

METHOD AND APPARATUS FOR MOULDING AN ARTICLE  
FROM A PARISON OF PLASTICS MATERIAL

The present invention relates to a method and apparatus for moulding an article from a parison of plastics material, preferably thermoplastics material.

When moulding articles from parisons of plastics material, there may be problems in achieving the desired re-forming of the parison where the extent of the re-forming is small by comparison with the wall thickness of the parison. For example, if the re-forming is achieved by applying a difference in pressure to the wall of the parison, it may be necessary to use a very large difference in pressure, particularly in the case of parisons made from plastics material which has already been oriented. This is the case, if, for example, it is required to produce annular protruberances in a tube-shaped parison where after the parison has finally been re-formed into the desired article the annular protruberances constitute a "neck support" ring or a "pilfer proof" ring in a bottle.

In other applications where the extent of the re-forming is great by comparison with the wall thickness and particularly in the case of plastics material which has not been oriented, existing methods enable re-forming to take place with the use of relatively small differences in pressure. However, if the re-forming involves extensive stretching of the material, then the wall thickness may

occasionally be reduced to such an extent that the strength or the dimensional stability of the moulded article is put at risk. The only solution to this problem with existing methods has been the use of a base material of adequate thickness.

When moulding a bottle, the requirement exists to produce a neck incorporating a "pilfer proof" ring and/or a "neck support" ring and in certain applications the "neck support" ring is so shaped that it also forms a gripping ring.

One of the purposes of the gripping ring is to act as a support for the hand so that it is easier to hold the bottle firmly, for instance when it is being opened. In order to meet this requirement the gripping ring has a diameter which is considerably greater than the diameter of the neck at the point of the neck at which the gripping ring is located. Additional cost is associated with the dimensions of the gripping ring because it increases the total amount of material required to mould the neck when existing methods are used. This is due to the overdimensioning of the neck which is necessary in order to provide the gripping ring with adequate strength, for example when pressurized liquids such as carbonated drinks are being stored. As a rule the gripping ring also has an undesirably large axial dimension due to the moulding problems indicated above.

One additional requirement for the rings described above is that they should exhibit dimensional stability even when heated to relatively high temperatures, for example so that filled containers may be stored at high  
5 temperatures and so that containers may be cleaned before re-use, etc. It is difficult to achieve this by existing methods without treating the material in such a way that its visual appearance changes in an undesirable manner, for example by becoming opaque, whilst the material in  
10 the remainder of the bottle remains clear and transparent.

One other disadvantage of existing methods is that in the case of coloured material those parts of the bottle where there is variation in the thickness of the material are either darker or lighter than the remainder of the  
15 bottle depending on whether there is accumulation or attenuation of the material.

According to the present invention there is provided a method of moulding an article from a parison of plastics material comprising the steps of arranging at least a por-  
20 tion of the parison adjacent a moulding surface and securing said parison such that said portion and the moulding surface define a cavity therebetween, the moulding surface being defined by a plurality of moulding elements movable relative to one another substantially longitudinally  
25 of the moulding surface, the moulding elements defining depressions in the moulding surface, moving selected areas of the material of the portion of the parison under press-

ure into contact against said moulding elements, moving  
said elements relative to each other such that the  
longitudinal extent of the depressions is reduced and  
simultaneously retaining said selected areas of the  
5 material against said moulding elements such that  
said selected areas are moved by the moulding elements,  
and moving further areas of the material of the parison  
adjacent said selected areas under pressure into contact  
with limiting surfaces of said depressions.

10 A method of the invention enables a parison of  
arbitrary form to be moulded such that certain areas  
of the parison are re-formed whilst other areas of the  
parison retain their original form to a very great  
extent. During moulding the selected areas of the  
15 material are moved towards the further areas of the  
material whereby it is possible to avoid all attenuation  
of the wall thickness, if necessary, during the final  
moulding process. The invention also permits an increase  
in wall thickness to be achieved in those areas which  
20 are re-formed. Even where the material in the parison  
has been oriented only relatively small forces will be  
required for re-forming to take place, since the re-  
forming process occurs without the material being stretched  
beyond the point to which it was stretched in conjunction  
25 with the orienting process. Thus, a method of the invent-  
ion makes it possible to re-form oriented material for

which, on the assumption that re-forming were to be at all possible, existing methods would require the use of unreasonably high differences in pressure. Experiments have shown that the material will fracture easily at such high differences in pressure.

