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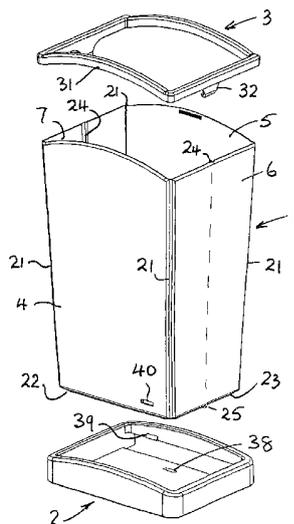
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(54) Title: INJECTION-MOULDED PLASTICS ARTICLES



(57) Abstract: Injection-moulding of the open-top container (1) of a collapsible plastics-vase includes definition of internal and external membrane-hinges (24, 21) running lengthwise of the container (1). The container (1) is moulded in the erect condition, the lades (56, 57) moving inwardly of the mould to impress the channels (12) into the plastics directly for external hinges (21) and to press the plastic against ridges (54) within the mould-cavity for internal hinges (24). The vase has a moulded-plastics base (2) into which the container-bottom clips, and a moulded-plastics rim (3) that clips into the top of the container (1) to hold it open. In the collapsed, flat-pack condition of the vase, the container (1) is trapped by lugs (32) under the main frame-part (31) of the rim (3) and extends through a slot (33) in a back wall (34) of the base (2) for engagement in a recess (35) of its front wall (36).

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### Injection-Moulded Plastics Articles

5 This invention relates to injection-moulded articles and methods of manufacturing them.

The invention is concerned with injection-moulded plastics articles of the kind which are of unitary construction and which incorporate flexible membrane portions located between and integral with spaced parts of the article to define hinges for enabling those parts to be deflected angularly with respect to one another.

15 It is very desirable in the injection moulding of plastics articles to ensure that the material injected flows uniformly throughout the mould and that the different fronts of the injected material are hot when they meet so that there is good fusion within the moulded article. However, there is the problem where articles of the above-specified kind are to be moulded, that the areas of restriction in the mould required for the formation of the membrane hinges, may create obstructions that give rise to differences of flow rate and temperature which jeopardize good fusion. It is one of the objects of the present invention to provide a method of injection moulding a plastics article of the above-specified kind, that may be used to overcome, or at least reduce, this problem.

25  
30 According to one aspect of the present invention there is provided a method of injection moulding a plastics article of the above-specified kind, wherein the membrane hinges are formed during completion of filling of the mould, by externally-applied compression of the plastics material as it is in the mould.

Thus, according to this method, obstruction of the mould where a membrane hinge is required can be avoided simply by the step of externally compressing the plastics material in that location during completion of the filling of the mould. The externally-applied compression of the plastics material may be applied to the material by blades mounted with the mould, each blade being moved from a retracted position into an extended position in which it projects into the mould cavity to compress the plastics material. The blades may be moved between their retracted and extended positions by means of longitudinal displacement of wedges that abut the blades respectively.

Where the article concerned is convertible between a three-dimensional erect state and a substantially-flat, folded state, and incorporates a multiplicity of membrane hinges to enable it to be converted between the two states, at least some of the membrane hinges may be formed by compression as aforesaid. The article in these circumstances may be moulded in its erect state.

According to another aspect of the present invention there is provided an injection-moulded plastics article of unitary construction which is convertible between a three-dimensional erect state and a substantially-flat, folded state, the article incorporating a multiplicity of flexible membrane portions located between and integral with spaced parts of the article to define hinges for enabling those parts to be deflected angularly with respect to one another in conversion between the two states, wherein at least some of the membrane hinges are hinges that have been formed by compression of the plastics material during the injection moulding.

The article may be an elongate container in its erect state having a plurality of membrane hinges formed by compression as aforesaid, extending lengthwise of the

article. The container may be open-topped in its erect state and may form part of an assembly for use, for example as a collapsible vase. In this latter case, the container may be assembled with a base member that serves  
5 to engage with the erect container in standing the vase, upright, and the base member and the container when folded, may engage with one another is a flat-pack assembly for convenient and compact handling. Furthermore, a rim member may be provided for engaging  
10 with the top of the container in the erect state to hold the top open in that state.

According to a further aspect of the invention a plastics vase comprises an elongate, open-topped container of  
15 injection-moulded, unitary construction which is convertible between a three-dimensional erect state and a substantially-flat, folded state, a rim member for engagement with the open top of the erect container for holding the top open, and a base member for engagement  
20 with the base of the erect container for holding the erect container upright, the container incorporating a multiplicity of flexible membrane portions located between and integral with walls of the container and parts of them, to define hinges for enabling those walls  
25 and parts to be folded with respect to one another in conversion between the erect and folded states, and wherein the container in its folded state is engageable with the rim and base member for retention of the rim and base members with it in that state.

30

A collapsible vase including an injection-moulded container and a method of manufacture of the container, all in accordance with the present invention, will now be described, by way of example, with reference to the  
35 accompanying drawings, in which:

Figure 1 is a perspective view of the vase according to the present invention, in its assembled, erect condition;

5 Figures 2 and 3 are exploded perspective views of the vase of Figure 1;

Figure 4 shows a container of the vase in a folded state together with other components of the vase of Figure 1 when disassembled;

10

Figures 5 and 6 are perspective views from opposite directions of the vase of Figure 1 when assembled in a flat-pack form with the container folded flat;

15 Figure 7 is illustrative of a membrane hinge typical of a multiplicity of such hinges of the container of the vase of Figure 1;

Figures 8 and 9 are, respectively, exploded and sectional views of an injection-moulding tool according to the invention, used in the manufacture of the container of the vase of Figure 1;

20

Figure 10 is a sectional side elevation of the injection-moulding tool of Figures 8 and 9 during an initial stage of moulding the container of the vase of Figure 1;

25

Figure 11 is part of an enlarged sectional plan view of the injection-moulding tool of Figures 8 and 9, the section being taken on the line XI-XI of Figure 10;

30

Figure 12 is a sectional side elevation of the injection-moulding tool of Figures 8 and 9 corresponding to that of Figure 10, during a subsequent stage of injection-moulding of the container of the vase of Figure 1; and

35

Figure 13 is part of an enlarged sectional plan view of the injection-moulding tool of Figures 8 and 9 corresponding to that of Figure 11, during the subsequent injection-moulding stage, the section being taken on the line XIII-XIII of Figure 12.

