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DRAWINGS ATTACHED

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Inventors:—PETER TAUBE SCHURMAN and RAYMOND CARL CONFER.

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COMPLETE SPECIFICATION

Method of and Apparatus for the Blow Moulding of Hinged Articles and Articles Made Thereby

We, W. R. GRACE & Co., a Corporation organised and existing under the laws of the State of Connecticut, United States of America, of 7, Hanover Square, New York 5, New York, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates generally to the blow moulding of thermoplastic material, and more specifically to a method of and apparatus for blow moulding thermoplastic articles, and to thermoplastic articles manufactured thereby.

15 While not limited thereto, the invention is particularly concerned with the moulding of containers of one-piece construction having a body part and a cover part hinged thereto. Heretofore such containers have been injection moulded, producing a one-piece construction which is relatively flimsy and relatively expensive as compared to containers using steel or other non-plastics materials. As a result, such containers have not achieved their full potential.

25 A primary object of our invention is to provide an improved method of and apparatus for moulding plastic articles which is particularly suitable for containers of one-piece construction having hinged body and cover parts.

30 According to the invention there is provided a method of moulding articles having two blow moulded parts connected by a hinge portion wherein thermoplastic material is fed into a mould which is closed simultaneously to form mould cavities for the parts and to

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compression mould the connecting hinge, the two parts then being blow moulded to their required shape within the mould cavities.

The invention also provides a container made by this method, such container having mating blow moulded parts joined by a compression moulded hinge integral with both of said parts, said parts and said hinge being of thermoplastic material, and at least one of said parts being of hollow double-wall construction.

In carrying out our invention in one preferred aspect thereof, the two hinged parts of a container are blow moulded, to form a double walled envelope for each part. One side of the envelope comprises an exterior wall of one side of the part while the other side of the envelope forms an interior wall thereof. This is accomplished by closing complementary mould parts about a tubular extrusion of molten plastic material, the mould parts having portions coacting to provide a pair of opposite cavities. The parts forming the exterior walls project into the cavity parts forming the exterior walls, leaving sufficient space for blow moulding the desired double wall structure. As the mould parts close they pinch the extrusion around the cavities to form the meeting edges and simultaneously form a connecting hinge by complementary parts extending between the two cavities.

However, a problem arises when the interior wall forming parts approach the exterior wall forming parts too closely, because that portion of the extrusion intended to engage the exterior wall forming part has a tendency in its

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molten state to collapse inwardly against that portion of the extrusion which is being forced into the cavity by the projecting, interior wall forming part, whereupon the desired structure cannot be formed.

A preferred feature of the invention is to provide a method of and means for controlling the tubular extrusion as the mould sections are brought together, to prevent undesired collapsing of the tubular walls against each other.

Another problem arises in providing a hinge having sufficient fatigue life. The mould is cooled to set the tubular extrusion as the mould sections are engaged thereabout. While the resulting double wall envelopes comprising the hinged parts have a flex life sufficient for the intended purpose, the hinge is subject to stresses and strains which tend to materially reduce its useful flex life.

Therefore, it is preferred to provide a method and means whereby the stresses and strains in the hinge section are relieved during the moulding process to produce a longer lasting hinge.

Another preferred feature of our invention is to provide an extrusion die especially adapted for the moulding of articles by the method of our invention, the die containing parts which can be adjusted or changed to vary the wall thickness of the extruded parison.

According to another aspect of the invention there is provided blow moulding apparatus for forming a thermoplastic container having mating parts joined by a hinge with each part being of hollow double wall construction, such apparatus comprising means for forming a tubular parison of thermoplastic material, mould sections adapted to be moved into engagement about such parison, said mould sections when engaged forming a pair of cavities one of which has the shape of one of the container parts and the other of which has the shape of the other of the container parts, said mould sections being adapted in their closed position during use of the apparatus also to engage the parison on opposite sides thereof to compress and weld the parison between the cavities to provide the hinge dividing the parison into a pair of hollow sections within the cavities, and means for introducing fluid into the parison section or expanding them into conformity with the respective cavities.

The method of moulding a container having mating parts joined by a hinge may conveniently include the steps of extruding tubing of thermoplastic material, compressing the tubing completely thereacross at three locations spaced therealong, thereby providing in the tubing a pair of hollow compartments separated by a compressed hinge portion, and expanding the tubing compartments within a pair of blow mould cavities to form the article parts.

The container of the invention preferably

includes mating parts of thermoplastic material hinged together, a fastener tongue integral with one of the parts, the tongue projecting beyond the one part and having laterally projecting ears on opposite sides thereof, the other part having an integral flange projecting therefrom along the tongue beyond the juncture thereof with the one part, the side of the flange opposite the tongue having laterally spaced shoulders undercut for snap-fit engagement with the ears when the tongue is rolled over the flange.

In general, during manufacture of the container, the thermoplastic material is extruded in tubular form. Thus tubular extrusion is preferably substantially of an elongated or oblong cross section and complementary mould parts are closed against the relatively flat surfaces of the extruded tube. One mould part has a pair of adjacent cavities which form the exteriors of the two parts of the receptacle and the other mould part is shaped to form the exposed surfaces of the interior walls of the receptacle parts. When the mould parts close they compress the extrusion walls about the aforesaid cavities to form the meeting edges of the two receptacle parts and a unitary hinge may be moulded by complementary mould parts which extend between the two cavities.

