

TITLE OF THE INVENTION

Method of and Apparatus for Molding Resin to Seal
Electronic Parts

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a method of and an
apparatus for molding resin to seal electronic parts, for
sealing electronic parts such as ICs, LSIs, diodes or
capacitors which are mounted on lead frames with a resin
10 material.

Description of the Background Art

In general, electronic parts are sealed with molded
resin by transfer molding, through a resin molding/sealing
apparatus having the following basic structure:

15 Such a resin molding/sealing apparatus comprises a
mold having fixed and movable mold sections which are
opposed to each other, resin material supply pots which
are arranged in the mold, plungers which are mounted on
the pots for pressurizing resin, cavities which are
20 provided in mold surfaces of the fixed and movable mold
sections respectively to face each other, and resin
passages provided between the pots and the cavities.

Resin tablets are supplied in the pots while
electronic parts which are mounted on lead frames are
25 supplied and set in prescribed positions of the cavities,

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REPLACED SHEETS		SG
☒	Description : paged 1... to paged	35
☒	Claim(s) : paged 36 to paged	47
☒	Drawing(s) : paged 1 to paged	7
☐	Abstract : paged 48 to paged	—

and the mold is closed. The resin tablets provided in the pots are heated and pressurized so that the resin materials melted in the pots are injected and charged into the cavities provided on side positions of the pots through the resin passages respectively. Thus, the resin is molded to seal the electronic parts engaged in the cavities respectively.

When a mold for mass production is employed for the aforementioned apparatus, this leads to the following problems:

For example, the mold, which is inevitably increased in weight and size, is hard to handle while it is difficult to maintain the mold in uniform working accuracy. Thus, portions of the mold differ in resin molding conditions from each other. Particularly in manufacturing of products such as electronic parts to be sealed with molded resin with requirement for high quality and high reliability, the cavities may be partially charged with no resin, or voids or defective parts may be formed in the interior and the exterior of the compacts as sealed due to such difference in resin molding/sealing conditions, to extremely reduce the quality of the products. In order to maintain the mold in uniform accuracy, further, the mold and the apparatus are increased in cost.



Further, resin flashes adhere to the mold surfaces in such a large quantity that the overall molding time is increased since it takes time to remove the resin flashes, leading to extreme reduction of productivity.

5 In addition, a mold for mass production which is to be mounted on the aforementioned conventional apparatus is inevitably restricted in size and production quantity since it is necessary to also take the size of a mold closing mechanism or the like into consideration in this
10 case.

 The mold provided in the aforementioned conventional apparatus is generally adapted to simultaneously mold the same type of compacts. In order to mold different types of compacts, therefore, it is necessary to exchange the
15 mold which is mounted on the molding apparatus itself. In order to simultaneously mold different types of compacts by the same molding apparatus, further, it is necessary to change the layout of the mold itself or to simultaneously mount different types of molds on the apparatus.

20 When the mold which is mounted on the molding apparatus itself is frequently changed for molding different types of compacts, however, the mold exchange operation is troublesome and reduces productivity. When the layout of the mold which is mounted on the molding
25 apparatus itself is changed to be capable of



simultaneously molding different types of compacts, the design of the mold is complicated and the usage of the mold is restricted to the layout, leading to inferiority in generality and increase in cost for the mold and the
5 molding apparatus.

When a plurality of molds of different types are simultaneously mounted on the molding apparatus, the molds themselves must be miniaturized due to restriction of spaces for receiving the same, leading to complicated
10 design of the molds and reduction in productivity. If a plurality of molding apparatuses are employed independently of each other in correspondence to the number of different types of compacts for solving this problem, for example, the cost for the production
15 equipment is disadvantageously increased.

In a conventional method of molding resin to seal electronic parts, on the other hand, an unsealed lead frame supplying step of supplying unsealed lead frames into prescribed positions of cavities provided in a mold,
20 a resin tablet supplying step of supplying resin tablets into pots provided in the mold, a sealed lead frame takeout step of taking out the sealed lead frames from the mold to the exterior, and a mold surface cleaning step of cleaning mold surfaces of the mold after resin
25 molding/sealing are generally successively carried out



independently of each other.

In such a conventional method of molding resin to seal electronic parts, therefore, the overall molding time is so increased that productivity is extremely reduced.

5 SUMMARY OF THE INVENTION

An object of the present invention is to provide a method of and an apparatus for molding resin to seal electronic parts, which can simply cope with production of electronic parts to be sealed with molded resin in small
10 and large quantities, for molding products in high quality and high reliability with neither voids nor defective parts formed in the interior and the exterior of the compacts as sealed.

Another object of the present invention is to provide
15 a method of and an apparatus for molding resin to seal electronic parts, which can simply cope with simultaneous production of different types of compacts for molding the products in high quality and high reliability.

Still another object of the present invention is to
20 provide a method of molding resin to seal electronic parts which can produce sealed compacts of electronic parts in high efficiency by reducing the overall time for molding resin to seal the electronic parts.

In order to attain the aforementioned objects, a
25 method of molding resin to seal electronic parts according



to a first aspect of the present invention is adapted to seal electronic parts which are mounted on lead frames with a molded resin material through molding units each having a mold, resin supply pots which are arranged in the mold, resin pressurizing plungers which are provided on the pots, cavities which are provided in mold surfaces of the mold, and resin passages provided between the cavities and the pots. According to this method, the number of the molding units is adjusted by detachably mounting an additional molding unit with respect to that already provided on an apparatus for molding resin to seal electronic parts. Thereafter unsealed lead frames having electronic parts mounted thereon and resin tablets are supplied to each molding unit. Then, the electronic parts are sealed with molded resin through each molding unit, and taken out from the same to the exterior.

According to this method, it is possible to utilize the unit as that having minimum forming units for molding resin to seal electronic parts, while it is also possible to utilize the same as that having a plurality of forming units by simple means of detachably combining an additional molding unit with the minimum forming units.

Therefore, it is possible to simply form an apparatus for molding resin to seal electronic parts which is responsive to mass production without increasing the mold



itself in size. Further, it is also possible to simply form an apparatus for molding resin to seal electronic parts which can cope with small production without increasing the mold itself in size since the additional
5 molding unit can be properly detached.

Namely, it is possible to arbitrarily and simply adjust the number of the molding units provided on the molding apparatus in response to the production quantity as required. Thus, it is possible to readily cope with
10 small production and mass production at need for molding resin to seal electronic parts.

According to this method, further, it is possible to simply form an apparatus for molding resin to seal electronic parts which is responsive to mass production
15 without increasing the mold itself in size, whereby products having high quality and high reliability can be produced in high efficiency with neither voids nor defective parts formed in the interior and the exterior of sealed compacts of electronic parts.

20 In a preferred embodiment, respective steps of the method of molding resin to seal electronic parts according to the first aspect of the present invention are carried out as follows:

In a step of supplying unsealed lead frames having
25 electronic parts mounted thereon and resin tablets to each



molding unit, a number of unsealed lead frames having electronic parts mounted thereon are supplied to and set in prescribed positions of a lead frame supply unit and thereafter transferred to a lead frame aligning unit to be
5 aligned with each other along a prescribed direction. After a prescribed number of resin tablets are supplied into a resin tablet discharge unit and aligned with each other, the unsealed lead frames and the resin tablets are transferred to a clearance between fixed and movable mold
10 sections provided in the molding unit, so that the unsealed lead frames and the resin tablets are supplied in prescribed positions of cavities and pots provided in the molding unit respectively.

In a step of molding resin to seal the electronic
15 parts, the fixed and movable mold sections are closed while the resin tablets provided in the pots are heated and pressurized to be melted so that molten resin materials are injected into and charged in the cavities through resin passages, to be molded for sealing the
20 electronic parts which are engaged in the cavities.

In a step of taking out the sealed electronic parts from each molding unit to the exterior, the lead frames sealed through the aforementioned molding/sealing step are taken out from the fixed and movable mold sections to the
25 exterior, while mold surfaces of the fixed and movable

mold sections are cleaned. Thereafter the sealed lead frames are transferred to a position of a degating unit, so that gate portions are removed from the same.

Thereafter the sealed lead frames are transferred to a lead frame storage unit, to be picked up independently of each other and stored in the storage unit.

In a more preferred embodiment of the method of molding resin to seal electronic parts according to the first aspect of the present invention, the already provided molding unit and another molding unit are adapted to mold resin for sealing different types of electronic parts, so that different types of products are simultaneously sealed with molded resin in parallel with each other through these molding units.

According to this method, it is possible to couple molding units with each other in response to the number of different types of products, for simultaneously sealing the respective types of products in parallel with each other. Thus, it is possible to efficiently cope with mass production of a number of types of electronic parts.

A method of molding resin to seal electronic parts according to a second aspect of the present invention comprises a step of supplying unsealed lead frames, a step of supplying resin tablets, a step of closing upper and lower mold sections, a step of molding resin to seal the



electronic parts, and a step of taking out the sealed lead frames, as well as a step of cleaning respective mold surfaces of the upper and lower mold sections. The feature of this method resides in that the steps of
5 cleaning the mold surfaces, supplying unsealed lead frames and supplying the resin tablets are simultaneously carried out in parallel with the step of taking out the sealed lead frames.

According to this method, the step of cleaning the
10 mold surfaces is carried out with the step of taking out the sealed lead frames, while the steps of supplying unsealed lead frames and the resin tablets are also carried out at the same time. Thus, it is possible to carry out the steps of taking out the sealed lead frames
15 and cleaning the mold surfaces in parallel with each other, while it is also possible to carry out the steps of supplying unsealed lead frames to be subsequently sealed and supplying the resin tablets in parallel with each other. Consequently, a waiting time for successive
20 operations for molding resin to seal electronic parts is reduced, whereby it is possible to reduce the overall molding time.

In a preferred embodiment of the method of molding resin to seal electronic parts according to the second
25 aspect of the present invention, respective steps are



carried out as follows: In a step of taking out sealed lead frames, an unloader unit is advanced into a clearance between upper and lower mold sections to engage with the sealed lead frames, and then retracted in this state to
5 take out the sealed lead frames to the exterior of the upper and lower mold sections.

In a step of supplying unsealed lead frames, on the other hand, a loader unit is advanced into the clearance between the upper and lower mold sections in retraction of
10 the unloader unit, to supply unsealed lead frames into prescribed positions of cavities provided in the upper and lower mold sections.

In a step of supplying resin tablets, the loader unit is advanced into the clearance between the upper and lower
15 mold sections in retraction of the unloader unit, to supply the resin tablets into pots. In a step of cleaning mold surfaces, a cleaner unit is moved along the clearance between the upper and lower mold sections, to clean the mold surfaces thereof.

20 According to this method, it is also possible to carry out the steps of supplying unsealed lead frames and the resin tablets simultaneously with the advancement of the loader unit into the clearance between the upper and lower mold sections.

25 It is also possible to carry out the step of cleaning



the mold surfaces with the cleaner unit in the retraction of the unloader unit.

Further, the step of cleaning the mold surfaces may be simultaneously carried out in parallel with the step of taking out the sealed lead frames.

The step of cleaning the mold surfaces may be carried out by retracting the cleaner unit which is mounted on the unloader unit with the same in retraction of the unloader unit in the step of taking out the sealed lead frames.

10 An apparatus for implementing the method of molding resin to seal electronic parts according to the first aspect of the present invention comprises a molding unit, a mechanism for supplying unsealed lead frames having electronic parts mounted thereon and resin tablets to the molding unit, and a mechanism for taking out the electronic parts as sealed from the molding unit to the exterior. The feature of this apparatus resides in that another molding unit can be detachably mounted with respect to the already provided molding unit, so that the number of the molding units can be increased/decreased.

20 An apparatus for implementing the method of molding resin to seal electronic parts according to the second aspect of the present invention comprises a molding unit, an unsealed lead frame supply mechanism, a resin tablet supply mechanism, a mold closing mechanism and a mechanism



for taking out sealed lead frames as well as a mold surface cleaning mechanism for cleaning respective mold surfaces of a mold. The resin tablet supply mechanism is formed to interlock with the mechanism for taking out
5 sealed lead frames, so that unsealed lead frames can be supplied simultaneously with the operation for taking out sealed lead frames.

The foregoing and other objects, features, aspects and advantages of the present invention will become more
10 apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A and 1B are a schematic plan view and a
15 schematic front elevational view of an apparatus for molding resin to seal electronic parts according to the present invention, showing a combination of minimum forming units for molding resin to seal electronic parts;

Fig. 2 is a schematic plan view showing the apparatus
20 for molding resin to seal electronic parts shown in Figs. 1A to 1B, in combination with an additional molding unit;

Fig. 3 is a schematic front elevational view of the apparatus for molding resin to seal electronic parts corresponding to Fig. 2;

25 Fig. 4 is a schematic plan view showing the apparatus



for molding resin to seal electronic parts shown in Figs. 1A to 1B, in combination with a plurality of additional molding units;

Fig. 5 is a schematic side elevational view of the apparatus for molding resin to seal electronic parts corresponding to Figs. 1A and 1B;

Figs. 6A to 6D illustrate steps of taking out sealed lead frames and storing the same in stock magazines; and

Fig. 7 is a schematic plan view showing a coupling portion between the apparatus for molding resin to seal electronic parts shown in Figs. 1A to 1B and another molding unit, and engaging means in the coupling portion between the molding units.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention is now described with reference to the drawings.

Referring to Figs. 1A and 1B, an apparatus for molding resin to seal electronic parts according to an embodiment of the present invention comprises a lead frame supply unit 1 for supplying unsealed lead frames having electronic parts mounted thereon, a lead frame aligning unit 2 for aligning the unsealed lead frames with each other along a prescribed direction, a resin tablet supply unit 3 for supplying resin tablets, a resin tablet discharge unit 4 for aligning the resin tablets with each



other and discharging the same, a molding unit 5 for molding resin to seal the electronic parts, a loader unit 6 for transferring the lead frames and the resin tablets which are aligned with each other to the molding unit 5, an unloader unit 7 for taking out the lead frames as sealed, a cleaner unit 8 for a mold, a transfer unit 9 for transferring the sealed lead frames, a degating unit 10 for removing gates from the sealed lead frames, a pickup unit 11 for picking up the sealed lead frames as degated independently of each other, a lead frame storage unit 12 for storing the degated sealed lead frames in respective magazines independently of each other, and a controller unit 13 for continuously and automatically controlling the operations of the aforementioned units.

The aforementioned lead frame supply unit 1 is provided with a set portion 16 for an in-magazine 15 storing a plurality of unsealed lead frames 14 having electronic parts mounted thereon, and a proper pusher mechanism 17 for transferring the unsealed lead frames 14 from the in-magazine 15 to the lead frame aligning unit 2 independently of each other.

The lead frame aligning unit 2 is provided with a proper aligning mechanism 18 for aligning the unsealed lead frames 14 which are received from the lead frame supply unit 1 with each other along a prescribed



direction.

While two unsealed lead frames 14 are aligned in parallel with each other and an inverting/aligning mechanism is provided for inverting one of the unsealed
5 lead frames 14 in response to a mold layout structure in the molding unit 5 in Figs. 1A and 1B, it is not necessary to invert any unsealed lead frame when the mold layout is adapted to supply a single unsealed lead frame 14.

The resin tablet supply unit 3 is provided with resin
10 tablet supply members 19 in a number corresponding to that of pots provided in the molding unit 5.

The resin tablet supply members 19 are arranged in a mode corresponding to the number of the pots provided in the molding unit 5 and intervals therebetween, and
15 integrally stored in a required resin tablet cassette 20, in consideration of convenience in handling.

The resin tablet supply members 19 can be appropriately replaced by proper ones when the mold layout is changed in the molding unit 5, in response to the
20 number of new pots and intervals therebetween.

As shown in Fig. 3, the resin tablet discharge unit 4 is provided with a proper pusher mechanism 22 for discharging the resin tablets 21, which are stored in the resin tablet supply members 19 provided in the resin
25 tablet supply unit 3, in states aligned with each other.



The molding unit 5 is provided with a fixed plate 25 which is fixed to an upper part of an apparatus body 23 through tie-bars 24, a fixed upper mold section 26 which is mounted on the fixed plate 25, a movable lower mold section 28 which is oppositely arranged under the fixed upper mold section 26 to be vertically driven by a required mold switching mechanism 27, and a plurality of (seven in Fig. 1A) pots 29 which are arranged on the movable lower mold section 27.

