

# PATENT SPECIFICATION (11)

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## (54) METHOD FOR OUTSERT MOULDING

(71) We, POLYPLASTICS COMPANY LIMITED, a Japanese Company, of 2-30 Azuchimachi, Higashi-ku, Osaka, Japan, 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:—

This invention relates to outsert moulding, and particularly relates to an improved method for outsert moulding whereby base plates are combined with moulded plastics material and in which the precision of functional features of the base plates are preserved during the moulding operation.

Outsert moulding is a known method of moulding plastics material onto base plates, and differs from insert moulding in which the base plate is introduced into the resin. In outsert moulding the base plate is anchored to the plastics material by injecting the plastics resin into anchoring means in the base plate, e.g. anchoring slots, grooves, holes or apertures in the base plate. Such a technique is described for example in the publication "Plastics", 26, 12, pages 52—53.

The material of the base plate that is used in this technique is not limited to a metal, but may be formed of material having heat resistance and rigidity sufficient to resist the moulding operation, for example synthetic resins, mica or ceramics or combinations of such materials may be used, e.g. a composite plain or notched plate which has been subjected to one or more initial plastics moulding operations.

The plastics materials used to form combinations with such base plates may be any formable resin material. Commonly used plastics materials are polyacetal resins.

The base plate is usually formed by pressing or stamping or by more precise methods e.g. draw processing. The plate may not be uniform in thickness and may be formed by laminating or lateral joining of one or more materials. The plates or composites thereof, may be formed with functional features incorporated. Such plates may be used as outer shell parts or chassis for electrical equipment e.g. measuring meters;

watches and toys. In some instances they may be of large size and irregular shape.

Various techniques have hitherto been used for combining such plates with plastics to form an integral moulded artefact, including outsert and combinations of insert and outsert moulding techniques, using the same or different materials. If desired two or more base plates may be combined in the same plastics material. The final moulded product generally incorporates one or more functional features, i.e. one or more holes, e.g. blind holes or apertures, which holes may possibly be screw-threaded holes; or portions of differing thickness e.g. bearing elements or runners, including partly detached runners. Such functional parts may be present in an initial base plate, or in a composite base plate subjected to an initial moulding, and possibly subjected to later processing.

Base plates (whether in the form of initial base plates or composite base plates e.g. incorporating plastics moulding), which contain one or more functional features, when subjected to outsert moulding processes, are subjected to considerable pressure. Thus the base plate is interposed and pressed between two moulding members e.g. moulding plates, and the plastics resin moulded onto the plate around and/or in anchoring means on or in the said plate. As a result of the pressure exerted by the moulding members on the base plate, the functional features on the plate tend to become distorted.

The present invention is directed to an improved method of outsert moulding whereby such distortions may be obviated.

The invention provides a method of outsert moulding synthetic resin plastics material to a base plate which contains anchoring means for the reception of resin during the moulding operation whereby the moulded plastics material becomes integral with the base plate, the base plate also comprising a functional feature comprising a hole or a part of the base plate of differing thickness, which feature is separate from the said anchoring means; wherein the said base plate is interposed and pressed between moulding members and the synthetic resin plastics material

is moulded on the said base plate, characterized in that during the moulding operation the functional feature of the base plate is not subjected to a pressure from the said moulding members which would result in distortion thereof.

In one embodiment of the invention a pressing surface of at least one of the said moulding members contains a cavity located so as to correspond with the location of the functional feature of the base plate interposed between the said moulding members, whereby during the moulding operation no pressure is applied to the functional feature on the said base member.

Such an embodiment may be applied to a functional feature which is a hole e.g. screw-threaded aperture or a feature which stands proud of the base plate e.g. post, bearing or runner. When the base plate is made of material which tends to flow under pressure, the walls of a hole may further be protected against distortion by forces generated in the base member during the moulding operation by providing at least one of the moulding members with a spigot located thereon so as to enter the said hole and to support the surface of the said hole during the moulding operation.

