United States Patent

[11] 3,633,322

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[21] Appl. No. 784,297
[22] Filed Dec. 13, 1968
[45] Patented Jan. 11, 1972

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[54] METHOD FOR TREATING THE FLANGES OF CONTAINERS

12 Claims, 8 Drawing Figs.

[52] U.S. Cl. 51/323, 51/5, 29/527.2

[51] Int. Cl. B24b 1/00, B24b 7/00, B24b 9/00

[50] Field of Search 51/4, 5, 323; 29/527.2

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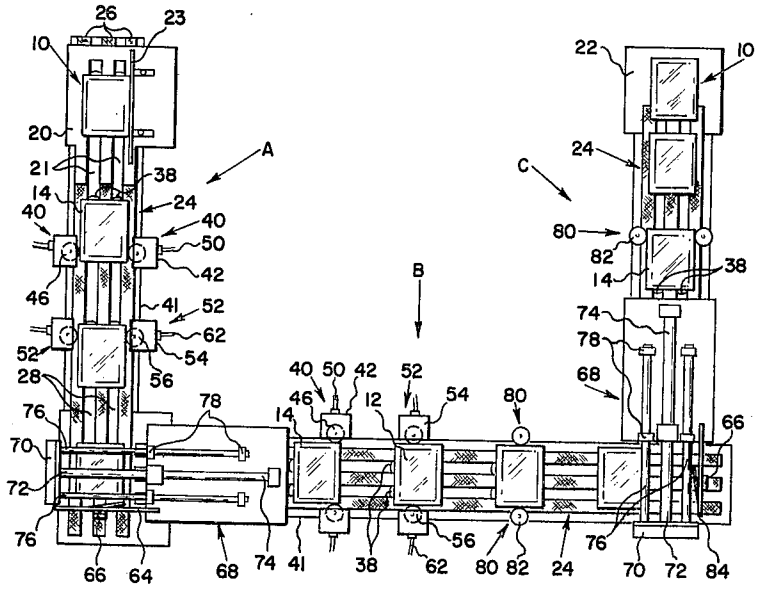
ABSTRACT: Containers of synthetic plastic material having an outwardly extending flange about at least a portion of their periphery are subjected to an abrading operation along the outer edge of the flange and then to a brushing operation along the surface of the flange adjacent to the outer edge. To avoid contamination of the interior of the container by the abraded and other plastic particles, desirably air or other gas is caused to flow outwardly across the surfaces of the flange during the abrading and brushing steps.



