

SPECIFICATION

Outsert moulded substrate device

- 5 This invention relates to a substrate device for use in for example tape recorders, radio receivers, time-keeping devices and toys, and particularly relates to a substrate device comprising a substrate member which may be
- 10 made of metal, for example aluminium, synthetic resin or ceramic material, to which is moulded a synthetic resin member e.g. a substrate plate, support or spigot or the like, maintaining good precision. The invention is
- 15 particularly useful with substrate members in the form of a strip, e.g. of a soft metal for example aluminium, whereby enhanced rigidity of the assembly is provided.

- Devices consisting of a substrate to which
- 20 are bonded various functional components e.g. radio chassis, have hitherto been composed of a metallic substrate and separately produced functional components attached thereto by means of caulking or the like, or
- 25 composed of a unit which was integrally made of a synthetic resin.

- More recently devices in which one or more synthetic resin-made functional members are integrally mounted on a metal substrate member have been produced by pouring a synthetic resin into a metal mould in which is placed a metallic substrate having suitable fastening means usually consisting of notched holes or apertures, grooves or projections,
- 30 such a method being known as outsert moulding, and is of increasing interest where it is desired to combine the characteristics of metals and of synthetic resins in such devices. A general description of outsert moulding is in
- 35 the journal PLASTICS Vol. 26, pp. 52 to 53.

- While outsert moulding techniques efficiently utilize the properties of dissimilar materials, they are susceptible to disadvantages resulting therefrom particularly to the problem
- 40 of deformation resulting from contraction of the synthetic resin during cooling after moulding. Such deformation is hereinafter described and illustrated in Figs. 1 to 6 of the accompanying drawings.

- Referring to Fig. 1, which is a perspective view of an outsert moulded substrate device, when a substrate plate 2 moulded from a synthetic resin into a block shape is to be secured onto a flat plate substrate member 1,
- 45 such a plate 2 will usually be secured by moulding into a plurality of independent fastening apertures 3, 4, 5 and 6 in the substrate member as shown in the plan view 4 of Fig. 2.

- 50 While such a device will exhibit sufficient integral strength against external forces, since the fastening holes are located near the peripheral portions, the synthetic resin exhibits a contraction relatively greater than the substrate member 1 and the device then becomes
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deformed as shown in the cross-sectional view of Fig. 5, in which reference numeral 9 indicates the moulded synthetic resin member, 10 the substrate member and 11 designates a

70 moulded securing portion on the under surface of the substrate.

Such a deformation results in loss of precision and therefore loss of desired quality of the final product.

- 75 If the substrate has great rigidity the moulded member itself will become deformed, or if the substrate member is provided with synthetic resin members on its front and back surfaces, the substrate member will develop
- 80 complicated deformation. To reduce such deformation, a securing aperture 7 may be provided at the centre of the substrate member as shown in the plan view of Fig. 3. This arrangement however has reduced strength
- 85 against external forces and further the resin which undergoes contraction when in the securing aperture in the direction from 12 to 13 as shown in Fig. 6 becomes a cause of rattling between the substrate and the synthetic resin. The securing aperture may be
- 90 formed in an oblong shape to provide increased strength against the external forces, but rattling is not eliminated.

- Provision of a securing aperture with radial
- 95 arms as shown at 8 in the plan view of Fig. 4 may reduce deformation but again rattling exists whereby the precision of the final product is decreased. Particularly when using a substrate member of soft metal such as aluminium undergoes deformation upwardly or downwardly due to the flow of resin at the time of moulding. Such deformation develops strongly when the final substrate device is provided with large moulded synthetic resin
- 100 members on both the front and back surfaces thereof.

- The deformation caused by the pressure of resin flow could be minimized by suitably designing a gate position during the moulding
- 110 operation or by suitably supporting the protruded portion on the central area of the substrate member by means of a core metal mould. This however requires complicated metal moulds which may prove impossible to use under practical conditions.

- Thus when washing, checking and the like during the manufacturing process starting from the pressing operation up to the integrating operation, substrate members of such
- 120 shapes may tend to become hooked onto installations and become deformed giving rise to an increase in reject products.

- This invention is directed to the mitigation of such disadvantages and particularly to the
- 125 provision of products which are resistant to external forces, are firmly secured, easy to handle and exhibit less deformation.

