

DESCRIPTIONGANG-POT MOULD

5 The present invention is concerned with a
gang-pot mould of the kind which is used to
encapsulate integrated circuit components in a
potting compound, such as an epoxy resin. Such a
mould is normally mounted in conventional fashion
10 between top and bottom mould platens which carry
respective upper and lower mould parts. The lower
mould part has a base plate which sits on the bottom
mould platen and a plunger platen, comprising a
plurality of plungers, is raised and lowered
15 relatively to the base plate by means of one or more
hydraulic rams. In use, with the mould closed, the
plunger platen and its plungers are raised from the
base plate, within the lower mould part, so that the
upper ends of the plungers are advanced through pots
20 in the lower mould part into respective culls where
the upper and lower mould parts meet to pressurise
fluent resin in the culls and force the resin through
runner systems into mould cavities between the mould
parts and containing the components to be
25 encapsulated.

 The mould is operated at a high temperature of
the order of 170-180°C, in order that the resin is
rendered, and maintained, fluent in the culls and
runner systems. As a result much heat is generated
30 and dissipated to the lower mould part. Oil which is
supplied to the hydraulic ram(s) will not function
adequately at a temperature of more than about 70°C.
For this reason it has been conventional to mount the
hydraulic ram(s) below the lower mould platen and to
35 connect the ram piston to the plunger platen by
rod(s) passing up through the lower mould platen and
base plate. In addition it has been necessary to

cool the oil by circulating it through a heat exchanger.

The object of the invention is to overcome these problems and to provide a simpler and more compact construction of lower mould part.

5 In accordance with the present invention, a lower mould part for a gang-pot mould comprises a base plate, which is arranged to be mounted, in use, on a bottom mould platen, a plunger platen which is guided for vertical movement relatively to the base plate and which carries a
10 plurality of plungers; and a metal slab which is seated on the base plate and is provided with a plurality of bores each forming the cylinder of an hydraulic ram, a piston of which is connected to the plunger platen whereby the plunger platen can be raised and lowered upon operation of
15 the rams.

This provides an extremely compact arrangement and the metal slab acts as a heat sink which protects oil, supplied to the ram cylinders through ducting in the slab, from overheating, for example by radiating the heat which it
20 receives by radiation and conduction from other parts of the mould above, and possibly by the circulation of a cooling medium such as water through cooling channels in the slab.

It is important that the plunger platen is maintained
25 level as it is raised and lowered within the lower mould part, to ensure that the plungers do not become jammed in pots through which they pass at the top of the lower mould part. Conventionally, the plunger platen has been guided by sliding relatively to fixed guide columns. This has not
30 been entirely satisfactory and it is now proposed to guide the plunger platen by means of vertical racks fixed to the sides of the plunger platen, the racks meshing with rotary pinions carried by a surrounding riser block or blocks of the lower mould part. In the usual case in which the
35 plunger platen is generally _____

rectangular in plan, there may be two racks at each corner, each facing outwardly perpendicular to a respective one of the sides of the block which meet at that corner, and the racks at opposite edges of each side meshing with
 5 respective ones of two pinions which are fixed on a common axle so that they rotate together. This arrangement ensures that one side of the plunger platen cannot lead or lag the opposite side during raising and lowering by means of the hydraulic ram(s).

10 An example of a gang-pot moulding machine having a lower mould part constructed in accordance with the present invention is illustrated diagrammatically in the accompanying drawings, in which:-

Figure 1 is a diagrammatic side elevation, partly in
 15 section;

Figure 1A is a diagram of cooling ducts for the slab;

Figure 2 are sketches showing the manner in which the piston rod of one of the hydraulic rams is connected to the underside of the plunger platen; and,

20 Figure 3 is a plan showing the plunger platen with its guiding racks and pinions.

The illustrated gang-pot moulding machine has a fixed lower platen 10 and an upper platen 11 which can be raised and lowered relatively to the lower platen by means of rams
 25 attached to the bottom of support rods 12, which slide through openings in the lower platen 10.