Further, plungers are engaged in the respective pots 29 for pressurizing the resin tablets 21 and heating means such as heaters are provided on the upper and lower mold sections 26 and 28, while required numbers of resin molding cavities are oppositely provided in mold surfaces of the upper and lower mold sections 26 and 28 and resin passages (not shown) are provided between the pots 29 and the cavities.

When the upper and lower mold sections 26 and 28 are closed and the resin tablets 21 provided in the respective pots 29 are heated and pressurized, therefore, molten resin materials can be injected/charged into the respective cavities through the resin passages.

The loader unit 6 is provided with a loader 30 for simultaneously transferring two unsealed lead frames 14 which are aligned with each other by the lead frame



aligning unit 2 and a plurality of (seven in Fig. 1A) resin tablets 21 which are aligned with each other and discharged by the resin tablet discharge unit 4 toward the molding unit 5.

5 The loader 30 is adapted to reciprocate between positions of the lead frame aligning unit 2 and the molding unit 5, for picking up two unsealed lead frames 14 through a proper mechanism (not shown) while picking up the respective resin tablets 21 discharged by the resin
10 tablet discharge unit 4 by a proper mechanism (not shown) in the position of the lead frame aligning unit 2 (see Fig. 3).

 At this time, two unsealed lead frames 14 and the respective resin tablets 21 are picked up by the loader 30
15 in the same mode as a mold layout in the molding unit 5. Thus, it is possible to supply two unsealed lead frames 14 and the respective resin tablets 21 into prescribed positions of the cavities and the pots 29 respectively by transferring the same to portions above the movable lower
20 mold section 28 of the molding unit 5 and relieving the same from the picked-up states.

 While it is possible to advantageously simplify the overall structure of the apparatus and to reduce the overall molding time since the loader 30 simultaneously
25 transfers the unsealed lead frames 14 and the respective



resin tablets 21, mechanisms for transferring the lead frames 14 and the resin tablets 21 may alternatively be provided independently of each other so that these transfer mechanisms are driven independently of each other.

The unloader unit 7 is provided with an unloader 31 for taking out the lead frames 14 which are sealed with molded resin in the molding unit 5 to the exterior of the upper and lower mold sections 26 and 28.

This unloader 31 is adapted to reciprocate with respect to the position of the molding unit 5, to be capable of taking out two sealed lead frames 14 and a gate portion integrated therebetween to the exterior in a state simultaneously picked up by a proper mechanism (not shown).

The cleaner unit 8 is provided with an air blow mechanism for blowing air to the mold surfaces of the upper and lower mold sections 26 and 28 provided in the molding unit 5 and a vacuum mechanism (not shown) for sucking dust away from the mold surfaces.

Further, the cleaner unit 8 is integrated with the unloader 31 of the unloader unit 7. Thus, the cleaner unit 8 is adapted to simultaneously reciprocate with the unloader unit 7 with respect to the position of the molding unit 5.



Further, the cleaner unit 8 is driven when the unloader unit 7 picking up the sealed lead frames 14 is retracted to the exterior, for example, to suck dust away from the mold surfaces by the actions of the air blow and vacuum mechanisms and store the same in a proper dust collection part 32. Thus, it is possible to simply and efficiently clean the mold surfaces in advance to next resin molding.

While it is possible to simplify the overall structure of the apparatus and to reduce the overall molding time due to the integrated structure of the unloader unit 7 and the cleaner unit 8, these units 7 and 8 may alternatively be formed independently of each other to be driven independently of each other.

Further, the cleaner unit 8 may be provided with a brush member for forcibly separating resin flashes adhering to the mold surfaces and an excitation mechanism therefor, for example.

As shown in Figs. 6A, 6B and 6D, the aforementioned transfer unit 9 for the sealed lead frames 14 is provided with a proper pallet 33 which reciprocates to transfer the sealed lead frames 14 taken out by the unloader unit 7 to positions of the degating unit 10 and the lead frame storage unit 12.

As shown in Fig. 6B, the degating unit 10 is provided



with a gate breaking mechanism 34 for removing the gate portion defined between the sealed lead frames 14 which are transferred by the pallet 33 of the transfer unit 9. This gate breaking mechanism 34 is adapted to pick up two
5 sealed lead frames 14 which are coupled/integrated with each other through a gate portion 35 as shown in Fig. 1A, for example, through a proper mechanism (not shown) and to pressurize the gate portion 35 defined between the lead frames 14 in this state for cutting/removing the same.

10 As shown in Figs. 6C and 6D, further, the pickup unit 11 is provided with a pickup mechanism 36 for picking up two sealed lead frames 14 which are transferred from the degating unit 10 through the pallet 33 of the transfer unit 9 independently of each other.

15 This pickup mechanism 36 can pick up two sealed lead frames 14 transferred by the pallet 33 of the transfer unit 9 independently of each other, as shown in Fig. 6C.

The lead frame storage unit 12 is provided with stock magazines 37 capable of storing two sealed lead frames 14
20 which are independently picked up through the pickup mechanism 36 of the pickup unit 11 independently of each other.

The two sealed lead frames 14 which are picked up by the pickup mechanism 36 of the pickup unit 11
25 independently of each other are relieved from the pickup



mechanism 36 when the pallet 33 of the transfer unit 9 is retracted to its original position so that the same can be stored in the prescribed stock magazines 37 provided under the same independently of each other, as shown in Fig. 6D.

5 The controller unit 13 is adapted to continuously and automatically control the operations of the aforementioned units, for molding resin to seal the electronic parts in the following manner, for example:

10 Two unsealed lead frames 14 provided in the in-magazine 15 of the lead frame supply unit 1 are transferred by the pusher mechanism 17 toward the lead frame aligning unit 2 independently of each other.

15 Then, the two unsealed lead frames 14 are aligned with each other along the prescribed direction by the aligning mechanism 18 of the lead frame aligning unit 2.

20 Following or in parallel with the aforementioned steps of transferring the two unsealed lead frames 14 and aligning the same with each other, the seven resin tablets 21 are aligned with each other and discharged by the resin tablet supply unit 3 and the resin tablet discharge unit

4.

25 Then, the two unsealed lead frames 14 provided in the lead frame aligning unit 2 and the seven resin tablets 21 provided in the resin tablet supply unit 3 are transferred to a clearance between the upper and lower mold sections



26 and 28 of the molding unit 5 through the loader 30 of the loader unit 6, and the same are relieved from the loader 30 so that the unsealed lead frames 14 are supplied into prescribed positions of the cavities provided in the movable lower mold section 28 while the respective resin tablets 21 are supplied into the pots 29.

Then, the upper and lower mold sections 26 and 28 are closed by the mold switching mechanism 27 while the resin tablets 21 received in the pots 29 are heated and pressurized to be melted so that molten resin materials are injected/charged into the cavities through the resin passages respectively, for sealing the electronic parts engaged in the cavities respectively.

Then, the lead frames 14 as sealed are taken out from the upper and lower mold sections 26 and 28 of the molding unit 5 to the exterior through the unloader 31 of the unloader unit 7, while the mold surfaces of the upper and lower mold sections 26 and 28 are cleaned by the air blow and vacuum mechanisms of the cleaner unit 8 in retraction of the unloader 31 so that dust is sucked away from the mold surfaces.

Then, the sealed lead frames 14 which are taken out by the unloader unit 7 are transferred to the position of the degating unit 10 through the pallet 33 of the transfer unit 9.



Then, the gate portion 35 between the sealed lead frames 14 is cut and removed through the gate breaking mechanism 34 of the degating unit 10.

5 Then, the two sealed lead frames 14 separated from each other by removal of the gate portion 35 are transferred to the position of the lead frame storage unit 12 through the pallet 33 of the transfer unit 9.

10 Then, the two sealed lead frames 14 which are separated from each other are picked up independently of each other through the pickup mechanism 36 of the pickup unit 11.

15 Then, the pallet 33 of the transfer unit 9 is retracted and the two sealed lead frames 14 are relieved from the pickup mechanism 36 of the pickup unit 11, to be stored in the respective stock magazines 37 independently of each other.

Engaging means 38 is provided on a right end portion of a bottom base 39 of the molding unit 5, to be coupled with another molding unit as described later.

20 As hereinabove described, the apparatus for molding resin to seal electronic parts shown in Figs. 1A and 1B is formed by a combination of minimum forming units for molding resin to seal electronic parts.

25 In this apparatus for molding resin to seal electronic parts, further, the series of steps are



continuously and automatically carried out by the controller unit 13.

Figs. 2 and 3 show the apparatus for molding resin to seal electronic parts formed by the combination of the minimum units shown in Figs. 1A and 1B, which is combined with an additional molding unit 5a having the same function as that of the molding unit 5, and Fig. 4 shows the apparatus which is combined with a plurality of additional molding units 5b and 5c.

The additional molding units 5a, 5b and 5c are identical in structure to the aforementioned molding unit 5, and detachably mountable on a side portion of the molding unit 5 provided in the apparatus for molding resin to seal electronic parts formed by the combination of the minimum units shown in Figs. 1A and 1B.

Therefore, it is possible to form an apparatus for molding resin to seal electronic parts which is responsive to mass production with molds substantially increased in size, by successively mounting the additional molding units 5a, 5b and 5c on the side portion of the molding unit 5 of the apparatus for molding resin to seal electronic parts formed by the combination of the minimum units shown in Figs. 1A and 1B.

Namely, it is possible to arbitrarily and simply adjust the number of molding units provided in the



aforementioned apparatus in response to the production quantity as required. Thus, it is possible to simply cope with production of sealed electronic parts in small and large quantities at need.

5 When the apparatus for molding resin to seal electronic parts is combined with the additional molding units, it is possible to use most of the members provided in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum
10 units shown in Figs. 1A and 1B as such.

Namely, it is possible to substantially use the unsealed lead frame supply unit 1, the lead frame aligning unit 2, the resin tablet supply unit 3, the resin tablet discharge unit 4, the loader unit 6, the unloader unit 7,
15 the cleaner unit 8, the transfer unit 9, the degating unit 10, the pickup unit 11, the lead frame storage unit 12 and the controller unit 13 as such by changing control conditions by the controller unit 13 in response to the number of the molding units as employed.

20 The engaging means 38 is provided between the molding unit 5 of the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B and the additional molding unit 5a which is coupled with or detached from the
25 same, for simply and reliably positioning the molding



units 5 and 5a and coupling the same with each other.

The engaging means 38 may be formed by irregular engaging parts which are formed on bottom bases 39 of the molding units 5 and 5a as shown in Figs. 3 and 7, for example.

In the mode shown in Figs. 2 to 4, the apparatus for molding resin to seal electronic parts is adapted to mold resin for simultaneously sealing the same type of products through steps which are basically identical to those in the mode shown in Figs. 1A and 1B, with addition of the following steps:

In addition to the steps carried out in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units, the same type of products are sealed in the additional molding units 5a, 5b and 5c through a step of transferring unsealed lead frames 14 and resin tablets 21 from the lead frame aligning unit 2 and the resin tablet supply unit 3 to the additional molding units 5a, 5b and 5c while setting the same in prescribed positions with the loader unit 6, a step of molding resin to seal electronic parts by the additional molding units 5a, 5b and 5c, a step of taking out the lead frames 14 as sealed by the unloader unit 7, a step of cleaning the mold surfaces by the cleaner unit 8, a step of transferring the sealed lead frames 14 to the position



of the degating unit 10 by the transfer unit 9, a step of cutting/removing gate portions 35 defined between the sealed lead frames 14 by the degating unit 10, a step of transferring the sealed lead frames 14 as degated to the position of the lead frame storage unit 12 by the transfer unit 9, a step of picking up the sealed lead frames 14 from the position of the lead frame storage unit 12 by the pickup unit 11, and a step of storing the sealed lead frames 14 picked up by the pickup unit 11 in the stock magazines 37.

At this time, most of the members provided in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B are used as such as described above. Therefore, periods for starting steps of molding resin to seal electronic parts in the respective molding units 5, 5a, 5b and 5c may be set at prescribed time intervals.

Also when the molding units 5, 5a, 5b and 5c are different in mold layout from each other in the apparatus for molding resin to seal electronic parts which is provided with the additional molding units 5a, 5b and 5c as shown in Figs. 2 to 4 for molding different types of products in the molding units 5, 5a, 5b and 5c, it is possible to use most of the units provided in the apparatus shown in Figs. 1A and 1B as such.



In this case, the unsealed lead frame supply unit 1 may be provided with in-magazines 15 in a number corresponding to that of the different mold layouts, while the lead frame storage unit 12 may be provided with stock magazines 37 in a number corresponding to that of the in-magazines 15.

When the numbers of the pots 29 provided in the molding units 5, 5a, 5b and 5c and the numbers and shapes of the lead frames 14 are different from each other, the respective units may be provided with functions which are changeable/adjustable in response thereto, in addition to the in-magazines 15 and the stock magazines 37 provided in numbers corresponding to that of the different mold layouts.

For example, the resin tablet supply unit 3, the resin tablet discharge unit 4, the loader unit 6, the unloader unit 7, the degating unit 10 and the pickup unit 11 may be provided with functions which are changeable/adjustable in correspondence to the changes in number of the pots 29 and in number and shape of the lead frames 14.

Alternatively, the additional molding units 5a, 5b and 5c may be provided with dedicated loader units, dedicated unloader units, dedicated degating units and dedicated pickup units respectively.



While the additional molding units 5a, 5b and 5c are identical to the molding unit 5, mold layouts thereof may be different from each other in response to compacts to be formed, for manufacturing different types of compacts in the molding units 5, 5a, 5b and 5c. Further, the additional molding units 5a, 5b and 5c can be detachably mounted on the side portion of the molding unit 5 provided in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B.

Therefore, it is possible to simply form an apparatus for molding resin to seal electronic components substantially comprising a plurality of molds by successively mounting the additional molding units 5a, 5b and 5c on the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units.

On the other hand, it is also possible to form an apparatus for molding resin to seal electronic parts having a substantially small number of mold(s) by successively removing the additional molding units 5a, 5b and 5c or stopping operations thereof.

In other words, the number of the molding units can be arbitrarily and simply adjusted in the aforementioned apparatus in response to the required production quantity,



whereby it is possible to simply and quickly cope with a case of simultaneously manufacturing different types of products in small or large quantities while it is also possible to simply cope with a case of simultaneously manufacturing the same type of products in small or large quantities.

When the apparatus for molding resin to seal electronic parts in the mode shown in Figs. 2 to 4 is adapted to simultaneously form different types of products, steps of forming additional products in the additional molding units 5a, 5b and 5c may be added to the aforementioned steps which are carried out in the apparatus formed by the combination of the minimum units for molding resin to seal electronic parts.

When the aforementioned steps of molding resin to seal electronic parts are continuously and automatically carried out, it is possible to produce sealed compacts of electronic parts in high efficiency while reducing the overall molding time, by carrying out the aforementioned steps of supplying and taking out the respective members and cleaning the mold surfaces in parallel with each other.

In parallel with the unsealed lead frame supplying step of transferring unsealed lead frames 14 into the clearance between the upper and lower mold sections 26 and



28 provided in the molding unit 5 and supplying the
unsealed lead frames 14 into the prescribed positions of
the cavities provided in the upper and lower mold sections
26 and 28, the resin tablet supplying step of transferring
5 the resin tablets 21 into the clearance between the upper
and lower mold sections 26 and 28 provided in the molding
unit 5 and supplying the same into the pots 29 provided in
the lower mold section 28 so that these steps can be
carried out substantially in a single step time, whereby
10 the overall molding time is reduced.

Further, it is possible to reduce the overall molding
time by simultaneously carrying out the sealed lead frame
takeout step of advancing the unloader unit 7 into the
clearance between the upper and lower mold sections 26 and
15 28, engaging the sealed lead frames 14 and retracting the
unloader unit 7 in this state for taking out the sealed
lead frames 14 to the exterior of the upper and lower mold
sections 26 and 28 with the step of cleaning the mold
surfaces of the upper and lower mold sections 26 and 28.

