thinner gauge sheet embossed material may be used by this invention to produce the rigidity of thicker smooth sheet material. This is particularly true where the containers have relatively large flat surfaces. For example, in horizontally rectangular receptacles with gently sloping side walls, it is possible to use embossed sheet material which is 0.0005 to 0.001 inch thinner to produce the same rigidity of thicker smooth sheet material. Also the same press and die can operate on 0.0005 to 0.001 inch thinner embossed material. This added rigidity of the embossed material permits a saving in cost by the use of thinner material, as well as by the cheaper and more effective tempering procedure above described.

Containers manufactured according to this invention are superior in quality, are pleasing in appearance, and are cheaper in cost.

Hence it is an object of this invention to provide improved methods and products having one or more of the above improved characteristics.

Further objects and advantages will become apparent as the description proceeds with reference to the accompanying drawings, in which:

FIGURE 1 is an enlarged surface view of an embossed thin sheet of aluminum or similar metal made according to this invention, which is adjacent to an enlarged measuring scale.

FIGURE 2 is a top view of a rectangular cover and receptacle which may be made of embossed thin metal sheet according to this invention.

FIGURE 3 is a vertical view partly in elevation and partly in section of the cover over receptacle of FIGURE 2, spread vertically apart and taken along the line 3—3 of FIGURE 2.

FIGURE 4 is a vertical view similar to FIGURE 3 taken along the line 4—4 of FIGURE 2.

FIGURE 5 is a top view of a circular, tapered side wall receptacle which may be made according to this invention.

FIGURE 6 is a cross-section taken along the line 6—6 of FIGURE 5.

FIGURE 7 is a top view of another receptacle which may be made according to this invention.

FIGURE 8 is a cross section taken along the line 8—8 of FIGURE 7.

FIGURE 9 is a cross section taken along the line 9—9 of FIGURE 7.

FIGURE 10 is a diagrammatic cross-section of a typical press for producing some of the receptacles made according to the invention.

FIGURE 11 is a further enlargement of the embossing pattern shown in FIGURE 1.

FIGURE 12 is a cross-section taken substantially along the line 12—12 of FIGURE 11, showing a cross-section produced by a single embossing roll and cooperating smooth flexible roll.

FIGURE 13 is a diagrammatic view showing the simultaneous embossing and work hardening of thin sheet material according to this invention.

FIGURE 14 is a diagrammatic view somewhat similar to FIGURE 12, showing a cross-section produced by a pair of matching embossing rolls, each of which has hills and valleys.

Referring first to FIGURE 1, a metallic thin sheet 20, such as an aluminum containing sheet, is in the order of from 0.0015 to 0.006 inch in thickness. Preferably it has been simultaneously embossed and work hardened to the desired hardness with an omni-directional stress embossing pattern having, for example, a plurality of closely formed, irregularly curved, narrow or hair-like undulations 22 adjacent each other, some of said undulations forming irregular C-shaped patterns, as indicated, for example, at 23. The prevailing length of said undulations is in the order of from 1/32 to 3/32 inch in length. These undulations have a height transverse to the sheet 20 in the order of from 0.001 to 0.005 inch and preferably give an apparent thickness as measured by a standard micrometer of from 130% to 200% of the thickness of the sheet. This apparent thickness is the perpendicular distance from the highest point or crest on one side of the sheet to the highest point or crest on the opposite side of the sheet. The embossing pattern has not been illustrated throughout the area of FIGURE 1, but it is understood that the embossing pattern is more or less uniform and does extend throughout the area, except as hereinafter specifically described. Other equivalent embossing patterns may also be used.

FIGURE 1 also includes an enlargement of a measuring scale 21 which has been enlarged exactly to the same extent as the enlargement of sheet 20. In the original scale, before enlargement, the distance (A) was 1/16 inch long, distance (B) was 1/8 inch long, distance (C) was 1/4 inch long, and distance (D) was 1/2 inch long.

