

Method and installation for encasing articles

The invention relates to a method according to Claim 1.

5 A method of this type is disclosed in the 'Patent Abstracts of Japan', vol. 13, no. 44 (E-710), 31 January 1989. In this publication the use of an elongated plunger which has to be moved in a corresponding distribution cavity is described. An elongated tablet is placed in this distribution cavity. The plastic tablet is of a particular size and it is therefore also necessary to produce this
10 tablet as a special product. The production of such elongated tablets is relatively complex and differs from the production of standard tablets. In this context reference is made to European Patent Application 0 370 564. The tablet is fed from above, i.e. in a direction parallel to the direction of movement of the plunger, in
15 a manner which is not indicated in more detail. With this procedure, the problem arises that it is necessary accurately to determine the amount of plastic for each injection. After all, the amount of plastic must be metered depending on the size of the injected casing.

20 If a large number of different sizes of casing are used in a factory, this implies that a large diversity of tablets is required.

In order to solve this problem, the largest possible casing is often taken as the starting point. This means that if smaller
25 casings are used a large amount of waste is produced. Frequently, the amount of waste will be greater than the amount of material used for the casing. Because these materials are frequently thermosetting plastics, there is no simple way of re-using them. If the tablets are to be fed through an opening in the plunger sleeve
30 when said opening is exposed by the plunger, a relatively long stroke of the plunger is required. This leads to complications because, at least in the final phase of this so-called transfer movement, the plunger has to transmit a very high force in order to inject the plastic.

35 Because of the presence of the opening or the movement of the plunger completely outside the plunger sleeve, an appreciable temperature difference arises between the plunger and the plunger sleeve. Because the plunger is colder, problems arise in liquefying

the tablets.

A further disadvantage is that if a machine is operated with various moulds where, for example, a larger or smaller number of injections is necessary, the plunger block together with the mould
5 must be interchanged.

US Patent 4 983 110 discloses a mould which has an elongated distribution cavity and rows of mould cavities located on either side. There is at least one further row of mould cavities behind each row of mould cavities. Fluid plastic originating from the
10 distribution cavity must be transported from the first row to the second row in order to encase the articles located therein. A construction of this type is found to be inadequate in practice and leads to metering difficulties and/or errors in encasing.

It is stated in this patent that one or more tablets can be
15 placed in the elongated mould cavity.

In the 'Patent Abstracts of Japan', vol. 16, no. 57, March 1990, a method and installation are disclosed for injecting into rows of mould cavities located opposite one another from an elongated distribution cavity. A single rectangular plunger is used for
20 this purpose.

In the 'Patent Abstracts of Japan', vol. 9, no. 226, a distribution cavity located between two rows of mould cavities is described, the plastic tablets being fed into the distribution cavity in a direction perpendicular to the plunger and perpendicular to the distribution cavity. It can immediately be seen from the
25 drawing that the tablets are present in the mould assembly for a relatively long period, which leads to warming of said tablets and the onset of the hardening reaction. This leads to substantial problems if a malfunction occurs in the installation. The tablets
30 will then be exposed to this heat for a prolonged period while the installation is stationary, and it is necessary to clean the entire installation.

The aim of the present invention is to avoid the disadvantages described above and to provide a method with which the feed
35 of the tablets is optimised, that is to say the tablets remain outside the heated environment of the mould as much as possible and for as long as possible.

This aim is achieved in the case of the method described

above by means of the characterising measures of Claim 1.

By feeding the tablet or tablets in a direction which is essentially parallel to the longitudinal centre line of the distribution cavity, said tablet(s) will be exposed to the sphere of influence of the mould halves for a short time only. By making the feed of the tablets independent of the plunger movement, the transfer stroke of the plunger can be shortened. Moreover, the transport path of the tablet feed no longer interferes with the movement of the plunger, with the result that it is possible to work more rapidly and with less risk of malfunction.

According to an advantageous embodiment of the invention, the tablets are introduced one after another horizontally into the distribution cavity. In this way it is possible to match the number of tablets to the amount of plastic which is required for the injection. That is to say, if a small amount of plastic is required, the tablets can be introduced some distance apart. With this arrangement, tablets of the same dimensions can always be used, irrespective of whether a large or a small amount is injected. As a result of the use of "universal" tablets, the logistics of the production process can be appreciably simplified, whilst, by varying the spacing between the tablets, the amount of plastic waste can be limited.

This implies that the length/diameter ratio of such tablets is preferably between 1.0 and 2.5.

The tablets are preferably fed via the side of the preferably closed mould, the plunger being in the opened position. This implies that the feed path is executed completely separately from the plunger movement.

