

SPECIFICATION

A Method of Assembling Plastics Units

The present invention relates to a method of assembling engageable resin-moulded units

- 5 made of crystalline thermoplastic resin, e.g. a polyacetal, whereby the engagement between the units is strengthened. More particularly the invention relates to a method of assembling such units by an annealing operation which utilizes
10 differences in the moulding contraction rate taking place during the annealing operation.

- It is known that when a crystalline thermoplastic resin is melted and then moulded and solidified, its volume is reduced. This is
15 because the degree of crystallization increases as solidification proceeds from the amorphous melt. Such contraction of the moulded units is hereinafter described for a polyacetal copolymer, which is an example of a crystalline thermoplastic
20 resin. Polyacetal copolymer is an engineering plastics material which has improved mechanical strength and mouldability and has a balanced combination of creep, fatigue, abrasion, heat and chemical resistance and dimensional stability.
25 Since a polyacetal resin crystallizes to a high degree, its moulding contraction rate is correspondingly large.

- The contraction rate of a moulding depends on the moulding conditions, as well as the shape of
30 the moulding and the annealing temperature. The contraction rate as a function of mould temperature of polyacetal copolymer can be demonstrated as follows. Assume that the thickness of the moulding is 5 mm and the
35 annealing step after the moulding operation is carried out at 150°C for 20 hours. With a moulding temperature of 30°C the contraction rate on annealing is 0.70%. With a moulding temperature of 80°C however, the contraction
40 rate on annealing is only 0.41%. Thus the moulding temperature affects the contraction rate to a great extent.

- Such differential rates provide the basis of the present invention. Thus if the moulding of an
45 outer frame unit of crystalline thermoplastic resin and having inside engaging portions e.g. concavities, is carried out at a lower temperature than that of an inner engageable unit having corresponding engaging portions e.g. convexities,
50 the outer frame of the assembled unit will contract to a greater degree than the inner unit mounted therein when subjected to an annealing step. Thus the inner unit becomes more securely engaged to the outer frame unit.

- 55 Thus the invention provides a method of assembling plastics units made of a crystalline thermoplastic resin, said units comprising an outer frame unit having sockets or projections engaging corresponding projections or sockets in
60 an inner unit, characterised in that the said outer unit is moulded at a lower temperature than the said inner unit, the moulded units are then

assembled one inside the other to provide a loose engagement between them, and the assembled
65 units are annealed at an elevated temperature whereby the engagement of the said units to each other becomes more secure due to differential contraction of the said inner and frame units.

- In applying the method of the invention to
70 frame and inner units of a polyacetal resin, if the moulding temperature of the low-temperature mould for moulding the outer frame unit is less than 50°C and the moulding temperature of the high-temperature mould for moulding the inner
75 engaging unit to be engaged into the outer frame unit is 50°C or more and the annealing temperature is 150°C for 20 hours, the difference in the contraction rate caused is about 0.3%, although the precise figure depends upon the
80 thickness of the mouldings.

Two embodiments of the invention are hereinafter described and illustrated in the accompanying drawings, of which

- Figure 1 (a) is a plan view of an outer frame
85 body 1, containing two concavities 2, each disposed in opposite internal surfaces of the frame;

- Figure 1 (B) is a plan view of a flap 3 to be engaged into the said outer frame body 1, by two
90 corresponding convex projections, each disposed on opposite side faces of the flap 3.

- If the said engageable units are fitted into each other so that the projections 4 snap fit into the
cavities 2 the clearance t_1 between the frame
95 body 1 and the flap 3 is as shown in Figure 2 (A) and is sufficiently loose so that the flap 3 is likely to disengage from the frame body 1 during use. By the application of the method of the invention, the clearance after annealing is greatly tightened,
100 as shown at t_2 in Figure 2 (B), thus obviating disengagement during use.

- An alternative configuration of units is shown in Figures 3 (A) and 3 (B). Figure 3 (A) shows a
frame body 1 having convex-shaped engaging
105 portions 5 on its inner side. Figure 3 (B) shows an inner flap 3 having concave portions 6 corresponding to the convex-shaped engaging portions 5.

Claims

- 110 1. A method of assembling plastics units made of a crystalline thermoplastic resin, said units comprising an outer frame unit having sockets or projections engaging corresponding projections or
sockets in an inner unit, characterised in that the
115 said outer unit is moulded at a lower temperature than the said inner unit, the moulded units are then assembled one inside the other to provide a loose engagement between them, and the assembled units are annealed at an elevated
120 temperature whereby the engagement of the said units to each other becomes more secure due to differential contraction of the said inner and frame units.