The vase to be described with reference to the drawings has a collapsed condition that enables it to be supplied conveniently in a unitary flat-pack form, for example with flowers that are to be entered in the vase. When the vase is to be used it can be readily erected from the flat-pack form.

Referring to Figures 1 to 3, the vase comprises a moulded-plastics, open-top container 1 which is of an elongate, rectangular cross-section that increases uniformly in area with height, a moulded-plastics base 2 into which the bottom of the container 1 is clipped, and a moulded-plastics rim 3 that clips into the open top of the container 1. The container 1 is of unitary sheet construction having front and back walls 4 and 5, two end walls 6 and 7 and a base wall 8, and when the base 2 and rim 3 are unclipped from it, is collapsible from the erect state shown in Figures 1 to 3 to a folded state shown in Figures 4 to 6. In this latter state, the walls 6 to 8 are folded to bring the front and back walls 4 and 5 flat onto one another with two halves of the walls 6 and 7 folded back to back.

Folding of the container 1 is enabled by hinging of the walls 4 to 7 to one another and the base wall 8, and of the walls 6 to 8 within themselves individually. The hinges involved are each, as illustrated in Figure 7, defined on one face 11 (specific either to the inside or outside of the container 1) by a channel 12 moulded in the face 11. A thin web or membrane 13 (for example, of 0.3 or 0.5 mm thickness) remains intermediate the

inclined flanks 14 of the channel 12 to establish a flexible joint integrally with the two sheet-parts 15 either side of the channel 12. When the hinge is fully open, that is to say when the parts 15 are coplanar as illustrated in Figure 7, the flanks 14 are inclined away from one another outwardly of the channel 12 (for example, substantially at a right angle to one another). The two parts 15 can accordingly be folded inwardly towards one another closing up the channel 12 as indicated by the arrows A until the flanks 14 come into abutment with one another and limit the extent of turning (for example, to some 90 degrees). On the other hand, they can be folded in the opposite, opening-up sense indicated by the arrows B, through some 180 degrees to bring the parts 15 back to back.

Referring again to Figures 1 to 3, the walls 4 and 5 are hinged integrally to each wall 6 and 7 by membrane hinges 21 that run lengthwise of the container 1, and also to the base wall 8 by membrane hinges 22, whereas each wall 6 and 7 is hinged integrally to the base wall 8 by membrane hinges 23. The profiling of the hinges 21 to 23 is on the outside of the container 1 in the sense that the channels forming them are on the outside (reference to the profile or profiling of a hinge being on the 'inside' or 'outside' refers to whether the channel corresponding to channel 12 of Figure 7, is located inside or outside, respectively). Each wall 6 and 7 also has a membrane hinge 24 which runs lengthwise of the wall to divide it into two halves; the hinge-profile in this case, in contrast to the profiling of the hinges 21 to 23, is on the inside of the container 1. A break 25 is provided in the outside-profiled hinge 23 halfway along its length across each wall 6 and 7. This is to enable the respective wall 6 or 7 for the folded state of the container 1 (Figures 4 to 6), to fold inwardly in half about its hinge 24 with the two halves flat onto one

another back to back (outside face to outside face)  
between the two sides 4 and 5.

Referring especially to Figure 2, the base wall 8 has  
5 four membrane hinges 26 profiled on the outside that  
extend diagonally from the corners of the base wall 8 to  
a central region 27. The region 27, which defines an  
elongate, double membrane-hinge profiled on the outside  
of the container 1, extends substantially parallel to the  
10 sides 4 and 5. Two membrane hinges 28 profiled inside  
the container 1 extend substantially in alignment with  
the region 27 to the hinges 23 respectively, so that two  
triangular parts of the base wall 8 defined between each  
hinge 28 and its adjacent hinges 26, can fold inwardly  
15 onto one another back to back (outside face to outside  
face); these two parts fold about their hinges 28 as the  
halves of their adjacent wall 6 and 7 fold inwardly about  
their hinges 24. The remaining parts of the base wall 8,  
each having the configuration of a regular trapezium  
20 (that is to say, a quadrilateral with opposite, unequal  
sides parallel and the other two sides equal), fold  
towards one another (inside face onto inside face) about  
the two membrane hinges 29 defined along the longitudinal  
margins of the region 27. This forms a trapezoidal nose  
25 30 (Figure 4) to the folded container 1.

Referring to Figures 4 to 6, the folded container 1  
engages with the base 2 and rim 3 to assemble the vase in  
its flat-pack form. In this regard, the nose 30 of the  
30 folded container 1 is entered under a main frame-part 31  
of the rim 3 to trap the container 1 between the part 31  
and two hook-lugs 32 that hang down from the part 31.  
The rim 3 is threaded onto the container 1 as shown in  
Figures 5 and 6, leaving the nose 30 free to be inserted  
35 through a slot 33 in a back wall 34 of the base 2. It is  
then pushed through the base 2 to enter a recess 35 on

the inside of its front wall 36, to complete the flat-pack assembly.

5 The vase is erected from the flat-pack form by first withdrawing the folded container 1 from within the base 2 and rim 3, and then unfolding it. The bottom of the unfolded container 1 is then entered (see Figures 2 and 3) into the base 2 with two lugs 37 on the base wall 8 locating in respective slots 38 through the base 2. This brings about resilient engagement of lugs 39 on the walls 10 34 and 36, with recesses 40 in the walls 4 and 5 respectively of the container 1. The container 1 is as a result clipped into the base 2, standing upright from it.

15 The rim 3 is now placed on the top of the container 1 to complete the assembly of the erected vase to the condition shown in Figure 1. The addition of the rim 3 assists in holding the top of the vase open and gives added structural rigidity to it. In this regard, the 20 underside of the frame 31 has a circumferential groove 41 that receives the top edges of the walls 4 to 7 so that the rim 3 is retained resiliently in place with the lugs 32 inside the container 1.

25 The container 1 is manufactured by injection moulding in the three-dimensional, unfolded state as will now be described with reference to Figures 8 to 16. Figures 8 to 16 show the injection-moulding tool used in the manufacturing method.