The upper platen 11 carries an upper mould part 13 incorporating an upper chase 14 with runner/cavity bars 15, and ejectors 16, attached to an ejector plate 17, which is
 30 urged downwardly by springs.

A lower mould part comprises a base plate 18, which is seated on the lower platen 10, and riser blocks 19 which extend upwards from the base plate _____

and carry a support plate 20 on which are mounted bottom
 chases 21, with cavity bars 22, complementary to those of
 the upper mould part, ejector pins 23, and pots 24. In
 use, with the upper platen 11 lowered so that the mould is
 5 closed and the cavity bars 15 meet the cavity bars 22,
 fluent resin is forced out of the pots 24, through a runner
 system and into the cavities by raising a series of
 plungers 25. These are slidable through bores in the
 support plate 20 and through bores in an ejector plate 26
 10 and seat at their lower ends on a plunger platen 27. This
 is raised and lowered by means of hydraulic rams consisting
 of cylinders 28 formed directly in a metal slab 29 which
 rests on the base plate 18, and pistons having rods 30
 which extend upwardly out of the cylinders and carry the
 15 plunger platen 27. The upper ends of the piston rods 30
 are secured to the underside of the plunger platen by means
 of heads 31 on the piston rods which are slid sideways into
 horseshoe shaped brackets 32 which are then bolted into
 position to the plunger platen, as indicated in Figure 2.
 20 The plunger platen 27 and plungers 25 are thus raised by
 the supply of hydraulic fluid beneath the pistons in the
 cylinders 28, to inject the resin into the cavities.

During this raising and lowering of the plunger
 platen, it is prevented from cocking sideways by means of
 25 four pairs of pinions 33, each pair of which is fixed on
 its respective axle 34 which is freely rotatably mounted in
 ones of the riser blocks 19, the pinions remaining in
 engagement with racks 35 mounted at the corners of the
 plunger platen.

30 The metal slab 29 acts as a heat sink and is formed
 with cooling channels 36, through which water is
 continually circulated by a pump, and through an external
 radiator. In fact, owing to the large size of the machine
 the slab 29 is divided into two _____

similar side by side parts, which are provided with channels 36 in mirror image arrays, as shown in Figure 1A. Thus the array in one slab part is provided with an inlet 36A, that in the other part with an outlet 36B, and the two arrays are connected by an external hose 36C.

After an injection cycle, the mould is opened by raising the upper platen 11, and the ejector pins 23 are raised by raising the ejector plate 26, on which the ejector pins indirectly sit via intermediate plates 36 which rest on plungers 37 that are slideable through bores in the support plate 20 and sit on the ejector plate 26. The ejector plate 26 is itself raised by means of rams disposed below the lower platen 10, and pushing upwards on the ejector plate via push rods 38 which slide through the lower platen 10.

CLAIMS

1. A lower mould part for a gang-pot mould, the mould part comprising a base plate, which is arranged to be mounted, in use, on a bottom mould platen, a plunger platen which is guided for vertical movement relatively to the base plate and which carries a plurality of plungers; and a metal slab which is seated on the base plate and is provided a plurality of bores each forming the cylinder of an hydraulic ram, a piston of which is connected to the plunger platen whereby the plunger platen can be raised and lowered upon operation of the rams.
2. A mould part according to claim 1, in which the slab is provided with cooling channels for the circulation of a cooling medium.
3. A lower mould part according to claim 1 or claim 2, in which the plunger platen is guided for vertical movement by means of vertical racks fixed to the sides of the plunger platen and meshing with rotary pinions carried by a riser of the lower mould part.
4. A mould part according to claim 3, wherein the plunger platen is generally rectangular in plan, there being two racks at each corner, each facing outwardly perpendicular to a respective one of the sides of the platen which meet at that corner, and the racks at opposite edges of each side meshing with respective ones of two pinions which are fixed on a common axle so that they rotate together.
5. A gang-pot mould having a lower mould part according to any one of the preceding claims.
6. A gang-pot mould, substantially described with reference to the accompanying drawings.
-