20 In this case, the mold surface cleaning step can be
carried out simultaneously with the retraction of the
unloader unit 7, whereby these steps can be carried out
substantially in a single step time.

In addition, a step of supplying unsealed lead frames
25 14 to be subsequently sealed to the prescribed positions



of the cavities provided in the upper and lower mold sections 26 and 28 by advancing the loader unit 6 into the clearance between the upper and lower mold sections 26 and 28 in the aforementioned retraction of the unloader unit 7.

Further, a resin tablet supplying step of supplying the resin tablets 21 employed for the next sealing operation into the pots 29 of the lower mold section 28 can be carried out simultaneously with the aforementioned advancement of the loader unit 6.

Namely, it is possible to substantially simultaneously carry out the advancement of the loader unit 6 in the retraction of the unloader unit 6 and the steps of supplying the unsealed lead frames 14 and the resin tablets 21 through the loader unit 6.

Thus, it is possible to further reduce the overall molding time by substantially simultaneously carrying out the sealed lead frame takeout step, the mold surface cleaning step, the unsealed lead frame supplying step and the resin tablet supplying step in parallel with each other within a short time.

As hereinabove described, it is possible to carry out the unsealed lead frame supplying step and the resin tablet supplying step with the sealed lead frame takeout step while carrying out the mold surface cleaning step.



Thus, it is possible to reduce the overall molding time by substantially simultaneously carrying out the sealed lead frame takeout step, the mold surface cleaning step, the unsealed lead frame supplying step and the resin
5 tablet supplying step in parallel with each other.

The aforementioned embodiment is adapted to take out the sealed lead frames from the upper and lower mold sections 26 and 28 to the exterior by the unloader 31 while cleaning the mold surfaces of the upper and lower
10 mold sections 26 and 28 by sucking dust away from the mold surfaces through the air blow and vacuum mechanisms provided in the cleaner unit 8 in retraction of the unloader 31. Further, the embodiment is also adapted to substantially simultaneously carry out the unsealed lead
15 frame and resin tablet supplying steps by the loader unit 6 in retraction of the unloader 31.

Namely, the steps of supplying the unsealed lead frames and the resin tablets are simultaneously carried out with the mold surface cleaning step of retracting the
20 unloader 31 in this case. According to this embodiment, therefore, it is possible to substantially simultaneously carry out the sealed lead frame takeout step, the mold surface cleaning step, the unsealed lead frame supplying step and the resin tablet supplying step in parallel with
25 each other within a short time.



However, if the unsealed lead frames 14 may be soiled by dust on the mold surfaces in an actual operation due to the aforementioned simultaneous performance of the steps of supplying the unsealed lead frames 14 and the resin
5 tablets 21 with the mold surface cleaning step, for example, the unsealed lead frame and resin tablet supplying steps may be continuously carried out following the mold surface cleaning step, to solve this problem.

While the unsealed lead frame and resin tablet
10 supplying steps cannot be simultaneously carried out with the mold surface cleaning step in this case, it is possible to minimize loss of the molding time as well as to form products having high quality and high reliability by carrying out the unsealed lead frame and resin tablet
15 supplying steps immediately after the mold surface cleaning step.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not
20 to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.





WHAT IS CLAIMED IS:

1. A method of molding resin to seal electronic parts for sealing electronic parts being mounted on lead frames with a resin material through a molding unit (5) having a mold (26, 28), resin supply pots (29) being
5 arranged in said mold, resin pressurizing plungers being provided on said pots, cavities being provided in mold surfaces of said mold, and resin passages being provided between said cavities and said pots, said method comprising:
10 a step of adjusting the number of molding units by detachably mounting an additional molding unit (5a, 5b, 5c) with respect to said molding unit (5) being already provided in an apparatus for molding resin to seal electronic parts;
15 a step of supplying unsealed lead frames (14) having electronic parts mounted thereon and resin tablets (21) into each said molding unit (5, 5a, 5b, 5c);
a step of molding resin to seal said electronic parts through each said molding unit (5, 5a, 5b, 5c); and
20 a step of taking out sealed said electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior.





2. A method of molding resin to seal electronic parts in accordance with claim 1, wherein said step of supplying said unsealed lead frames (14) having electronic parts mounted thereon and said resin tablets (21) into each said molding unit (5, 5a, 5b, 5c) includes:

a step of supplying and setting a number of said unsealed lead frames (14) having electronic parts mounted thereon in prescribed positions of a lead frame supply unit,

a step of transferring said unsealed lead frames (14) being set in said lead frame supply unit (1) to a lead frame aligning unit (2),

a step of aligning said unsealed lead frames (14) being transferred to said lead frame aligning unit (2) with each other along a prescribed direction,

a step of supplying a prescribed number of said resin tablets (21) into a resin tablet discharge unit (4) and aligning the same with each other, and

a step of transferring said unsealed lead frames (14) being set in said lead frame aligning unit (2) and said resin tablets (21) being aligned with each other in said resin tablet discharge unit (4) into a clearance between a fixed mold section (26) and a movable mold section (28) in each said molding unit (5, 5a, 5b, 5c) while supplying said unsealed lead frames (14) into prescribed positions





of said cavities in each said molding unit (5, 5a, 5b, 5c) and supplying resin tablets (2) into said pots,

said step of molding resin to seal said electronic components includes:

30 a step of closing said fixed mold section (26) and said movable mold section (28) while heating, pressurizing and melting said resin tablets (21) in said pots for injecting and charging molten resin materials into said cavities through said resin passages thereby molding resin
35 to seal said electronic parts being engaged in said cavities; and

said step of taking out said sealed electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior includes:

40 a step of taking out said sealed lead frames passing through said resin molding/sealing step from said fixed mold section (26) and said movable mold section (28) to the exterior,

a step of cleaning mold surfaces of said fixed mold
45 section (26) and said movable mold section (28),

a step of transferring said sealed lead frames to a position of a degating unit (10),

a step of removing gate portions from said sealed lead frames in said degating unit (10),

50 a step of transferring said sealed lead frames





passing through said step of removing said gate portions to a lead frame storage unit (12),

55 a step of picking up said sealed lead frames passing through said step of removing said gate portions in said lead frame storage unit (12) independently of each other, and

a step of storing said sealed lead frames being picked up independently of each other.

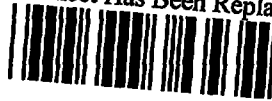
3. A method of molding resin to seal electronic parts in accordance with claim 1, wherein said already provided molding unit (5) and said additional molding units (5a, 5b, 5c) are adapted to mold resin for sealing products of types being different from each other,

5 said step of molding resin to seal said electronic parts through said molding units (5, 5a, 5b, 5c) includes a step of simultaneously sealing products of different types with molded resin in parallel with each other.

4. A method of molding resin to seal electronic parts, comprising:

an unsealed lead frame supplying step of transferring unsealed lead frames (14) into a clearance between an upper mold section (26) and a lower mold section (28) in a molding unit for supplying said unsealed lead frames (14)





to prescribed positions of cavities in said upper and lower mold sections (26, 28);

10 a resin tablet supplying step of transferring resin tablets (21) into said clearance between said upper and lower mold sections (26, 28) in said molding unit (5, 5a, 5b, 5c) and supplying the same in pots being provided in said lower mold section (28);

15 a mold closing step of closing said upper and lower mold sections (26, 28) in said molding unit (5, 5a, 5b, 5c);

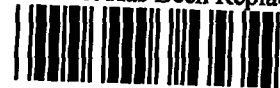
20 a resin molding/sealing step of heating, pressurizing and melting said resin tablets (21) being supplied into said pots while injecting and charging molten resin materials into said cavities through resin passages being provided between said pots and said cavities, thereby molding resin to seal electronic parts mounted on said lead frames (14) being engaged in said cavities;

25 a sealed lead frame takeout step of taking out sealed said lead frames passing through said resin molding/sealing step from said upper and lower mold sections (26, 28) to the exterior; and

30 a mold surface cleaning step of cleaning respective mold surfaces of said upper and lower mold sections (26, 28),

said mold surface cleaning step being simultaneously





carried out in parallel with said sealed lead frame
takeout step,

35 said steps of supplying said unsealed lead frames
 (14) and said resin tablets (21) being further
simultaneously carried out in parallel with said sealed
lead frame takeout step.

5 5. A method of molding resin to seal electronic
parts in accordance with claim 4, wherein said sealed lead
frame takeout step includes a step of advancing an
unloader unit (7) into a clearance between said upper and
lower mold sections (26, 28) for engaging said sealed lead
frames and retracting said unloader unit (7) in this state
for taking out said sealed lead frames to the exterior of
said upper and lower mold sections (26, 28),

10 said step of supplying said unsealed lead frames (14)
includes a step of advancing a loader unit (6) into said
clearance between said upper and lower mold sections (26,
28) in retraction of said unloader unit (7) for supplying
said unsealed lead frames (14) in prescribed positions of
cavities in said upper and lower mold sections (26, 28),

15 said step of supplying said resin tablets (21)
includes a step of advancing said loader unit (6) into
said clearance between said upper and lower mold sections
(26, 28) in retraction of said unloader unit (7) for





supplying said resin tablets (21) into said pots, and
20 said mold surface cleaning step includes a step of
moving a cleaner unit (8) along said mold surfaces of said
upper and lower mold sections (26, 28) for cleaning said
mold surfaces of said upper and lower mold sections (26,
28).

6. A method of molding resin to seal electronic
parts in accordance with claim 5, wherein said steps of
supplying said unsealed lead frames (14) and said resin
tablets (21) are simultaneously carried out in advancement
5 of said loader unit (6) into said clearance between said
upper and lower mold sections (26, 28).

7. A method of molding resin to seal electronic
parts in accordance with claim 5, wherein said mold
cleaning step is carried out with said cleaner unit (8) in
retraction of said unloader unit (7).

8. A method of molding resin to seal electronic
parts in accordance with claim 4, wherein said mold
surface cleaning step is simultaneously carried out in
parallel with said sealed lead frame takeout step.

9. A method of molding resin to seal electronic





parts in accordance with claim 8, wherein said mold surface cleaning step is carried out by retracting said cleaner unit (8), being mounted on said unloader unit (7),
5 with said unloader unit (7) in retraction of said unloader unit (7) in said sealed lead frame takeout step.

10. An apparatus for molding resin to seal electronic parts, comprising:

a molding unit having a mold (26, 28), resin material supply pots being arranged in said mold, resin
5 pressurizing plungers being provided on said pots, cavities being provided in mold surfaces of said mold, and resin passages being arranged between said pots and said cavities;

means for supplying unsealed lead frames (14) having
10 electronic parts mounted thereon and resin tablets (21) into said molding unit (5); and

means for taking out sealed said electronic parts from said molding unit (5) to the exterior,

additional molding units (5a, 5b, 5c) being rendered
15 detachably mountable with respect to already provided said molding unit (5), thereby freely increasing/decreasing the number of said molding units.

11. An apparatus for molding resin to seal





electronic parts in accordance with claim 10, wherein said means for supplying said unsealed lead frames (14) having electronic parts mounted thereon and said resin tablets

5 (21) into each said molding unit (5, 5a, 5b, 5c) includes:

a supply unit (1) for supplying a number of unsealed lead frames (14) having electronic parts mounted thereon,

a lead frame aligning unit (2) for aligning said unsealed lead frames with each other along a prescribed

10 direction,

a resin tablet supply unit (3),

a resin tablet discharge unit (4) for discharging said resin tablets (21) in alignment with each other, and

a loader unit (6) for transferring aligned said lead

15 frames (14) and said resin tablets (21) to each said molding unit (5, 5a, 5b, 5c), and

said means for taking out said sealed electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior includes:

20 an unloader unit (7) for taking out said sealed lead frames,

a mold cleaner unit (8),

a sealed lead frame transfer unit (9),

a degating unit (10) for removing gates from said

25 sealed lead frames,

a pickup unit (11) for picking up degated said sealed





lead frames independently of each other, and
a lead frame storage unit (12) for storing picked-up
said sealed lead frames independently of each other,
30 said apparatus further comprising a controller unit
(13) for continuously and automatically controlling
operations of respective said units.

12. An apparatus for molding resin to seal
electronic parts in accordance with claim 10, wherein said
already provided molding unit (5) and said additional
molding units (5a, 5b, 5c) are adapted to mold resin for
5 sealing different types of products respectively.

13. An apparatus for molding resin to seal
electronic parts, comprising:

a molding unit having a pair of mold sections (26,
28), resin material supply pots being arranged in said
5 mold, resin pressurizing plungers being provided on said
pots, cavities being provided in respective mold surfaces
of said mold, and resin passages being arranged between
said pots and said cavities;

unsealed lead frame supply means (1) for transferring
10 unsealed lead frames (14) into a clearance between said
pair of mold sections (26, 28) of said molding unit (5)
and supplying the same to prescribed positions of said





cavities;

resin tablet supply means (3) for transferring resin
15 tablets (21) into said clearance between said pair of mold
sections (26, 28) of said molding unit (5) and supplying
the same into said pots;

mold closing means (27) for closing said pair of mold
sections (26, 28) in said molding unit (5);

20 sealed lead frame takeout means for taking out sealed
said lead frames from said pair of mold sections (26, 28)
to the exterior; and

mold surface cleaning means (8) for cleaning
respective said mold surfaces of said pair of mold
25 sections (26, 28),

said resin tablet supply means (3) being formed to
interlock with said sealed lead frame takeout means for
making said unsealed lead frames (14) suppliable
simultaneously with an operation for taking out said
30 sealed lead frames.

14. An apparatus for molding resin to seal
electronic parts in accordance with claim 13, wherein said
mold surface cleaning means (8) is formed to interlock
with said sealed lead frame takeout means, so that said
5 mold surface cleaning means (8) is moved to clean said
mold surfaces simultaneously with said operation for
taking out said sealed lead frames.



15. A method of molding resin to seal electronic parts,
or an apparatus for molding resin to seal electronic parts,
substantially as herein particularly described with reference
to the accompanying drawings.

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ABSTRACT OF THE DISCLOSURE

A method of and an apparatus for molding resin to seal electronic parts are adapted to seal electronic parts which are mounted on lead frames (14) with molded resin materials through molding units (5, 5a, 5b, 5c). Additional molding units (5a, 5b, 5c) are detachably mounted with respect to an already provided molding unit (5) so that the number of the molding units can be arbitrarily adjusted, thereby enabling arrangement in a resin molding/sealing step, to implement simple response to mass production.