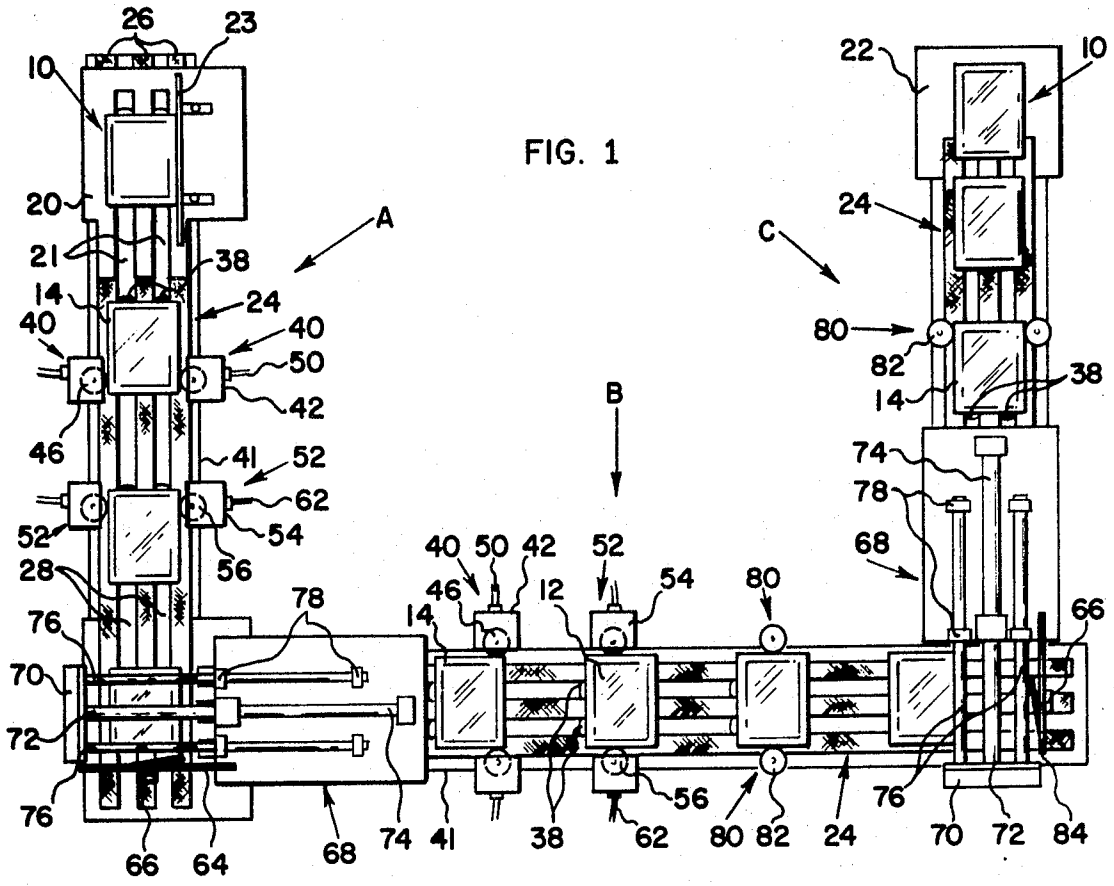


FIG. 1

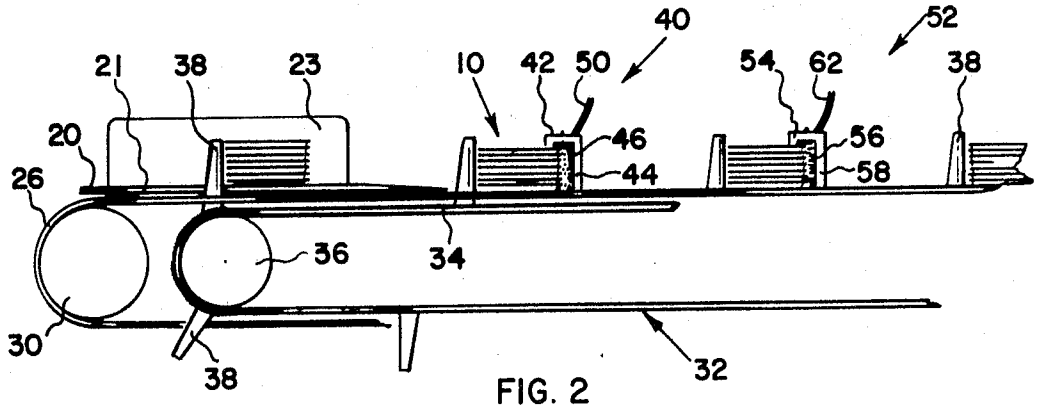


FIG. 2

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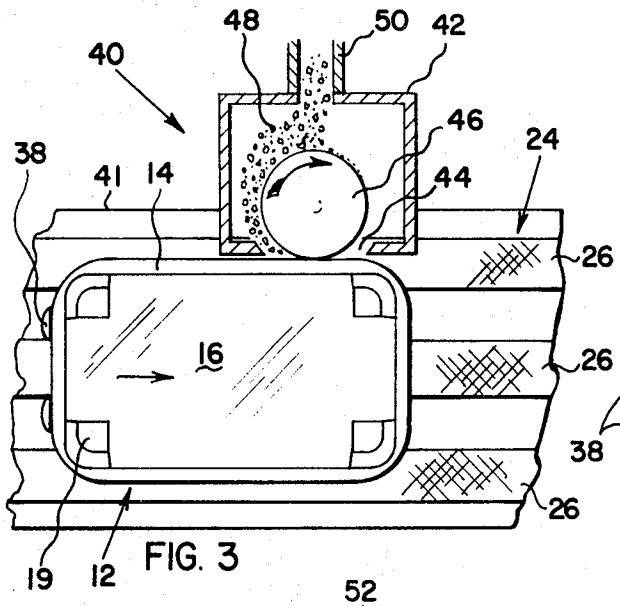

FIG. 3

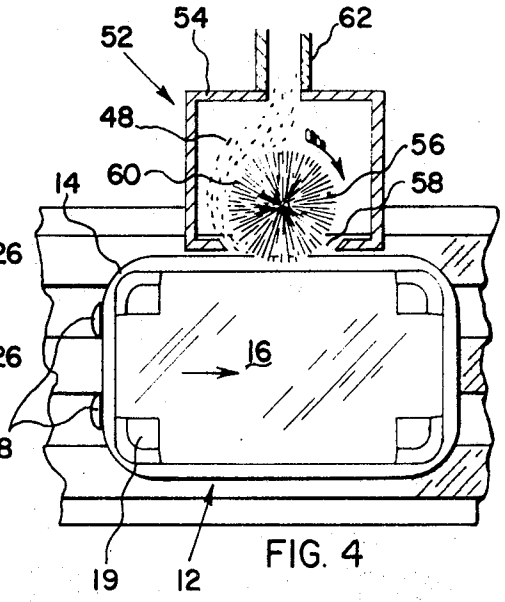

FIG. 4

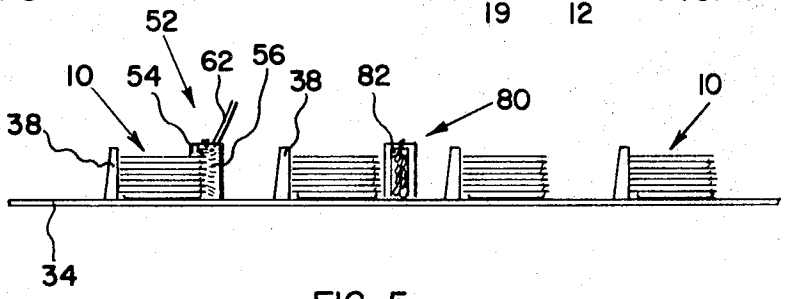

FIG. 5

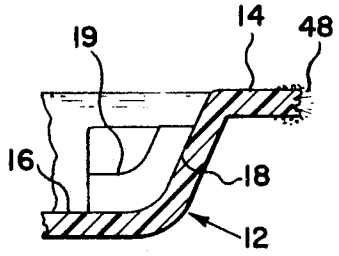

FIG. 6

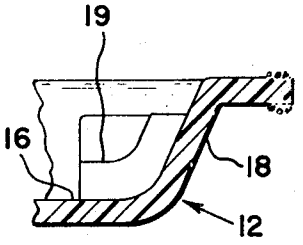

FIG. 7

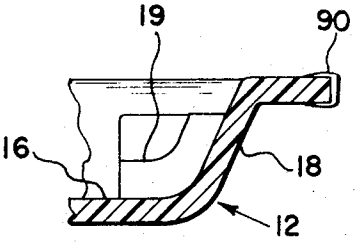

FIG. 8

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METHOD FOR TREATING THE FLANGES OF CONTAINERS

BACKGROUND OF THE INVENTION

In recent years there has been ever-increasing utilization of thermoformed containers of synthetic plastic material for various packaging applications. Among the most widely utilized container forms are trays which may be overwrapped with a film of synthetic plastic material to provide an attractive and hygienic container affording the opportunity to display the goods either partially or in their entirety if the tray is formed of a transparent material.