This compressing and forming forms two joined envelopes which are then inflated to assume the configurations of the mould cavities of one mould part and the exposed surfaces of the inner walls of the receptacle parts which are formed at the other mould part. In manufacturing one of the containers of the present invention, the aforesaid oblong extrusion is preferably formed so that one of its flat wall surfaces is substantially thinner than the other whereby, after blowing, the exterior walls of the receptacle are substantially stiffer and more rigid than the interior walls.

In a preferred form shown and described herein the container parts are simultaneously moulded and are joined by an integral flexible plastic hinge which is formed during the moulding operation.

In another embodiment of the present invention as shown herein by way of example, a portion of one of the interior walls is cut away, leaving the remainder to form a permanently covered compartment, in a manner and for purposes which will be explained more fully later herein.

A further preferred feature of the present invention resides in the provision of an inwardly depressed formation in an exterior wall of one part of the container which provides a pad or platform at the interior thereof which supports one side of an object in the container, the other side of such object being held resiliently against the pad or platform by the relatively flexible interior wall of the other part of the container.

The invention will be described, merely by

way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a vertical sectional view through an extrusion die of blow moulding apparatus embodying the invention;

Figure 2 is a vertical sectional view taken along line 2—2 of Figure 1;

Figure 3 is a bottom plan view of the die of Figure 1;

Figure 4 is a fragmentary detail view showing a modified extrusion die construction;

Figure 5 is a view similar to Figure 4 but showing a further modified die construction;

Figure 6 is a vertical sectional view, to an enlarged scale, through moulding apparatus of the present invention, showing mould sections closed about a tubular parison during the moulding of a hinged container;

Figure 7 is a schematic layout of a blow moulding apparatus;

Figure 8 is a side elevational view of a hinged container in closed position, the container being similar to that shown being moulded in Figure 6;

Figure 9 is a rear elevational view of the container of Figure 8;

Figure 10 is a vertical sectional view taken along line 10—10 of Figure 9;

Figure 11 is a bottom view of the container of Figure 8;

Figure 12 is a view corresponding to Figure 10, but showing the container in open position;

Figure 13 is a sectional view taken along line 13—13 of Figure 12;

Figure 14 is a sectional view taken along line 14—14 of Figure 12;

Figure 15 is an enlarged, fragmentary sectional view through the fastener of the container;

Figure 16 is a top plan view of an embodiment of container in open condition showing the interior surface thereof;

Figure 17 is a cross sectional view on the line 17—17 of Figure 16 but with the parts in closed condition;

Figure 18 is a top plan view of still another embodiment of container of the present invention in open condition showing the interior surfaces thereof; and

Figure 19 is a cross sectional view on the line 19—19 of Figure 18.

Referring to the drawings, there is shown apparatus for moulding a hinged thermoplastic container. As shown in Figure 6, and as described in greater detail hereinafter, the container comprises mating parts 1 and 2 joined by a hinge 3 integral therewith. Part 1 comprises a relatively deep body part of hollow, double wall construction formed by an outer shell having opposite end and side walls 4 and a bottom wall 5, and an inner shell having opposite end and side walls 6 and a bottom wall 7. Side and end walls 4 of the outer shell are joined to the side and end walls 6 of the inner shell by a peripheral flange in the form

of a ledge 8 completely encircling the inner shell. An upstanding rib 9 is formed on ledge 8, for indexing purposes.

In like manner, part 2 comprises a relatively shallow top cover part of hollow, double wall construction having an outer shell formed by opposite end and side walls 11 and a bottom wall 12, and an inner shell formed by opposite end and side walls 13, and a bottom wall 14. The inner and outer side and end walls 13, 11 are joined by a peripheral flange in the form of an inwardly offset ledge 15 encircled by a skirt 16 and completely encircling the inner shell.

Of course, parts 1 and 2 can be of the same size, and part 2 can be larger or deeper than part 1, if desired.

The body and cover parts 1 and 2 are moulded integrally with hinge 3, in one piece, this being accomplished by a blow-moulding operation as follows:

Molten plastics material, not shown, is fed into an extrusion die 17 by conventional feed means, not shown, from a suitable supply (Figure 7). The extrusion die 17, as shown in Figures 1 to 3, includes a die body 18 having an inlet opening 19 through one side, the opening 19 communicating with a vertical bore 20 opening downwardly through die body 18. Preferably bore 20 is not circular, as is conventional, but is laterally elongated, having generally parallel flat sides and curved ends.

A mandrel 21 is positioned in bore 20, the upper portion of the mandrel having a sliding fit in bore 20 and the lower portion of the mandrel having a cross sectional configuration generally concentric with body 18 around bore 20 and spaced therefrom to define a tubular extrusion passage. Mandrel 21 is positioned in bore 20 as by bolts 22 which extend through the upper end of die body 18 and are threaded into the upper end of mandrel 21 on opposite sides of a bolt valve 23 to be described. Mandrel 21 has a lateral passage 24 therethrough, comprising a continuation of inlet passage 19. Also, the upper portion of mandrel 21 has downwardly opening recesses 25 of downwardly diverging side wall form on opposite sides thereof, communicating with passages 19 and 24 and with the tubular extrusion passage along the elongated sides thereof.