30

Referring initially to Figures 8 and 9, the injection-moulding tool has a head 50 and a base 51 that are brought and held together securely under high pressure with a core 52 of the head 50 within a recess 53 of the 35 base 51 to define the mould-cavity. The core 52 is configured to define the inside of the container 1, namely, the internal configurations of the walls 4 to 8,

and in this respect has two ridge-projections 54 (only one shown in Figure 8) to define internal grooving for hinges 24 and 28. The wall of the recess 53, on the other hand, is configured to define the external configurations of the walls 4 to 8 (including the recesses 40), the grooving of the hinges 22, 23, 26 and 29, and the lugs 37, but specifically not the grooving of the hinges 21 and external impression of the hinges 24.

Injection of the molten plastics into the mould-cavity between the core 52 and the wall of the recess 53 is from a gate 55 located centrally of the bottom of the recess 53. For good fusion within the product, it is desirable that the material injected flows uniformly throughout the mould with the least obstruction by restricted (thin) areas and such that the different fronts of the injected material are hot when they meet. It is with the object of reducing as far as possible the restriction on free flow that the wall of the recess 53 does not include definition of the grooving for the hinges 21 and external impression of the hinges 24. The absence of the restrictions that would otherwise occur on flow of material from one to the other of the walls 4 to 7 (across the locations for the hinges 21) and within the walls 6 and 7 (across the locations for the hinges 24) during their formation, enhances the strength and robustness of the longitudinal hinging of those walls in the resultant product.

The grooving required for the hinges 21 and the external impression required to complete formation of the hinges 24 is effected only once filling of the mould is reaching conclusion. More particularly, the base 51 incorporates four blades 56 for impressing the grooving of the four hinges 21 respectively, and two blades 57 for external impression of the hinges 24 against the ridge-projections 54.

Each blade 56 and 57 is retained in a retracted position as illustrated in Figures 10 and 11, while molten material is injected through the gate 55 to fill the mould-cavity almost to completion. During completion of the filling step, the blades 56 and 57 are moved inwardly towards the core 52 under the action of six wedges 58. In this regard, the six wedges 58 are mounted within the base 51 abutting the six blades 56 and 57 respectively, and are lifted within the base 51 under control of individual actuators 59.

Lifting of the wedges 58 urges the abutted blades 56 and 57 inwardly to project into the mould-cavity as illustrated by Figures 12 and 13. This compresses the plastics-material filling the mould-cavity where the hinges 21 and 24 are required. The blades 56 impress grooving into the plastics material filling the mould-cavity around the corners lengthwise of the core 52. On the other hand, the blades 57 compress the plastics material along the ridge-projections 54 so that grooving is established there by impression into the material of those projections 54. Once the molten plastics material has solidified, the six blades 56 and 57 are retracted and the head 50 is withdrawn from the base 51 to eject the moulded container 1.

**Claims:**

1. A method of injection moulding a plastics article of unitary construction which incorporates flexible membrane portions located between and integral with spaced parts of the article to define hinges for enabling those parts to be deflected angularly with respect to one another, wherein the membrane hinges are formed during completion of filling of the mould, by externally-applied compression of the plastics material as it is within the mould.
2. A method according to Claim 1 wherein the externally-applied compression of the plastics material is applied to the material by blades mounted with the mould, each blade being moved from a retracted position into an extended position in which it projects into the mould cavity to compress the plastics material.
3. A method according to Claim 2 wherein the blades are moved between their retracted and extended positions by means of longitudinal displacement of wedges that abut the blades respectively.
4. A method according to any one of Claims 1 to 3 wherein the article is convertible between a three-dimensional erect state and a substantially-flat, folded state, the article incorporating a multiplicity of membrane hinges to enable conversion of it between the two states, wherein at least some of the membrane hinges are formed by compression as aforesaid.
5. A method according to Claim 5 wherein the article is moulded in its erect state.

6. A method according to Claim 5 wherein the article forms an elongate container in its erect state having a plurality of membrane hinges formed by compression as aforesaid extending lengthwise of the article.

7. A method according to Claim 6 wherein at least one of the hinges running lengthwise of the article is formed by compression of the plastics material against a ridge-projection within the cavity of the mould.

8. An article manufactured according to any one of Claims 1 to 7.

9. An injection-moulded plastics article of unitary construction which is convertible between a three-dimensional erect state and a substantially-flat, folded state, the article incorporating a multiplicity of flexible membrane portions located between and integral with spaced parts of the article to define hinges for enabling those parts to be deflected angularly with respect to one another in conversion between the two states, wherein at least some of the membrane hinges are hinges that have been formed by compression of the plastics material during the injection moulding.

10. An injection-moulded plastics article according to Claim 9 wherein the article is an elongate container in its erect state having a plurality of membrane hinges formed by compression as aforesaid, extending lengthwise of the article.

11. An injection-moulded plastics article according to Claim 10 in combination with a base member for engaging with the base of the container in the erect state of the container, to hold the container upright in that state.

12. An injection-moulded plastics article according to Claim 11 wherein the container in its folded state is engageable with the base member for retention of the container and base member together in that state.

13. An injection-moulded plastics article according to any one of Claims 10 to 12 wherein the container is open-topped in its erect state and wherein a rim member is provided in combination with the container for engaging with the top of the container in the erect state to hold the top open in that state.

14. An injection-moulded plastics article according to Claim 13 wherein the container in its folded state is engageable with the rim member for retention of the container and rim member together in that state.

15. A plastics vase comprising an elongate, open-topped container of injection-moulded, unitary construction which is convertible between a three-dimensional erect state and a substantially-flat, folded state, a rim member for engagement with the open top of the erect container for holding the top open, and a base member for engagement with the base of the erect container for holding the erect container upright, the container incorporating a multiplicity of flexible membrane portions located between and integral with walls of the container and parts of them, to define hinges for enabling those walls and parts to be folded with respect to one another in conversion between the erect and folded states, and wherein the container in its folded state is engageable with the rim and base member for retention of the rim and base members with it in that state.

16. A plastics vase according to Claim 15 wherein the folded container is engaged with the rim member by trapping it against a main-frame part of the rim member.

17. A plastics vase according to Claim 15 or Claim 16 wherein the folded container is engaged with the base member by insertion of it through a slot in the base member.