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FIG. 1A

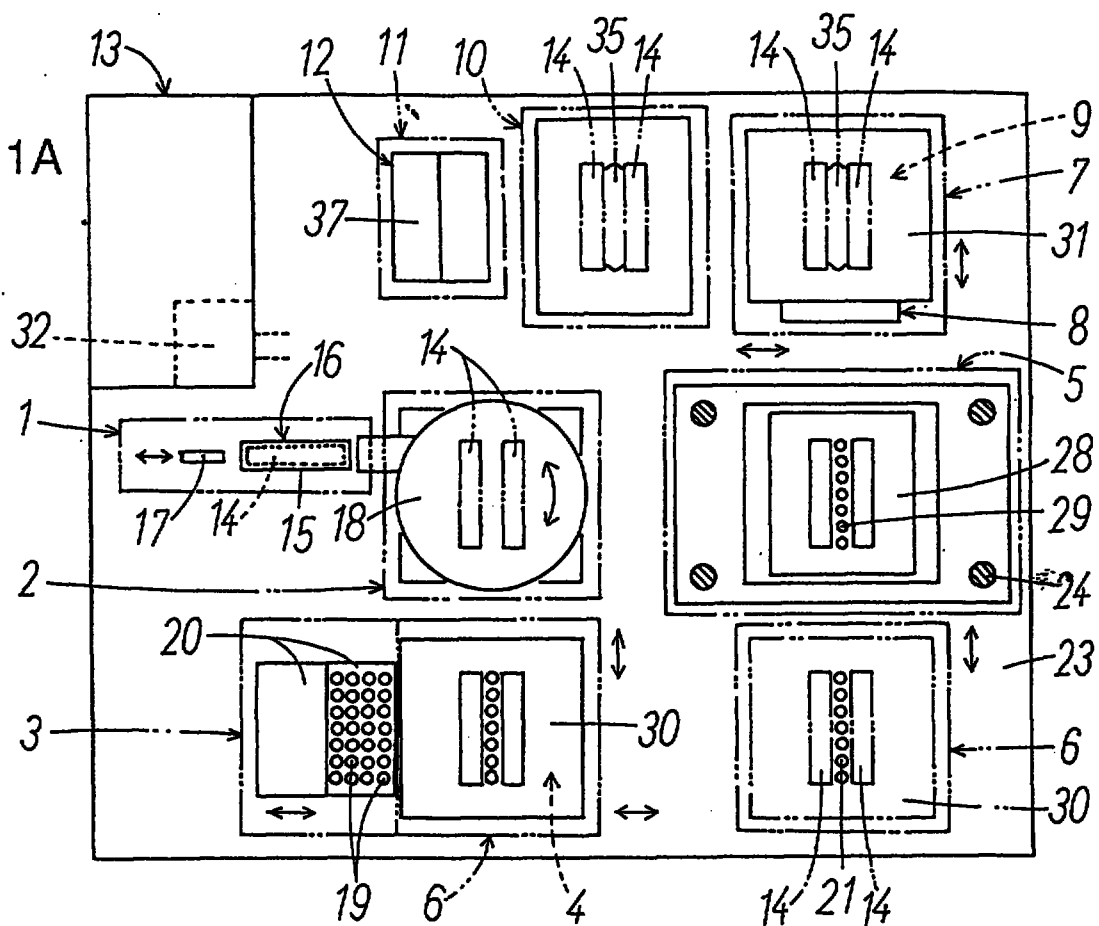
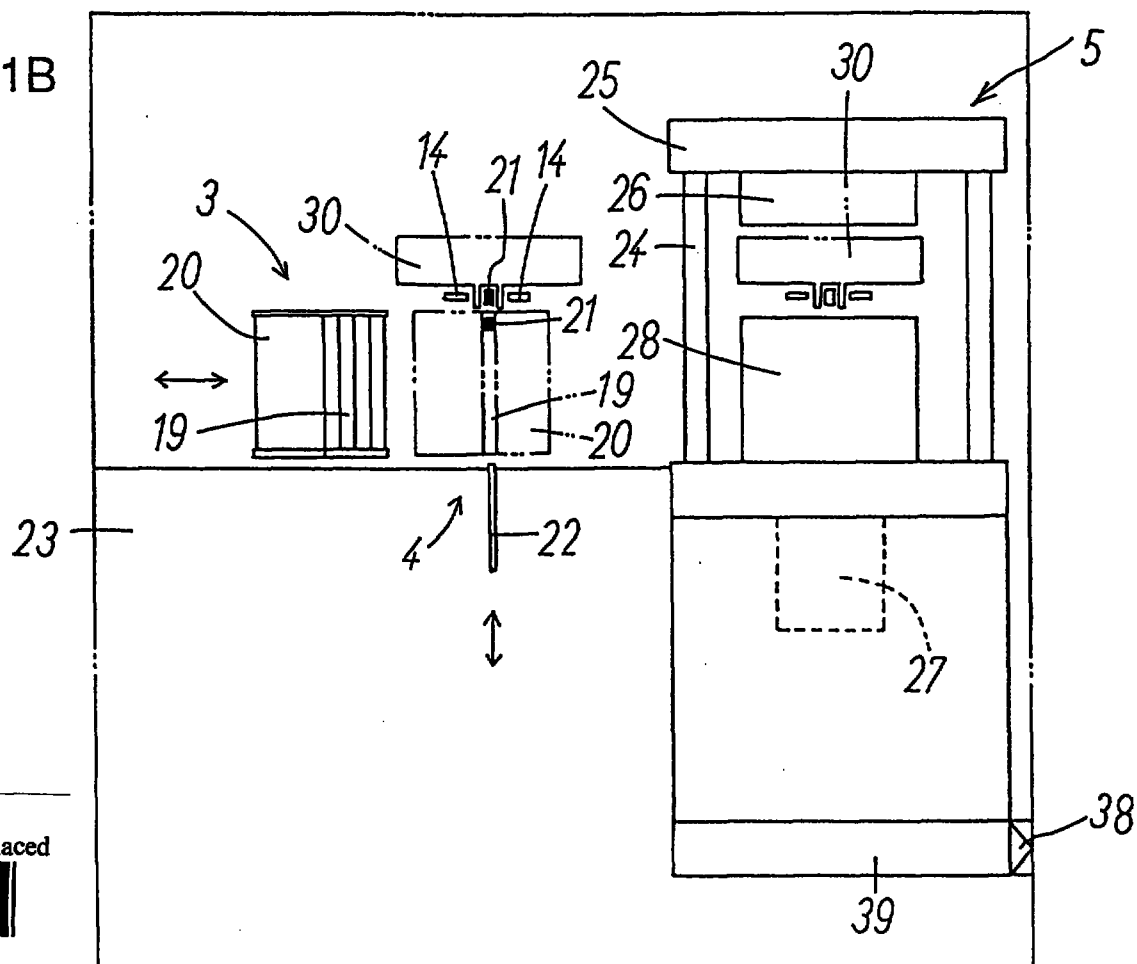


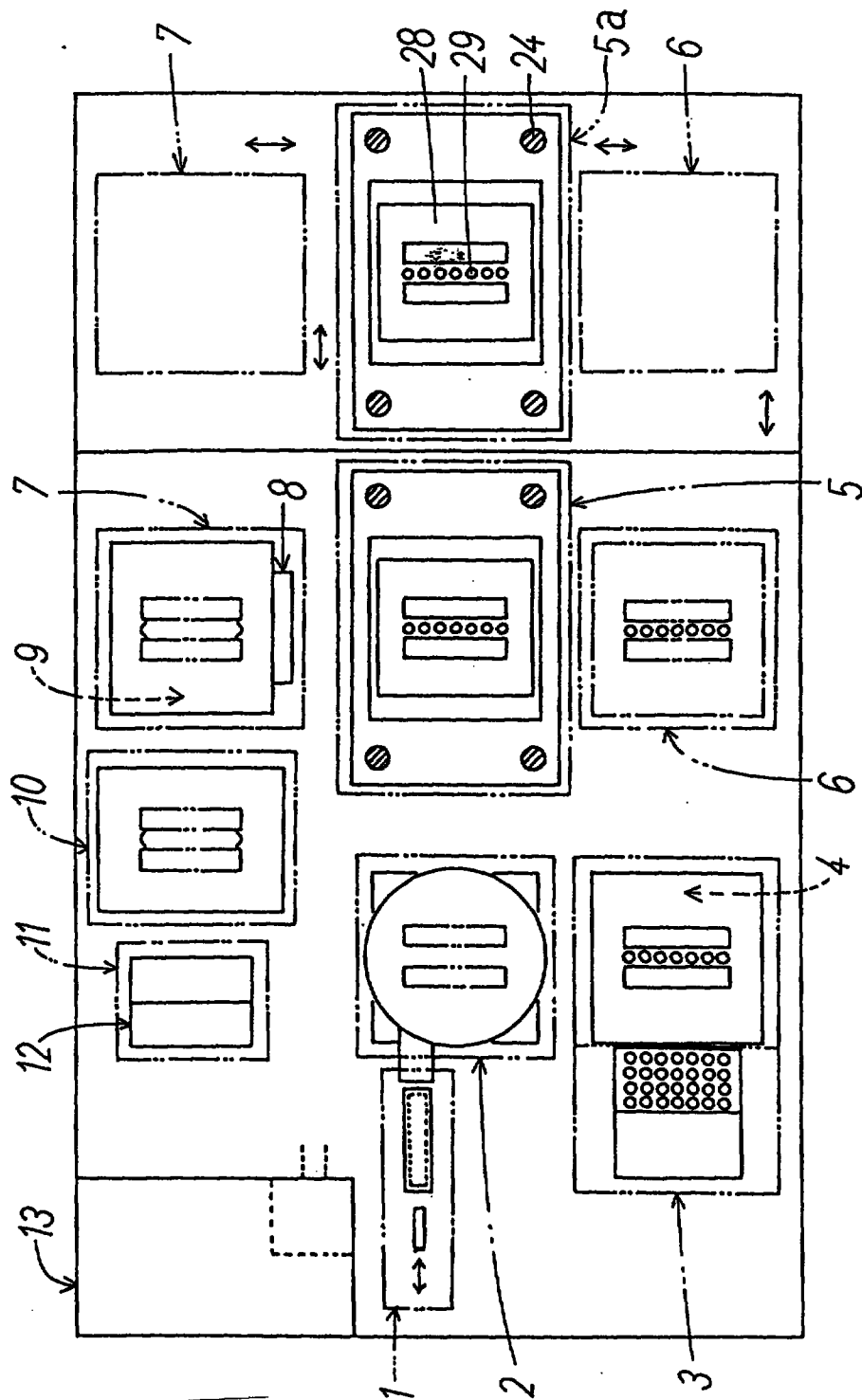
FIG. 1B



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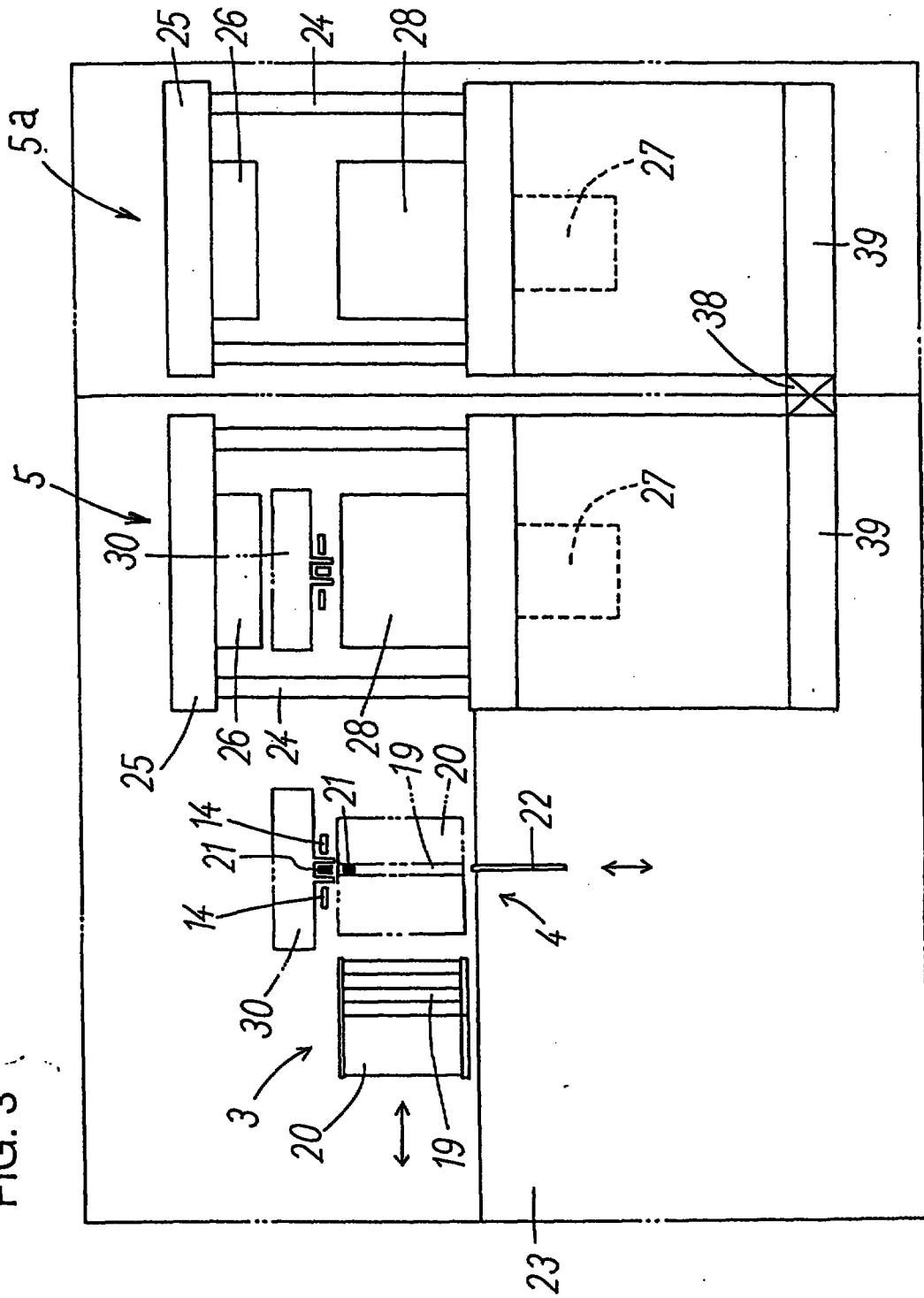
FIG. 2



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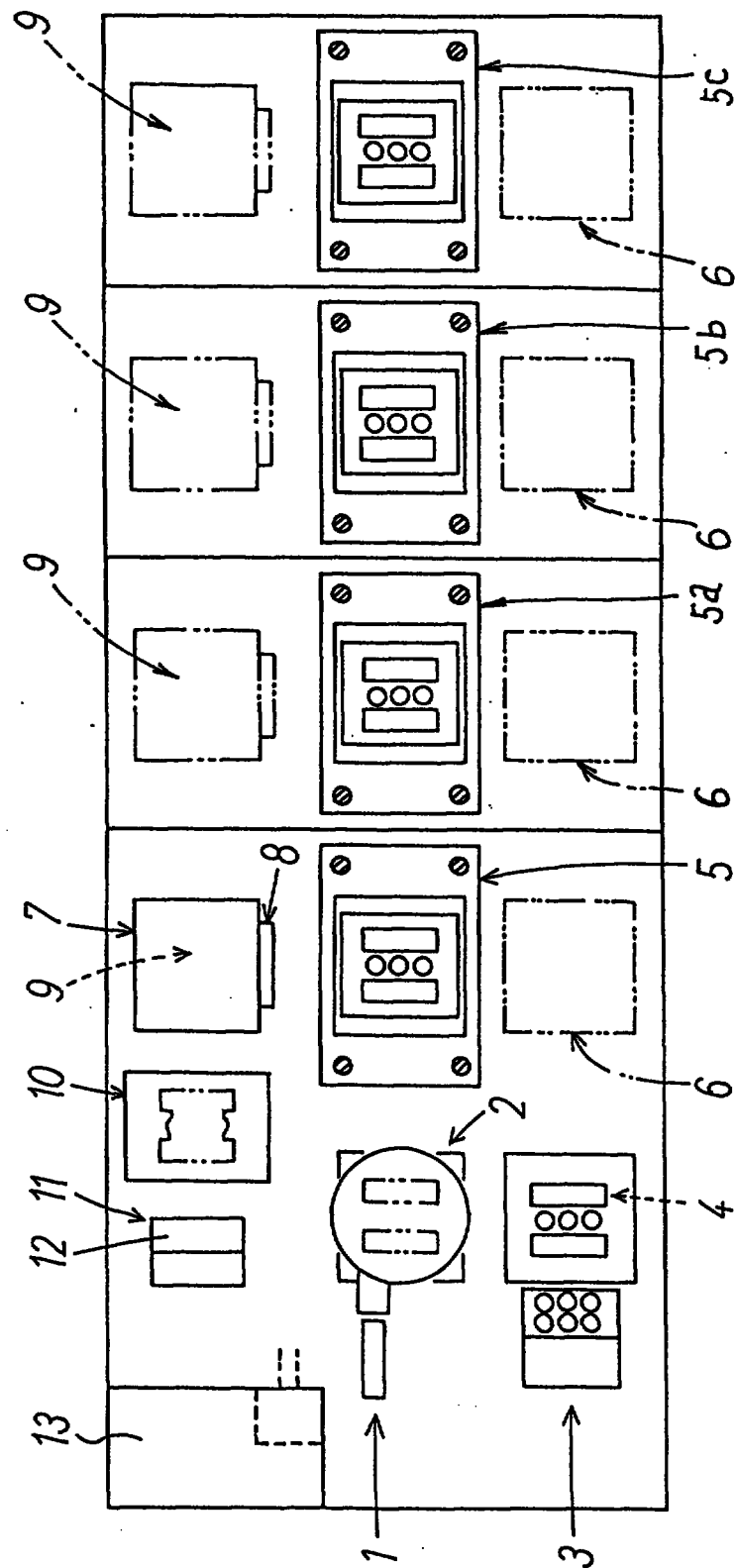
FIG. 3