Raw material fed through inlet opening 19 is held at plasticising temperature by means such as cartridge-type electric heaters 26 positioned in body 18. The heated die body causes the thermoplastic material to remain molten, and semi-fluid, and this semi-fluid material flows into the upper end of bore 20. Some of the molten material flows through the recess 25 immediately adjacent passage 19, downwardly along the near side of the mandrel, while some molten material flows through mandrel passage 24 to the far recess 25, whereby the molten plastics material is caused to surround mandrel 21 and move downwardly therealong. The lower portion of mandrel 21 is spaced from the

side wall of the bore 20 to define a tubular extrusion passageway which fills with the molten thermoplastic material to extrude a tubular parison 27 of laterally elongated, flat-sided form.

The extrusion of a laterally elongated, flat-sided parison offers many advantages. Such a tube tends to be non-directional, unlike a circular tube, and furthermore has the approximate shape of the container to be moulded as shown in Figure 6. If a circular tube were used, an undesirably large diameter often would be required.

The flow of molten plastics material through the mandrel passage 24 can be regulated by a bolt valve 23 which is threaded in the upper end of die body 18. Bolt 23 has a rotary valve end 28 extending through the upper end of mandrel 21 into the passage 24 for variably restricting the same.

The cross-sectional shape and wall thickness of the parison 27 is determined by a plate 29 mounted on the lower end of mandrel 21 which is recessed immediately above the plate, as indicated at 30. Plate 29 is secured to mandrel 21 as by screws 31, whereby it can be detached and replaced by a plate of different configuration. In this way, parisons of different wall thicknesses can be extruded from a single die 17.

Instead of a removable plate 29 coacting with a fixed wall of bore 20, the lower end of the mandrel can be fixed and permanent, with the die body having a removable insert 32 forming the lower end of the bore wall as shown in Figure 4. Insert 32 can be detachably secured in place as by bolts 33 for replacement by an insert of different configuration to provide an extrusion of different side wall form.

Plate 29 and insert 32 can be designed to provide an extrusion having different wall thicknesses therearound. In Figure 3, for example, one side 32' of the extrusion passage is approximately twice as wide or thick as the opposite side 33'. In addition to providing opposite side walls of different thicknesses, a given side wall can have portions of different thickness by appropriately recessing or embossing either the removable plate 29 or the removable rim insert 32.

Also, the extruded parison 27 can be provided with axially spaced sections of different thickness. This can be accomplished, for example, by providing a die body 18' (Figure 5) having an undercut inner wall 34 at the lower end of extrusion bore 20'. The mandrel 21' has a plate 29' which can be detachable and which projects beneath the overhang of wall 34. By providing the mandrel with lift jacks as indicated at 35 (Figure 7) actuated by hydraulic-pneumatic, or other forms of motor indicated at 36 the mandrel can be raised and lowered to vary the spacing between the plate 29' and wall 34. This will vary the wall thickness of the

parison as it is extruded. The extruded parison 27 is passed between paired mould sections generally designated 37, 38 which are mounted for movement into and out of engagement about parison 27. Mould sections 37, 38 can be pivotally mounted or otherwise supported and can be moved by conventional drive means 39.

Mould section 37 comprises a plate section, having a body 40 and removable cores 41, 42. Core 41 is mounted in a recess in body 40, the portions of the core projecting from body 40 having surfaces defining the inner wall, ledge and rib portions 6, 7, 8, 9 and 10 of the inner shell of container body part 1. Core 42 is mounted in another recess in body 40, and its projecting surfaces are formed to define the inner shell portions 13, 14 and 15 of container cover part 2. Mould section 38 is recessed to define the outer shell portions of container parts 1 and 2.

Thus, mould sections 37, 38, when engaged, define a pair of cavities. One cavity has the shape of one container part, and the other cavity has the shape of the other container part. Mould section 38 defines the outer shell configuration of the moulded article, and mould section 37 the inner shell configuration thereof. The configuration of either inner shell can be changed without changing the configuration of the other and without changing either outer shell configuration. This is accomplished by removing the appropriate core 41, 42, which are simply bolted in place through body 40, from behind, and replacing it with another core having the desired configuration.

Mould section 38 and body 40 are provided with opposed land portions 43, 44, respectively, which are arranged to pinch the parison between them, welding the opposite side walls of the parison together and forming the hinge 3. Mould section 38 also is provided with a knife edge formation 45, extending completely around the cavities except at the hinge and adapted to engage against the mould body 40 as a bed plate for pinching and severing the enclosed parison portion.

Thus, upon closing mould sections 37, 38 about the parison 27, a portion thereof is enclosed. The mould sections pinch off the enclosed portion, and simultaneously pinch form the hinge 3, thereby dividing the enclosed parison portion into a pair of hollow sections positioned within the mould cavities and separated by hinge 3. Mould section 37 carries means for introducing expansion fluid into each hollow parison section, such means comprising a pair of needles 46 which are mounted in section 37 and project beyond the cavity defining faces thereof through the wall of the enclosed parison. A source of compressed air is connected via conduit 47 to each needle 46, for introducing compressed air into each of the hollow parison sections, thereby expanding

them into engagement with the cavity walls, causing the parison sections to assume the shape of the cavities. Cores 41, 42 and the mould 38 are cooled, as by cooling water ducts 48 connected to a suitable source of cooling fluid. This cools and sets the moulded plastic, causing it to retain the mould configuration.