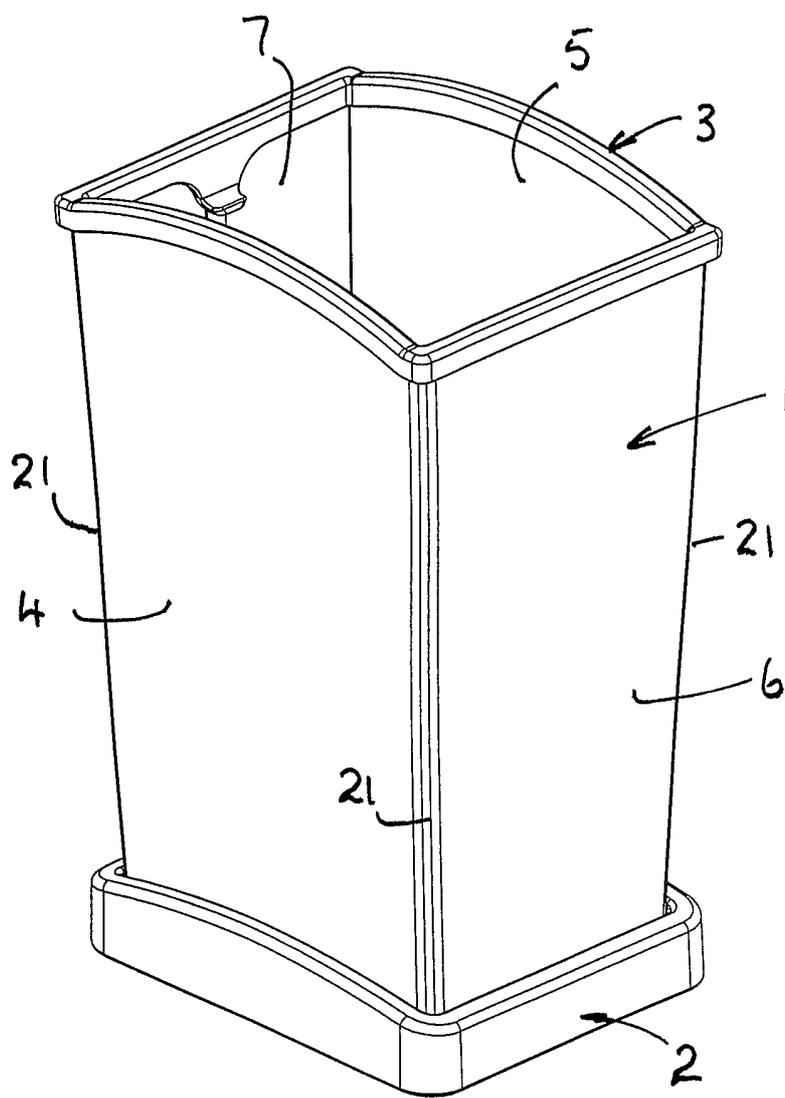


Fig.1

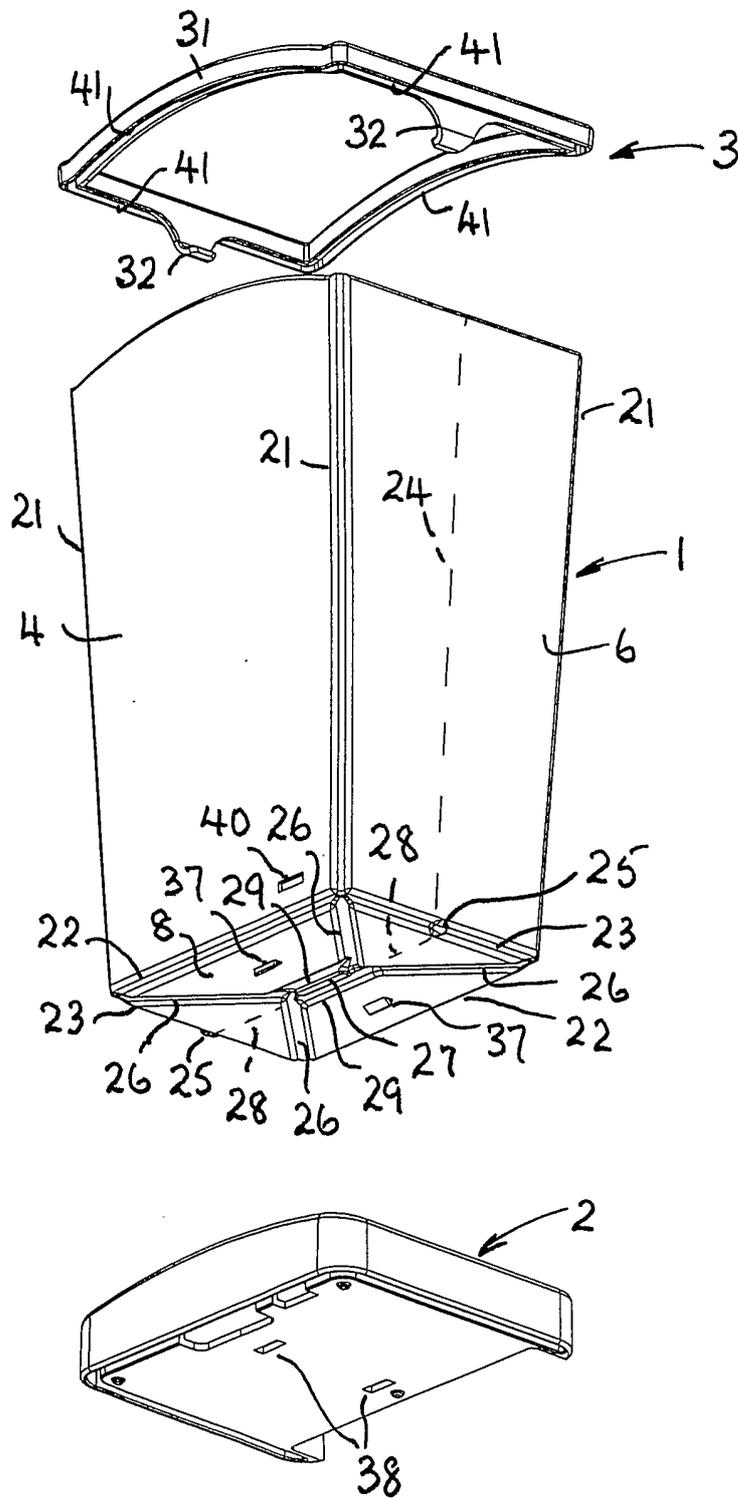
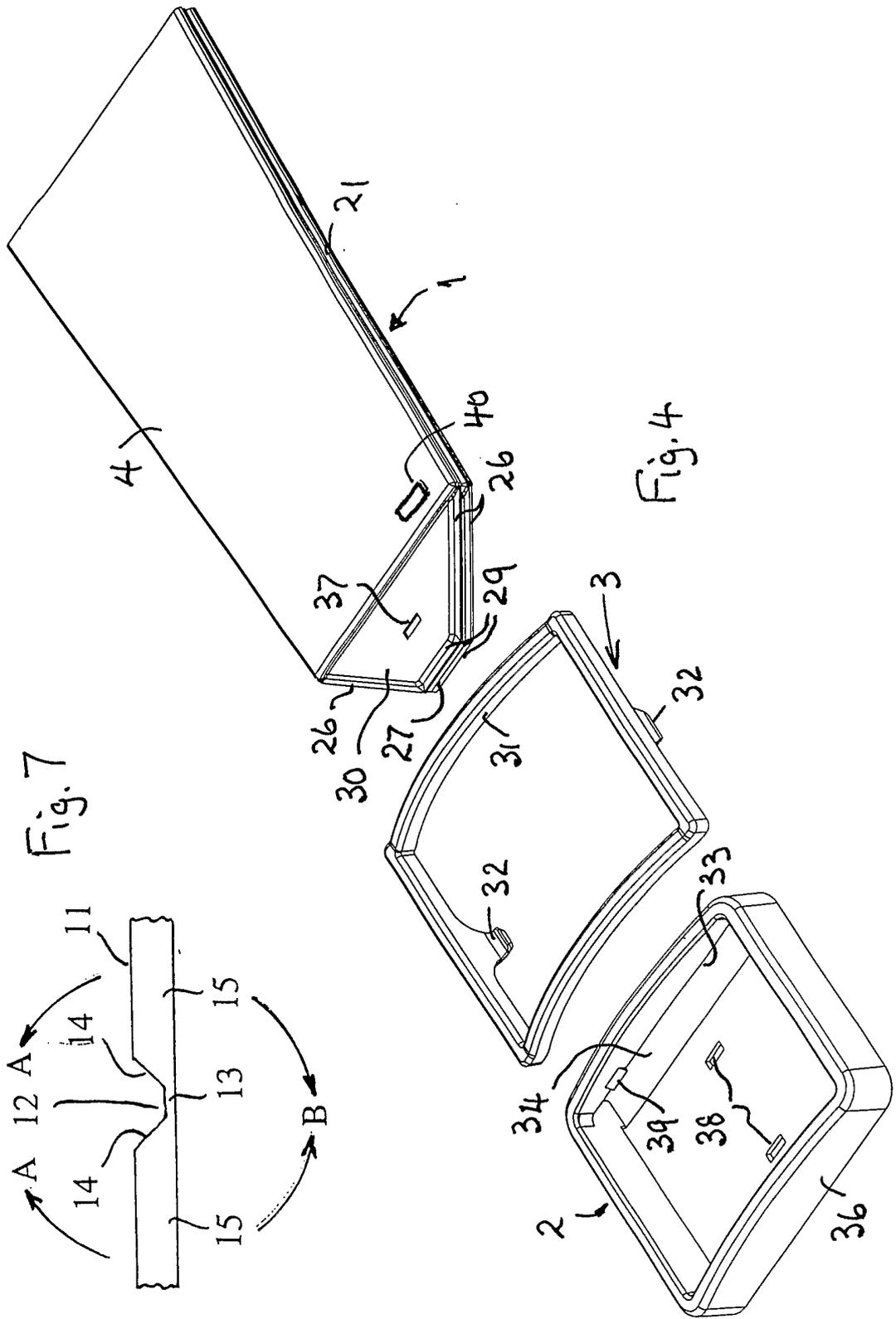