When this invention is used in the manufacture of a bottle the starting point is a tube-shaped or tubular parison in which the areas of the material of the parison which will form the neck of the bottle are already oriented and have preferably been oriented uniaxially. In those applications in which a requirement exists for dimensional stability to be present in the finished article even at high temperatures, the internal stresses which were created during the orienting process may be relieved by heat treatment. In a method of the invention, those areas of the material which are located adjacent to the material which will become the ring which is about to be moulded are moved during the moulding of the respective ring towards that area of the material which makes up the ring after the moulding process is complete. Material is thus brought to the area where the ring is moulded, thereby determining the wall thickness of the ring. The ring is moulded without any significant stretching of the material, but by means of a process which resembles folding. This movement of the material

means that the rings are moulded with the internal pressure of the parison at a relatively low level. Where moulding is possible by existing methods, on the other hand, this requires unreasonably high pressures to be used  
5 which can easily produce fractures in the material.

When articles are to be moulded to provide preforms for bottles, preferably a tubular parison is used, of which the central areas have been oriented uniaxially by stretching the tube in the direction of the axis of the tube.  
10 When the parison is re-formed, the central areas are moulded into two opposing necks in the preforms.

In a preferred embodiment of the invention the re-forming of the parison occurs at a temperature in excess of the glass-transition temperature (TG). In the event  
15 of the parison being formed into an article which must then undergo further moulding the moulding of parison to form the article should take place at a temperature in excess of the temperature at which the article will be moulded subsequently.

20 This invention is particularly suitable for use with the plastics material polyethylene terephthalate or with similar materials. Of the polyesters and polyamides, the following materials may be regarded as being of interest in the application of this invention: polyhexamethylene  
25 adipamide; polycaprolactam; polyhexamethylene sebacamide;

polyethylene 2.6- and 1.5- naphthalate; polytetramethylene 1.2-dioxybenzoate and the copolymers of ethylene terephthalate, ethylene isophthalate and other similar polymer plastics material.

5        When using polyethylene terephthalate, the re-forming of the parison takes place with the material of the parison at a temperature within the range of approximately 70 to 150°C, and preferably within the range of approximately 90 to 125°C. This temperature is well in excess of  
10 the glass-transition temperature (TG). The material of the parison is oriented by having been stretched in the respective direction of the axis, preferably about three times. In certain applications, for example when tube-shaped parisons are used as the base material for the  
15 manufacture of preforms for bottles, the material is of course uniaxially oriented.

      The recommended values indicated above in respect of temperature and stretching when using polyethylene terephthalate shall be amended when using any of the other  
20 materials referred to above, depending on the characteristics of said material as regards the glass-transition temperature and the maximum crystallization temperature, etc.

      The present invention also extends to apparatus when  
25 used to mould an article from a parison of plastics material by a method as defined above, the apparatus

comprising a moulding surface defined by a plurality of  
moulding elements movable relative to each other substan-  
tially longitudinally of the moulding surface, the  
moulding elements defining depressions in the moulding  
5 surface and being arranged to reduce the longitudinal  
extent of the depressions upon relative movement  
thereof, means for securing said parison such that at  
least a portion of the parison defines a cavity with  
said moulding surface, means for moving selected areas of  
10 the material of the parison into contact with said  
moulding elements and for retaining said selected areas  
against said moulding elements during movement thereof,  
and means for moving further areas of the material of  
the parison adjacent said selected areas into contact  
15 with limiting surfaces of said depressions.

In an embodiment for moulding a hollow article, for  
example, a tubular article, from a tubular parison, the  
parison is surrounded by an outer mould in which a number  
of retaining elements are positioned to secure the parison  
20 externally of the area to be re-formed. These retaining  
elements may be moved relative to each other along the  
axis of the mould. Between the retaining elements the  
outer mould also has a number of moulding elements which  
are arranged to be contacted by a plurality of selected  
25 areas of the material of the parison. These moulding

elements may also be moved relative to each other along the axis of the mould and may also be moved relative to the retaining elements. Between the moulding elements are depressions in the wall of the mould in which details of the article are to be moulded from a number of further areas of the material of the parison, for example, to form annular protuberances corresponding to the aforementioned "neck support" rings or "pilfer proof" rings. When the article is being moulded, the moulding elements are in such close contact with the selected areas of the material that, when the moulding elements are moved relative to each other along the axis of the mould, the selected areas of the material are moved towards those areas of the material from which the details of the article are to be moulded. The distance over which each respective area of the material is moved substantially corresponds with the protuberance in the wall of the parison which is produced as the respective details are moulded.