Thus, by utilising the described apparatus it is possible to obtain a one-piece container of plastics material having mating parts joined by an integral hinge, all in a single blow-moulding operation.

Where a single wall construction is desired, the inner shell of either part 1, 2 can be either wholly or partially removed, as by severing with a circular cutting saw. Preferably, this is done by cutting through the side and end walls 6, 13, as the case may be.

The plastics parison can be pinched very thin by the knife edge 45 easily and without using great force. The mould body 40 is heated, as by cartridge heating element 49, in the area against which the knife edge formation 45 engages. The heated body 40 maintains the parison at or near its plasticising temperature and therefore in a molten, semi-fluid condition at the area of pinching, as the mould sections close, whereby the weight of the moulds themselves is sufficient to cut almost through the plastics material. This is accomplished during the blow moulding operation, without requiring special cutting equipment or the large force required to pinch off cooled plastics material.

A hinge of long flex life is provided, notwithstanding the cooling of the expanded parison sections in the mould. This is accomplished by heating the land 44 to a temperature maintaining the pinched hinge web in a semi-fluid condition long enough to relieve stresses and strains set up in the pinched hinge web.

It will be noted that mould section 37 is simultaneously heated in part and cooled in part. Therefore, cores 41, 42 are substantially insulated from body 40. This is accomplished by bevelling or tapering the side wall portions of the cores 41, 42 away from the side walls of the recesses in which they are seated, as shown at 50, and by spacing the inner faces of the cores from the bottom walls of the recesses, thereby providing insulating dead air spaces between body 40 and the core portions seated in the recesses. Further, the spaces between the inner faces of cores 41, 42 and the bottom walls is filled with heat insulating and/or dissipating spacing material, such as the wire screening 51. As a result, cores 41, 42 contact body 40 only adjacent the outer edges of the recesses, and the desired heating of body 40 does not interfere with the desired cooling of cores 41 and 42.

It will be appreciated that the illustrated arrangement of cooling ducts 48 and heaters 49 is schematic, and that the same are provided in

sufficient numbers and at proper locations to achieve the desired result.

In the illustrated container, the inner shells of the parts 1 and 2 approach the outer shells thereof very closely. Indeed, they are welded together at spaced locations 52 for added reinforcement, although this need not necessarily be done. Where welding is desired, the cores 41, 42 are shaped accordingly. However, a problem of undesired welding together arises because of the close positioning of the inner and outer shells. There is a tendency for the parison portions 5, 12 to fall away from the mould 38 and collapse against portions 7, 14 as the mould sections close about the parison. If this occurs, at any point, the opposite wall portions of the parison weld together, preventing subsequent expansion in the mould cavity. Therefore, means are provided for controlling those portions of the parison intended to engage the recessed cavity faces, the opposite parison portions being maintained under control by the projecting cores 41, 42.

The desired control is provided by evacuating or withdrawing air from between the cavity faces of mould section 38 and the adjacent wall sections of the enclosed parison. This can be accomplished in various ways. In the illustrated embodiment, air is withdrawn from between the wall section 12 and the adjacent cavity face of mould section 38 through vacuum passages 53 which are of extremely small diameter, for example .03 inch, and which communicate with a manifold passage 54 through the mould section 38. Manifold passage 54 communicates with an appropriate source of suction through a conduit 55. In the case of the outer shell of container part 1, the wall portion 5 thereof is defined in part by a removable insert plate 56 mounted on the mould section 38 from behind, as by bolts or the like. Plate 56 is provided with a slight clearance therearound, between it and the surrounding portion of mould section 38, this clearance being indicated at 57 and being on the order of .01 inch. The rear face of plate 56 is provided with transverse grooves extending between the opposite edges thereof, in generally right angular relation, as indicated at 58 and 59, for placing the clearance 57 in communication with the manifold passage 54, through the connecting passage 60.

Thus, as the mould sections 37, 38 are closed about the parison, air is withdrawn from between the parison and the cavity faces of mould section 38. A strong suction source is not essential. All that is required is to relieve the pressure of air trapped between the parison and the cavity faces of mould section 38, which otherwise prevents the parison from following the contour of the mould section 38 as the mould sections are engaged about the parison. The clearance space 57 and passages 53 are so small as to preclude the

passage of plastics material therethrough, while being sufficient to permit the desired withdrawal of air. Such withdrawal takes place as the mould sections 37, 38 close about the extruded parison, prior to the introduction of expansion fluid through needles 46. The introduction of expansion fluid causes the parison envelopes to expand into conformance with the surface defining of their respective cavities, undesired inward collapsing of the parison wall being avoided by such expansion. Also, it will be appreciated that the oblong, flat sided shape of the parison, approximating the outline configuration of the container in its open position, assists in providing a controlled expansion of the hollow parison sections within the cavities.

The feeding of the raw plastics material, the opening and closing of the mould sections and the heating and cooling thereof, the withdrawal of air from between the parison and mould section 38 and the introduction of expansion fluid all are controlled by suitable programming means, which also can control the lifting and lowering motor 36 connected to the extrusion die mandrel. Such controls are conventional, in and of themselves, and therefore are only schematically indicated in Figure 7.