As is well known, various techniques are employed for the thermoforming and finishing of the containers from the basic sheet stock. From the standpoint of speed and economy of operation, the thermoforming technique which has achieved very widespread application involves the forming of the container depressions in a long length of the sheet material at one stage, usually several across the width of the sheet material, by means of multicavity dies, and the use of the web between the container cavities to carry the partially formed containers to a subsequent stage where the sheet material is treated to separate the container from the web of material about them. Generally, the forming dies also include cooperating surfaces providing a cutting knife edge and bed to cut substantially through the thickness of the synthetic plastic material so that the tray forms may be separated from the web at a subsequent stage simply by flexing the sheet material or otherwise applying a separating pressure.

Since the cutting dies tend to wear and since the material is, in fact, not cut through cleanly at the time of separation, there is a tendency for the crushing and fracturing to produce jagged edges and feathery whiskers of the synthetic plastic along the edge or flange of the container, which render it unsightly. This tendency is particularly pronounced when the material is biaxially oriented to achieve great strength at relatively low cost per pound of material. The jagged edge of the container represents a potential problem in that it may subsequently cut through a film overwrapped about the container and it and the whiskers may be unpleasant to the touch of the customer. Moreover, particles of plastic adjacent the edge may contaminate the contents of the container or provide a gritty feel to the customer.

It will be appreciated that the problems of slivers or crushing may be avoided by hot die or wire cutting but such a step would involve elimination of the web as a carrier for the many container units being formed or additional equipment of substantial complexity and cost and the likelihood of an increase in overall process time. Thus, it can be seen that any additional steps to be performed on the trays are desirably performed outside of that type of existing thermoforming equipment which makes use of the web of the sheet material as a carrier for the molded container and at a speed sufficient to avoid any delay in high-speed or in-line thermoforming operations.

It is an object of the present invention to provide a novel method for treating the flanges of synthetic plastic containers so as to provide a substantially smooth outer edge and which method is adapted to high-speed operation.

It is also an object to provide such a method which also removes any synthetic plastic particles formed by the separating and forming operations and deposited on the surfaces of the flange adjacent the other edge.

Another object is to provide such a method in which a multiplicity of containers may be so treated in nested relationship at high speed and with a relatively high degree of economy.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects may be readily attained by a method wherein a container having a laterally projecting flange about at least a portion of the periphery thereof is subjected to a series of steps in which the outer edge of the flange is abraded to remove projecting portions of synthetic plastic material therefrom such as jagged edges and whiskers. Thereafter the surface of the flange adjacent the abraded outer edge is brushed to remove abraded and other synthetic plastic particles therefrom. To minimize contamination of the container by abraded and other synthetic plastic particles and facilitate operation, most desirably a gas is caused to flow outwardly across the surface of the flange concurrently with the abrading and brushing steps.

The technique of the present invention is readily adapted to the treatment of a multiplicity of trays stacked in nested relationship with spacing between their flanges. It may be effected by passing the trays vertically by the abrading and brushing stations, or most desirably by passing them in a horizontal path thereby. To provide an even smoother feel to the flange, a very thin coating of an oil is desirably applied to the surface thereof following the abrading and brushing operations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of apparatus embodying the present invention and showing stacks of trays at various points along the flow path through the apparatus:

FIG. **2** is a partially diagrammatical, side elevational view of the first section of the apparatus for abrading and brushing the trays;

FIG. **3** is a partially diagrammatical top view of the abrading apparatus with the housing in section and showing the abrading wheel acting upon an edge of the flanges of a stack of trays;

FIG. **4** is a similar view of the brushing apparatus acting upon the surface and edges of the flanges of a stack of trays;

FIG. **5** is a partially diagrammatical, fragmentary side elevational view of the second section of the apparatus showing the brushing and lubricant application stages;

FIG. **6** is a fragmentary sectional view to an enlarged scale of a single tray showing the flange with a typical rough edge and particles on its surfaces;