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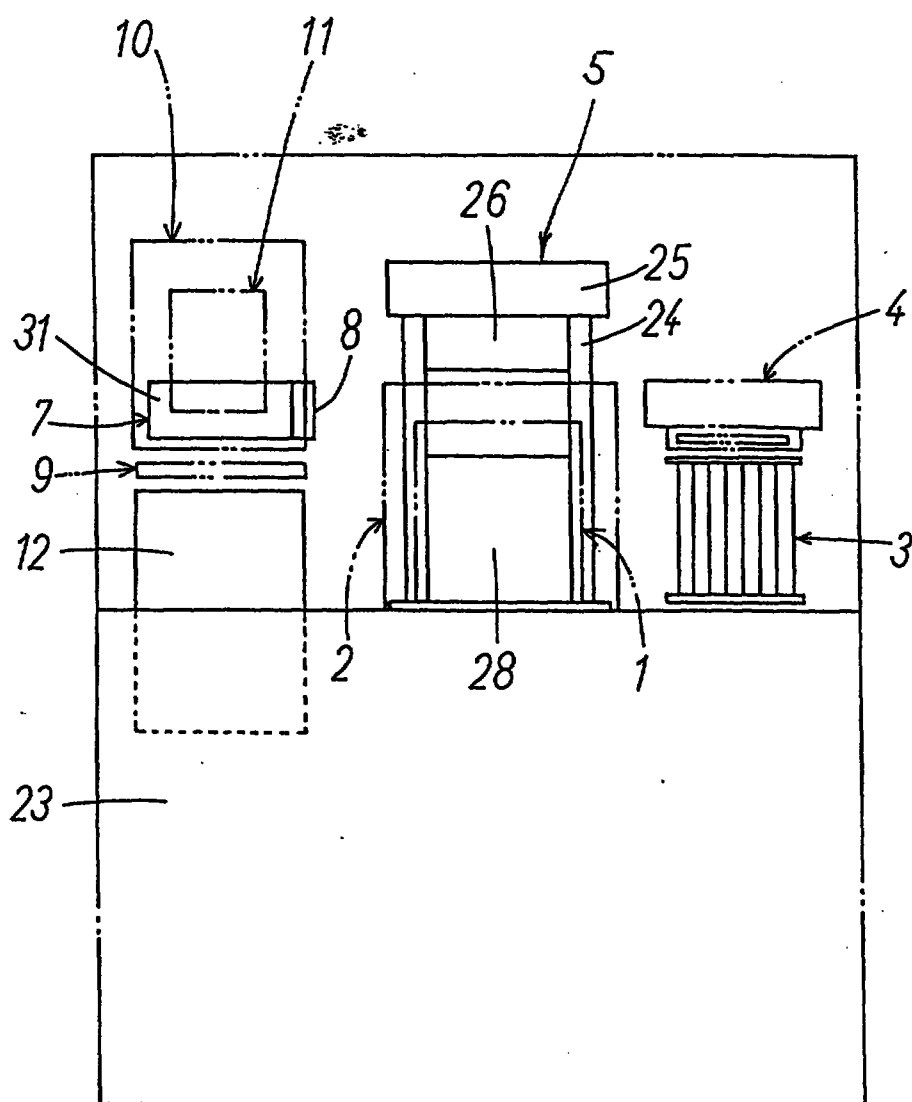
FIG. 4



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FIG. 5



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FIG. 6A

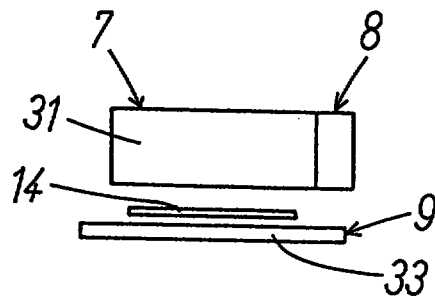


FIG. 6B

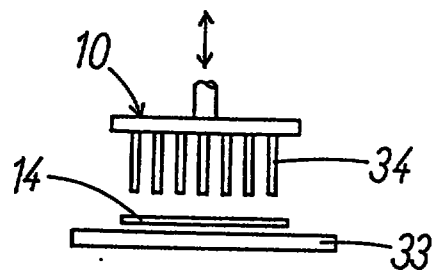


FIG. 6C

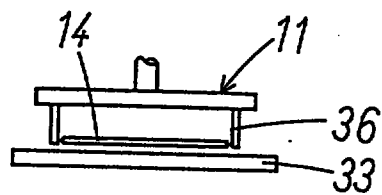
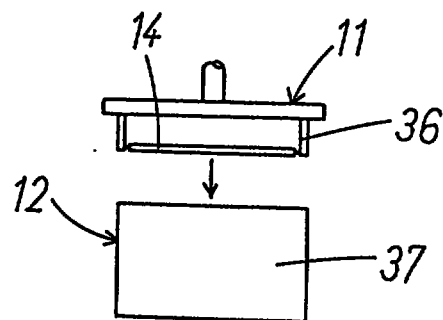


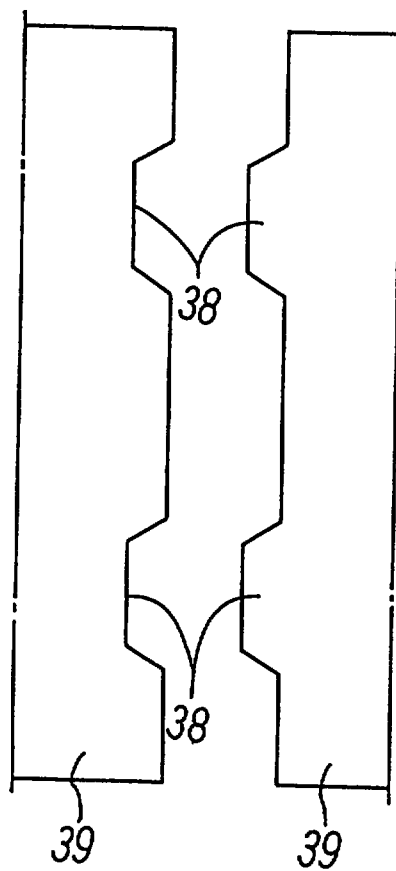
FIG. 6D



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FIG. 7



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Date: 26 OCT 1996

TITLE OF THE INVENTION

Method of and Apparatus for Molding Resin to Seal
Electronic Parts

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a method of and an apparatus for molding resin to seal electronic parts, for sealing electronic parts such as ICs, LSIs, diodes or capacitors which are mounted on lead frames with a resin material.

Description of the Background Art

In general, electronic parts are sealed with molded resin by transfer molding, through a resin molding/sealing apparatus having the following basic structure:

Such a resin molding/sealing apparatus comprises a mold having fixed and movable mold sections which are opposed to each other, resin material supply pots which are arranged in the mold, plungers which are mounted on the pots for pressurizing resin, cavities which are provided in mold surfaces of the fixed and movable mold sections respectively to face each other, and resin passages provided between the pots and the cavities.

Resin tablets are supplied in the pots while electronic parts which are mounted on lead frames are supplied and set in prescribed positions of the cavities,

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☐	Description : paged	to paged
☒	Claim(s) : paged 36..	to paged 47.
☐	Drawing(s) : paged	to paged
☒	Abstract : paged 48.	to paged

REPLACEMENT SHEETS		SG
☒	Description : paged /....	to paged 35
☒	Claim(s) : paged 36..	to paged 47
☒	Drawing(s) : paged /...	to paged 7...
☒	Abstract : paged 48	to paged
DATE OF RECEIPT 26 OCT 1996		

and the mold is closed. The resin tablets provided in the pots are heated and pressurized so that the resin materials melted in the pots are injected and charged into the cavities provided on side positions of the pots through the resin passages respectively. Thus, the resin is molded to seal the electronic parts engaged in the cavities respectively.

When a mold for mass production is employed for the aforementioned apparatus, this leads to the following problems:

For example, the mold, which is inevitably increased in weight and size, is hard to handle while it is difficult to maintain the mold in uniform working accuracy. Thus, portions of the mold differ in resin molding conditions from each other. Particularly in manufacturing of products such as electronic parts to be sealed with molded resin with requirement for high quality and high reliability, the cavities may be partially charged with no resin, or voids or defective parts may be formed in the interior and the exterior of the compacts as sealed due to such difference in resin molding/sealing conditions, to extremely reduce the quality of the products. In order to maintain the mold in uniform accuracy, further, the mold and the apparatus are increased in cost.

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Date: 26 OCT 1996

Further, resin flashes adhere to the mold surfaces in such a large quantity that the overall molding time is increased since it takes time to remove the resin flashes, leading to extreme reduction of productivity.

In addition, a mold for mass production which is to be mounted on the aforementioned conventional apparatus is inevitably restricted in size and production quantity since it is necessary to also take the size of a mold closing mechanism or the like into consideration in this case.

The mold provided in the aforementioned conventional apparatus is generally adapted to simultaneously mold the same type of compacts. In order to mold different types of compacts, therefore, it is necessary to exchange the mold which is mounted on the molding apparatus itself. In order to simultaneously mold different types of compacts by the same molding apparatus, further, it is necessary to change the layout of the mold itself or to simultaneously mount different types of molds on the apparatus.

When the mold which is mounted on the molding apparatus itself is frequently changed for molding different types of compacts, however, the mold exchange operation is troublesome and reduces productivity. When the layout of the mold which is mounted on the molding apparatus itself is changed to be capable of

This is the replacement sheet

Date: 26 OCT 1996

simultaneously molding different types of compacts, the design of the mold is complicated and the usage of the mold is restricted to the layout, leading to inferiority in generality and increase in cost for the mold and the molding apparatus.

When a plurality of molds of different types are simultaneously mounted on the molding apparatus, the molds themselves must be miniaturized due to restriction of spaces for receiving the same, leading to complicated design of the molds and reduction in productivity. If a plurality of molding apparatuses are employed independently of each other in correspondence to the number of different types of compacts for solving this problem, for example, the cost for the production equipment is disadvantageously increased.

In a conventional method of molding resin to seal electronic parts, on the other hand, an unsealed lead frame supplying step of supplying unsealed lead frames into prescribed positions of cavities provided in a mold, a resin tablet supplying step of supplying resin tablets into pots provided in the mold, a sealed lead frame takeout step of taking out the sealed lead frames from the mold to the exterior, and a mold surface cleaning step of cleaning mold surfaces of the mold after resin molding/sealing are generally successively carried out

This is the replacement sheet

Date: 26 OCT 1996

independently of each other.

In such a conventional method of molding resin to seal electronic parts, therefore, the overall molding time is so increased that productivity is extremely reduced.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a method of and an apparatus for molding resin to seal electronic parts, which can simply cope with production of electronic parts to be sealed with molded resin in small and large quantities, for molding products in high quality and high reliability with neither voids nor defective parts formed in the interior and the exterior of the compacts as sealed.

Another object of the present invention is to provide a method of and an apparatus for molding resin to seal electronic parts, which can simply cope with simultaneous production of different types of compacts for molding the products in high quality and high reliability.

Still another object of the present invention is to provide a method of molding resin to seal electronic parts which can produce sealed compacts of electronic parts in high efficiency by reducing the overall time for molding resin to seal the electronic parts.

In order to attain the aforementioned objects, a method of molding resin to seal electronic parts according

This is the replacement sheet

Date: 26 OCT 1996

to a first aspect of the present invention is adapted to seal electronic parts which are mounted on lead frames with a molded resin material through molding units each having a mold, resin supply pots which are arranged in the mold, resin pressurizing plungers which are provided on the pots, cavities which are provided in mold surfaces of the mold, and resin passages provided between the cavities and the pots. According to this method, the number of the molding units is adjusted by detachably mounting an additional molding unit with respect to that already provided on an apparatus for molding resin to seal electronic parts. Thereafter unsealed lead frames having electronic parts mounted thereon and resin tablets are supplied to each molding unit. Then, the electronic parts are sealed with molded resin through each molding unit, and taken out from the same to the exterior.

According to this method, it is possible to utilize the unit as that having minimum forming units for molding resin to seal electronic parts, while it is also possible to utilize the same as that having a plurality of forming units by simple means of detachably combining an additional molding unit with the minimum forming units.

Therefore, it is possible to simply form an apparatus for molding resin to seal electronic parts which is responsive to mass production without increasing the mold

itself in size. Further, it is also possible to simply form an apparatus for molding resin to seal electronic parts which can cope with small production without increasing the mold itself in size since the additional molding unit can be properly detached.

Namely, it is possible to arbitrarily and simply adjust the number of the molding units provided on the molding apparatus in response to the production quantity as required. Thus, it is possible to readily cope with small production and mass production at need for molding resin to seal electronic parts.

According to this method, further, it is possible to simply form an apparatus for molding resin to seal electronic parts which is responsive to mass production without increasing the mold itself in size, whereby products having high quality and high reliability can be produced in high efficiency with neither voids nor defective parts formed in the interior and the exterior of sealed compacts of electronic parts.

In a preferred embodiment, respective steps of the method of molding resin to seal electronic parts according to the first aspect of the present invention are carried out as follows:

In a step of supplying unsealed lead frames having electronic parts mounted thereon and resin tablets to each

This is the replacement sheet

Date: 26 OCT 1996

molding unit, a number of unsealed lead frames having electronic parts mounted thereon are supplied to and set in prescribed positions of a lead frame supply unit and thereafter transferred to a lead frame aligning unit to be aligned with each other along a prescribed direction. After a prescribed number of resin tablets are supplied into a resin tablet discharge unit and aligned with each other, the unsealed lead frames and the resin tablets are transferred to a clearance between fixed and movable mold sections provided in the molding unit, so that the unsealed lead frames and the resin tablets are supplied in prescribed positions of cavities and pots provided in the molding unit respectively.

In a step of molding resin to seal the electronic parts, the fixed and movable mold sections are closed while the resin tablets provided in the pots are heated and pressurized to be melted so that molten resin materials are injected into and charged in the cavities through resin passages, to be molded for sealing the electronic parts which are engaged in the cavities.

In a step of taking out the sealed electronic parts from each molding unit to the exterior, the lead frames sealed through the aforementioned molding/sealing step are taken out from the fixed and movable mold sections to the exterior, while mold surfaces of the fixed and movable

This is the replacement sheet

Date: 26 OCT 1996

mold sections are cleaned. Thereafter the sealed lead frames are transferred to a position of a degating unit, so that gate portions are removed from the same. Thereafter the sealed lead frames are transferred to a lead frame storage unit, to be picked up independently of each other and stored in the storage unit.

In a more preferred embodiment of the method of molding resin to seal electronic parts according to the first aspect of the present invention, the already provided molding unit and another molding unit are adapted to mold resin for sealing different types of electronic parts, so that different types of products are simultaneously sealed with molded resin in parallel with each other through these molding units.

According to this method, it is possible to couple molding units with each other in response to the number of different types of products, for simultaneously sealing the respective types of products in parallel with each other. Thus, it is possible to efficiently cope with mass production of a number of types of electronic parts.

A method of molding resin to seal electronic parts according to a second aspect of the present invention comprises a step of supplying unsealed lead frames, a step of supplying resin tablets, a step of closing upper and lower mold sections, a step of molding resin to seal the

This is the replacement sheet

Date: 26 OCT 1996

electronic parts, and a step of taking out the sealed lead frames, as well as a step of cleaning respective mold surfaces of the upper and lower mold sections. The feature of this method resides in that the steps of cleaning the mold surfaces, supplying unsealed lead frames and supplying the resin tablets are simultaneously carried out in parallel with the step of taking out the sealed lead frames.

According to this method, the step of cleaning the mold surfaces is carried out with the step of taking out the sealed lead frames, while the steps of supplying unsealed lead frames and the resin tablets are also carried out at the same time. Thus, it is possible to carry out the steps of taking out the sealed lead frames and cleaning the mold surfaces in parallel with each other, while it is also possible to carry out the steps of supplying unsealed lead frames to be subsequently sealed and supplying the resin tablets in parallel with each other. Consequently, a waiting time for successive operations for molding resin to seal electronic parts is reduced, whereby it is possible to reduce the overall molding time.