2. A method according to Claim 1, wherein the



SPECIFICATION

A Method of Assembling Plastics Units

The present invention relates to a method of assembling engageable resin-moulded units made of crystalline thermoplastic resin, e.g. a polyacetal, whereby the engagement between the units is strengthened. More particularly the invention relates to a method of assembling such units by an annealing operation which utilizes differences in the moulding contraction rate taking place during the annealing operation.

It is known that when a crystalline thermoplastic resin is melted and then moulded and solidified, its volume is reduced. This is because the degree of crystallization increases as solidification proceeds from the amorphous melt. Such contraction of the moulded units is hereinafter described for a polyacetal copolymer, which is an example of a crystalline thermoplastic resin. Polyacetal copolymer is an engineering plastics material which has improved mechanical strength and mouldability and has a balanced combination of creep, fatigue, abrasion, heat and chemical resistance and dimensional stability. Since a polyacetal resin crystallizes to a high degree, its moulding contraction rate is correspondingly large.

The contraction rate of a moulding depends on the moulding conditions, as well as the shape of the moulding and the annealing temperature. The contraction rate as a function of mould temperature of polyacetal copolymer can be demonstrated as follows. Assume that the thickness of the moulding is 5 mm and the annealing step after the moulding operation is carried out at 150°C for 20 hours. With a moulding temperature of 30°C the contraction rate on annealing is 0.70%. With a moulding temperature of 80°C however, the contraction rate on annealing is only 0.41%. Thus the moulding temperature affects the contraction rate to a great extent.

Such differential rates provide the basis of the present invention. Thus if the moulding of an outer frame unit of crystalline thermoplastic resin and having inside engaging portions e.g. concavities, is carried out at a lower temperature than that of an inner engageable unit having corresponding engaging portions e.g. convexities, the outer frame of the assembled unit will contract to a greater degree than the inner unit mounted therein when subjected to an annealing step. Thus the inner unit becomes more securely engaged to the outer frame unit.

Thus the invention provides a method of assembling plastics units made of a crystalline thermoplastic resin, said units comprising an outer frame unit having sockets or projections engaging corresponding projections or sockets in an inner unit, characterised in that the said outer unit is moulded at a lower temperature than the said inner unit, the moulded units are then

assembled one inside the other to provide a loose engagement between them, and the assembled units are annealed at an elevated temperature whereby the engagement of the said units to each other becomes more secure due to differential contraction of the said inner and frame units.

In applying the method of the invention to frame and inner units of a polyacetal resin, if the moulding temperature of the low-temperature mould for moulding the outer frame unit is less than 50°C and the moulding temperature of the high-temperature mould for moulding the inner engaging unit to be engaged into the outer frame unit is 50°C or more and the annealing temperature is 150°C for 20 hours, the difference in the contraction rate caused is about 0.3%, although the precise figure depends upon the thickness of the mouldings.

Two embodiments of the invention are hereinafter described and illustrated in the accompanying drawings, of which

Figure 1 (a) is a plan view of an outer frame body 1, containing two concavities 2, each disposed in opposite internal surfaces of the frame;

Figure 1 (B) is a plan view of a flap 3 to be engaged into the said outer frame body 1, by two corresponding convex projections, each disposed on opposite side faces of the flap 3.

If the said engageable units are fitted into each other so that the projections 4 snap fit into the cavities 2 the clearance t_1 between the frame body 1 and the flap 3 is as shown in Figure 2 (A) and is sufficiently loose so that the flap 3 is likely to disengage from the frame body 1 during use. By the application of the method of the invention, the clearance after annealing is greatly tightened, as shown at t_2 in Figure 2 (B), thus obviating disengagement during use.

An alternative configuration of units is shown in Figures 3 (A) and 3 (B). Figure 3 (A) shows a frame body 1 having convex-shaped engaging portions 5 on its inner side. Figure 3 (B) shows an inner flap 3 having concave portions 6 corresponding to the convex-shaped engaging portions 5.

Claims

1. A method of assembling plastics units made of a crystalline thermoplastic resin, said units comprising an outer frame unit having sockets or projections engaging corresponding projections or sockets in an inner unit, characterised in that the said outer unit is moulded at a lower temperature than the said inner unit, the moulded units are then assembled one inside the other to provide a loose engagement between them, and the assembled units are annealed at an elevated temperature whereby the engagement of the said units to each other becomes more secure due to differential contraction of the said inner and frame units.

2. A method according to Claim 1, wherein the

said plastics units are made of a polyacetal resin.
3. An assembly of a frame unit and inner unit

obtained by a method according to Claim 1 or
Claim 2.

The text of the specification has been reproduced by photocopying. The
original typescript may be inspected on the premises of the Patent Office