A suitable container for manufacture by the above described method and apparatus will now be described with reference to Figures 8 to 15 of the accompanying drawings. This container comprises mating parts 1 and 2 joined by a hinge 3 integral therewith. Part 1 comprises a relatively deep body part of hollow, double-wall construction formed by an outer shell having opposite end and side walls 4 and a bottom wall 5, and an inner shell having opposite end and side walls 6 and a bottom wall 7. Side and end walls 4 of the outer shell are joined to side and end walls 6 of the inner shell by a peripheral flange in the form of a ledge 8 completely encircling the inner shell. An upstanding rib 9 is formed on ledge 8, for a purpose to be described.

In like manner, part 2 comprises a relatively shallow top cover part of hollow, double-wall construction having an outer shell formed by end and side walls 11 and a bottom wall 12, and an inner shell formed by end and side walls 13 and a bottom wall 14. The inner and outer side and end walls 13, 11 are joined by a peripheral flange in the form of an inwardly offset ledge 15 encircled by a skirt 16 and completely encircling the inner shell.

Of course, parts 1 and 2 also can be of the same size, and part 2 can be large or deeper than part 1, if desired.

Body and cover parts 1 and 2 are moulded, integral with hinge 3, in one piece and in a manner imparting great flex endurance to hinge 3 while providing the hollow, double-wall construction of parts 1 and 2. This is accomplished by blow moulding parts 1 and 2

and compression moulding hinge 3 in one operation. To this end, the container is moulded with the parts positioned as shown in Figure 12, the handle being added later.

As previously described molten plastics material is extruded in tubular form between mating die parts which then are brought together to pinch the plastic tube at its upper and lower ends, whereupon air under pressure is introduced into the closed tube to force it outwardly against the die parts. However, whereas the tube of molten plastic normally is pinched closed only at its ends, in the present instance the tube also is pinched closed between its ends, to define and compression mould the hinge 3.

The mating die parts are arranged so that one die part defines the outer shells 4, 5 and 11, 12 while the other die part defines the inner shells 6, 7 and 13, 14. These portions of the container, together with parts 8, 9, 10, 15 and 16, are formed by blow moulding, compressed air being introduced into the container parts 1 and 2 through needle openings 126 and 126' respectively, the location of which is not critical. The coacting die parts, in addition to defining spaced cavities for blow moulding the container parts, pinch the plastic tube at the hinge and thereby compression mould hinge 3.

Any thermoplastic material having the requisite flexibility for hinge 3 can be used, high density polyethylene, polypropylene, polyvinyl and elastomeric polyolefin being examples of suitable materials.

The ledge 8 provides a shelf imparting, in conjunction with inner shell 6, 7, substantial rigidity to body 1. In like manner, ledge 15, together with inner shell 13, 14 imparts substantial rigidity to cover 2. For increased rigidity, the corners of the inner shells can be made to contact the outer shell, and can be joined thereto, as indicated at 127 in Figures 11 and 12. Also, the inner and outer shells can be welded at selected points as shown at 128 in Figure 12. In this way the flimsiness characteristic of conventional, single shell moulded plastic containers is avoided.

The hollow, double-wall construction of the container parts also provides a protective cushion for the contents of the container. The shock resistance of such construction affords a degree of protection not available with conventional single shell construction.

Where buoyancy is desired, as in fishing tackle boxes, either body part 1 or cover 2, or both can be made fluid tight by sealing the needle holes 126, 126'.

Where it is desired to provide a separate insert, the inner shell 6, 7 of the body part 1 can be either partially or wholly removed, as indicated by the broken line showing thereof in Figure 11. This can be done by cutting, preferably through side and end walls 6 in a plane parallel to ledge 8. This hides the cut, and also leaves a portion of wall 6 for added

rigidity. In this respect, it will be noted that ledge 8 continues to impart rigidity to the body part, even with the inner shell removed. An inwardly offset shoulder 10 can be provided to receive and support an insert, not shown.

If desired, the inner shell of cover 2 can be removed, preferably in like manner. Of course, where the inner shell is to be removed, it will not be joined to the outer shell as shown at 127 and 128.

Hinge 3, being compression moulded, has a long flex life, and will withstand repeated opening and closing of the container for as long as the container is used. In closed position, skirt 16 of cover part 2 rests against ledge 8, in encircling relation to rib 9 which helps maintain parts 1 and 2 aligned when they are closed.

Extending from cover part 2, opposite hinge 3 and in the plane of skirt 16, is a fastener tab or tongue 117 terminating at its outer end in an enlarged head 118 having ears 119 projecting laterally beyond the opposite sides of tongue 117.

Body part 1 has a flange 120 projecting laterally outwardly along tongue 117 to a point between fastener head 118 and the juncture of tongue 117 and side wall 11. Undercut shoulders 121 are formed on the side of flange 120 opposite tongue 117, and project beyond flange 120 in alignment with ears 119.

When container parts 1 and 2 are brought together, to the closed position shown in Figure 11, the fastener tongue 117 is rolled over the cam surface of flange 120, and ears 119 snap over and beneath undercut shoulders 121, releasably to hold the container closed. Fastener tongue 117, with its head 118 and ears 119, is compression moulded in the same manner and at the same time as hinge 3, and thereby has a long flex life. The flex life of tongue 117 is extended by the provision of flange 120 which causes the tongue to flex along a line spaced from its juncture with wall 11, instead of at that juncture.