20 In many applications the strength of the parison is sufficient for the moulding described above to take place without the use of mechanical restraints inside the tubular parison. The excess pressure present inside the tube contributes to the stability of the tube. A certain reduction in the internal volume of the tube also occurs during moulding causing the internal pressure to increase,

which in turn both increases the dimensional stability of the parison and contributes to the achievement of the internal pressure required for the re-forming of the parison.

- 5        Certain applications have used an internal mandrel which operates in conjunction with the outer mould. The mandrel is fitted with spring-loaded elements for reducing the length of the mandrel in the direction of its axis. The reduction in the length of the mandrel corresponds  
10 with the reduction in the length of the outer mould when the article is moulded.

Between the moulded elements in contact with the selected areas of the material are arranged spring-loaded elements in which the spring tension varies along the  
15 direction of the axis of the mould. In this way the spring-loaded elements will be compressed in turn in accordance with a pre-determined pattern so that the wall of the parison will be moved in the order in which the annular protuberances are moulded.

- 20        The heating up of the material of the parison may take place either before the parison is placed in the mould and/or by means of heating devices preferably located inside the mandrel. An insulating layer is to be found on the mandrel, said insulating layer delineating  
25 the one or more areas of the mandrel at which heating takes place. The mould is provided with cooling ducts.

The cooling ducts and the insulating layer separate those areas of the parison where heating takes place from other areas of the parison.

An embodiment of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:

Figures 1a to 1c illustrates the basic sequence of events when moulding an article in accordance with a method of the invention,

Figures 2a to 2c show schematically apparatus for moulding an article at various stages in the method,

Figures 3 and 4 show longitudinal sections of a mould of the apparatus at different stages of the method, the sections being taken along the line B-B of Figure 6,

Figures 5a to 5c show detailed cross-sections of a mandrel of the apparatus,

Figure 6 shows a cross-section of the mould taken along the line C-C of Figure 3, and

Figure 7 shows a cross-section of the mould and supporting framework therefor, taken along the line A-A of Figures 3 and 4 and showing the mould in its open position.

Figures 1a to 1c show steps in the re-forming of a

parison 10 of thermoplastics material into an article 11. Fig. 1a shows the parison 10 which in Fig. 1b has been partly re-formed into the parison 10' and which in Fig. 1c has taken on its final shape and as such constitutes the article 11.

A mould 34 is provided which is particularly suitable for the re-forming of a tube-shaped parison 10. The mould 34 comprises a plurality of component parts which may be moved relative to each other and which are arranged to make contact initially with a plurality of areas of the material in the parison 10. Thus, the mould 34 has moulding elements 21, 22 and 25 which are arranged to make contact initially respectively with areas 12, 13 and 20 of the parison 10. In addition, there are also a number of depressions, in the illustration, two depressions 26, 27, in the wall of the mould which are arranged to face a number of further areas of the material of the parison 10, areas 16, 17 as illustrated. The moulding element 21 is supported by and is movable relative to the moulding elements 22 and 25 such that the three elements may be moved relative to each other in the direction of the axis of the tube-shaped parison 10. The elements are held spaced from each other when at rest by means of spring-loaded elements 43, 44 designed such that the spring tension in the spring-loaded element 44 is greater than that in the spring loaded element 43. A further depression 35 in the wall of the mould is also

shown in Figures 1a to 1c. The mould 34 also has a retaining element 40 in which cooling ducts 42 are incorporated.

To re-form the parison 10 into the article 11, the  
5 inside of the parison is first put under pressure whereby the parison is dilated to a predetermined small extent (Fig. 1b) to ensure contact between the moulding elements 21, 22 and 25 and the initial areas 12, 13 and 20 of the material and to ensure that the parison 10 is secured  
10 by the retaining element 40. The large depression 35 in the wall of the mould is of such proportions that the excess pressure within the parison 10 is able to dilate the parison into contact with the wall of the mould in the depression 35. However the pressure is insufficient  
15 to move the two other areas of the material 16, 17 into contact with the wall of the mould in the depressions 26, 27.