Fig. 2





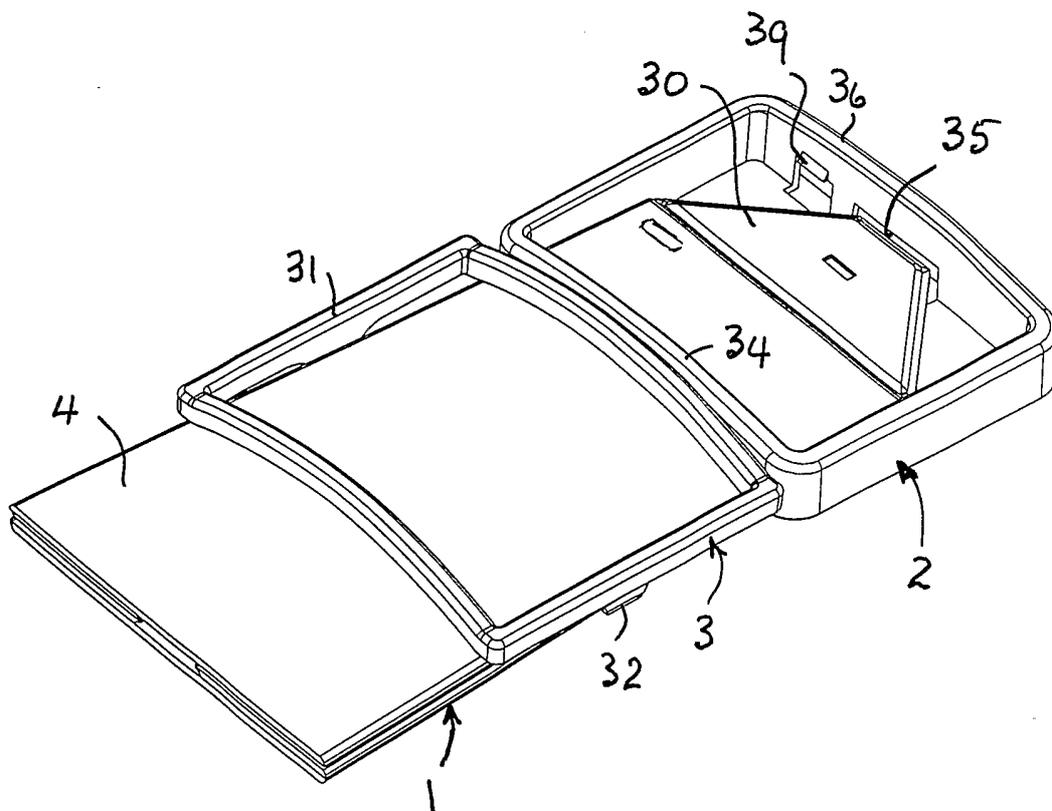
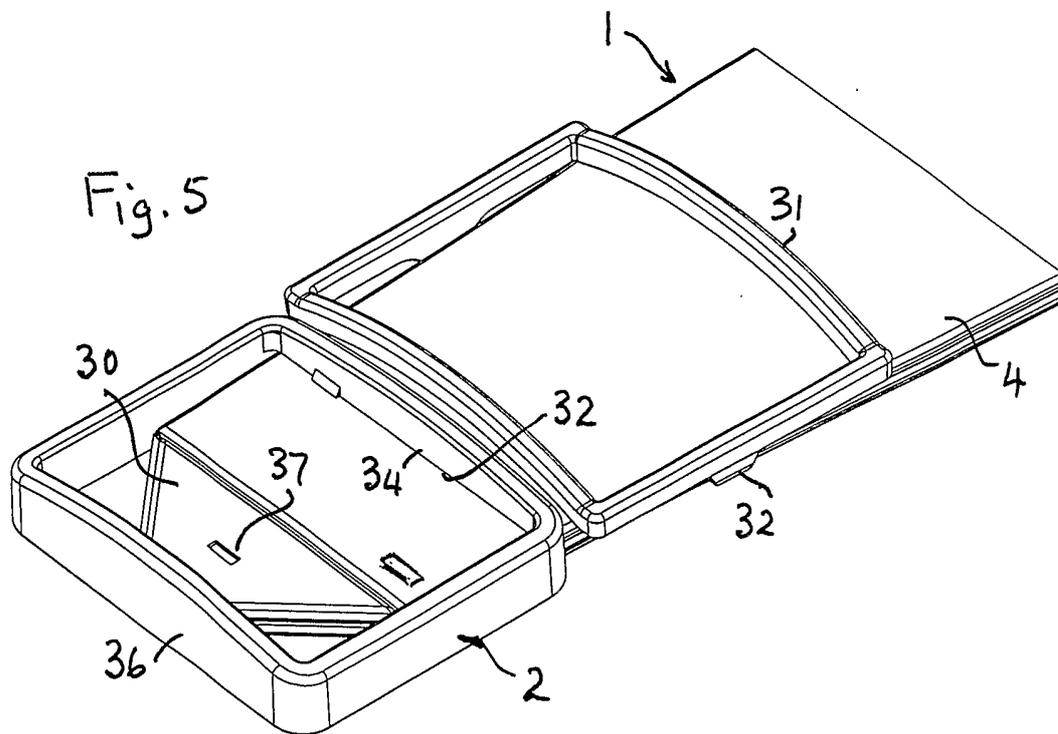