FIG. **7** is a similar view showing the flange after the abrading step; and

FIG. **8** is a similar view after the brushing and lubricant application steps with the lubricant film in exaggerated thickness for purpose of illustration.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Turning now in detail to the attached drawing, FIG. **1** illustrates apparatus embodying the present invention which permits treatment of all four sides of stacks of trays generally designated by the numeral **10**. As best seen in FIGS. **3** and **5**, the individual trays are generally designated by the numeral **12** and are of generally rectangular cross section with a flange **14** extending laterally outwardly about the periphery thereof but greatly reduced in width or eliminated entirely at the rounded corners. As seen in FIG. **6**, the tray has a bottom wall **16** and a sidewall **18** extending upwardly at an angle therefrom with the laterally extending flange **14** at the upper end thereof. To provide a spacing between the flanges **14** of adjacent trays **12**, the sidewall **18** is provided with a stepped portion **19** adjacent the corner which provides a shelf seating the base of the overlying tray **12**. Details of preferred tray configurations are set forth in copending U.S. Pat. application, Ser. No. 684,417, filed Nov. 20, 1967, by Donald W. Donovan, and assigned to the same assignee as the present invention.

The illustrated apparatus is generally comprised of three right-angularly disposed conveyor sections A, B and C preceded by a feed table **20** and followed by a discharge table **22**. Initially, a multiplicity of trays **12** is provided as a stack **10** on the feed table **20**, either manually or preferably automatically, and caused to bear against the back plate **23** to effect alignment thereof. As best seen in FIG. **1**, the feed table **20** provides a trifurcated bed with channels **21** therein extending parallel to the back plate **23**. In this embodiment, the conveyor sections A, B and C each include a continuous con-

veyor, generally designated by the numeral 24, provided by three bands 26 spaced apart to provide channels 28 therebetween and rotating on pulley units 30 driven by suitable means (not shown).

Disposed within the conveyor belts 24 are pusher units generally designated by the numeral 32 and each comprised of a continuous belt 34 driven by pulley units 36 synchronously with the conveyor belts 24. Spaced along the length of the belts 34 and supported thereon in a position generally perpendicular thereto are pairs of rods or fingers 38 which project upwardly through the channels 28 between the bands 26 of the conveyor belts 24. As the continuous belt 34 of the pusher unit 32 of the conveyor section A rotates, its rods or fingers 38 pass through the channels 21 of the bed of the feed table 20 and engage the side of the stack 10 of trays thereon moving it from the surface of the table 20 and onto the conveyor belt 24.

As the stack 10 of trays is moved along by the conveyor belt 24 and pusher unit 32, it passes through a burnishing section comprised of a pair of burnishing units each generally designated by the numeral 40. The burnishing unit 40 includes a housing 42 with an elongated aperture 44 in its inner face adjacent the conveyor belt 24 and a brush or wheel 46 of abrasive material rotating about an axis perpendicular to the conveyor belt 24 and having a portion of its periphery extending outwardly through the aperture 44 in the housing 42 so as to contact the outer edge of the flanges 14 of the trays 12 in the stack 10 passing thereby. As best seen in FIG. 3, the abrasive wheel 46 polishes the outer edge of the flanges 14 to smooth the jagged edge and remove whiskers or other particles 48 of plastic therefrom, and the abraded material is carried into the housing by the rotation of the wheel 46 which is opposite to the path of movement of the conveyor belt 24. The housing 42 is a substantially airtight enclosure with the wheel 46 and aperture 44 being cooperatively dimensioned and configured to minimize the spacing therebetween. A fitting 50 on the housing is connected to a suitable source of vacuum or negative pressure (not shown) which causes air to flow over the surface of the flanges 12 and into the aperture 44, thus minimizing any tendency for abraded particles to pass into the interior of the trays 12 or to be scattered into the atmosphere. The abraded particles will generally be conveyed by the stream of air through the fitting 50 and the stream of air is passed through suitable means for removing particulate matter (not shown) such as a bag-type filter or cyclone separator.