In another embodiment of the invention a pressing surface of at least one of the said moulding members is provided with an auxiliary press member located to correspond with the location of the functional feature of the press plate, the said auxiliary press member being adapted to provide during the moulding operation a reduced pressure on the said functional portion insufficient to cause distortion thereof.

The invention is hereinafter particularly described and illustrated in the accompanying drawings, of which

Figure 1 is a representational longitudinal sectional view of an assembly of base plate and moulding plate for a conventional outsert moulding process before the moulding plate reaches an outsert moulding position,

Figure 2 is a side view of the distortion suffered by a functional aperture during conventional outsert moulding, and

Figure 3 is a side view of a form of functional aperture which is particularly susceptible to deformation during outsert moulding.

Figure 4 is a representational longitudinal sectional view of an assembly of one embodiment of the present invention,

Figure 5 is a representational part sectional view of an assembly of another embodiment of the present invention,

Figure 6 is a representational part sectional view of an assembly of a further embodiment of the present invention employing a spigot for further support of a functional aperture in the base plate,

Figure 7 is a representational part sectional view of an assembly of the present invention employing an auxiliary portion of a moulding plate,

Figure 8 is a representational sectional view of an assembly of a further embodiment of the invention,

Figure 9 is a representational part plan view of an embodiment of the invention employing additional means for avoiding pressure on a functional portion of the base plate, and

Figure 10 is a representational part plan view of another embodiment of the invention for avoiding distortion of a functional portion of a base plate when an uneven pressure is applied to the base plate.

Referring to Figure 1, a base plate 3 is interposed between moulding plates 1, 2. The base plate has an aperture 5 for anchoring a synthetic resin member to be moulded thereon, and further has a functional aperture 4. At the moulding step, the base plate 3 is clamped by both the moulding plates 1 and 2, and synthetic resin is introduced into the cavities 6 and 7 and into the anchoring aperture 5. This clamping is performed under a pressure sufficiently high to resist the synthetic resin-filling pressure. Thus when features such as the functional aperture 4 are present, the configuration of the aperture becomes distorted by the clamping pressure as indicated by the reference numeral 8 in Figure 2. With screw holes, holes produced by pressing, and the like, raised rim portions as shown by reference numeral 9 in Figure 3, are often formed on the hole edge, which also results in deformation of the holes when pressure is applied.

In one embodiment of the method of the present invention, a cavity is formed on one or both moulding plates at a location corresponding to the functional feature of the base plate e.g. an aperture as indicated at 4 in Figure 1. Such cavity may be similar to the moulding cavities 6, 7 of Figure 1.

Figure 4 illustrates such an embodiment wherein a moulding plate having cavities 10, 11 at a location corresponding to and embracing the functional aperture 4 is provided. Such cavities have the result that no pressure is exerted on the aperture 4 during the moulding operation, and a high degree of precision can be maintained for the configuration thereof. Preferably more than one cavity may be present in a moulding plate to ensure non-deformation, as hereinafter described, and the area of such cavities may be increased if desired, providing that no disadvantages thereby arise.

For a mild steel base plate, good results are obtained when the diameter of the non-compressing cavity in the moulding plate exceeds the diameter of a functional aperture e.g. a screw hole in the base plate by 2mm.

The optimum size of such pressure-removing cavities can readily be determined by experiment for any particular moulding conditions.

The pressure-removing cavity may be present in one moulding plate only as shown by reference numeral 14 in Figure 5. Clearly in such an assembly such a cavity should be on the same side as any raised rim portions present in the functional aperture.

In the embodiment of the invention illustrated in Figure 6 and which is an improvement on the arrangement of Figure 5, a spigot or core 17 is provided on one moulding plate corresponding to the position of the functional aperture in the base plate.

In the embodiment of the invention illustrated in Figure 7, a part of the base plate surrounding the functional aperture 21 therein is lightly pressed by an auxiliary moulding plate 19, which is separate from the main moulding plate 18 and it is connected thereto, for example, through a spring whereby the pressure of the auxiliary portion 19 on the base plate is sufficiently low to avoid significant deformation, but is sufficiently high not to be displaced by the pressure of the resin being moulded.