The simultaneous embossing and final work hardening of the sheet 20 to the desired hardness may be accomplished as diagrammatically indicated in FIGURE 13. A thick sheet 24, of dead softness, for example, may be drawn and elongated through a number of rolls 26 so the sheet, at 28, is at a substantial or full hardness and the thickness has been reduced to any desired degree. The sheet is then passed through the annealing furnace 30 and emerges at 32 in a dead soft condition, or in any easily controlled substantially soft condition. If desired, the sheet may then pass through one or more smooth rolls 34, further to decrease the thickness and partially to increase the hardness. Under certain conditions, the rolling by rolls 34 may be omitted. Thereafter the sheet is passed through the embossing rolls 36, or through an embossing roll and a smooth resilient roll, simultaneously to emboss and work harden the sheet to the desired hardness with the omni-directional stretch embossing pattern shown in FIGURE 1. The desired final hardness is controlled, in part, by the pressure applied at the rolls 36. The sheet emerges from the rolls 36, as indicated at 20, in the embossed condition of FIGURE 1, and is work hardened to the desired degree. Eventually, it is formed or drawn by a suitable apparatus or press, as diagrammatically indicated at 38. If desired, the sheet 20, in FIGURE 13, may be rolled up and stored for future use in the apparatus 38, or for future use in variously different machines 38, as may be desired.

FIGURE 11 shows a further enlargement of the embossing pattern shown in FIGURE 1, which is intended merely to indicate a typical condition. The distance between the particular undulations 22 illustrated in FIGURE 11 from crest 22A to crest 22A, or from crest to valley varies throughout the pattern of sheet 20 as shown in FIGURE 1, and may be variously determined in FIGURE 1 by comparison with the measuring scale distances (A), (B), (C), and (D). The undulations may be all on one side of the sheet, as indicated in FIGURE 12, or they may be on both sides of the sheet, as indicated in the FIGURE 14. The sheet of FIGURE 12 is produced by a single embossing roll cooperating with a smooth flexible roll. The sheet of FIGURE 14 is produced by a pair of embossing rolls, each having hills and valleys.

FIGURES 2, 3 and 4 show a substantially rectangular container 40 which may be made of embossed thin sheet material, such as shown in FIGURE 1, and which may be used with or without the matching cover 42 likewise made of embossed thin sheet material of this invention. In use the cover 42 is moved down from the spaced position shown in FIGURES 3 and 4 so the upper edges 44 and 46 respectively of the side walls 48 and 50 are received within the inside of the inverted V edges 52 and 54 of the cover 42. When the cover 42 and the receptacle 40 are so assembled together, the edges 44, 46, 52, and 54 are crimped together to secure and/or seal the receptacle and cover together. The container or receptacle 40 has a flat rectangular bottom 56, and opposed pairs

of flat side walls 48 and 50, one of the pairs of side walls, such as 50, having folded corners 58. All of said side walls 48 and 50 have reversely directed flaps 60 and 62 respectively which are rounded at their ends, as indicated at 64.

The covers 42 have a rectangular lower deck 66 from which the inverted grooves 52 and 54 rise. The grooves 54 extend downwardly to form tabs 68, while the grooves 52 extend downwardly to form a shorter tab 70 and to form another tab 72 which may be longer than the tab 70, and which may be a pull tab. The tab 70 may be substantially of the same length as the tabs 68.

Containers of the character disclosed in FIGURES 2, 3 and 4, without the embossed pattern, have been extensively used. These horizontally rectangular receptacles, with their gently sloping side walls, are improved materially by the use of the omni-directional stretch embossing pattern in the thin sheet material used to form such receptacles and covers. The embossed sheet material may be as much as 0.0005 to 0.001 inch thinner material to produce the same rigidity of the thicker smooth sheet material. Also, smooth foil aluminum containers and covers of this type have not heretofore been satisfactorily formed with foil which is thinner than about 0.004 inch, whereas containers with foil embossed as herein disclosed may be formed with omni-directionally embossed foil of aluminum which is 0.003 inch in thickness, and such embossed containers and covers have substantially the same rigidity as the smooth foil containers of 0.004 inch in thickness . The same relative superiority of the embossed thin sheet containers, of thicker gauge, exists over similarly corresponding smooth containers.

The forming process and apparatus to produce the covers and containers of FIGURES 2, 3, and 4 are much more effective when the embossed thin sheet material of this invention is used in forming the containers and covers.

The baking and other cooking characteristics of containers are improved by the use of omni-directionally embossed thin sheet material, in accordance with this invention. For example, referring to the circular pie plate shown on FIGURES 5 and 6, may be made from the embossed sheet material as described in connection with FIGURE 1. The pie plate 76 may have a substantially flat circular bottom 78 with or without the circular grooves 80 and 82 and the radial grooves 84. These grooves 80, 82, and 84 may be omitted, particularly in pie pans later to be described, and in similar circular receptacles of smaller diameter.