In a preferred embodiment of the method of molding resin to seal electronic parts according to the second aspect of the present invention, respective steps are

This is the replacement sheet

26 OCT 1996

Date:

carried out as follows: In a step of taking out sealed lead frames, an unloader unit is advanced into a clearance between upper and lower mold sections to engage with the sealed lead frames, and then retracted in this state to take out the sealed lead frames to the exterior of the upper and lower mold sections.

In a step of supplying unsealed lead frames, on the other hand, a loader unit is advanced into the clearance between the upper and lower mold sections in retraction of the unloader unit, to supply unsealed lead frames into prescribed positions of cavities provided in the upper and lower mold sections.

In a step of supplying resin tablets, the loader unit is advanced into the clearance between the upper and lower mold sections in retraction of the unloader unit, to supply the resin tablets into pots. In a step of cleaning mold surfaces, a cleaner unit is moved along the clearance between the upper and lower mold sections, to clean the mold surfaces thereof.

According to this method, it is also possible to carry out the steps of supplying unsealed lead frames and the resin tablets simultaneously with the advancement of the loader unit into the clearance between the upper and lower mold sections.

It is also possible to carry out the step of cleaning

This is the replacement sheet

Date: 26 OCT 1996

the mold surfaces with the cleaner unit in the retraction of the unloader unit.

Further, the step of cleaning the mold surfaces may be simultaneously carried out in parallel with the step of taking out the sealed lead frames.

The step of cleaning the mold surfaces may be carried out by retracting the cleaner unit which is mounted on the unloader unit with the same in retraction of the unloader unit in the step of taking out the sealed lead frames.

An apparatus for implementing the method of molding resin to seal electronic parts according to the first aspect of the present invention comprises a molding unit, a mechanism for supplying unsealed lead frames having electronic parts mounted thereon and resin tablets to the molding unit, and a mechanism for taking out the electronic parts as sealed from the molding unit to the exterior. The feature of this apparatus resides in that another molding unit can be detachably mounted with respect to the already provided molding unit, so that the number of the molding units can be increased/decreased.

An apparatus for implementing the method of molding resin to seal electronic parts according to the second aspect of the present invention comprises a molding unit, an unsealed lead frame supply mechanism, a resin tablet supply mechanism, a mold closing mechanism and a mechanism

This is the replacement sheet

Date: 26 OCT 1996

for taking out sealed lead frames as well as a mold surface cleaning mechanism for cleaning respective mold surfaces of a mold. The resin tablet supply mechanism is formed to interlock with the mechanism for taking out sealed lead frames, so that unsealed lead frames can be supplied simultaneously with the operation for taking out sealed lead frames.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A and 1B are a schematic plan view and a schematic front elevational view of an apparatus for molding resin to seal electronic parts according to the present invention, showing a combination of minimum forming units for molding resin to seal electronic parts;

Fig. 2 is a schematic plan view showing the apparatus for molding resin to seal electronic parts shown in Figs. 1A to 1B, in combination with an additional molding unit;

Fig. 3 is a schematic front elevational view of the apparatus for molding resin to seal electronic parts corresponding to Fig. 2;

Fig. 4 is a schematic plan view showing the apparatus

This is the replacement sheet

26 OCT 1996

Date:

for molding resin to seal electronic parts shown in Figs. 1A to 1B, in combination with a plurality of additional molding units;

Fig. 5 is a schematic side elevational view of the apparatus for molding resin to seal electronic parts corresponding to Figs. 1A and 1B;

Figs. 6A to 6D illustrate steps of taking out sealed lead frames and storing the same in stock magazines; and

Fig. 7 is a schematic plan view showing a coupling portion between the apparatus for molding resin to seal electronic parts shown in Figs. 1A to 1B and another molding unit, and engaging means in the coupling portion between the molding units.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention is now described with reference to the drawings.

Referring to Figs. 1A and 1B, an apparatus for molding resin to seal electronic parts according to an embodiment of the present invention comprises a lead frame supply unit 1 for supplying unsealed lead frames having electronic parts mounted thereon, a lead frame aligning unit 2 for aligning the unsealed lead frames with each other along a prescribed direction, a resin tablet supply unit 3 for supplying resin tablets, a resin tablet discharge unit 4 for aligning the resin tablets with each

This is the replacement sheet
26 OCT 1996

Date:

other and discharging the same, a molding unit 5 for molding resin to seal the electronic parts, a loader unit 6 for transferring the lead frames and the resin tablets which are aligned with each other to the molding unit 5, an unloader unit 7 for taking out the lead frames as sealed, a cleaner unit 8 for a mold, a transfer unit 9 for transferring the sealed lead frames, a degating unit 10 for removing gates from the sealed lead frames, a pickup unit 11 for picking up the sealed lead frames as degated independently of each other, a lead frame storage unit 12 for storing the degated sealed lead frames in respective magazines independently of each other, and a controller unit 13 for continuously and automatically controlling the operations of the aforementioned units.

The aforementioned lead frame supply unit 1 is provided with a set portion 16 for an in-magazine 15 storing a plurality of unsealed lead frames 14 having electronic parts mounted thereon, and a proper pusher mechanism 17 for transferring the unsealed lead frames 14 from the in-magazine 15 to the lead frame aligning unit 2 independently of each other.

The lead frame aligning unit 2 is provided with a proper aligning mechanism 18 for aligning the unsealed lead frames 14 which are received from the lead frame supply unit 1 with each other along a prescribed

This is the replacement sheet

26 OCT 1996

Date:

direction.

While two unsealed lead frames 14 are aligned in parallel with each other and an inverting/aligning mechanism is provided for inverting one of the unsealed lead frames 14 in response to a mold layout structure in the molding unit 5 in Figs. 1A and 1B, it is not necessary to invert any unsealed lead frame when the mold layout is adapted to supply a single unsealed lead frame 14.

The resin tablet supply unit 3 is provided with resin tablet supply members 19 in a number corresponding to that of pots provided in the molding unit 5.

The resin tablet supply members 19 are arranged in a mode corresponding to the number of the pots provided in the molding unit 5 and intervals therebetween, and integrally stored in a required resin tablet cassette 20, in consideration of convenience in handling.

The resin tablet supply members 19 can be appropriately replaced by proper ones when the mold layout is changed in the molding unit 5, in response to the number of new pots and intervals therebetween.

As shown in Fig. 3, the resin tablet discharge unit 4 is provided with a proper pusher mechanism 22 for discharging the resin tablets 21, which are stored in the resin tablet supply members 19 provided in the resin tablet supply unit 3, in states aligned with each other.

This is the replacement sheet

26 OCT 1996

Date:

The molding unit 5 is provided with a fixed plate 25 which is fixed to an upper part of an apparatus body 23 through tie-bars 24, a fixed upper mold section 26 which is mounted on the fixed plate 25, a movable lower mold section 28 which is oppositely arranged under the fixed upper mold section 26 to be vertically driven by a required mold switching mechanism 27, and a plurality of (seven in Fig. 1A) pots 29 which are arranged on the movable lower mold section 27.

Further, plungers are engaged in the respective pots 29 for pressurizing the resin tablets 21 and heating means such as heaters are provided on the upper and lower mold sections 26 and 28, while required numbers of resin molding cavities are oppositely provided in mold surfaces of the upper and lower mold sections 26 and 28 and resin passages (not shown) are provided between the pots 29 and the cavities.

When the upper and lower mold sections 26 and 28 are closed and the resin tablets 21 provided in the respective pots 29 are heated and pressurized, therefore, molten resin materials can be injected/charged into the respective cavities through the resin passages.

The loader unit 6 is provided with a loader 30 for simultaneously transferring two unsealed lead frames 14 which are aligned with each other by the lead frame

This is the replacement sheet

Date: 26 OCT 1996

aligning unit 2 and a plurality of (seven in Fig. 1A) resin tablets 21 which are aligned with each other and discharged by the resin tablet discharge unit 4 toward the molding unit 5.

The loader 30 is adapted to reciprocate between positions of the lead frame aligning unit 2 and the molding unit 5, for picking up two unsealed lead frames 14 through a proper mechanism (not shown) while picking up the respective resin tablets 21 discharged by the resin tablet discharge unit 4 by a proper mechanism (not shown) in the position of the lead frame aligning unit 2 (see Fig. 3).

At this time, two unsealed lead frames 14 and the respective resin tablets 21 are picked up by the loader 30 in the same mode as a mold layout in the molding unit 5. Thus, it is possible to supply two unsealed lead frames 14 and the respective resin tablets 21 into prescribed positions of the cavities and the pots 29 respectively by transferring the same to portions above the movable lower mold section 28 of the molding unit 5 and relieving the same from the picked-up states.

While it is possible to advantageously simplify the overall structure of the apparatus and to reduce the overall molding time since the loader 30 simultaneously transfers the unsealed lead frames 14 and the respective

This is the replacement sheet

26 OCT 1996

Date:

resin tablets 21, mechanisms for transferring the lead frames 14 and the resin tablets 21 may alternatively be provided independently of each other so that these transfer mechanisms are driven independently of each other.

The unloader unit 7 is provided with an unloader 31 for taking out the lead frames 14 which are sealed with molded resin in the molding unit 5 to the exterior of the upper and lower mold sections 26 and 28.

This unloader 31 is adapted to reciprocate with respect to the position of the molding unit 5, to be capable of taking out two sealed lead frames 14 and a gate portion integrated therebetween to the exterior in a state simultaneously picked up by a proper mechanism (not shown).

The cleaner unit 8 is provided with an air blow mechanism for blowing air to the mold surfaces of the upper and lower mold sections 26 and 28 provided in the molding unit 5 and a vacuum mechanism (not shown) for sucking dust away from the mold surfaces.

Further, the cleaner unit 8 is integrated with the unloader 31 of the unloader unit 7. Thus, the cleaner unit 8 is adapted to simultaneously reciprocate with the unloader unit 7 with respect to the position of the molding unit 5.

This is the replacement sheet

Date: 26 OCT 1990

Further, the cleaner unit 8 is driven when the unloader unit 7 picking up the sealed lead frames 14 is retracted to the exterior, for example, to suck dust away from the mold surfaces by the actions of the air blow and vacuum mechanisms and store the same in a proper dust collection part 32. Thus, it is possible to simply and efficiently clean the mold surfaces in advance to next resin molding.

While it is possible to simplify the overall structure of the apparatus and to reduce the overall molding time due to the integrated structure of the unloader unit 7 and the cleaner unit 8, these units 7 and 8 may alternatively be formed independently of each other to be driven independently of each other.

Further, the cleaner unit 8 may be provided with a brush member for forcibly separating resin flashes adhering to the mold surfaces and an excitation mechanism therefor, for example.

As shown in Figs. 6A, 6B and 6D, the aforementioned transfer unit 9 for the sealed lead frames 14 is provided with a proper pallet 33 which reciprocates to transfer the sealed lead frames 14 taken out by the unloader unit 7 to positions of the degating unit 10 and the lead frame storage unit 12.

As shown in Fig. 6B, the degating unit 10 is provided

This is the replacement sheet

Date: 26 OCT 1996

with a gate breaking mechanism 34 for removing the gate portion defined between the sealed lead frames 14 which are transferred by the pallet 33 of the transfer unit 9. This gate breaking mechanism 34 is adapted to pick up two sealed lead frames 14 which are coupled/integrated with each other through a gate portion 35 as shown in Fig. 1A, for example, through a proper mechanism (not shown) and to pressurize the gate portion 35 defined between the lead frames 14 in this state for cutting/removing the same.

As shown in Figs. 6C and 6D, further, the pickup unit 11 is provided with a pickup mechanism 36 for picking up two sealed lead frames 14 which are transferred from the degating unit 10 through the pallet 33 of the transfer unit 9 independently of each other.

This pickup mechanism 36 can pick up two sealed lead frames 14 transferred by the pallet 33 of the transfer unit 9 independently of each other, as shown in Fig. 6C.

The lead frame storage unit 12 is provided with stock magazines 37 capable of storing two sealed lead frames 14 which are independently picked up through the pickup mechanism 36 of the pickup unit 11 independently of each other.

The two sealed lead frames 14 which are picked up by the pickup mechanism 36 of the pickup unit 11 independently of each other are relieved from the pickup

This is the replacement sheet

Date: 26 OCT 1996

mechanism 36 when the pallet 33 of the transfer unit 9 is retracted to its original position so that the same can be stored in the prescribed stock magazines 37 provided under the same independently of each other, as shown in Fig. 6D.

The controller unit 13 is adapted to continuously and automatically control the operations of the aforementioned units, for molding resin to seal the electronic parts in the following manner, for example:

Two unsealed lead frames 14 provided in the in-magazine 15 of the lead frame supply unit 1 are transferred by the pusher mechanism 17 toward the lead frame aligning unit 2 independently of each other.

Then, the two unsealed lead frames 14 are aligned with each other along the prescribed direction by the aligning mechanism 18 of the lead frame aligning unit 2.

Following or in parallel with the aforementioned steps of transferring the two unsealed lead frames 14 and aligning the same with each other, the seven resin tablets 21 are aligned with each other and discharged by the resin tablet supply unit 3 and the resin tablet discharge unit 4.

Then, the two unsealed lead frames 14 provided in the lead frame aligning unit 2 and the seven resin tablets 21 provided in the resin tablet supply unit 3 are transferred to a clearance between the upper and lower mold sections

This is the replacement sheet

Date: 26 OCT 1996

26 and 28 of the molding unit 5 through the loader 30 of the loader unit 6, and the same are relieved from the loader 30 so that the unsealed lead frames 14 are supplied into prescribed positions of the cavities provided in the movable lower mold section 28 while the respective resin tablets 21 are supplied into the pots 29.

Then, the upper and lower mold sections 26 and 28 are closed by the mold switching mechanism 27 while the resin tablets 21 received in the pots 29 are heated and pressurized to be melted so that molten resin materials are injected/charged into the cavities through the resin passages respectively, for sealing the electronic parts engaged in the cavities respectively.

Then, the lead frames 14 as sealed are taken out from the upper and lower mold sections 26 and 28 of the molding unit 5 to the exterior through the unloader 31 of the unloader unit 7, while the mold surfaces of the upper and lower mold sections 26 and 28 are cleaned by the air blow and vacuum mechanisms of the cleaner unit 8 in retraction of the unloader 31 so that dust is sucked away from the mold surfaces.

Then, the sealed lead frames 14 which are taken out by the unloader unit 7 are transferred to the position of the degating unit 10 through the pallet 33 of the transfer unit 9.

This is the replacement sheet

Date: 26 OCT 1996

Then, the gate portion 35 between the sealed lead frames 14 is cut and removed through the gate breaking mechanism 34 of the degating unit 10.

Then, the two sealed lead frames 14 separated from each other by removal of the gate portion 35 are transferred to the position of the lead frame storage unit 12 through the pallet 33 of the transfer unit 9.

Then, the two sealed lead frames 14 which are separated from each other are picked up independently of each other through the pickup mechanism 36 of the pickup unit 11.

Then, the pallet 33 of the transfer unit 9 is retracted and the two sealed lead frames 14 are relieved from the pickup mechanism 36 of the pickup unit 11, to be stored in the respective stock magazines 37 independently of each other.

Engaging means 38 is provided on a right end portion of a bottom base 39 of the molding unit 5, to be coupled with another molding unit as described later.

As hereinabove described, the apparatus for molding resin to seal electronic parts shown in Figs. 1A and 1B is formed by a combination of minimum forming units for molding resin to seal electronic parts.

In this apparatus for molding resin to seal electronic parts, further, the series of steps are

This is the replacement sheet

Date: 26 OCT 1996

continuously and automatically carried out by the controller unit 13.

Figs. 2 and 3 show the apparatus for molding resin to seal electronic parts formed by the combination of the minimum units shown in Figs. 1A and 1B, which is combined with an additional molding unit 5a having the same function as that of the molding unit 5, and Fig. 4 shows the apparatus which is combined with a plurality of additional molding units 5b and 5c.