Fig. 6

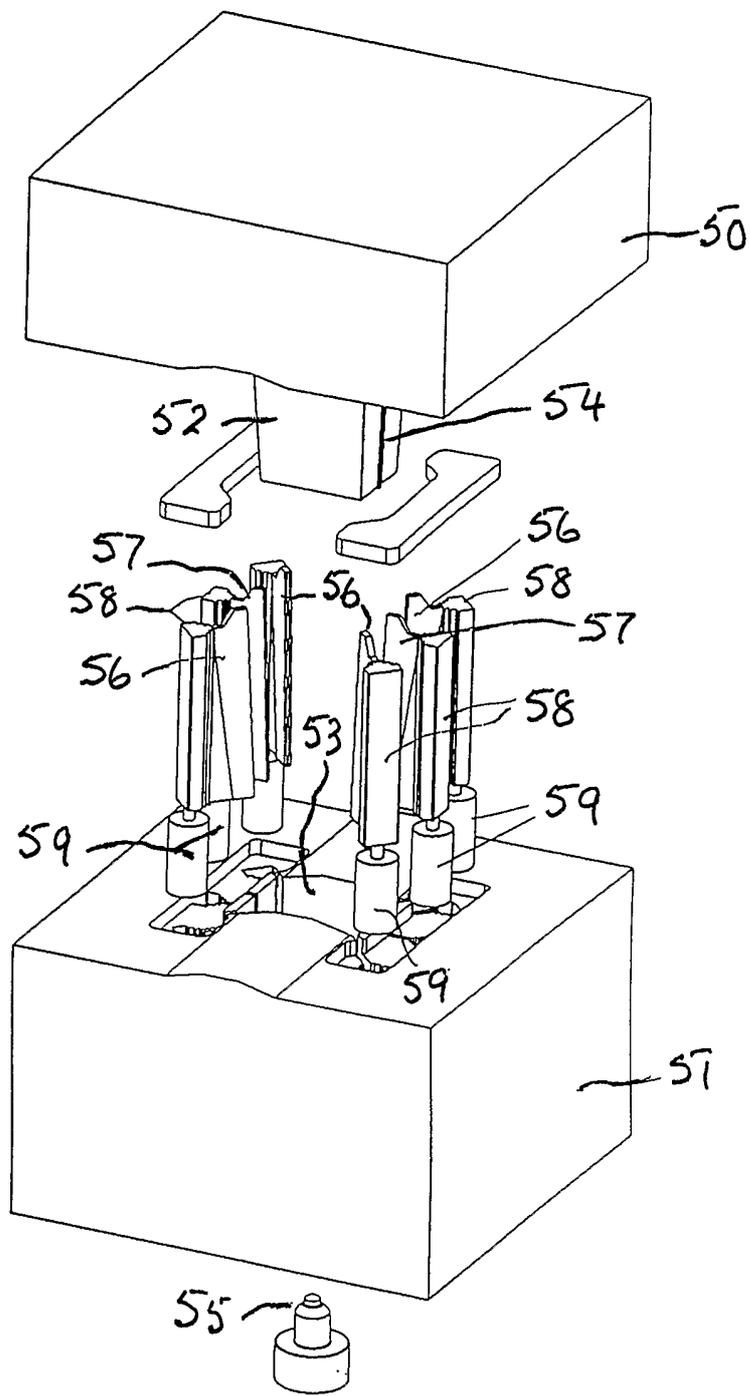


Fig. 8

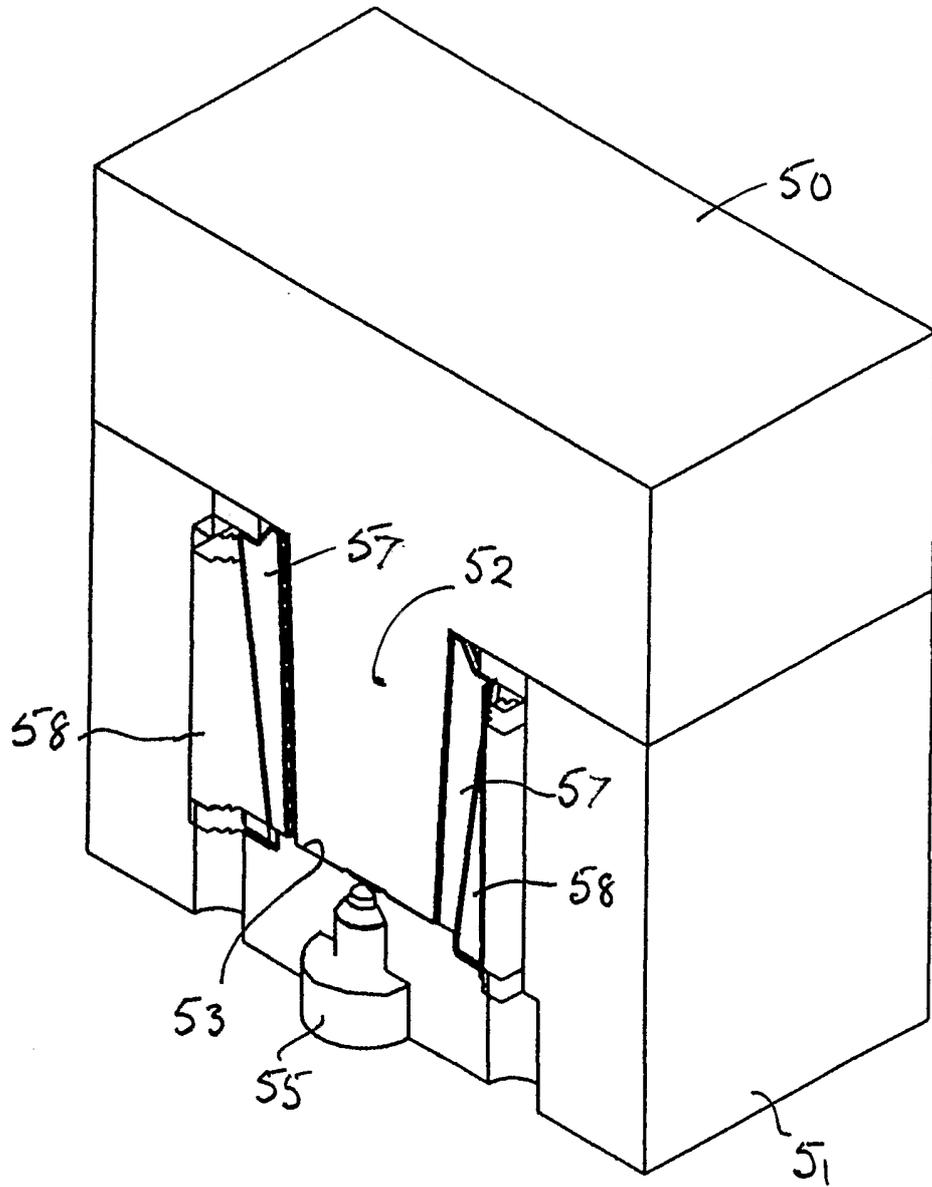