With the method described above, it is possible continuously to hold the plunger of the plunger means and the plunger sleeve in continuous engagement with one another, so that optimum heat transfer takes place. Since, according to the invention, the tablets can now be fed horizontally, there is a larger surface which is in contact with the distribution cavity, as a result of which heat transfer can take place more rapidly. As a result of the higher temperature of the plunger, rapid liquefaction of the tablets is also promoted, as a result of which there is an improvement in the overall quality of the casing.

The invention also relates to an installation for encasing various 'lead frames' which are provided with integrated circuits and arranged in two mould cavities of a mould which are located opposite one another, comprising a divisible mould having an elongated distribution cavity arranged between the rows of mould cavities located opposite one another, wherein one of the mould parts is provided with a receptacle for plunger means, which plunger means are equipped for forcing out the plastic which is supplied in tablet form, brought into the distribution cavity and rendered liquid, wherein feed means for the plastic material in tablet form are provided, wherein the feed means for plastic material in tablet form are arranged alongside the plunger means and equipped for placing the plastic material in tablet form directly into the distribution cavity along a path essentially parallel to the longitudinal centre line of the distribution cavity, and wherein the distribution cavity contains an elongated channel extending in the feed direction of the tablets.

If, for certain applications, the tablets have to be placed a certain distance apart, it is possible to fit an insert in the channel, which insert has constrictions such that the parts of the channel located between the tablets have a relatively small cross-sectional surface area.

With the construction according to the invention, it is possible to construct the plunger means such that they are optimum for the sole remaining task, i.e. forcing out the plastic. Because it is no longer necessary to take account of transport of the tablets effected by the plunger means by take-up of the plunger, it is possible to construct the plunger means with a plunger of elongated shape. That is to say, instead of a number of circular plungers located alongside one another, as is known from the prior art, a single elongated plunger which can be driven by one or more plunger rods can suffice. A plunger of this type is preferably of rectangular construction. The consequence of the use of an elongated plunger, i.e. a plunger which extends over essentially the entire surface of the distribution channel, is that it is no longer necessary to change the plunger means when changing the mould for a mould which has a larger or smaller number of mould cavities. Only if the plunger sleeve is connected to the mould to be changed is it

necessary to change said plunger sleeve, but said plunger sleeve can be a universal article which has the same dimensions for all moulds.

5 The installation according to the invention can be employed both for pilot (manual) use and for large-scale use.

Further advantageous embodiments of the invention can be seen from the sub-claims.

10 The invention will be explained in more detail below with reference to an illustrative embodiment shown in the drawings. In the drawings:

Fig. 1 shows, diagrammatically, a perspective and partially exposed view of part of the installation according to the invention in the open state;

15 Fig. 2 shows a cross-section of the installation according to the invention in the closed state, and

Fig. 3 shows a different embodiment of the distribution channel according to the invention.

20 In Figs. 1 and 2 the frame to which a lower mould 2 is movably attached is indicated by 1. The upper mould 3 is firmly fixed to the frame 1. The drive for lower mould 2 is not shown in more detail and this drive is generally known from the prior art.

25 Mould cavities 10 for accommodating an integrated circuit 15, shown diagrammatically, and for injection of plastic around said integrated circuit are arranged in both the upper mould 3 and the lower mould 2. Such plastic is fed through injection channel 11, which, in turn, is connected to distribution channel 8. Plunger sleeve 5, in which a rectangular plunger 6 can move upwards and downwards driven by plunger rods 7, is located above distribution channel 8. Part of plunger sleeve 5 is arranged in upper block 4, 30 which is also provided with heating means, which are not shown. Plunger 6 is provided with peripheral grooves 9, which during operation will become filled with plastic and provide a seal. The remainder of plunger sleeve 5 is arranged in upper mould 3.

35 The tablets 9 are introduced into distribution channel 8, with the aid of device 16, through a lateral opening 20 made in the upper mould 3. This device 16 comes into operation when upper mould 3 and lower mould 2 are closed with respect to one another. The device consists of a support 12, on which an elongated spoon 13 is

arranged. A number of tablets are arranged on said spoon 13, by hand or automatically. While it is carrying the tablets, spoon 13 is then moved inwards, i.e. to the left in the drawing. At the same time as this movement is made, pin 14 executes the same movement.