The next stage in the re-forming of the parison 10' involves the downward movement as viewed in Figs 1a and  
20 1b, of the element 22 and hence of the element 21. Friction between the parison and the elements 21 and 22 causes the areas 12, 13 of the material to be drawn along together with the area 17 of the material as the elements are moved downwardly. At the same time the pressure  
25 inside the parison forces the area 16 of the material into contact with the wall of the mould in the depression

26. It will be appreciated that the axial length of the depression 26 is reduced during the moulding process. An annular protuberance 30 is formed in the article 11 in this way (Fig. 1c). Further downward movement of the element 22 then takes place, as indicated in Fig. 1c, and the area 13 of the material is drawn along by the downward movement of the element 22 and the internal pressure inside the parison 10' forces the area 17 of the material into contact with the wall of the mould in the depression 27. The axial length of the depression 27 is reduced simultaneously in a similar manner to the reduction in axial length of the depression 26. An annular protuberance 31 is formed in the depression 27 in this way (Fig. 1c). The movement of the initial areas 12, 13 of the material means that the annular protuberances 30, 31 may be moulded without stretching the material and without the reduction in wall thickness associated with stretching.

The stages in the re-forming of a parison into an article by a method of this invention have been described above in relation to a tube-shaped parison. The invention is of course applicable to parisons of other shapes. In the case of a flat parison, for example, the elements 40, 25, 21, 22 are supplemented by means of restraints arranged on the opposite side of the flat parison. Moulding elements, for example mechanical ones, are arr-

anged to move areas of the material into the depressions 35, 26, 27. as the parison is being re-formed and into contact with the wall of the mould in the respective depression. Thus in this latter embodiment of the  
5 invention the movements of the initial areas 12, 13 of the material also enable protuberances to be formed which correspond with the annular protuberances 30 and 31. In the embodiment illustrated, when re-forming the parison to obtain contact with the wall of the mould  
10 in the large depression 35 re-forming only occurs by stretching the material, which results in a reduction in the wall thickness. Of course, it is possible to cause or take advantage of the movement of the material even in this re-forming process in order to reduce the  
15 attenuation of the material which would otherwise occur.

Figures 2a to 2c illustrate schematically apparatus for moulding a tube-shaped parison and illustrate the stages of the moulding process. The apparatus comprises a two part mould of which an upper half 65 may be moved  
20 to an open position (Fig. 2a) by means of brackets 74, 75. The surfaces of the upper half 65 of the mould which make contact with those of the lower half of the mould (not shown in the Figures) are hatched for the sake of clarity. As can be seen in Figure 2a, the article to be  
25 formed in the apparatus consists of two opposing necks

in preforms for use in the manufacture of bottles. In Figs. 2a to 2c features which are similar to those already described in connection with Figs. 1a to 1c have been given the same reference numerals. In addition, 5 the designations a and b are used in respect of symmetrically arranged features so as to indicate the symmetry of the apparatus.

As is shown in Fig. 2a, the retaining element 40a is attached to a carriage 73 such that the element 40a cannot 10 be moved axially with respect to the carriage 73. Although this arrangement simplifies the construction of the apparatus, it is also possible to use other combinations of stationary and moving elements in order to achieve the required relative movements between the elements.

15 In addition to the elements already described, Figs. 2a to 2c show a supporting framework 60 with a sliding bearing. The framework 60 supports the carriage 73 in which the lower half of the mould rests. A mandrel 50, which is shown in its extended position in Fig. 2a, has 20 a central section 51 with end sections 52 and 53. The central section is separated from each end section by a respective spring-loaded element 55, 56 enabling the axial length of the mandrel to be reduced. A hydraulic union 57 is provided for connection to the drive unit 25 of the carriage 73, and a hydraulic union 67 is also provided for connection to the drive unit of the mandrel.

In addition, a compressed fluid union 61 is provided for setting the internal pressure of the parison. A heating device (not shown) within the mandrel has an electrical connection lead 59. The interconnected  
5 components of the mould in the upper half of the mould are held together by the linking elements 62, 63.

In the position shown in Fig. 2a, a tube-shaped parison is placed in the lower half of the mould and the upper half of the mould is moved to its closed position  
10 by a drive unit. From their positions of greatest disengagement, which are necessary in order to permit the upper half of the mould to move past the end surfaces of the tube in its movement to the closed position, the retaining elements 40a, 40b are moved towards each other  
15 over the distance 2E so as to seal the mould against the end surfaces of the tube. The mandrel 50 is then moved by means of its drive unit into a position inside the parison and the inside of the parison is put under pressure. At the point in time at which the pressure is set, the  
20 material in the parison is at a temperature in excess of the glass-transition temperature (TG). Heating takes place either before the parison is brought to the mould or after the parison has been placed in the mould. Alternatively, heating of the parison before it is placed  
25 in the mould may be combined with a certain amount of post-heating inside the mould.