Fig. 9

Fig. 10

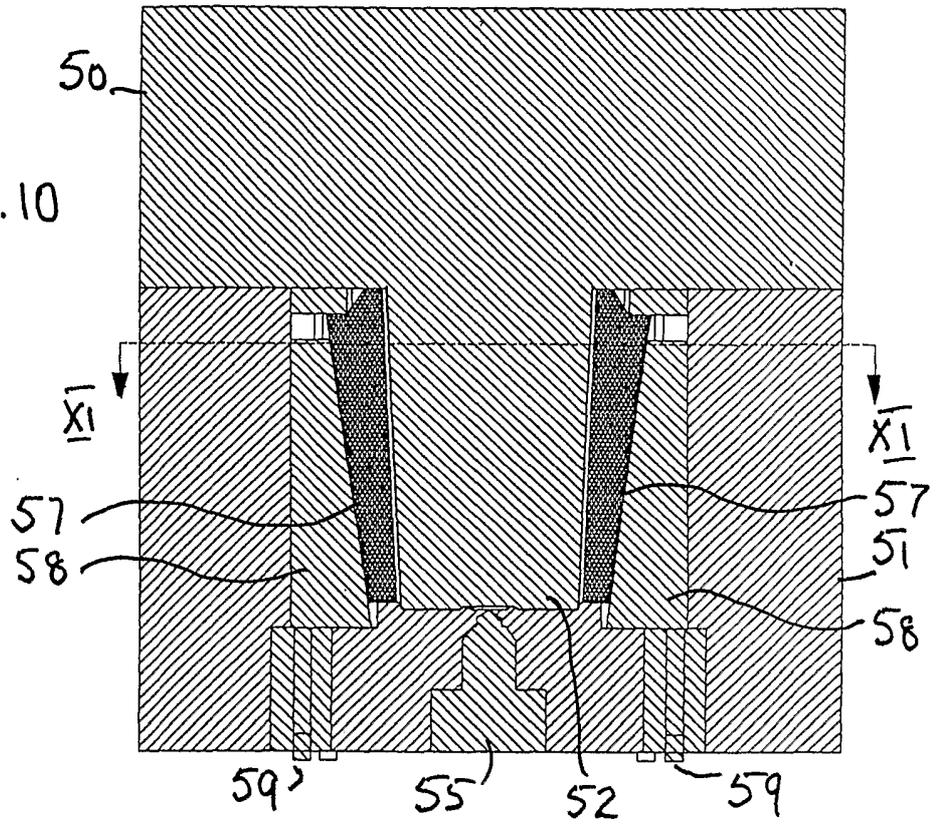
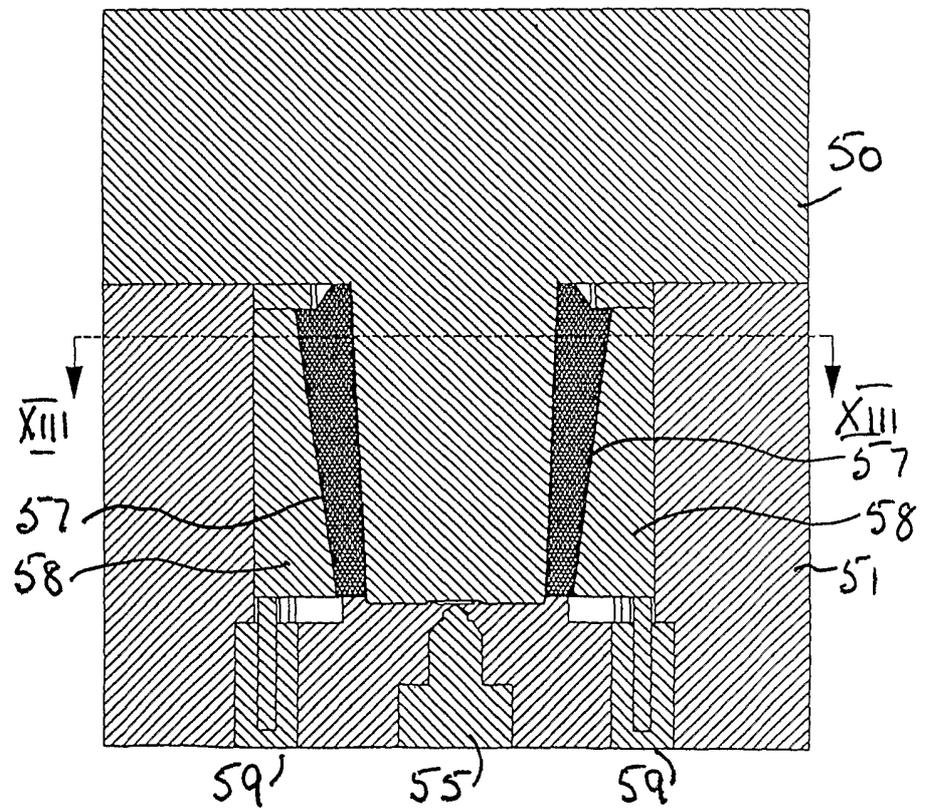