5 After spoon 13 has moved accurately above the position furthest to the left in Fig. 1 for placing a pellet above the distribution channel 8, spoon 13 is retracted whilst the position of pin 14 is maintained. As a result, the pellet furthest to the left drops into distribution channel 8. By further retraction of spoon 13, optionally in combination with retraction of pin 14, tablets 9 can be placed in position. These tablets can be arranged lying against one another, as shown in Fig 1, but it is also possible to introduce these tablets some distance apart. Plunger 6 has no influence whatsoever on the introduction of the tablets. Plunger 6 can now be moved downwards. In the meantime, heat transfer has taken place between the tablets 9, which are lying with a relatively large surface area in contact with the distribution channel 8, and the lower mould 2. Plunger 6 then has to execute a relatively small stroke in order to reach the tablets and to distribute the plastic material, which has liquefied as a result of the influence of pressure and temperature, in mould cavities 10. Because plunger 6 remains continuously in contact with plunger sleeve 5, optimum heat transfer can take place. In the embodiment according to the drawing, operation of plunger 6 is effected by means of jacks.

25 If a product subsequently has to be encased for which a smaller amount of plastic is needed, it is necessary only to replace lower mould 2 and upper mould 3 with the new, appropriate mould cavities. In general, universal sleeve 5 will then likewise be replaced, because said sleeve forms part of the upper mould, but plunger 6, which is likewise universal for every application, does not need to be replaced.

If a smaller amount of plastic is needed, it is then possible to use a smaller number of tablets 9. These tablets can be arranged a small distance apart.

35 In this case, the empty space between the tablets can be reduced by providing the distribution channel 8 with constrictions 18 (see Fig 3).

Although the invention has been described above with refer-

ence to a preferred embodiment, it must be understood that numerous modifications can be made thereto without going outside the basic concept of the present invention. For instance, it is possible to arrange the upper mould so that it is movable. In the case of such

5 a so-called 'bottom transfer', the plunger and plunger sleeve remain assembled and the tablets have to be introduced into the plunger pot from above when the mould is open. The essential characteristic of the invention is that the tablets are processed horizontally instead of vertically. This means that the pellets are

10 pre-heated horizontally.



Claims

1. Method for encasing various 'lead frames' which are provided with integrated circuits and arranged in two mould cavities of a mould which are located opposite one another, by melting a plastic material in an elongated distribution cavity located between said rows and moving the molten material from the distribution cavity to the mould cavity using a single plunger, wherein the plastic material is supplied in tablet form, characterised in that each plastic tablet is fed along a path which is essentially perpendicular to the direction of movement of the plunger and essentially parallel to the longitudinal centre line of the mould cavity.

2. Method according to Claim 1, wherein the feeding of the plastic material into the distribution cavity comprises placing various tablets one after the other.

3. Method according to Claim 2, wherein the free spaces between the tablets can be filled using auxiliary means.

4. Method according to one of the preceding claims, wherein the tablets are standard cylindrical tablets having a length/diameter ratio between 1.0 and 2.5.

5. Method according to one of the preceding claims, wherein the mould comprises a divisible mould.

6. Method according to one of the preceding claims, wherein the plunger means comprise at least one plunger and a plunger sleeve and said plunger and plunger sleeve are held continuously in engagement with one another.

7. Installation for encasing various 'lead frames' which are provided with integrated circuits and arranged in two mould cavities of a mould which are located opposite one another, comprising a divisible mould having an elongated distribution cavity (8) arranged between the rows of mould cavities located opposite one another, wherein one of the mould parts is provided with a receptacle for plunger means (5-7), which plunger means are equipped for forcing out the plastic which is supplied in tablet form, brought into in the distribution cavity and rendered liquid, wherein feed means (16) for the plastic material in tablet form are provided, characterised in that the feed means (16) for plastic material in tablet form are arranged alongside the plunger means and equipped



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for placing the plastic material in tablet form directly into the distribution cavity along a path essentially parallel to the longitudinal centre line of the distribution cavity, wherein the distribution cavity contains an elongated channel (8) extending in the feed direction of the tablets.

8. Installation according to Claim 7, wherein the channel or the distribution cavity contains constrictions (18).

9. Installation according to Claim 7 or 8, wherein the plunger means comprise an elongated plunger (6), which is driven by at least one plunger rod (7), arranged in a plunger sleeve (5).

10. Installation according to one of the preceding claims, wherein the feed means (16) are equipped for placing various tablets in the mould cavity (8) in a single operation.

11. Installation according to one of Claims 8-10, wherein the plunger means are arranged in the machine part (4) in the vicinity of the relevant mould part.

12. Installation according to one of Claims 8-11, wherein the plunger means comprise an elongated sleeve (5) for accommodating the plunger, wherein the plunger is always in contact, over its entire periphery, with the plunger sleeve (5) in every position.

13. Installation according to one of Claims 8-12, wherein the plunger sleeve is detachably fixed to the relevant mould part.

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