- The invention provides a substrate device comprising a substrate member and a synthetic resin member which is integrally
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bonded and secured thereto by securing portions within the perimeter of the synthetic resin member formed by the said resin entering into apertures in the substrate member

- 5 during an outsert moulding operation whereby such apertures are wholly filled to form said securing portions moulded therein, characterised in that a plurality of said apertures are disposed adjacent to each other and are of
10 such configuration that at least one of the said securing portions moulded therein of the said resin member is of elongate section in a direction parallel to the interface of the substrate member surface and the said resin
15 member.

The elongate section includes all sections of elongate shape, e.g. semi-circular, elliptical, arcuate or wedge-shaped and is preferably oblong, by which term is meant an oblong section which may have rounded shorter ends.

- 20 Thus at least one pair of the said securing portions have their long axes directed towards each other. If desired at least two of the said
25 securing portions may have their long axes at an angle to each other, one of the ends of each of the said axes being adjacent to each other.

- 30 The invention is hereinafter particularly described and illustrated in Figs. 7 to 9 of the accompanying drawings.

- Fig. 7 is a schematic partial plan view of one embodiment of a device according to the invention, in which an oblong securing aperture 14 (having in this instance rounded shorter ends) and a securing aperture 15 of circular section adjacent thereto are formed in the substrate during moulding whereby the synthetic resin member is integrally secured to the substrate by the said fastening portions. In this embodiment the length a in the long axis of the oblong securing aperture 14 provides resistance to a twisting force which may be applied to the device, and the distance between the two portions 14 and 15 provides resistance to deformation of the device. In the device illustrated in Fig. 7, since the width b is small as compared to the length a, deformation is substantially absent, and a further
50 securing force is created between the two portions due to the contraction, whereby no rattling is produced.

- There is no limitation on the shape of the securing portion 15 formed adjacent to said oblong portion 14. In addition to a position at the side of the oblong portion illustrated, the securing portion 15 may be near the tip in the length-wise direction of the oblong portion 14.

- 60 There may further be provided another securing aperture provided it does not negatively affect the advantages of the invention. The increase in the number of securing apertures however tends to increase deformation.
65 Particular substrates to which the invention is

applied usually have particular directions which experience deformation, and therefore the elongate securing portion should be along such a direction, and a suitable number of
70 securing portions should be provided in other directions to cope with the required fastening strength. When this invention is to be applied to a device that is required to exhibit little or no deformation but large strength in various
75 directions, it is recommended that a securing portion adjacent to the elongate portion is also formed in an elongate shape.

- Fig. 8 shows in partial plan, another embodiment of a suitable device according to the invention, wherein four oblong securing apertures 16, 16', 16'' and 16''' are formed on the substrate member 19 to provide corresponding securing portions of the moulded resin member. Broken line 17 indicates the
80 outer circumferential position of the synthetic resin member. Further, as indicated at broken line 18, the synthetic resin member may have an outer circumference which is smaller than the region occupied by the group of securing
85 apertures.

- The longest distance between the outside short lengths c and c' between the pair of securing portions 16 and 16'' respectively contributes to an increase in strength, and the
90 distance between the inside lengths d and d' thereof respectively contributes to reduce the deformation. The same holds true for the other pair of securing portions 16' and 16'''.

- A further embodiment of this invention is shown in Figure 9A, in which elongate securing portions 20, 21 are arrayed on both sides of a longer elongate securing portion 22 at right angles thereto.

- Another embodiment of the invention is shown in Fig. 9B in which an elongate securing portion 23 is arrayed obliquely with respect to an elongate securing portion 24.

- If desired, a further securing portion of circular section may be provided at a central
110 portion where the long axes of the elongate portions intersect.

CLAIMS

1. A substrate device comprising a substrate member and a synthetic resin member which is integrally bonded and secured thereto by securing portions within the perimeter of the synthetic resin member formed by the said resin entering into apertures in the substrate member during an outsert moulding operation whereby such apertures are wholly filled to form said securing portions moulded therein, characterised in that a plurality of said apertures are disposed adjacent to each other
125 and are of such configuration that at least one of the said securing portions moulded therein of the said resin member is of elongate section in a direction parallel to the interface of the substrate member surface and the said
130 resin member.



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The elongate section includes all sections of elongate shape, e.g. semi-circular, elliptical, arcuate or wedge-shaped and is preferably oblong, by which term is meant an oblong section which may have rounded shorter ends.