In this operation, it can be seen that the fingers 38 are providing positive driving action against the trailing side of the stack 10 of trays 12, thus counteracting the pressure of the wheels 46 provided by their rotation in the opposite direction and moving them forwardly in proper timed sequence and disposition. Moreover, both sides of the stack 10 are being acted upon simultaneously so that displacement transversely of the belt 24 is avoided. It is important that the burnishing wheels 46 and the stack 10 of trays be properly aligned so that only the desired amount of surface of the flanges 14 is removed. To this end, the back plate 23 is desirably adjustable to provide the initial adjusted position for the stack 10 and the pair of fingers 38 maintains this position; similarly, the burnishing units 40 may be adjustably mounted on the frame 41 of the apparatus.

After the burnishing section, the stack 10 of trays passes to the brushing section comprised of a pair of brushing units generally designated by the numeral 52 mounted on the apparatus frame 41 and each having a housing 54 with a brush 56 rotating therein about an axis perpendicular to the conveyor belt 24. As best seen in FIG. 4, the housing 54 has an elongated aperture 58 in its inner face adjacent the conveyor belt 24 and the brush 56 has filamentary or bristlelike elements 60 defining its periphery and which project outwardly through the aperture 58 so as to project inwardly of the outer edges of the flanges 14 between the trays 12. Since the brushes 56 are rotating in a direction opposite to the path of movement of the stack 10 of trays 12, the bristlelike elements 60 remove any synthetic plastic particles 48 thereon and propel them into the housing 54. Again, contamination is substantially avoided and movement of the particles 48 into the housing 54 is facilitated by the flow of air across the surfaces of the flanges 14 as a result of a source vacuum or negative pressure connected to the fitting 62 on the housing 56.

As the conveyor belt 24 continues to carry the stack 10 of trays, the path of movement brings the stack 10 against the stop plate 64 at the end of the conveyor section A and the stack 10 strikes the limit switch 66 thereon actuating the transfer unit generally designated by the numeral 68. In the illustrated embodiment, the transfer unit 68 is generally disposed above the conveyor belts 24 of the conveyor sections A and B and includes a vertically extending pusher plate 70 supported on the piston rod 72 which reciprocates within the piston cylinder 74 operated by air or other suitable fluid medium from a source (not shown) and controlled by the limit switch 66 to drive it to the piston-retracted position and then automatically returned to the piston-extended position shown in FIG. 1 of the drawings. The movement of the pusher plate 70 is stabilized by the shafts 76 which are slidably supported in the blocks 78 of the transfer unit 68. When the piston cylinder is operated by the limit switch 66, the pusher plate 70 abuts against the side of the stack 10 of trays and pushes the stack 10 from the conveyor belt 24 of the section A onto the conveyor belt 24 of the section B.

The conveyor belt 24 of the conveyor section B now begins to carry the stack 10 of trays 12 along the length thereof. The fingers 38 of the pusher units 32 move into engagement with the trailing edge of the stack 10 prior to its passage between the burnishing units 40 so as to provide the desired positive driving pressure therebehind. From the burnishing units 40, the stack 10 then passes between the brushing units 52 and still further along the length of the conveyor belt until it reaches the lubricant application section comprised of a pair of applicator units generally designated by the numeral 80. Although various types of applicator units may be employed, the illustrated embodiment utilizes a roller 82 mounted for rotation about a vertical shaft and having an absorbent outer surface and an internal cavity (not shown) into which the lubricant is fed from an external source (not shown). The flexible character of the absorbent covering on the roller 82 permits it to apply a thin film of the lubricant over the surfaces of the flanges 14 of the trays 12 for some distance inwardly of the outer edge thereof. In FIG. 8, the lubricant film bears the numeral 90.

