

BGA MOULD FOR PREVENTING THE FORMATION OF FLASHES ON BGA SUBSTRATES DURING ENCAPSULATION

5 FIELD OF THE INVENTION

The present invention relates to the field of semiconductor packaging, and in particular, to a mould for preventing the formation of flashes on a BGA substrates during an encapsulating process.

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BACKGROUND OF THE INVENTION

BGAs (Ball Grid Arrays) are relatively new semiconductor devices which use substrates rather than leadframes which are used for packaging QFPs (Quad-Flat Packages). Unlike with the leadframes where the width can be controlled with high accuracy and precision, the industry has had difficulty controlling the width of the substrates for BGAs. Hence, the BGA substrates can come with widely varying widths.

To initiate the encapsulation process, the substrate carrying the semiconductor device is placed precisely in a mould of a BGA packaging machine where a cavity bar is provided to receive the substrate. The mould used to handle BGA substrates is substantially similar to that used to handle QFP leadframes, and is not designed to easily adapt to the varying width of the BGA substrates. To ensure that the mould can accommodate substrates of all available widths, the cavity bar is made sufficiently wide to be able to accept the total range of widths that may be available. Consequently, where the substrates having widths less than that of the cavity bar are placed on the

mould, a gap exists between the edge of the cavity bar and that of the substrate.

For these substrates, as the BGA device is being encapsulated, the liquefied resin flows into and partially fills the gap. Because the gap is somewhat narrow, the viscosity of the liquefied resin prevents it from filling in the gap too quickly, and hence, the resin hardens or cures before the entire gap is completely filled. As the resin hardens, it bonds to the edge of the substrate and forms what-is-known in the industry as "flash" or "side flash" which is simply residual hardened resin periodically protruding out from the side of the substrate. FIG. 1 illustrates substrates 5 having such flashes 10. These flashes are highly undesirable in that they can cause problems during the subsequent processing of the substrate. In particular, jams can occur during the handling of the substrate as the flashes break off from the substrates and are caught between moving parts of the BGA packaging machine.

The elimination of the flashes has been proven difficult. Because the flashes are small, fragile, and intermittently placed, they are not easily removed. Although it has been suggested to cut a thin slice at the edge of the substrate, the suggestion has not been proven successful because the cut leaves a very jagged edge which tends to cause problems during subsequent processing. As of this date, there is no effective way of removing or preventing these flashes. Clearly, there is a need for an apparatus for eliminating or preventing such flashes on BGA substrates during the encapsulating process.

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OBJECT OF THE INVENTION

It is therefor the objective of the present invention to provide a BGA mould which effectively prevents the flashes from forming during the encapsulation stage of a BGA device.

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SUMMARY OF THE INVENTION

The present invention is a mould for preventing the formation flashes on BGA substrates during an encapsulation process. The mould includes a pair cavity bars, each having a row of cavities, and a cull block having a row of culls. Each of the culls is connected to a set of cavities via a runner system. A flood runner is provided at the edge of the cull block. The flood runner should be sufficiently wide such that a liquefied resin can freely flow through the runner and fill the flood runner without prematurely hardening before the fill-in process is completed.

During the encapsulation process, a liquefied resin completely fills in the cavities, culls, runner system, and the flood runner. After it has cured, the resin which was in the culls and in the runner system forms a resin bridge between the two substrates. The resin which was in the flood runner is hardened into a long continuous resin strip which adheres to the edge of the substrates. The runner system portion of the resin bridge is bonded to both the substrate and the resin strip.

After the resin has cured, the resin bridge can be removed using a customary degating procedure. As the resin bridge is removed, the resin strip is cleanly separated from the substrate leaving a clean, flashless edge.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of BGA substrates having flashes.

FIG. 2 is a plan view of a mould having the flood runners of the present
5 invention.

FIG. 3 is a plan view of BGA substrates which was packaged in the
mould of FIG. 2.

10 FIG. 3A is a plan view of the BGA substrates of FIG. 3 after the
substrates are degated.

FIG. 4A is a cross-sectional view of a substrate placed in a mould
without the flood runners of the present invention.
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FIG. 4B is cross-sectional view of a substrate placed in a mould with
the flood runners of the present invention.