The container 76 has a circumferentially disposed side wall 86, said side wall being outwardly and upwardly flared and having a bead 88 and a flange 90 along its upper edge.

The baking and other cooking characteristics of the container 76, and similar containers, are greatly improved by use of the embossed sheet material by reason of the increased area which is exposed for heat absorption. In addition, the release characteristics of baked or other cooked products are enhanced by the embossing pattern. For example, the unbaked dough which is to produce the baked or cooked product does not go into the valleys of the embossment because of its putty-like nature. Consequently, when carmelization takes place, because of the sugar content of the dough, the caramel substance adheres only to the tops of the hills of the embossment, which hills are a minor part of the entire surface involved. The baked product can be more easily removed from the slightly adhering caramel at the tops of the hills as compared to the complete adherence in the case of smooth foil where the carmelization adheres to the entire surface because such entire smooth surface is available for the adherence of unbaked dough.

The pie plate 76 shown in FIGURES 5 and 6 may also be made, according to this invention, with the embossing pattern applied substantially only to the bottom 78 and with the remainder of the sheet, which forms the pie plate, made of smooth sheet material. The bottom grooves 80, 82 and 84 may be used or omitted in this embodiment. If they are omitted, the bottom 78 has sufficient rigidity imparted thereto by the embossing pattern.

The pie plate with the bottom only having the embossed pattern has an advantage in that the baking characteristics heretofore described are enhanced by the embossing pattern on the bottom. The side wall 86 has many wrinkles formed in it during the drawing operation which impart good baking characteristics to the side wall whether the metal sheet is embossed or not in the side wall area. The bead 88 and flange 90 likewise are efficient to a sufficient degree, whether the metal sheet is embossed or not. However, the bead 88 is believed to be slightly stronger when the metal sheet is unembossed. Consequently the pie plate 76 of this embodiment has its bottom area 78 increased in strength and in baking qualities by the embossed pattern, while the side wall 86, bead 88, and flange 90 are retained in their original satisfactory conditions produced by the unembossed portion of the metal sheet. Hence the pie plate of this embodiment is superior to the prior unembossed pie plates. The embossing pattern of this embodiment may be formed in the metal sheet at the area which is to form the bottom prior to the drawing process, or the embossing pattern may be formed by the drawing press between the punch and die members. When a plurality of plates of this embodiment are to be made from a strip of sheet material, such strip may be embossed at proper intervals and in proper shapes to form the bottom of the plates as the plates are blanked out of the strip, or the strip may be maintained smooth throughout and the bottom embossment may be made by the drawing press, as desired.

Another type of container which is improved by the use of omni-directionally embossed foil or thin sheet material, in accordance with this invention, is illustrated in FIGURES 7, 8 and 9. The container 92 shown in FIGURES 7, 8 and 9 is of the character used for frozen dinners and the like. Ordinarily it has a substantially rectangular shape with upwardly and outwardly directed side walls 94. It has a substantially flat bottom 96, which is substantially flat except for the integral inverted V-shaped dividers 98 and 100 which extend upwardly and integrally from the bottom 96. The upwardly directed sides 94 have beads 102 and flanges 104. The corners are rounded at 106.

The container 92 has three compartments 108, 110, and 112 for the reception of various parts of the dinner. There are several sharp corners, particularly at 114 and 116, as well as the square corners at 106 which require the sheet material to stretch considerably during the drawing operation.

The tray FIGURES 7, 8, and 9 is greatly improved by the use of the embossed thin sheet 20, in accordance with this invention, because the stretching qualities of the embossed foil or sheet permit the material to stretch the required amount for the sharp corners at 114 and 116, the square corners at 106, and any other places where undue stretching is required.

The forming or drawing qualities of the embossed foil or sheet make the practice of this invention particularly advantageous in connection with the receptacles heretofore described. The stretching and drawing qualities of the embossed sheet, due to the embossing pattern, and the spongy quality of the sheet, due to the thinness of the sheet, permit the material to be drawn or formed with greater ease than is the case with smooth sheets.

For example, in connection with the drawing operations for the receptacles of FIGURES 5 to 9 inclusive, the embossed thin sheets may be more uniformly drawn, as will become apparent with reference to FIGURE 10 which shows a typical die press.