Thus at least one pair of the said securing portions have their long axes directed towards each other. If desired at least two of the said securing portions may have their long axes at an angle to each other, one of the ends of each of the said axes being adjacent to each other.

The invention is hereinafter particularly described and illustrated in Figs. 7 to 9 of the accompanying drawings.

Fig. 7 is a schematic partial plan view of one embodiment of a device according to the invention, in which an oblong securing aperture 14 (having in this instance rounded shorter ends) and a securing aperture 15 of circular section adjacent thereto are formed in the substrate during moulding whereby the synthetic resin member is integrally secured to the substrate by the said fastening portions. In this embodiment the length *a* in the long axis of the oblong securing aperture 14 provides resistance to a twisting force which may be applied to the device, and the distance between the two portions 14 and 15 provides resistance to deformation of the device. In the device illustrated in Fig. 7, since the width *b* is small as compared to the length *a*, deformation is substantially absent, and a further securing force is created between the two portions due to the contraction, whereby no rattling is produced.

There is no limitation on the shape of the securing portion 15 formed adjacent to said oblong portion 14. In addition to a position at the side of the oblong portion illustrated, the securing portion 15 may be near the tip in the length-wise direction of the oblong portion 14.

There may further be provided another securing aperture provided it does not negatively affect the advantages of the invention. The increase in the number of securing apertures however tends to increase deformation. Particular substrates to which the invention is

applied usually have particular directions which experience deformation, and therefore the elongate securing portion should be along such a direction, and a suitable number of securing portions should be provided in other directions to cope with the required fastening strength. When this invention is to be applied to a device that is required to exhibit little or no deformation but large strength in various directions, it is recommended that a securing portion adjacent to the elongate portion is also formed in an elongate shape.

Fig. 8 shows in partial plan, another embodiment of a suitable device according to the invention, wherein four oblong securing apertures 16, 16', 16'' and 16''' are formed on the substrate member 19 to provide corresponding securing portions of the moulded resin member. Broken line 17 indicates the outer circumferential position of the synthetic resin member. Further, as indicated at broken line 18, the synthetic resin member may have an outer circumference which is smaller than the region occupied by the group of securing apertures.

The longest distance between the outside short lengths *c* and *c'* between the pair of securing portions 16 and 16'' respectively contributes to an increase in strength, and the distance between the inside lengths *d* and *d'* thereof respectively contributes to reduce the deformation. The same holds true for the other pair of securing portions 16' and 16'''.

A further embodiment of this invention is shown in Figure 9A, in which elongate securing portions 20, 21 are arrayed on both sides of a longer elongate securing portion 22 at right angles thereto.

Another embodiment of the invention is shown in Fig. 9B in which an elongate securing portion 23 is arrayed obliquely with respect to an elongate securing portion 24.

If desired, a further securing portion of circular section may be provided at a central portion where the long axes of the elongate portions intersect.

CLAIMS

1. A substrate device comprising a substrate member and a synthetic resin member which is integrally bonded and secured thereto by securing portions within the perimeter of the synthetic resin member formed by the said resin entering into apertures in the substrate member during an outsert moulding operation whereby such apertures are wholly filled to form said securing portions moulded therein, characterised in that a plurality of said apertures are disposed adjacent to each other and are of such configuration that at least one of the said securing portions moulded therein of the said resin member is of elongate section in a direction parallel to the interface of the substrate member surface and the said resin member.



2. A device according to Claim 1 wherein the said securing portion or portions are of oblong section.
3. A device according to Claim 1 or Claim 2, wherein at least one pair of elongate-section-securing portions are provided which have their long axes directed towards each other.
4. A device according to Claim 1 or Claim 2, wherein at least two elongate-sectioned securing portions are provided which have their long axes at an angle to each other, one of the ends of each of the said axes being adjacent to each other.
5. A device according to any of Claims 1 to 4, wherein the said securing portions are formed by the said resin passing through said apertures whereby moulded portions are formed on the surface of the substrate member opposite to that on which the synthetic resin member is formed.
6. A device according to any of Claims 1 to 5, wherein the said substrate member is a strip member.
7. A device according to Claim 6, wherein the said strip is a metal strip.
8. A device according to Claim 1, substantially as hereinbefore described and illustrated in any of Figs. 7 to 9 of the accompanying drawings.