The additional molding units 5a, 5b and 5c are identical in structure to the aforementioned molding unit 5, and detachably mountable on a side portion of the molding unit 5 provided in the apparatus for molding resin to seal electronic parts formed by the combination of the minimum units shown in Figs. 1A and 1B.

Therefore, it is possible to form an apparatus for molding resin to seal electronic parts which is responsive to mass production with molds substantially increased in size, by successively mounting the additional molding units 5a, 5b and 5c on the side portion of the molding unit 5 of the apparatus for molding resin to seal electronic parts formed by the combination of the minimum units shown in Figs. 1A and 1B.

Namely, it is possible to arbitrarily and simply adjust the number of molding units provided in the

This is the replacement sheet

Date: 26 OCT 1996

aforementioned apparatus in response to the production quantity as required. Thus, it is possible to simply cope with production of sealed electronic parts in small and large quantities at need.

When the apparatus for molding resin to seal electronic parts is combined with the additional molding units, it is possible to use most of the members provided in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B as such.

Namely, it is possible to substantially use the unsealed lead frame supply unit 1, the lead frame aligning unit 2, the resin tablet supply unit 3, the resin tablet discharge unit 4, the loader unit 6, the unloader unit 7, the cleaner unit 8, the transfer unit 9, the degating unit 10, the pickup unit 11, the lead frame storage unit 12 and the controller unit 13 as such by changing control conditions by the controller unit 13 in response to the number of the molding units as employed.

The engaging means 38 is provided between the molding unit 5 of the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B and the additional molding unit 5a which is coupled with or detached from the same, for simply and reliably positioning the molding

This is the replacement sheet

Date: 26 OCT 1996

units 5 and 5a and coupling the same with each other.

The engaging means 38 may be formed by irregular engaging parts which are formed on bottom bases 39 of the molding units 5 and 5a as shown in Figs. 3 and 7, for example.

In the mode shown in Figs. 2 to 4, the apparatus for molding resin to seal electronic parts is adapted to mold resin for simultaneously sealing the same type of products through steps which are basically identical to those in the mode shown in Figs. 1A and 1B, with addition of the following steps:

In addition to the steps carried out in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units, the same type of products are sealed in the additional molding units 5a, 5b and 5c through a step of transferring unsealed lead frames 14 and resin tablets 21 from the lead frame aligning unit 2 and the resin tablet supply unit 3 to the additional molding units 5a, 5b and 5c while setting the same in prescribed positions with the loader unit 6, a step of molding resin to seal electronic parts by the additional molding units 5a, 5b and 5c, a step of taking out the lead frames 14 as sealed by the unloader unit 7, a step of cleaning the mold surfaces by the cleaner unit 8, a step of transferring the sealed lead frames 14 to the position

This is the replacement sheet

Date: 26 OCT 1996

of the degating unit 10 by the transfer unit 9, a step of cutting/removing gate portions 35 defined between the sealed lead frames 14 by the degating unit 10, a step of transferring the sealed lead frames 14 as degated to the position of the lead frame storage unit 12 by the transfer unit 9, a step of picking up the sealed lead frames 14 from the position of the lead frame storage unit 12 by the pickup unit 11, and a step of storing the sealed lead frames 14 picked up by the pickup unit 11 in the stock magazines 37.

At this time, most of the members provided in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B are used as such as described above. Therefore, periods for starting steps of molding resin to seal electronic parts in the respective molding units 5, 5a, 5b and 5c may be set at prescribed time intervals.

Also when the molding units 5, 5a, 5b and 5c are different in mold layout from each other in the apparatus for molding resin to seal electronic parts which is provided with the additional molding units 5a, 5b and 5c as shown in Figs. 2 to 4 for molding different types of products in the molding units 5, 5a, 5b and 5c, it is possible to use most of the units provided in the apparatus shown in Figs. 1A and 1B as such.

This is the replacement sheet

Date: 26 OCT 1996

In this case, the unsealed lead frame supply unit 1 may be provided with in-magazines 15 in a number corresponding to that of the different mold layouts, while the lead frame storage unit 12 may be provided with stock magazines 37 in a number corresponding to that of the in-magazines 15.

When the numbers of the pots 29 provided in the molding units 5, 5a, 5b and 5c and the numbers and shapes of the lead frames 14 are different from each other, the respective units may be provided with functions which are changeable/adjustable in response thereto, in addition to the in-magazines 15 and the stock magazines 37 provided in numbers corresponding to that of the different mold layouts.

For example, the resin tablet supply unit 3, the resin tablet discharge unit 4, the loader unit 6, the unloader unit 7, the degating unit 10 and the pickup unit 11 may be provided with functions which are changeable/adjustable in correspondence to the changes in number of the pots 29 and in number and shape of the lead frames 14.

Alternatively, the additional molding units 5a, 5b and 5c may be provided with dedicated loader units, dedicated unloader units, dedicated degating units and dedicated pickup units respectively.

This is the replacement sheet

Date: 26 OCT 1996

While the additional molding units 5a, 5b and 5c are identical to the molding unit 5, mold layouts thereof may be different from each other in response to compacts to be formed, for manufacturing different types of compacts in the molding units 5, 5a, 5b and 5c. Further, the additional molding units 5a, 5b and 5c can be detachably mounted on the side portion of the molding unit 5 provided in the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units shown in Figs. 1A and 1B.

Therefore, it is possible to simply form an apparatus for molding resin to seal electronic components substantially comprising a plurality of molds by successively mounting the additional molding units 5a, 5b and 5c on the apparatus for molding resin to seal electronic parts which is formed by the combination of the minimum units.

On the other hand, it is also possible to form an apparatus for molding resin to seal electronic parts having a substantially small number of mold(s) by successively removing the additional molding units 5a, 5b and 5c or stopping operations thereof.

In other words, the number of the molding units can be arbitrarily and simply adjusted in the aforementioned apparatus in response to the required production quantity,

This is the replacement sheet

Date: 26 OCT 1996

whereby it is possible to simply and quickly cope with a case of simultaneously manufacturing different types of products in small or large quantities while it is also possible to simply cope with a case of simultaneously manufacturing the same type of products in small or large quantities.

When the apparatus for molding resin to seal electronic parts in the mode shown in Figs. 2 to 4 is adapted to simultaneously form different types of products, steps of forming additional products in the additional molding units 5a, 5b and 5c may be added to the aforementioned steps which are carried out in the apparatus formed by the combination of the minimum units for molding resin to seal electronic parts.

When the aforementioned steps of molding resin to seal electronic parts are continuously and automatically carried out, it is possible to produce sealed compacts of electronic parts in high efficiency while reducing the overall molding time, by carrying out the aforementioned steps of supplying and taking out the respective members and cleaning the mold surfaces in parallel with each other.

In parallel with the unsealed lead frame supplying step of transferring unsealed lead frames 14 into the clearance between the upper and lower mold sections 26 and

This is the replacement sheet

Date: 26 OCT 1996

28 provided in the molding unit 5 and supplying the unsealed lead frames 14 into the prescribed positions of the cavities provided in the upper and lower mold sections 26 and 28, the resin tablet supplying step of transferring the resin tablets 21 into the clearance between the upper and lower mold sections 26 and 28 provided in the molding unit 5 and supplying the same into the pots 29 provided in the lower mold section 28 so that these steps can be carried out substantially in a single step time, whereby the overall molding time is reduced.

Further, it is possible to reduce the overall molding time by simultaneously carrying out the sealed lead frame takeout step of advancing the unloader unit 7 into the clearance between the upper and lower mold sections 26 and 28, engaging the sealed lead frames 14 and retracting the unloader unit 7 in this state for taking out the sealed lead frames 14 to the exterior of the upper and lower mold sections 26 and 28 with the step of cleaning the mold surfaces of the upper and lower mold sections 26 and 28.

In this case, the mold surface cleaning step can be carried out simultaneously with the retraction of the unloader unit 7, whereby these steps can be carried out substantially in a single step time.

In addition, a step of supplying unsealed lead frames 14 to be subsequently sealed to the prescribed positions

This is the replacement sheet

Date: 26 OCT 1990

of the cavities provided in the upper and lower mold sections 26 and 28 by advancing the loader unit 6 into the clearance between the upper and lower mold sections 26 and 28 in the aforementioned retraction of the unloader unit 7.

Further, a resin tablet supplying step of supplying the resin tablets 21 employed for the next sealing operation into the pots 29 of the lower mold section 28 can be carried out simultaneously with the aforementioned advancement of the loader unit 6.

Namely, it is possible to substantially simultaneously carry out the advancement of the loader unit 6 in the retraction of the unloader unit 6 and the steps of supplying the unsealed lead frames 14 and the resin tablets 21 through the loader unit 6.

Thus, it is possible to further reduce the overall molding time by substantially simultaneously carrying out the sealed lead frame takeout step, the mold surface cleaning step, the unsealed lead frame supplying step and the resin tablet supplying step in parallel with each other within a short time.

As hereinabove described, it is possible to carry out the unsealed lead frame supplying step and the resin tablet supplying step with the sealed lead frame takeout step while carrying out the mold surface cleaning step.

This is the replacement sheet

Date: 26 OCT 1996

Thus, it is possible to reduce the overall molding time by substantially simultaneously carrying out the sealed lead frame takeout step, the mold surface cleaning step, the unsealed lead frame supplying step and the resin tablet supplying step in parallel with each other.

The aforementioned embodiment is adapted to take out the sealed lead frames from the upper and lower mold sections 26 and 28 to the exterior by the unloader 31 while cleaning the mold surfaces of the upper and lower mold sections 26 and 28 by sucking dust away from the mold surfaces through the air blow and vacuum mechanisms provided in the cleaner unit 8 in retraction of the unloader 31. Further, the embodiment is also adapted to substantially simultaneously carry out the unsealed lead frame and resin tablet supplying steps by the loader unit 6 in retraction of the unloader 31.

Namely, the steps of supplying the unsealed lead frames and the resin tablets are simultaneously carried out with the mold surface cleaning step of retracting the unloader 31 in this case. According to this embodiment, therefore, it is possible to substantially simultaneously carry out the sealed lead frame takeout step, the mold surface cleaning step, the unsealed lead frame supplying step and the resin tablet supplying step in parallel with each other within a short time.

This is the replacement sheet

Date: 26 OCT 1996

However, if the unsealed lead frames 14 may be soiled by dust on the mold surfaces in an actual operation due to the aforementioned simultaneous performance of the steps of supplying the unsealed lead frames 14 and the resin tablets 21 with the mold surface cleaning step, for example, the unsealed lead frame and resin tablet supplying steps may be continuously carried out following the mold surface cleaning step, to solve this problem.

While the unsealed lead frame and resin tablet supplying steps cannot be simultaneously carried out with the mold surface cleaning step in this case, it is possible to minimize loss of the molding time as well as to form products having high quality and high reliability by carrying out the unsealed lead frame and resin tablet supplying steps immediately after the mold surface cleaning step.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

This is the replacement sheet

Date: 26 OCT 1996



WHAT IS CLAIMED IS:

1. A method of molding resin to seal electronic parts for sealing electronic parts being mounted on lead frames with a resin material through a molding unit (5) having a mold (26, 28), resin supply pots (29) being arranged in said mold, resin pressurizing plungers being provided on said pots, cavities being provided in mold surfaces of said mold, and resin passages being provided between said cavities and said pots, said method comprising:

a step of adjusting the number of molding units by detachably mounting an additional molding unit (5a, 5b, 5c) with respect to said molding unit (5) being already provided in an apparatus for molding resin to seal electronic parts;

a step of supplying unsealed lead frames (14) having electronic parts mounted thereon and resin tablets (21) into each said molding unit (5, 5a, 5b, 5c);

a step of molding resin to seal said electronic parts through each said molding unit (5, 5a, 5b, 5c); and

a step of taking out sealed said electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior.





2. A method of molding resin to seal electronic parts in accordance with claim 1, wherein said step of supplying said unsealed lead frames (14) having electronic parts mounted thereon and said resin tablets (21) into each said molding unit (5, 5a, 5b, 5c) includes:

a step of supplying and setting a number of said unsealed lead frames (14) having electronic parts mounted thereon in prescribed positions of a lead frame supply unit,

a step of transferring said unsealed lead frames (14) being set in said lead frame supply unit (1) to a lead frame aligning unit (2),

a step of aligning said unsealed lead frames (14) being transferred to said lead frame aligning unit (2) with each other along a prescribed direction,

a step of supplying a prescribed number of said resin tablets (21) into a resin tablet discharge unit (4) and aligning the same with each other, and

a step of transferring said unsealed lead frames (14) being set in said lead frame aligning unit (2) and said resin tablets (21) being aligned with each other in said resin tablet discharge unit (4) into a clearance between a fixed mold section (26) and a movable mold section (28) in each said molding unit (5, 5a, 5b, 5c) while supplying said unsealed lead frames (14) into prescribed positions





of said cavities in each said molding unit (5, 5a, 5b, 5c) and supplying resin tablets (2) into said pots,

said step of molding resin to seal said electronic components includes:

a step of closing said fixed mold section (26) and said movable mold section (28) while heating, pressurizing and melting said resin tablets (21) in said pots for injecting and charging molten resin materials into said cavities through said resin passages thereby molding resin to seal said electronic parts being engaged in said cavities, and

said step of taking out said sealed electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior includes:

a step of taking out said sealed lead frames passing through said resin molding/sealing step from said fixed mold section (26) and said movable mold section (28) to the exterior,

a step of cleaning mold surfaces of said fixed mold section (26) and said movable mold section (28),

a step of transferring said sealed lead frames to a position of a degating unit (10),

a step of removing gate portions from said sealed lead frames in said degating unit (10),

a step of transferring said sealed lead frames

This is the replacement sheet



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Date: 26 OCT 1996



passing through said step of removing said gate portions to a lead frame storage unit (12),

a step of picking up said sealed lead frames passing through said step of removing said gate portions in said lead frame storage unit (12) independently of each other, and

a step of storing said sealed lead frames being picked up independently of each other.

3. A method of molding resin to seal electronic parts in accordance with claim 1, wherein said already provided molding unit (5) and said additional molding units (5a, 5b, 5c) are adapted to mold resin for sealing products of types being different from each other,

said step of molding resin to seal said electronic parts through said molding units (5, 5a, 5b, 5c) includes a step of simultaneously sealing products of different types with molded resin in parallel with each other.

4. A method of molding resin to seal electronic parts, comprising:

an unsealed lead frame supplying step of transferring unsealed lead frames (14) into a clearance between an upper mold section (26) and a lower mold section (28) in a molding unit for supplying said unsealed lead frames (14)

This is the replacement sheet

Date: 26 OCT 1996





to prescribed positions of cavities in said upper and lower mold sections (26, 28);

a resin tablet supplying step of transferring resin tablets (21) into said clearance between said upper and lower mold sections (26, 28) in said molding unit (5, 5a, 5b, 5c) and supplying the same in pots being provided in said lower mold section (28);

a mold closing step of closing said upper and lower mold sections (26, 28) in said molding unit (5, 5a, 5b, 5c);

a resin molding/sealing step of heating, pressurizing and melting said resin tablets (21) being supplied into said pots while injecting and charging molten resin materials into said cavities through resin passages being provided between said pots and said cavities, thereby molding resin to seal electronic parts mounted on said lead frames (14) being engaged in said cavities;

a sealed lead frame takeout step of taking out sealed said lead frames passing through said resin molding/sealing step from said upper and lower mold sections (26, 28) to the exterior; and

a mold surface cleaning step of cleaning respective mold surfaces of said upper and lower mold sections (26, 28),

said mold surface cleaning step being simultaneously

This is the replacement sheet



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Date: 26 OCT 1996



carried out in parallel with said sealed lead frame takeout step,

said steps of supplying said unsealed lead frames (14) and said resin tablets (21) being further simultaneously carried out in parallel with said sealed lead frame takeout step.