As pressure is applied the parison takes on a shape which corresponds with that of the parison 10' shown in Fig. 1b. The components of the mould are then moved so that shapes which correspond to the protuberance 30 in Fig. 1c are produced, followed by the production of the shapes corresponding to the protuberance 31 in Fig. 1c. The letter F is used in the Figures to indicate the movement required in order to produce the shapes corresponding to the two protuberances 30 and 31. Since two opposing preforms are produced simultaneously, the length of the mould is reduced by the distance  $2E + 2F$  during the moulding of the article.

Figures 3 and 4 show a longitudinal section through a mould 34 for moulding two opposing preforms suitable for subsequent re-forming into bottles. In Figs. 3 and 4, features which are similar to those already described with reference to Figs. 1 and 2 have been given the same reference numerals. Fig. 3 shows the mandrel 50 and the parison 10 in position within the mould which is in the initial position corresponding to that shown in Fig. 1a. Fig. 4 shows the mould in its final position corresponding to that shown in Figs. 1c and 2c.

The Figures 5a to 5c show in detail the construction of the mandrel 50. Again, in Fig. 5, features which are similar to those already described with reference to Figs. 2 to 4 have been given the same reference numerals.

An electrical heating device 47 is arranged within the central section 51 of the mandrel 50 and is connected to the electrical connection 59 (Fig. 2b) by means of sliding contacts 58.

5        The central section 51 of the mandrel is delineated by insulating layers 48 which prevent heat from the central section of the mandrel from being transmitted to the end sections 52, 53 of the mandrel and thus to the parison in areas where no re-forming of the parison is to  
10    take place.

Fig. 6 shows a cross-section of the mould taken along the line C-C of Fig. 3, and Fig. 7 shows a cross-section of the mould taken along the line A-A of Figs. 3 and 4 illustrating the opening of the mould.

15    Fig. 6 illustrates the division of the mould 34 into an upper half 65 and a lower half 66. Respective sliding bearings 70, 71 for the component parts of the mould are provided in the upper half 65 and in the lower half 66 of the mould. Fig. 6 also shows an area 16b of the material  
20    in the parison which has not yet been put under pressure. Fig. 7 shows the manner in which the carriage 73 in which the mould rests is supported in the framework 60. A hydraulic cylinder 68 for driving the mandrel and a further hydraulic cylinder 69 are mounted in the carriage  
25    73. The further hydraulic cylinder 69 forms a drive unit for moving the component parts of the mould in a

direction parallel to the axis of the mould. An additional drive unit 72 links the carriage 73 to the bracket 74 for moving the upper half 65 of the mould between the open and closed positions of the mould 34. A similar drive unit is connected to the other end of the carriage 73 and to the bracket 75.

The method of the invention has been described with reference to Figs. 1a to 1c, and the operation of the apparatus has been described with reference to Figs. 2a to 2c. The detailed Figures 3 to 7 represent only a clarification of Figs. 2a to 2b and thus the description with reference to Fig. 2 is also applicable to Figs. 3 to 7 which are not therefore further described.

Of course, the method of the invention may be performed with apparatus other than the apparatus which has been illustrated in detail and this apparatus is only an example of apparatus of the invention.



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CLAIMS

1. A method of moulding an article from a parison of plastics material comprising the steps of arranging at least a portion of the parison adjacent a moulding surface and securing said parison such that said portion and the moulding surface define a cavity therebetween, the moulding surface being defined by a plurality of moulding elements movable relative to one another substantially longitudinally of the moulding surface, the moulding elements defining depressions in the moulding surface, moving selected areas of the material of the portion of the parison under pressure into contact against said moulding elements, moving said elements relative to each other such that the longitudinal extent of the depressions is reduced, and simultaneously retaining said selected areas of the material against said moulding elements such that said selected areas are moved by the moulding elements, and moving further areas of the material of the parison adjacent said selected areas under pressure into contact with limiting surfaces of said depressions.

2. A method as claimed in Claim 1, wherein the distance over which the selected areas of the material are moved substantially corresponds with the re-forming by protruding which takes place in said further areas of the material in the direction in which the selected areas of the material are moved when said further areas of the material are re-formed.