In FIGURE 10, the die press 120 may include a punch member 122 and a die member 124. These members are

movable relatively to each other. In the case illustrated, the die member **124** is moved downwardly by any suitable means diagrammatically indicated by the spring construction **126**. The die member has a leading mouth edge **128** and the punch member has a leading face **130** with a leading edge **132**. The leading mouth **128** and the leading edge **132** pull the thin sheet material between the combined upper pressure plate construction **134** and **136** and the combined lower pressure plate construction **138** and **140**. The combined pressure plate construction **134**, **136**, **138**, and **140** provides a frictional sliding resistance to the sheet material as the sheet material is drawn into the conical shape of the die press cavity.

Aluminum thin sheet material of the thickness herein described has a 10% variation in thickness and such variation causes the pressure plate construction to produce uneven frictional drag around the die members **122** and **124** since thin smooth sheet material is uncompressible by the pressure plate construction. On the other hand, the embossed aluminum thin sheet material, as used in this invention, has a spongy reaction as it passes through the combined pressure plate constructions **134**, **136**, **138**, and **140**, which enable these constructions to produce an evenly distributed frictional drag around the die members **124** and **122**.

During the drawing operation, many bends and stretching points are encountered for which the smooth thin sheet material does not have sufficient stretch characteristics. This is particularly true at such corners as **106**, **114**, and **116** of FIGURES 8, 9, and 10. The stretching qualities of the embossed undulations predistributes the stretching qualities of the embossed sheets so that there is always at least one stretchable undulation near the stretch points of such corners or edges.

Other members diagrammatically indicated in FIGURE 10 include yieldable means such as spring constructions **142** to maintain the member **140** upward and to yield to the downward movement of the member **136** above, which is moved down by the diagrammatic spring construction **143**. The member **140** has an inward flange **144** which passes around the ring **146**, and permits the ring **146** to stop the member **138** before the bottom of the stroke is reached. The members **134** and **138** produce the flange **90** or the flange **104** of FIGURES 5 to 9. The bead **88** or the bead **102** are formed by the further downward movement of the members **136** and **140** which form the bead on the return stroke by operation of the ring cavities **148** and **150** in a manner well known in the art. The blank cutting and pressure ring **152** is moved downwardly by any resilient means such as spring **154** against the stationary cutting and pressure ring **156** which is supported by stationary guide ring **158**. The rings **152** and **156** cut a circular blank from the strip of material being fed through the press as the members **136** and **140** move downwardly. A knockout member **160** is operated by the plunger **162** at the proper time to release the receptacle which has been drawn.

The spring constructions diagrammatically shown at **126**, **142**, **143** and **154** may include well known proper reciprocatable plungers, platforms, etc., which insure proper operation of the elements moved thereby.

From the foregoing it will be evident that the spongy character of the relatively thin embossed sheet permits proper cooperation with the combined pressure plate members **134**, **136**, **138**, and **140** to insure a more even inward feeding of the thin sheet into the drawing cavity and to permit the necessary elongation of the material as it passes through the various bending points in a manner superior to the smooth foil heretofore used.

Folded foil containers of the square type herein disclosed in FIGURES 2, 3 and 4, have relatively sharp, square corners. In forming these trays, elements of the blank at the corners are folded and pressed flat. For strength and rigidity the folded tray requires that the stock be in a hardened temper, i.e., ¾ to full hard temper. It has been found that the strain imposed in the folding operation exceeds the elongation properties of the plain, smooth foil stock in gauges lighter than .004" and result in cracking and breaking at the folded edges. In effect, the folding operation is a 180° bend of the stock around a zero thickness inner radius and a thickness outer radius equal to the thickness of the sheet material. Practical experience has shown that the minimum outer radius for the 180° bend in the tempered foil without cracking is .004"; thus .004" has been established as the minimum plain smooth stock gauge.

In attempting to establish whether embossing before forming would enable the square trays to be produced from a lighter gauge of stock, embossed stock of this invention was used. The stock having the pattern of this invention produced quality trays. Foil gauge before embossing was .003". Micrometer measurements of the embossed stock gave an apparent thickness of .005". This represents a measurement between the peaks on one side to the peaks on the other side produced by embossing.

Examination of the square type trays of FIGURES 2, 3 and 4 produced from the .003" embossed stock leads to the conclusion that the successful use of the light gauge stock is due to two characteristics imparted by embossing:

(1) In the forming operation the rough embossed surfaces are not flattened at the folds. Thus the outside radius on a 180° bend is equal to the measured thickness of the embossed metal rather than to the thickness of the plain smooth stock before embossing. As pointed out above, in the case of embossed aluminum sheet or foil of this invention, this apparent thickness is .005" rather than the .003" thickness of the foil before embossing. This .005" outer radius at the flat folds causes no difficulty with cracking or breaking at the folded edges.