Such an assembly is particularly effective when the functional aperture is present at a point near to the resin being moulded.

In the embodiment shown in Figure 7, a side face of the auxiliary moulding plate 19 constitutes a part of a moulding cavity 20. Since the resin pressure is applied to this side face, weak clamping is sufficient for the subsidiary moulding plate 19. When the functional aperture 21 is close to the resin being moulded, there may be adopted an embodiment in which as shown in Figure 8, a further and relatively shallow moulding cavity 22 is provided on one moulding plate connected to the main moulding cavity, and a spigot or core 23 having a diameter substantially equal to the diameter of the functional aperture is provided on the other moulding plate. No clamping pressure is applied to the hole, and the moulding is carried out so that a small amount of the resin enters the shallow cavity, to provide a thin plate of moulded plastics, which may subsequently be removed. With a relatively soft base plate, deformation of the functional aperture is readily caused by the resin-filling pressure applied to the vicinity of the aperture, and deformation can be further prevented for example by providing a further cavity 25 (as shown in Figure 9) in the vicinity of the functional aperture. This further cavity is also effective for preventing any deformation due to the pressure of the moulding plates.

A plurality of functional portions of the base plate may collectively be contained in one pressure-removing cavity. When a moulded plastics portion is present on the

back surface of the base plate and deformation is caused by unevenness of the pressure applied, a support part may be formed in the pressure-removing cavity to support the base plate and prevent deformation.

One embodiment of the foregoing feature is shown in Figure 10, wherein a base plate supporting part 32 is formed in a cavity 28. When the cavities on both the surfaces of the base plate are asymmetric as in this embodiment and unevenness of the filling pressure is caused, provision of an appropriate supporting part in the cavity is effective also in the ordinary outsert moulding method.

Particular examples of base plates comprising a base plate and functional features formed of a synthetic resin are shown in Figure 1 of Patent Application 6223/78 Serial No 1593031 and in Figure 1 of Japanese Utility Model 110 966/78.

#### WHAT WE CLAIM IS:—

1. A method of outsert moulding synthetic resin plastics material to a base plate which contains anchoring means for the reception of resin during the moulding operation whereby the moulded plastics material becomes intergral with the base plate, the base plate also comprising a functional feature comprising a hole or a part of the base plate of differing thickness, which feature is separate from the said anchoring means; wherein the said base plate is interposed and pressed between moulding members and the synthetic resin plastics material is moulded on the said base plate, characterized in that during the moulding operation the functional feature of the base plate is not subjected to a pressure from the said moulding members which would result in distortion thereof.

2. A method as claimed in Claim 1, wherein a pressing surface of at least one of the said moulding members contains a cavity located so as to correspond with the location of the functional feature of the base plate interposed between the said moulding members, whereby during the molding operation no pressure is applied to the functional feature on the said base plate.

3. A method as claimed in Claim 2, wherein the said functional feature is a hole in the said base plate, and at least one of the said moulding members is provided with a spigot adapted to enter said hole during the moulding operation.

4. A method as claimed in Claim 1, wherein a pressing surface of at least one of the said moulding members is provided with an auxiliary press member located to correspond with the location of the functional feature of the press plate, the said auxiliary press member being adapted to provide during the moulding operation a reduced pressure on the said functional feature in-



The optimum size of such pressure-removing cavities can readily be determined by experiment for any particular moulding conditions.

The pressure-removing cavity may be present in one moulding plate only as shown by reference numeral 14 in Figure 5. Clearly in such an assembly such a cavity should be on the same side as any raised rim portions present in the functional aperture.

In the embodiment of the invention illustrated in Figure 6 and which is an improvement on the arrangement of Figure 5, a spigot or core 17 is provided on one moulding plate corresponding to the position of the functional aperture in the base plate.