FIG. 4C is cross-sectional view of a substrate disposed in a mould with
20 an alternate embodiment of the flood runners of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

25 FIG. 2 illustrates the plan view of a mould for packaging BGA devices
which is the preferred embodiment of the present invention. The mould
includes a pair of cavity bars 20, each having a row of cavities 25, and a cull
block 30 having a row of culls 35. Each of the culls 35 is connected to a pair

of cavities 25 via a runner system 40. A flood runner 45 is provided at the edge 32 of the cull block 30. The flood runner 45 should be sufficiently wide such that a liquefied resin can freely flow through the runner and fill the flood runner without prematurely hardening before the fill-in process is completed.

5 The purpose of the flood runner 45 is to widen a gap between an edge of a BGA substrate and the cull block 30 so that the resin can freely and completely fill in the entire gap. The flood runner 45 allows the formation of a long and continuous resin strip instead of short and intermittent placement of hardened resin which is characteristic of flashes.

10 During an encapsulation process, a liquefied resin completely fills in the cavities 25, culls 35, runner system 40, and the flood runner 45. After it has cured, the resin forms a continuous solid block having a shape that of the pattern on the mould, e.g., culls, cavities, etc. As shown in FIG. 3, the resin which was in the culls 35 and the runner system 40 forms a resin bridge 60
15 between the two substrates 50. The resin which was in the flood runner 45 has now hardened into a long continuous resin strip 55 which adheres to the edge of the substrates 50. The runner system portion 65 of the resin bridge 60 is bonded to both the substrate 50 and the resin strip 55.

After the resin has cured, the resin bridge 60 is removed using a
20 customary degating procedure. Because the resin strip 55 is bonded solidly to the resin bridge 60, it is degated along with the bridge 60. FIG. 3A illustrates the resin bridge 60 and the resin strip 55 after they have been separated with the substrates 50. As can be seen, the resin strip 55 is separated cleanly from the edge of the substrates 50 leaving no side flashes
25 or other resin residue.

To further ensure that the resin strip 55 is removed in a single piece, the flood runner 45 of FIG. 2 can be deepened such that the resin strip 55 has a greater thickness. This point is illustrated in FIG. 4A, 4B, and 4C. FIG. 4A

shows a cross-sectional view of a substrate 80 in between an upper and lower mould 75 and 76 of the traditional kind without the flood runner. As illustrated, a short flash 85 is formed at the edge of the substrate. FIG. 4B illustrates a substrate 90 in a mould having the flood runner of the present invention. As can be seen, the resin strip 95 formed from the flood runner has a thickness substantially similar to that of the substrate 90. FIG. 4C illustrates an alternative embodiment to the present invention where the flood runner is deepened to produce a thicker resin strip. As can be seen, the resin strip 100 is substantially thicker than the substrate 105.

Although the preferred embodiment has been shown here as a way of illustrating the way to make and use the invention, it is contemplated that there are other ways to form the resin strip for the purpose of eliminating the flashes. In addition, although the preferred embodiment showed a continuous resin strip, some discontinuity can exist without unduly affecting the performance of the present invention. Furthermore, although the preferred embodiment has a pair of rows of cavities, only a single row, or even single cavity, is possible. Hence, various modifications, additions and substitutions are possible for the invention described herein, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

CLAIMS

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I Claim:

- 1 1. A BGA mould for preventing a formation of flashes on a BGA
 2 substrates during an encapsulation process comprising:
 3 a cull block with a plurality of culls;
 4 a cavity bar, said cavity bar having a plurality of cavities;
 5 a runner system connecting said culls to said cavities;
 6 a flood runner disposed at an intersection of said cull block and
 7 cavity bar, said flood runner being wide enough to allow a liquefied resin to
 8 substantially fill in said runner before hardening during the BGA
 9 encapsulation process;
 10 whereby said resin in the flood runner forms a strip of hardened resin
 11 on an edge of said substrate after said resin has cured.
- 1 2. The BGA mould as recited in claim 1 wherein said flood runner is
 2 continuous along an entire length of said substrate.
- 1 3. The BGA mould as recited in claim 1 wherein said flood runner has a
 2 depth substantially greater than a thickness of said substrate.
- 1 4. A method of preventing a formation of flashes on a BGA substrate
 2 during an encapsulating process comprising forming a channel of a
 3 sufficient dimension immediately adjacent to an edge of said BGA substrate,
 4 said edge being a location where flashes form, whereby a liquefied resin
 5 freely flows into said channel without prematurely curing such that when
 6 said resin is cured, a resin strip is formed on said edge of the substrate
 7 which can easily be separated from said edge.
- 1 5. The method as recited in claim 4 wherein said channel is continuous
 2 along an entire length of said substrate.