The continuing movement of the conveyor belt 24 causes the stack to abut against the stop plate 84 and strike the limit switch 66 producing actuation of the transfer unit 68 constructed and operating similarly to that previously described. This, in turn, results in movement of the stack 10 of trays 12 from the conveyor belt 24 of the section B onto the conveyor belt 24 of the section C. Again, pusher fingers 38 of the pusher unit 32 abut against the trailing edge of the stack 10 to provide positive driving engagement between the rollers 82 of the applicator unit 80 which is constructed and operates similar to that previously described to provide a thin film of lubricant along the surfaces of the flanges 14 at the previously untreated sides. Lastly, the conveyor belt 24 discharges the stack 10 onto the discharge table 22 from which it may be transferred either manually or automatically.

The process and apparatus of the present invention are applicable to containers formed of various synthetic plastics and preferably thermoplastics. Exemplary materials are the polyolefins such as polyethylene, ethylene-propylene copolymers and isotactic polypropylene, polyacrylates, polymethacrylates, polycarbonates, polyvinyl chloride, polyethylene terephthalates and styrene polymers. The preferred thermoplastics are styrene polymers such as biaxially oriented polystyrene, impact polystyrene, ABS and styrene/acrylonitrile copolymers. Of the various styrene polymers, biaxially oriented polystyrene is most desirably utilized because of its excellent toughness and resilience even in

thin sections and because of its relatively inert qualities with respect to foods and other materials.

Most usually, the containers will be thermoformed from synthetic plastic sheet material in order to achieve fabrication at the greatest possible rates of speed and with the greatest economy. The actual configuration of the container and of the flange is not critical since the apparatus and process may be modified to accommodate substantially any type of configuration. However, for most facile operation, the container will normally be polygonal and preferably rectangular in cross section although it may have rounded corners as in the illustrated embodiment. The technique of the present invention is also applicable to injection-molded or blow-molded containers to remove flash and other projecting portions about any flange provided thereon.

The burnishing units may utilize various types of abrasive members including wheels or rollers of the type illustrated or belts of abrasive material operating about pulleys. Generally, the periphery of the abrading element should be well defined in order to provide close control over the amount of surface being abraded; however, some resiliency in the surface of the element may be provided such as in a flap wheel using abrasive-impregnated cloth flaps mounted on a core. The abrading element also may be provided by an abrasive-filled synthetic plastic material or simply by abrasive material bonded to a suitable support surface.

Since it is desirable for the brushing elements to penetrate somewhat inwardly of the abraded outer edge to effect removal of the synthetic plastic particles lying on the surface of the flanges, the brushes preferably employ flexible filamentary or bristlelike elements which will deform about and penetrate between the flanges of adjacent trays to dislodge and propel the particles outwardly therefrom. Bristle brushes have proven particularly advantageous for this purpose, and the bristles may be natural or synthetic plastic.

Instead of the apertured housings shown in the illustrated embodiment which facilitate the flow of air across the surface of the flanges, it is possible to utilize larger enclosures providing ducts or hoods adjacent the burnishing and brushing elements which are connected to fans or vacuum units of sufficient capacity so as to produce the desired air flow across the surface of the flanges. Generally, the illustrated arrangement minimizes the amount of air flow required to achieve the desired purpose and thereby the resultant amount of air which must be treated so as to remove the entrained synthetic plastic particles. In another type of apparatus, positive air pressure may be utilized to blow across the surfaces on the flanges and into a duct or hood arrangement cooling the synthetic plastic particles.

From the standpoint of applicators for the lubricant, various devices may be employed in addition to the roller provided with an internal cavity heretofore described. For example, a pair of rollers may be employed, the first being highly absorbent and abutting against the actual applicator so as to transfer lubricant from its surface to the absorbent surface of the applicator. The first roller may then be supplied with lubricant by dripping, spraying or otherwise, and the amount transferred from the first roller to the applicator will be dependent upon the pressure at the nip and the relative absorbency of the two surfaces. It will also be appreciated that lubricant may be supplied to the applicator surface directly by spraying or dripping thereonto.