The outer shell of body 1 may be recessed, at its end opposite hinge 3, as indicated at 122, the opposite side walls of the recess being apertured to receive pintles 123 projecting laterally from the opposite ends of a handle 24. The opposite end of the outer body shell may be moulded to provide a pair of tapered feet 125, the outer extremities of which are spaced from wall 4 a distance slightly greater than the projection of hinge 3 from walls 11 and 4 when the container is closed. Similar feet 125', or a single foot, may be moulded into the outer cover shell. These feet support the closed container in an upright position and prevent the weight of the container and its contents from resting on the hinge.

Flange 120 and undercut shoulders 121 are compression moulded in body part 1, and recess 122 and feet 125 and 125' are blow moulded therein, at the time body part 1 is

formed.

In another embodiment of the present invention, the receptacle or container shown in Figures 16 and 17 comprises a pair of box-like complementary body members designated generally 129 and 130 which in the illustrated instance are moulded integrally to include a relatively thin connecting hinge portion 131. For convenience of reference the member 129 may be considered to be the bottom member and the member 130 the top or cover member.

The body member 129, as is clearly shown in Figure 17, comprises a blown hollow structure which includes a relatively rigid outer wall 132 and an inner wall 133 which is substantially thinner than outer wall 132 and is accordingly substantially more flexible. The body member 130 likewise includes a relatively rigid outer wall portion 135 and a thinner inner wall portion 136 which is substantially more flexible than the outer wall portion 135.

It will be noted by reference to Figure 17 that in the case of both of the body members 129 and 130 the blowing of the inner and outer wall portions thereof produces interfitting marginal edge formations designated 137 and 138, respectively, which formations occur generally along lines which define the meeting edges of the respective outer and inner wall portions of the body members.

The containers may be designed to receive a variety of articles, the container being arranged particularly to receive specific articles or pieces of equipment or as general carry-all containers. In the present instance the container, merely by way of example, is designed to receive an electric carving knife which conventionally includes a body member which includes a handle portion and electric motor means contained therein, the knife blade *per se* being normally separated from the handle portion when the device is not in use.

Referring particularly to Figure 16, the inner wall 133 of the bottom body member 129 is provided with a pair of depressed well formations 139 and 140 which receive portions of the body or holder member of the electric carving knife and the inner wall 136 of upper body member 130 is provided with a depressed well formation 141 which seats over the opposite side of the body member of the knife, whereby such body member, which is indicated in dot and dash lines at A in Figure 17 is securely held between the respective well formations of the members 129 and 130 when the container is closed. Any desired form of clasp or latching means may be provided for holding the container body members 129 and 130 in relatively closed position, as for instance the latch means previously described with reference to Figures 8 to 15.

The knife-blades which are separable from the knife holder are adapted to seat in recesses 142 and 143 in lower body member 129, and elevated surface portions 144 and 145 of inner

wall 136 of upper body member 130 seat against the knife blades when the container is closed to hold them firmly in position. A further well portion 146 in lower body member 5 129 may receive the electrical cord which extends from the knife body member and the numeral 147 designates a relatively shallow recess in inner wall 136 of the upper body member 130 which in the present instance 10 merely receives labelling indicia.

It will be seen from the foregoing that the knife body member indicated as A is in a sense resiliently suspended between the rigid outer walls 132 and 135 by the relatively more 15 flexible inner walls 133 and 136 so that a floating mounting for the body member A is provided which is calculated to protect the same against jarring or shock to which the container generally may be subject at times.

In another embodiment of the present invention as shown in Figures 18 and 19, the form of container shown herein by way of example comprises a pair of box-like complementary body members designated generally 20 148 and 149 which are moulded integrally to include a relatively thin connecting hinge portion 150. The body member 148, as will be noted particularly from Figure 19, comprises a blown hollow structure which includes an 25 outer wall portion 151 of such thickness as to be relatively rigid and an inner wall 152 which is substantially thinner than outer wall portion 151 and is accordingly somewhat flexible.

The body member 149 likewise includes a 30 relatively rigid outer wall portion 153 and a relatively thinner inner wall 154 which is more flexible than the outer wall. Body member 149 is likewise blow moulded but in this instance portions of the inner wall 154 are cut away in a 35 manner and for purposes which will presently appear.

As hereinbefore pointed out, the containers or receptacles constructed according to the present invention may be designed to receive a 40 wide variety of articles. For the purpose of illustration, a case for an electrical soldering gun and certain accessories therefor are completely described by way of example.

It will be noted that inner wall 152 of body 45 member 148 lies substantially at the meeting plane of the body members but includes a major depressed portion 155 to provide an article-receiving recess and a further depression 156 is formed in depressed portion 155. The 50 inner wall 152 further includes a pair of raised bead or rail formations 157 and 158.

Referring to the other body member 149, inner wall 154 thereof has cutout portion 159 55 corresponding roughly in outline with the depressed portion 155 and has a raised pad 160 in the rigid wall 153 thereof which registers generally with depression 156 when the container is closed and is formed by depressing 60 rigid wall 153 inwardly.

The remainder of inner wall 154, that is, the

portion which is not cut away to form the opening 159, forms a shelf connected at three sides to the rigid portion 153 of body member 149.