In the embodiment of the invention illustrated in Figure 7, a part of the base plate surrounding the functional aperture 21 therein is lightly pressed by an auxiliary moulding plate 19, which is separate from the main moulding plate 18 and it is connected thereto, for example, through a spring whereby the pressure of the auxiliary portion 19 on the base plate is sufficiently low to avoid significant deformation, but is sufficiently high not to be displaced by the pressure of the resin being moulded.

Such an assembly is particularly effective when the functional aperture is present at a point near to the resin being moulded.

In the embodiment shown in Figure 7, a side face of the auxiliary moulding plate 19 constitutes a part of a moulding cavity 20. Since the resin pressure is applied to this side face, weak clamping is sufficient for the subsidiary moulding plate 19. When the functional aperture 21 is close to the resin being moulded, there may be adopted an embodiment in which as shown in Figure 8, a further and relatively shallow moulding cavity 22 is provided on one moulding plate connected to the main moulding cavity, and a spigot or core 23 having a diameter substantially equal to the diameter of the functional aperture is provided on the other moulding plate. No clamping pressure is applied to the hole, and the moulding is carried out so that a small amount of the resin enters the shallow cavity, to provide a thin plate of moulded plastics, which may subsequently be removed. With a relatively soft base plate, deformation of the functional aperture is readily caused by the resin-filling pressure applied to the vicinity of the aperture, and deformation can be further prevented for example by providing a further cavity 25 (as shown in Figure 9) in the vicinity of the functional aperture. This further cavity is also effective for preventing any deformation due to the pressure of the moulding plates.

A plurality of functional portions of the base plate may collectively be contained in one pressure-removing cavity. When a moulded plastics portion is present on the

back surface of the base plate and deformation is caused by unevenness of the pressure applied, a support part may be formed in the pressure-removing cavity to support the base plate and prevent deformation.

One embodiment of the foregoing feature is shown in Figure 10, wherein a base plate supporting part 32 is formed in a cavity 28. When the cavities on both the surfaces of the base plate are asymmetric as in this embodiment and unevenness of the filling pressure is caused, provision of an appropriate supporting part in the cavity is effective also in the ordinary outsert moulding method.

Particular examples of base plates comprising a base plate and functional features formed of a synthetic resin are shown in Figure 1 of Patent Application 6223/78 Serial No 1593031 and in Figure 1 of Japanese Utility Model 110 966/78.

#### WHAT WE CLAIM IS:—

1. A method of outsert moulding synthetic resin plastics material to a base plate which contains anchoring means for the reception of resin during the moulding operation whereby the moulded plastics material becomes integral with the base plate, the base plate also comprising a functional feature comprising a hole or a part of the base plate of differing thickness, which feature is separate from the said anchoring means; wherein the said base plate is interposed and pressed between moulding members and the synthetic resin plastics material is moulded on the said base plate, characterized in that during the moulding operation the functional feature of the base plate is not subjected to a pressure from the said moulding members which would result in distortion thereof.

2. A method as claimed in Claim 1, wherein a pressing surface of at least one of the said moulding members contains a cavity located so as to correspond with the location of the functional feature of the base plate, interposed between the said moulding members, whereby during the molding operation no pressure is applied to the functional feature on the said base plate.

3. A method as claimed in Claim 2, wherein the said functional feature is a hole in the said base plate, and at least one of the said moulding members is provided with a spigot adapted to enter said hole during the moulding operation.

4. A method as claimed in Claim 1, wherein a pressing surface of at least one of the said moulding members is provided with an auxiliary press member located to correspond with the location of the functional feature of the press plate, the said auxiliary press member being adapted to provide during the moulding operation a reduced pressure on the said functional feature in-

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sufficient to cause distortion thereof.

5 5. A method according to any of Claims 2 to 4, wherein the said cavity adjoins a moulding cavity, and is a relatively shallow cavity whereby a film of moulded plastics is formed thereon during the moulding operation.

10 6. A method of outsert moulding as claimed in Claim 1, substantially as hereinbefore described.

7. A method of outsert moulding, substantially as hereinbefore described and illustrated in any of Figures 4 to 10 of the accompanying drawings.

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