(2) In embossing according to this invention, the pattern is imparted by bending and forming with substantially no reduction in metal thickness. This results in a slight shrinkage of lineal dimensions of plain foil when embossed. When embossed foil is subjected to tensile strain, the first effect is the removal of the embossed pattern before any reduction in basic metal thickness takes place. In forming containers certain small areas of the blank are highly strained. In these areas the stock required for forming the required contour is obtained by flattening of the embossed pattern rather than solely by a reduction in metal thickness such as would occur if plain foil was used. On the light foil or sheet gauges herein specified and used for containers, any appreciable reduction in basic metal thickness at the highly stressed areas frequently results in fractures at these points.

The practice of this invention produces a superior product, at reduced cost, and in most cases retains the rigidity on thinner embossed material than was maintained by a thicker smooth material. It permits the use of about 0.001 inch thinner sheet material, such as 0.003 inch instead of 0.004 inch with the same or superior results. The practice of the invention also reduces corner crack during the formation of the containers, and improves the baking and cooking characteristics of the containers. Added elongation is provided in the material, and the temper and hardness of the material are easily and more cheaply controlled than is the case with smooth material. Lubricant is carried more efficiently in the valleys of the embossed material to the drawing presses and other forming apparatus. Surface imperfections in the material are hidden, defaced, or repaired and reflections on imperfections do not stand out as is the case with smooth material. Improved forming and drawing characteristics of the thin sheet are enhanced. And a pleasing appearance is provided.

While the form of the invention now preferred has been disclosed, in accordance with the requirements of the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. The method of manufacturing a food container and the like from an aluminum containing thin sheet of from 0.0015 to 0.006 inch in thickness and having at least one cup-shaped compartment formed therein and defined by drawing critical bends in said sheet to produce integral continuous side walls of said compartment which comprises: simultaneously embossing and work hardening said sheet to the desired hardness with an omni-directional stretch embossing pattern having a plurality of closely formed narrow undulations adjacent each other, said undulations causing said sheet to have an apparent thickness in the order of 130% to 200% of the thickness of the unembossed sheet; and forming said sheet into the form of said container by stretching said sheet at the critical bends of said container without substantially changing the actual cross-sectional thickness of said sheet.

2. A container formed from an aluminum containing thin sheet of from 0.0015 to 0.006 inch in thickness and having at least one cup-shaped compartment formed therein and defined by drawing critical bends in said sheet to produce integral continuous side walls of said compartment, said sheet being embossed and work hardened to the desired degree with an omni-directional stretch embossing pattern including a plurality of closely formed, narrow undulations adjacent each other, said undulations causing said sheet to have an apparent thickness in the order of 130% to 200% of the thickness of the unembossed sheet said sheet being stretched at the critical bends of said container without substantial change in the actual cross-sectional thickness of said sheet.

3. A container made from a metallic thin sheet of from 0.0015 to 0.006 inch in thickness and having at least one cup-shaped compartment formed therein and defined by drawing critical bends in said sheet to produce integral continuous side walls of said compartment, said sheet being embossed and work hardened to the desired degree with an omni-directional stretch embossing pattern including a plurality of closely formed, irregularly curved, hair-

like undulations adjacent each other, the prevailing length of said undulations being in the order of from $\frac{1}{32}$ to $\frac{3}{32}$ in length, said undulations causing said sheet to have an apparent thickness in the order of 130% to 200% of the thickness of the unembossed sheet, said sheet being stretched at the critical bends of said container without substantial change in the actual cross-sectional thickness of said sheet.

4. The method of manufacturing a container from an aluminum containing thin sheet in the order of from 0.0015 to 0.006 inch in thickness and having at least one cup-shaped compartment formed therein and defined by drawing critical bends in said sheet to produce integral continuous side walls of said compartment which comprises: embossing said sheet with an omni-directional stretch embossing pattern including a plurality of closely formed undulations adjacent each other, said undulations causing said sheet to have an apparent thickness in the order of 130% to 200% of the thickness of the unembossed sheet; and forming said sheet into form of said container by stretching said sheet at the critical points of said container without substantially changing the actual cross-sectional thickness of said sheet.

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