The shelf portion of inner wall 118 is formed 70 with elongate recesses of semi-circular cross section as at 161, 162, 163, and 164, a circular recess or depression 165 and an angular recess 166. The handle portion of a conventional 75 soldering gun lies in the cutout 159 of wall 154 with its barrel lying in recess 161 and with one of its side walls lying against pad 160. When the container is closed the depressed portion 155 of 80 the other inner wall 152 engages against the other side of the handle portion of the gun and the proportions are such that the handle of the gun is closely confined and securely held 85 between pad 160 and the depressed portion 155 of inner wall 152.

The relative flexibility of wall 152 permits 90 the latter to yield resiliently upon engagement of depressed portion 155 against the gun handle. The pad 160, being offset from outer wall 153, may likewise contribute to the yieldable 95 gripping of the handle of the gun between depressed portion 155 and pad 160. Prior to placing the solder gun handle in the opening or cutout 159 the electrical cord thereof is pushed beneath the shelf formed by inner wall 154.

The usual soldering gun barrel which holds the soldering tip at its outer end lies in recess 161 when the gun handle is placed as described 100 above. Other sizes or types of barrels or tips are received in recesses 162, 163, 164 and 166 and recess 165 is provided to receive a coil or solder wire.

When the body member 148 is closed the 105 dy member 149 as aforesaid the bead or rail formation 157 engages across and against the barrel of the soldering gun in recess 161 and against the accessories in recesses 162, 163, 164, and 166. The formation 158 engages across the barrels and tips in recesses 163 and 164 and 110 overlies recess 165.

Since both the recess and the bead or rail formations are formed in the relatively flexible 115 inner wall portions 154 and 152, respectively, the grooves and beads are proportioned to cause slight flexure of walls 152 and 154 whereby the parts are held securely between such walls and the walls exert a resilient pressing engagement against the contained parts.

The present container may have a latch 120 means like that previously described with reference to Figures 8 to 15. In the present drawing the tab portion of the fastener is designated 167 and the complementary tab receiving notch formation of body member 149 is designated 168. The handle member 169 125 may likewise be like that previously described with reference to Figures 8 to 15. Facing wall surfaces for receiving the handle member 169 are formed by a recess formation 170 in outer wall 153 of body member 11. 130



WHAT WE CLAIM IS:—

1. A method of moulding articles having two blow moulded parts connected by a hinge portion wherein thermoplastic material is fed into a mould which is closed simultaneously to form mould cavities for the parts and to compress the connecting hinge, the two parts then being blow moulded to their required shape within the mould cavities.

2. A method according to claim 1, wherein a length of tubing of the thermoplastic material is extruded into the mould, the mould is closed to compress an intermediate portion of the tube to form the hinge, and the portions of the tube on either side of the intermediate hinge portion are blow moulded to their required shape.

3. A method according to claim 2, wherein the mould is closed to compress the tubing together at three locations spaced therealong to provide in the tubing a pair of hollow compartments separated by a compressed hinge portion, the compartments then being expanded within a pair of blow mould cavities to form the two parts.

4. A method according to claim 2 or 3, wherein plasticizing heat is applied to the tubing during the compression thereof.

5. A method according to claim 4 when appendant claim 3, wherein the plasticizing heat is applied to those portions of the tubing which are compressed together whilst the compartments are cooled as they are expanded within the blow mould cavities.

6. A method according to any preceding claim, wherein subsequent to the blow moulding to form two parts of hollow double wall construction, a wall portion is removed from one of the parts.

7. A method according to claim 2 or claim appendant thereto, wherein after cavity defining mould sections have been moved into engagement about the tubing, air is withdrawn from between the enclosed tubing and one mould section to cause adherence of the tubing to the mould section and thereby preclude inward collapsing of the tubing.

8. Blow moulding apparatus for forming a thermoplastic container having mating parts joined by a hinge with each part being of hollow double wall construction, such apparatus comprising means for forming a tubular parison of thermoplastic material, mould sections adapted to be moved into engagement about such parison, said mould sections when engaged forming a pair of cavities one of which has the shape of one of the container parts and the other of which has the shape of the other of the container parts, said mould sections being adapted in their closed position during use of the apparatus also to engage the parison on opposite sides thereof to compress and weld the parison between the cavities to provide the hinge dividing the parison into a pair of hollow sections within the cavities, and means for

introducing fluid into the parison sections for expanding them into conformity with the respective cavities.

9. Apparatus according to claim 8, wherein the cavity faces provided by one of its mould sections define the outer walls of both container parts and the cavity faces provided by the other of the mould sections define the inner walls of both container parts.

10. Apparatus according to claim 9, wherein means are provided for withdrawing air from between the parison and a portion of the cavity faces provided by the one mould section during use of the apparatus to hold the parison thereagainst prior to the introduction of expansion fluid into the parison sections.

11. Apparatus according to claim 9 or 10, wherein a portion of a cavity face provided by said other mould section projects into the corresponding cavity face provided by said one mould section.

12. Apparatus according to claim 11, wherein said other mould section includes a body and cores mounted on said body, said cores providing said projecting cavity face portions.

13. Apparatus according to claim 12, wherein the body of said other mould section has recesses receiving the cores, the core portions within the recesses being spaced from the walls thereof substantially throughout.

14. Apparatus according to claim 13, wherein the side walls of the cores taper inwardly away from the side walls of the recesses and the inner faces of the cores are spaced from the bottom walls of the recesses thereby providing in the recesses an insulating space between the cores and the body.