Various types of lubricants may be employed to provide a smooth feel to the user including silicone oils, polyethylene glycol, vegetable oils and various natural and synthetic waxes. If the viscosity of the lubricant is sufficiently high, it may be desirable to employ a solvent solution thereof which will deposit the desired film. Generally, the lubricant should form a very thin coating on the order of less than a tenth of a mil and preferably less than 0.05 mil.

It will be appreciated that various types of conveyors and pusher arrangements may be employed to effect the desired movement of the trays through the burnishing and brushing stations. For example, the trays may slide on a fixed conveyor bed and be moved therealong by an overhead pusher unit or the pusher unit may have fingers projecting upwardly through the fixed slide bed. If automatic or semiautomatic operation is not required, trays may be moved manually through the burnishing and brushing stations. Instead of the three-section conveying apparatus illustrated, the apparatus may eliminate one section by providing a lubricant application station along the first section after the brushing station; the stacks of trays may then be discharged from the second conveying section onto the discharge table.

It can be seen that the present invention readily adapts itself to high-speed operation either in conjunction with high-speed thermoforming units producing containers for packaging and shipment elsewhere or in line with the actual packaging installations. The method and apparatus are relatively economical and are operable independently of the forming equipment so as to provide considerable versatility and adjustability to containers of various configurations and dimensions.

What is claimed is:

1. In a method for treating containers of synthetic plastic material the steps comprising: stacking a multiplicity of containers of synthetic plastic material having a laterally projecting flange about at least a portion of the periphery thereof in nested relationship with spacing between the flanges thereof; abrading the outer edge of said flanges of said stack of containers to remove projecting portions of synthetic plastic material therefrom; brushing the surface of said flanges of said stack at said abraded outer edge thereof to remove abraded and other synthetic plastic particles therefrom; and concurrently with said abrading and brushing steps causing a gas to flow outwardly across said flange adjacent said abraded outer edge to minimize contamination of the interior of said containers by abraded and other synthetic plastic particles.

2. The method in accordance with claim 1 wherein said synthetic plastic material is biaxially oriented and wherein said containers are thermoformed from said synthetic thermoplastic sheet material.

3. The method in accordance with claim 1 wherein said containers are of generally rectangular cross section and wherein said abrading and brushing steps are concurrently conducted with respect to flanges along opposite sides thereof.

4. The method in accordance with claim 3 wherein similar abrading and brushing steps are subsequently conducted with respect to the remaining sides of the container.

5. The method in accordance with claim 1 wherein said gas is drawn outwardly across said flange by means of negative pressure.

6. The method in accordance with claim 1 wherein a thin film of lubricant is applied to the surface of said abraded flanges subsequent to said abrading and brushing steps to provide a smooth slippery feel thereto.

7. The method in accordance with claim 1 wherein said containers are of generally rectangular cross section, wherein a multiplicity of containers are disposed in nested relationship with spacing between the flanges thereof and the brushing action extends inwardly from the outer edge of said flanges and between said flanges, and wherein said abrading and brushing steps are concurrently conducted with respect to flanges along opposite sides thereof.

8. The method in accordance with claim 7 wherein similar abrading and brushing steps are subsequently conducted with respect to the remaining sides of the containers.

9. The method in accordance with claim 7 wherein a thin film of lubricant is applied to the surface of said abraded flanges subsequent to said abrading and brushing steps to provide a smooth slippery feel thereto.

10. The method in accordance with claim 1 wherein said brushing action is provided by a brush rotating on an axis parallel to the height of said stack of containers.

11. The method in accordance with claim 10 wherein said brush rotates in a direction opposite to the direction of relative movement between said stack of containers and said brush.

12. The method of claim 1 wherein said brushing action extends inwardly between the flanges of said stacks to remove particles from the edge portions adjacent said outer edges.

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