- 1 6. A BGA mould for preventing a formation of flashes on a BGA
2 substrate during an encapsulation process comprising:
3 a cull block with at least one cull;
4 a cavity bar, said cavity bar having at least one cavity;
5 a runner system connecting said cull to said cavity;
6 a flood runner disposed at an intersection of said cull block and
7 cavity bar, said flood runner being wide enough to allow a liquefied resin to
8 substantially fill in said runner before hardening during the BGA
9 encapsulation process;
10 whereby said resin in the flood runner forms a strip of hardened resin
11 on an edge of said substrate after said resin has cured.

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ABSTRACT

BGA MOULD FOR PREVENTING THE FORMATION OF FLASHES ON BGA SUBSTRATES DURING ENCAPSULATION

A mould for preventing the formation flashes on BGA substrates during an encapsulation process. The mould includes cavity bars, each having a row of cavities, and a cull block having a row of culls. Each of the culls is connected to a set of cavities via a runner system. A flood runner is provided at the edge of the cull block. The flood runner should be sufficiently wide such that a liquefied resin can freely flow through the runner and fill the flood runner without prematurely hardening before the fill-in process is completed.

FIG. 2

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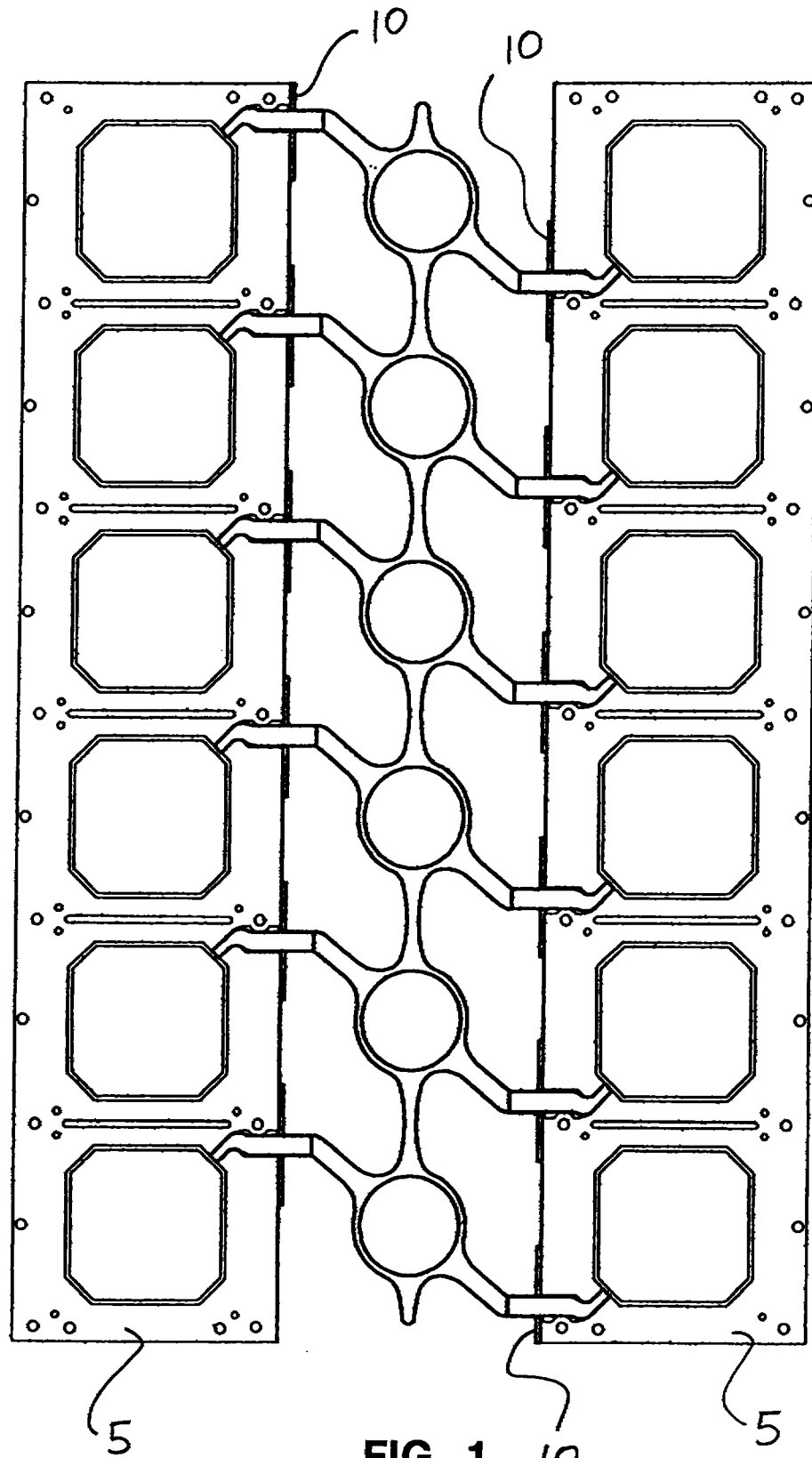