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3. A method as claimed in Claim 1 or Claim 2, wherein the material of the parison is oriented in one or more of said further areas which are re-formed when the article is moulded, the orientation being preferably mono-axial and in the axial direction of the parison.

4. A method as claimed in any preceding claim, wherein the material of the parison is heated before the parison is re-formed into the article to a temperature in excess of the glass-transition temperature.

5. A method as claimed in Claim 4, wherein at least the material of the parison which is re-formed as the article is moulded, is at a temperature during the re-forming process which exceeds the temperature which the material of the article has when the article is subsequently re-formed into the finished product.

6. A method as claimed in any preceding claim, wherein the plastics material of the parison is in the form of a polyester or a polyamide, for example polyhexamethylene adipamide, polycaprolactam, polyhexamethylene sebacamide, polyethylene 2.6- and 1.5- naphthalate, polytetramethylene 1,2-dioxybenzoate and copolymers of ethylene teraphthalate, ethylene isophthalate or other similar polymer plastics material.



7. A method as claimed in Claim 6, wherein, where the parison is of polyethylene terephthalate, the material of the parison is oriented by having been stretched about three times in at least one of the directions of the axis of the material and/or the material of the parison which is to be re-formed is at a temperature of between 70° and 150° C during the re-forming process.
8. A method as claimed in Claim 7, wherein the material of the parison is at a temperature of between 90° and 125°C during the re-forming process.
9. A method as claimed in any preceding claim, for moulding an article from a tubular parison having at least one open end, wherein the or each open end of the parison is retained in position to define said cavity between the parison and said moulding surface and wherein said moulding surface is substantially cylindrical and surrounds said parison and is defined by said moulding elements which are cylindrical and movable relative to each other axially of the moulding surface, and further comprising the step of putting said cavity under pressure to move said selected areas into contact with the cylindrical moulding elements and to retain said selected areas against said moulding elements during the movement of said moulding elements, and to move said further areas into contact with the limiting surfaces of said depressions.

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10. A method as claimed in Claim 9, wherein the parison is re-formed into an article of which the central part constitutes two opposing necks for two future preforms which are suitable for re-forming into containers.

5 11. A method of moulding an article from a parison of plastics material substantially as hereinbefore described with reference to the accompanying drawings.

12. Apparatus when used to mould an article from a parison of plastics material by a method as claimed in any  
10 preceding claim, the apparatus comprising a moulding surface defined by a plurality of moulding elements movable relative to each other substantially longitudinally of the moulding surface, the moulding elements defining depressions in the moulding surface and being  
15 arranged to reduce the longitudinal extent of the depressions upon relative movement thereof, means for securing said parison such that at least a portion of the parison defines a cavity with said moulding surface, means for moving selected areas of the material of the  
20 parison into contact with said moulding elements and for retaining said selected areas against said moulding elements during movement thereof, and means for moving further areas of the material of the parison adjacent said selected areas into contact with limiting surfaces  
25 of said depressions.



13. Apparatus as claimed in Claim 12 for moulding a hollow article from a tubular parison, wherein the moulding surface is substantially cylindrical and forms the inner surface of an outer mould in which the tubular  
5 parison is secured and further comprising a mandrel arranged to extend axially through said parison, said mandrel being provided with spring-loaded elements such that the axial length of the mandrel can be reduced to correspond to the reduction of the axial length of the  
10 outer mould effected by relative movement of said moulding elements.

14. Apparatus as claimed in Claim 13, further comprising spring-loaded elements provided between adjacent moulding  
15 elements and arranged to place the mould in an initial position in which its axial length is greatest, the spring tension of the spring-loaded elements in the axial direction of the mould differing in value such that the moulding elements are movable in turn towards each other.

20 15. Apparatus as claimed in Claim 13 or 14, wherein the mandrel has a central section provided with a heating device for heating the material in the parison, the central section being provided with an insulating layer which separates the central section from adjacent end  
25 sections of the mandrel.



16. Apparatus as claimed in Claim 15, wherein the mould is provided with retaining elements for securing the parison outside those areas of the parison which are to be re-formed during moulding of the article, said
- 5 retaining elements being movable relative to each other in the axial direction of the mould, and wherein said retaining elements are provided with cooling ducts for cooling the material of the parison at the point of transition between those areas of the parison which
- 10 are heated by the central section of the mandrel and those areas of the parison which are adjacent to the end sections of the mandrel.

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