Fig. 12



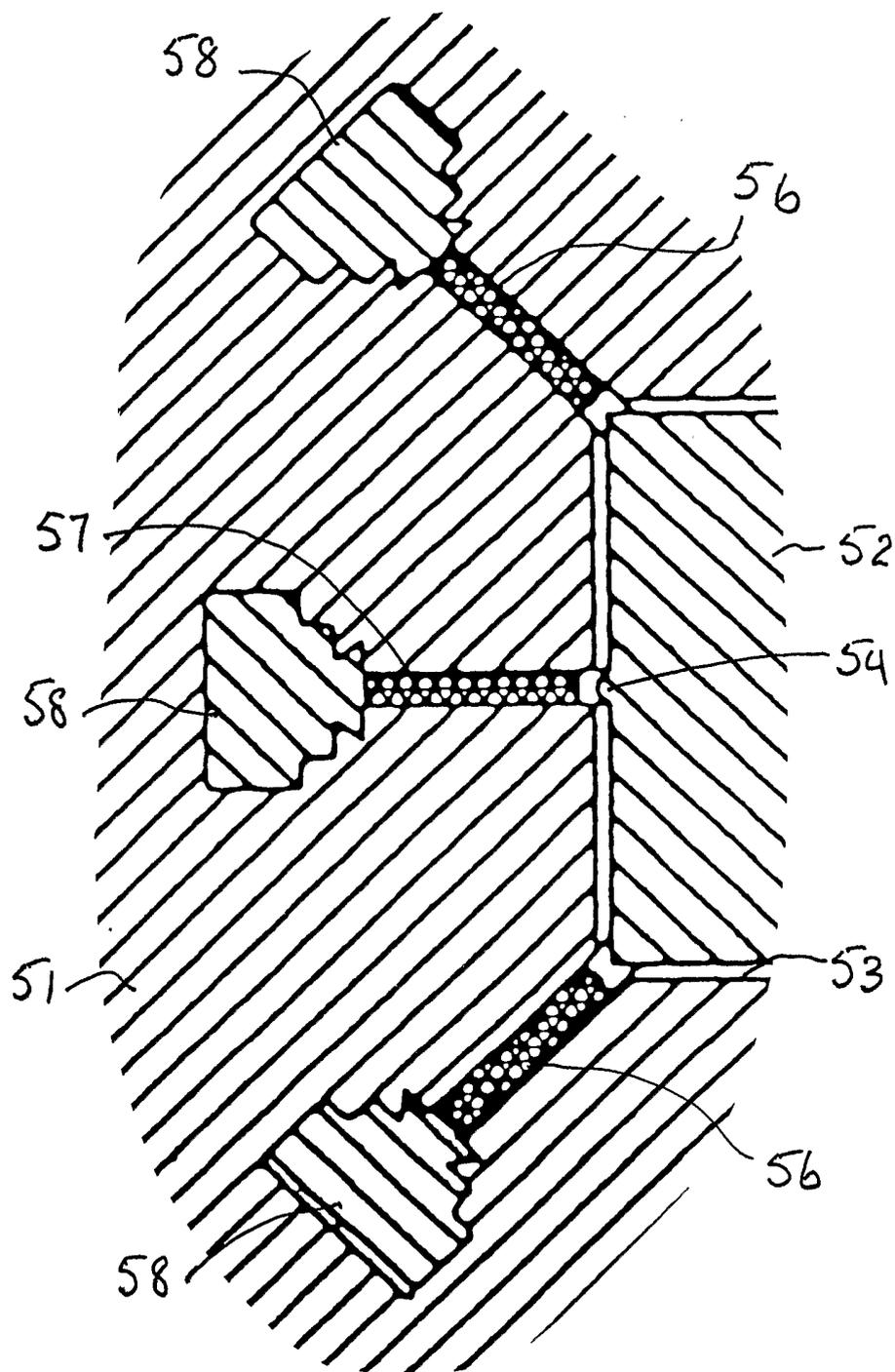


Fig. 11