15. Apparatus according to claim 12 or 13, wherein means are provided for cooling the cores and said one mould section.

16. Apparatus according to claim 9, 10, 11, 12, 13 or 14, wherein means are provided for heating the body of said other mould section at a position where the body is adapted to compress and weld the parison.

17. Apparatus according to claim 12, or any claim appendant thereto, wherein a heat dissipating screen is provided between the cores and the body.

18. Apparatus according to any one of claims 8 to 17 which includes an extrusion die for extruding the tubular parison, such extrusion die comprising a die body having an inlet passage communicating with an extrusion bore which has an outlet opening through the die body, a laterally elongated tubular extrusion passage for thermoplastic material formed between the extrusion bore and a mandrel within the extrusion bore, and a die plate carried by the mandrel adjacent the outlet opening.

19. Apparatus according to claim 18, wherein the die plate is detachable from the mandrel for replacement by another die plate

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- having a different configuration for varying the configuration of the parison extruded by the die.
20. Apparatus according to claim 18, wherein a detachable insert is carried by the die body around at least a portion of the outlet opening, said insert being detachable from the die body for replacement by another insert having a different configuration for varying the configuration of the parison extruded by the die.
21. Apparatus according to claim 18, 19 or 20, wherein the mandrel has a passage there-through across the extrusion bore communicating with the inlet passage, adjustable valve means being provided for variably restricting the mandrel passage.
22. Apparatus according to claim 21, wherein the mandrel is recessed on opposite sides thereof adjacent the mandrel passage, thereby providing an enlarged extrusion passage thereat.
23. Apparatus according to claim 18, 19, 20, 21 or 22, wherein the outlet opening is enlarged relative to the extrusion bore, the outer end of the mandrel is enlarged and extends into the enlarged outlet opening, and the mandrel is movable lengthwise of the bore thereby to vary the cross-sectional configuration of the extrusion passage.
24. Apparatus according to claim 23, wherein means are provided for moving the mandrel lengthwise of the extrusion bore as a parison is being extruded.
25. A container made by the method of any one of claims 1 to 7, having mating blow moulded parts joined by a compression moulded hinge integral with both of said parts, said parts and said hinge being of thermoplastic material, and at least one of said parts being of hollow double-wall construction.
26. A container according to claim 25, wherein separable fastener sections are provided integral with said parts.
27. A container according to claim 26, wherein the fastener sections comprise a compression moulded fastener tongue integral with one of said parts and extending therefrom for locking engagement with the other of said parts.
28. A container according to claim 27 wherein its fastener tongue projects laterally outwardly beyond the one part and terminates in an enlarged head having ears on opposite sides of the tongue, the other of said parts having a flange integral therewith and projecting laterally therefrom along said tongue to a point between said head and the juncture of said tongue and said one part, the side of said flange opposite said tongue having a tongue and head receiving recess and undercut shoulders on opposite sides thereof the end of said flange being received between said shoulders, said ears snap-fitting beneath said shoulders when said tongue is wrapped around the recessed end of said flange.
29. A container according to any one of claims 25 to 28, wherein at least one of the parts has inner and outer shells joined adjacent the periphery thereof in spaced apart relation to comprise the double-wall construction.
30. A container according to claim 29, wherein the shells have at least one point of contact therebetween in spaced relation to the peripheral juncture thereof.
31. A container according to claim 30, wherein the shells are joined at the point of contact therebetween.
32. A container according to any one of claims 25 to 31, wherein one of the parts has a one-piece hollow double-wall construction comprising inner and outer shells each having a bottom wall and opposite side and end walls, said side and end walls of said inner and outer shells being joined adjacent the periphery thereof by a transverse wall, the other of the parts also being of one-piece construction and comprising a shell having an internal lateral flange therearound adjacent the periphery thereof, said flange terminating in a depending flange therearound.
33. A container according to any one of claims 25 to 32, wherein feet are carried by said parts at the same side thereof as the hinge, said feet being integral with said parts and projecting outwardly beyond said hinge when said parts are in closed position for supporting said container in an upright position, a handle being carried by one of said parts at side thereof opposite to the feet.
34. A container according to any one of claims 25 to 33, wherein each of the parts comprise a blown thermoplastic moulding forming a double-wall structure comprising an actively rigid outer wall and a thinner more flexible inner wall whereby an article disposed within said container is resiliently supported between the flexible inner walls.
35. A container according to claim 34, wherein the inner walls have recess portions shaped to receive particular articles against lateral displacement in the container.
36. A container according to claim 34 or 35, wherein at least one of said parts comprise a box-like structure with the inner wall fitting within the outer wall but spaced therefrom excepting at the marginal joinder of the inner and outer walls.
37. A container according to claim 34, 35 or 36, wherein the marginal juncture positions of the inner and outer walls of the parts are formed with portions adapted to interfit when the parts are moved to closed position.
38. A method of moulding articles substantially as herein described with reference to the accompanying drawings.
39. Blow moulding apparatus constructed and arranged substantially as herein described with reference to and as illustrated in Figures 1 to 7 of the accompanying drawings.
40. Blow moulded container constructed and



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arranged substantially as herein described with reference to and as illustrated in Figures 8 to 19 of the accompanying drawings.

J. A. KEMP & CO.,
Chartered Patent Agents,
14 South Square,
Gray's Inn, London, W.C.1.

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