FIG. 1 10

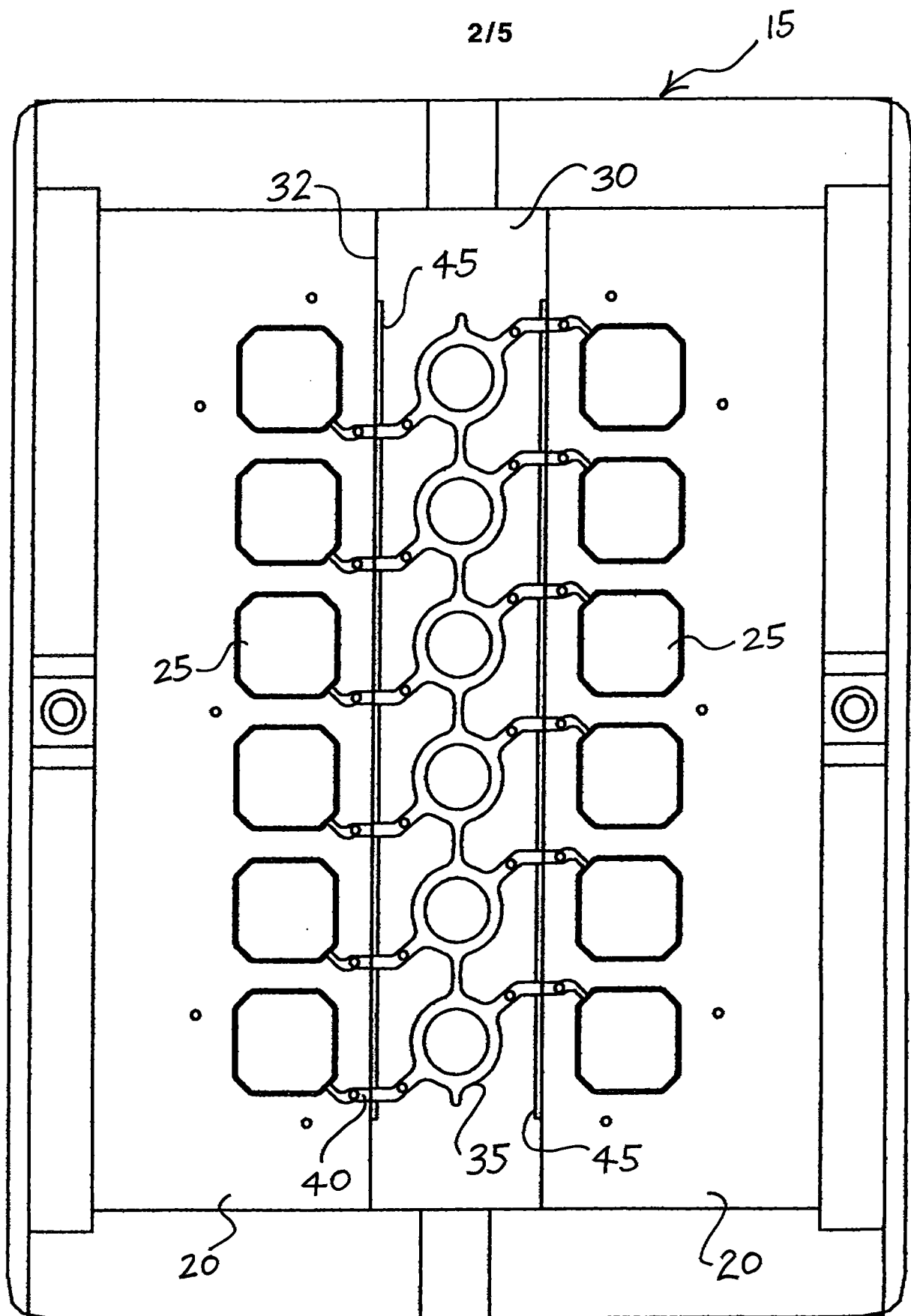


FIG. 2

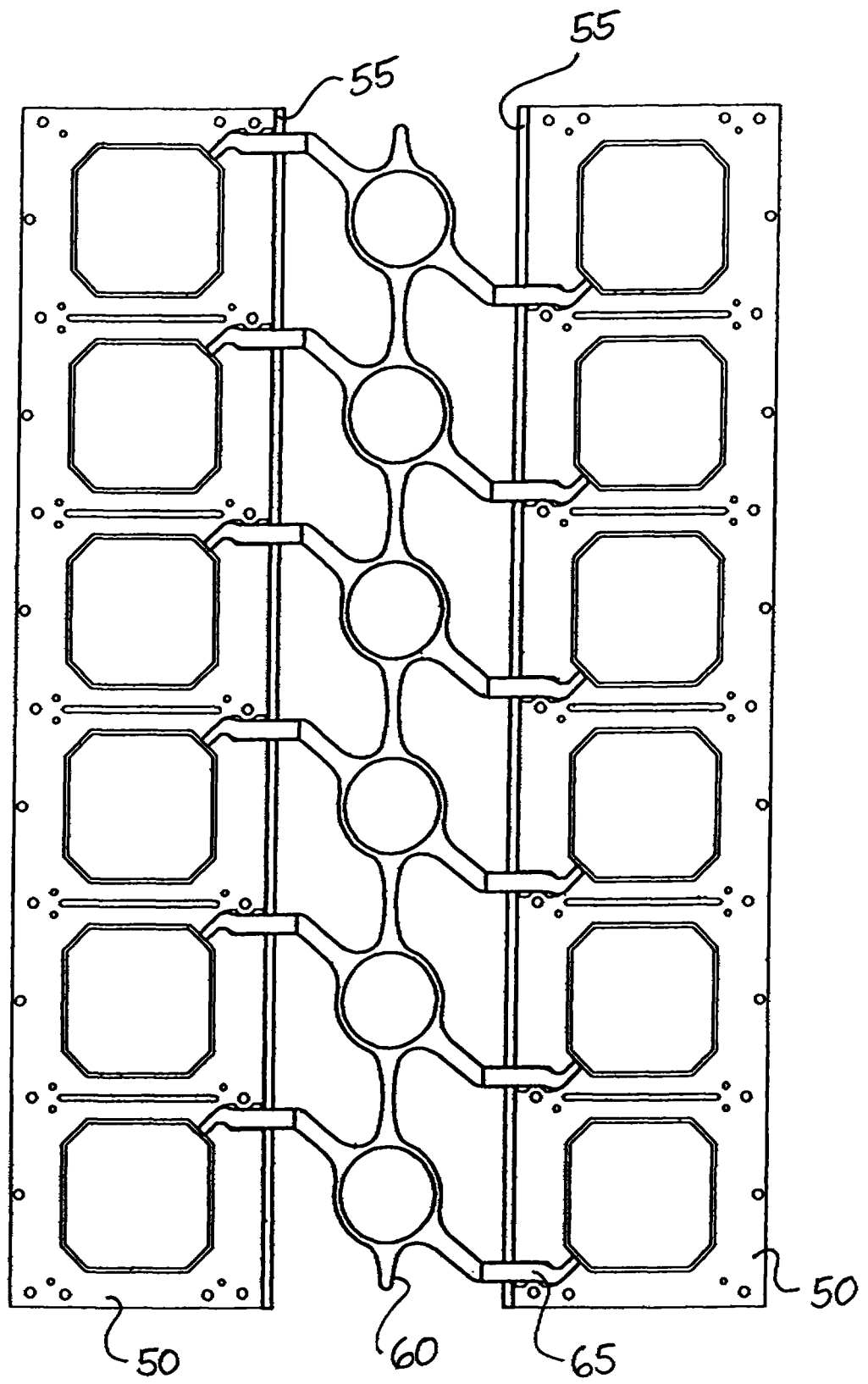


FIG. 3

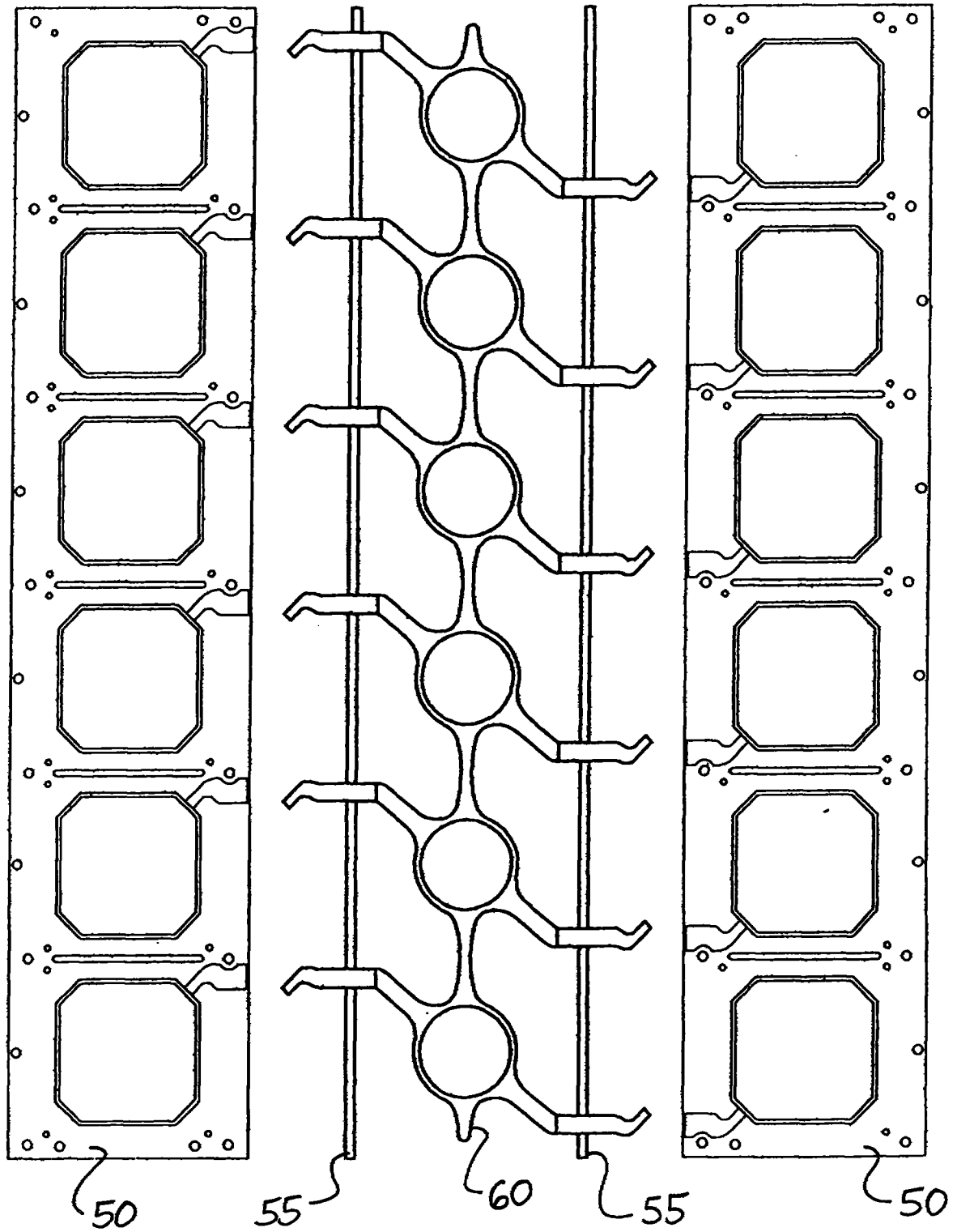


FIG. 3A

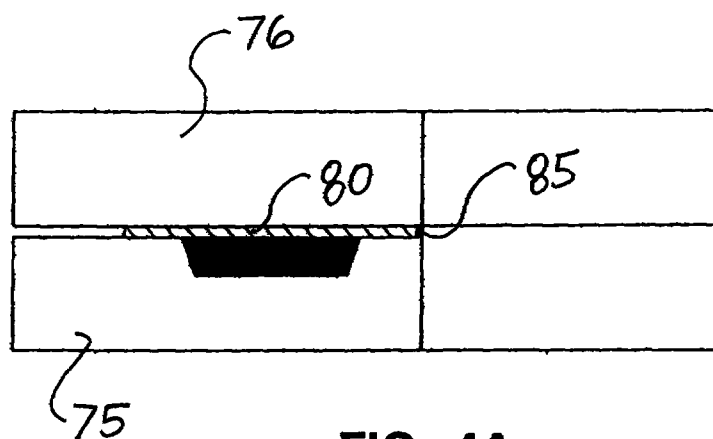


FIG. 4A

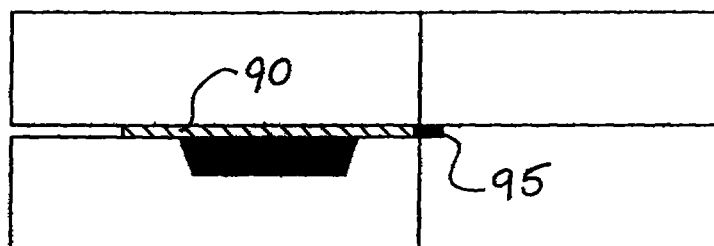


FIG. 4B

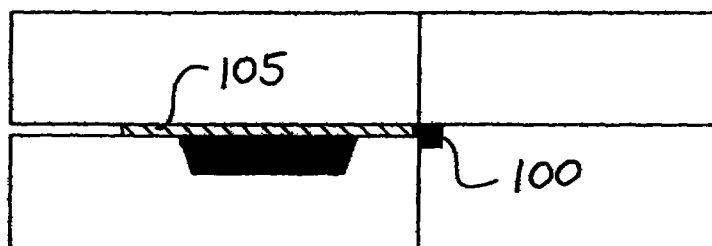
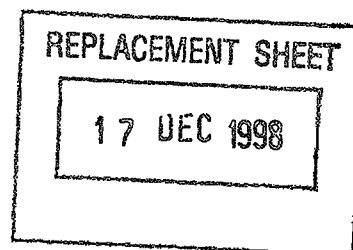


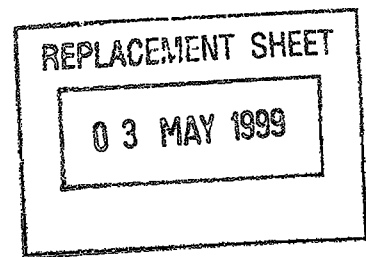
FIG. 4C

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

A mould for preventing the formation flashes on BGA substrates during an encapsulation process. The mould includes cavity bars (20) each having a row of cavities (25), and a cull block (30) having a row of culls (35). Each of the culls (35) is connected to a set of cavities (25) via a runner system (40). A flood runner (45) is provided at the edge of the cull block. The flood runner (45) should be sufficiently wide such that a liquefied resin can freely flow through the runner and fill the flood runner without prematurely hardening before the fill-in process is completed. The flood runner (45) allows the formation of a long and continuous resin strip which may be separated cleanly from the BGA substrates, using a conventional degating procedure, without leaving resin flashes.

Fig 2



**CLAIMS**

I Claim:

1 1. A BGA mould for preventing a formation of flashes on a BGA
2 substrates during an encapsulation process comprising:

3 a cull block with a plurality of culls;

4 a cavity bar, said cavity bar having a plurality of cavities;

5 a runner system connecting said culls to said cavities;

6 a flood runner disposed at an intersection of said cull block and cavity
7 bar, said flood runner being wide enough to allow a liquefied resin to
8 substantially fill in said runner before hardening during the BGA
9 encapsulation process, said flood runner running continuously along an
10 entire length of said substrate;

11 whereby said resin in the flood runner forms a strip of hardened resin
12 on an edge of said substrate after said resin has cured.

1 2. The BGA mould as recited in claim 1 wherein said flood runner has a
2 depth substantially greater than a thickness of said substrate.

1 3. A method of preventing a formation of flashes on a BGA substrate
2 during an encapsulating process comprising forming a channel immediately
3 adjacent to an edge of said BGA substrate which runs continuously along
4 an entire length of said substrate, said edge being a location where flashes
5 form, whereby a liquefied resin freely flows into said channel without
6 prematurely curing such that when said resin is cured, a resin strip is formed
7 on said edge of the substrate which can easily be separated from said edge.