5. A method of molding resin to seal electronic parts in accordance with claim 4, wherein said sealed lead frame takeout step includes a step of advancing an unloader unit (7) into a clearance between said upper and lower mold sections (26, 28) for engaging said sealed lead frames and retracting said unloader unit (7) in this state for taking out said sealed lead frames to the exterior of said upper and lower mold sections (26, 28),

said step of supplying said unsealed lead frames (14) includes a step of advancing a loader unit (6) into said clearance between said upper and lower mold sections (26, 28) in retraction of said unloader unit (7) for supplying said unsealed lead frames (14) in prescribed positions of cavities in said upper and lower mold sections (26, 28),

said step of supplying said resin tablets (21) includes a step of advancing said loader unit (6) into said clearance between said upper and lower mold sections (26, 28) in retraction of said unloader unit (7) for

This is the replacement sheet



Date: 26 OCT 1996



supplying said resin tablets (21) into said pots, and
said mold surface cleaning step includes a step of
moving a cleaner unit (8) along said mold surfaces of said
upper and lower mold sections (26, 28) for cleaning said
mold surfaces of said upper and lower mold sections (26,
28).

6. A method of molding resin to seal electronic
parts in accordance with claim 5, wherein said steps of
supplying said unsealed lead frames (14) and said resin
tablets (21) are simultaneously carried out in advancement
of said loader unit (6) into said clearance between said
upper and lower mold sections (26, 28).

7. A method of molding resin to seal electronic
parts in accordance with claim 5, wherein said mold
cleaning step is carried out with said cleaner unit (8) in
retraction of said unloader unit (7).

8. A method of molding resin to seal electronic
parts in accordance with claim 4, wherein said mold
surface cleaning step is simultaneously carried out in
parallel with said sealed lead frame takeout step.

9. A method of molding resin to seal electronic





parts in accordance with claim 8, wherein said mold surface cleaning step is carried out by retracting said cleaner unit (8), being mounted on said unloader unit (7), with said unloader unit (7) in retraction of said unloader unit (7) in said sealed lead frame takeout step.

10. ~~An~~ apparatus for molding resin to seal electronic parts, comprising:

a molding unit having a mold (26, 28), resin material supply pots being arranged in said mold, resin pressurizing plungers being provided on said pots, cavities being provided in mold surfaces of said mold, and resin passages being arranged between said pots and said cavities;

means for supplying unsealed lead frames (14) having electronic parts mounted thereon and resin tablets (21) into said molding unit (5); and

means for taking out sealed said electronic parts from said molding unit (5) to the exterior,

additional molding units (5a, 5b, 5c) being rendered detachably mountable with respect to already provided said molding unit (5), thereby freely increasing/decreasing the number of said molding units.

11. An apparatus for molding resin to seal

This is the replacement sheet



Date: 26 OCT 1996



electronic parts in accordance with claim 10, wherein said means for supplying said unsealed lead frames (14) having electronic parts mounted thereon and said resin tablets (21) into each said molding unit (5, 5a, 5b, 5c) includes:

a supply unit (1) for supplying a number of unsealed lead frames (14) having electronic parts mounted thereon,

a lead frame aligning unit (2) for aligning said unsealed lead frames with each other along a prescribed direction,

a resin tablet supply unit (3),

a resin tablet discharge unit (4) for discharging said resin tablets (21) in alignment with each other, and

a loader unit (6) for transferring aligned said lead frames (14) and said resin tablets (21) to each said molding unit (5, 5a, 5b, 5c), and

said means for taking out said sealed electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior includes:

an unloader unit (7) for taking out said sealed lead frames,

a mold cleaner unit (8),

a sealed lead frame transfer unit (9),

a degating unit (10) for removing gates from said sealed lead frames,

a pickup unit (11) for picking up degated said sealed

This is the replacement sheet



Date: 26 OCT 1996



lead frames independently of each other, and
a lead frame storage unit (12) for storing picked-up
said sealed lead frames independently of each other,
said apparatus further comprising a controller unit
(13) for continuously and automatically controlling
operations of respective said units.

12. An apparatus for molding resin to seal
electronic parts in accordance with claim 10, wherein said
already provided molding unit (5) and said additional
molding units (5a, 5b, 5c) are adapted to mold resin for
sealing different types of products respectively.

13. An apparatus for molding resin to seal
electronic parts, comprising:

a molding unit having a pair of mold sections (26,
28), resin material supply pots being arranged in said
mold, resin pressurizing plungers being provided on said
pots, cavities being provided in respective mold surfaces
of said mold, and resin passages being arranged between
said pots and said cavities;

unsealed lead frame supply means (1) for transferring
unsealed lead frames (14) into a clearance between said
pair of mold sections (26, 28) of said molding unit (5)
and supplying the same to prescribed positions of said

This is the replacement sheet

Date: 26 OCT 1996





cavities;

resin tablet supply means (3) for transferring resin tablets (21) into said clearance between said pair of mold sections (26, 28) of said molding unit (5) and supplying the same into said pots;

mold closing means (27) for closing said pair of mold sections (26, 28) in said molding unit (5);

sealed lead frame takeout means for taking out sealed said lead frames from said pair of mold sections (26, 28) to the exterior; and

mold surface cleaning means (8) for cleaning respective said mold surfaces of said pair of mold sections (26, 28),

said resin tablet supply means (3) being formed to interlock with said sealed lead frame takeout means for making said unsealed lead frames (14) suppliable simultaneously with an operation for taking out said sealed lead frames.

14. An apparatus for molding resin to seal electronic parts in accordance with claim 13, wherein said mold surface cleaning means (8) is formed to interlock with said sealed lead frame takeout means, so that said mold surface cleaning means (8) is moved to clean said mold surfaces simultaneously with said operation for taking out said sealed lead frames.

This is the replacement sheet

Date: 26 OCT 1996



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15. A method of molding resin to seal electronic parts,
or an apparatus for molding resin to seal electronic parts,
substantially as herein particularly described with reference
to the accompanying drawings.

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Date: 26 OCT 1996

**METHOD OF AND APPARATUS FOR MOLDING RESIN
TO SEAL ELECTRONIC PARTS**

ABSTRACT OF THE DISCLOSURE

A method of and an apparatus for molding resin to seal electronic parts are adapted to seal electronic parts which are mounted on lead frames (14) with molded resin materials through molding units (5, 5a, 5b, 5c).

Additional molding units (5a, 5b, 5c) are detachably mounted with respect to an already provided molding unit (5) so that the number of the molding units can be arbitrarily adjusted, thereby enabling arrangement in a resin molding/sealing step, to implement simple response to mass production.

FIGURE 1A & 4

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Date: 26 OCT 1996

Date: 26 OCT 1996

- 1 -

FIG. 1A

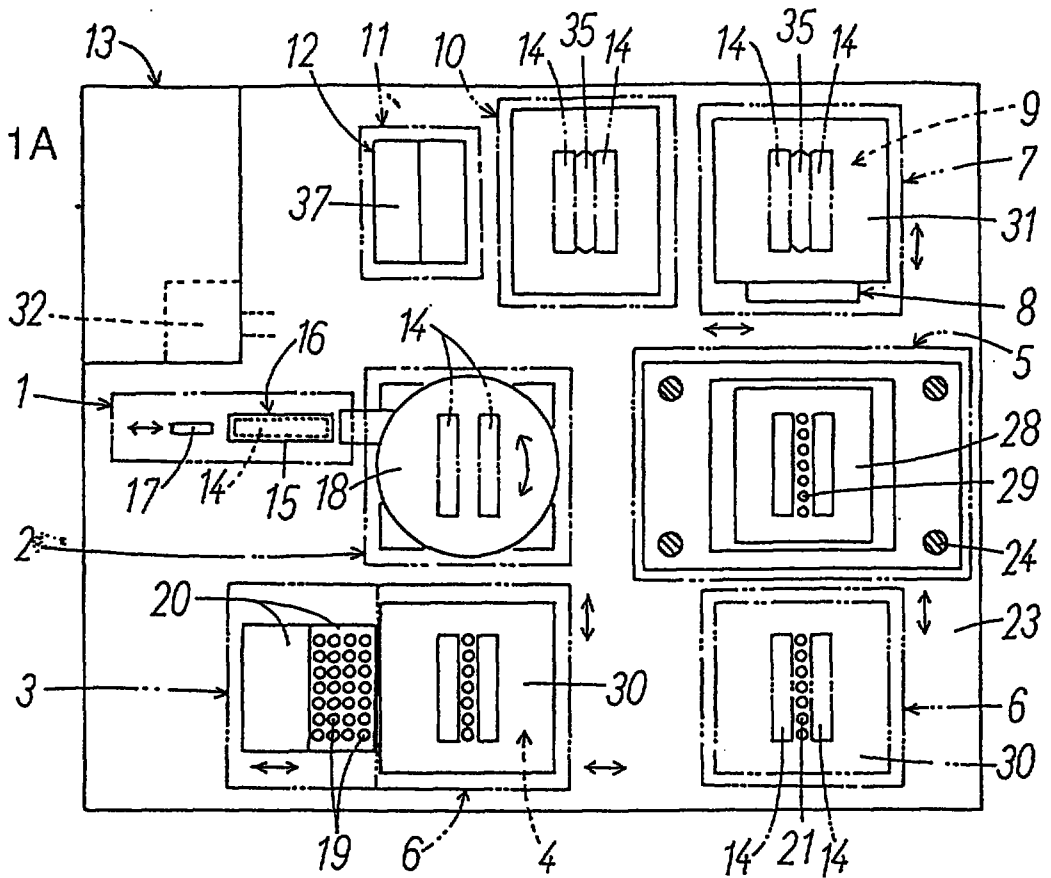
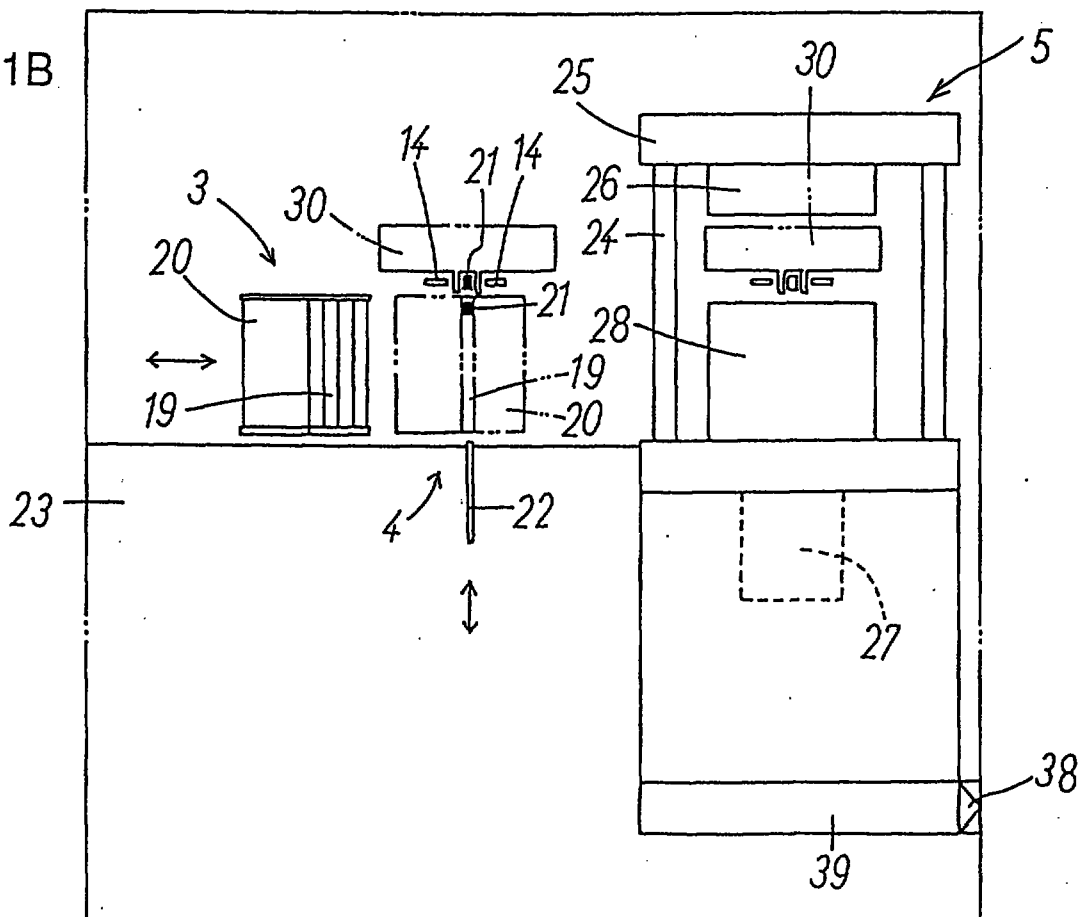
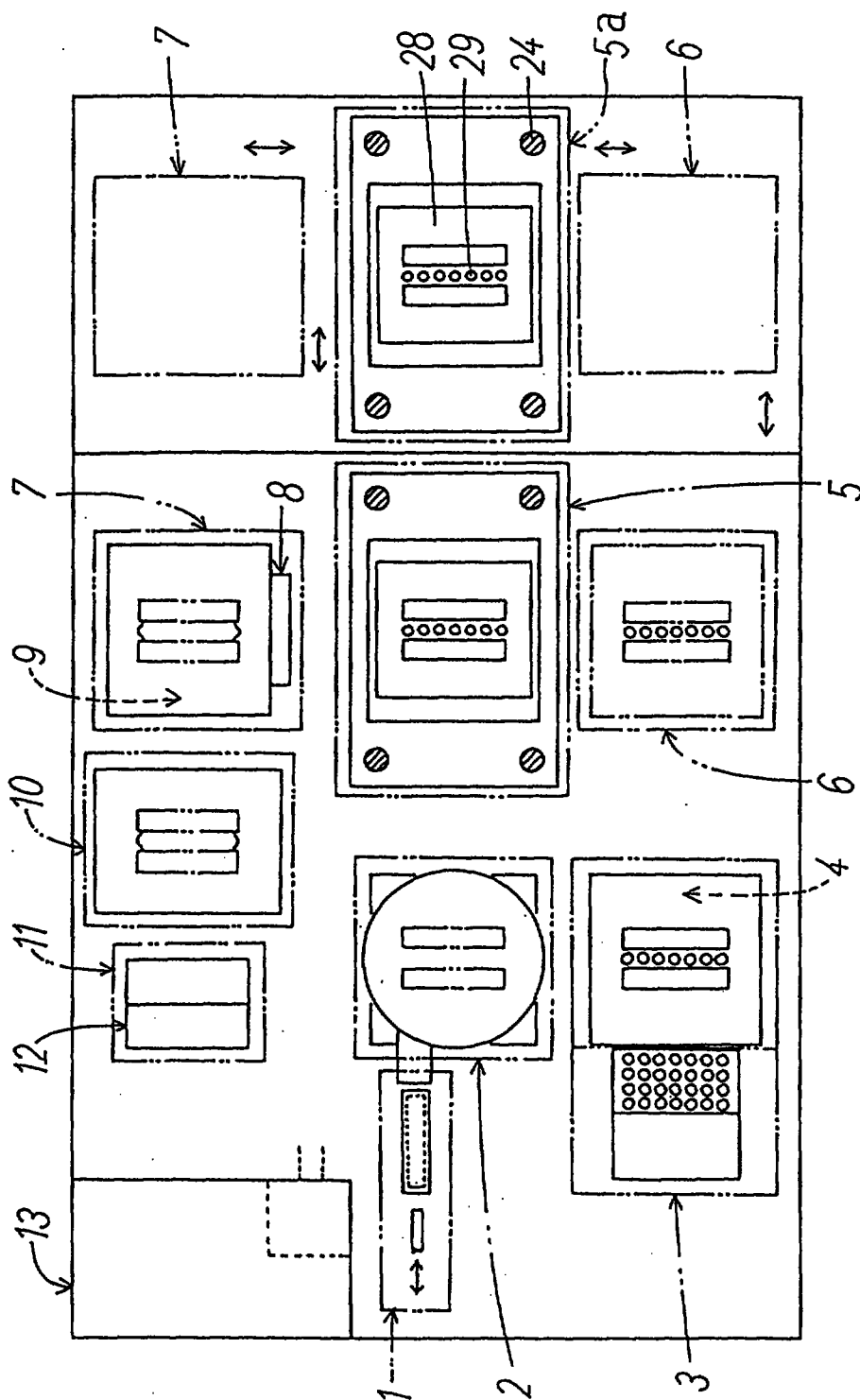


FIG. 1B



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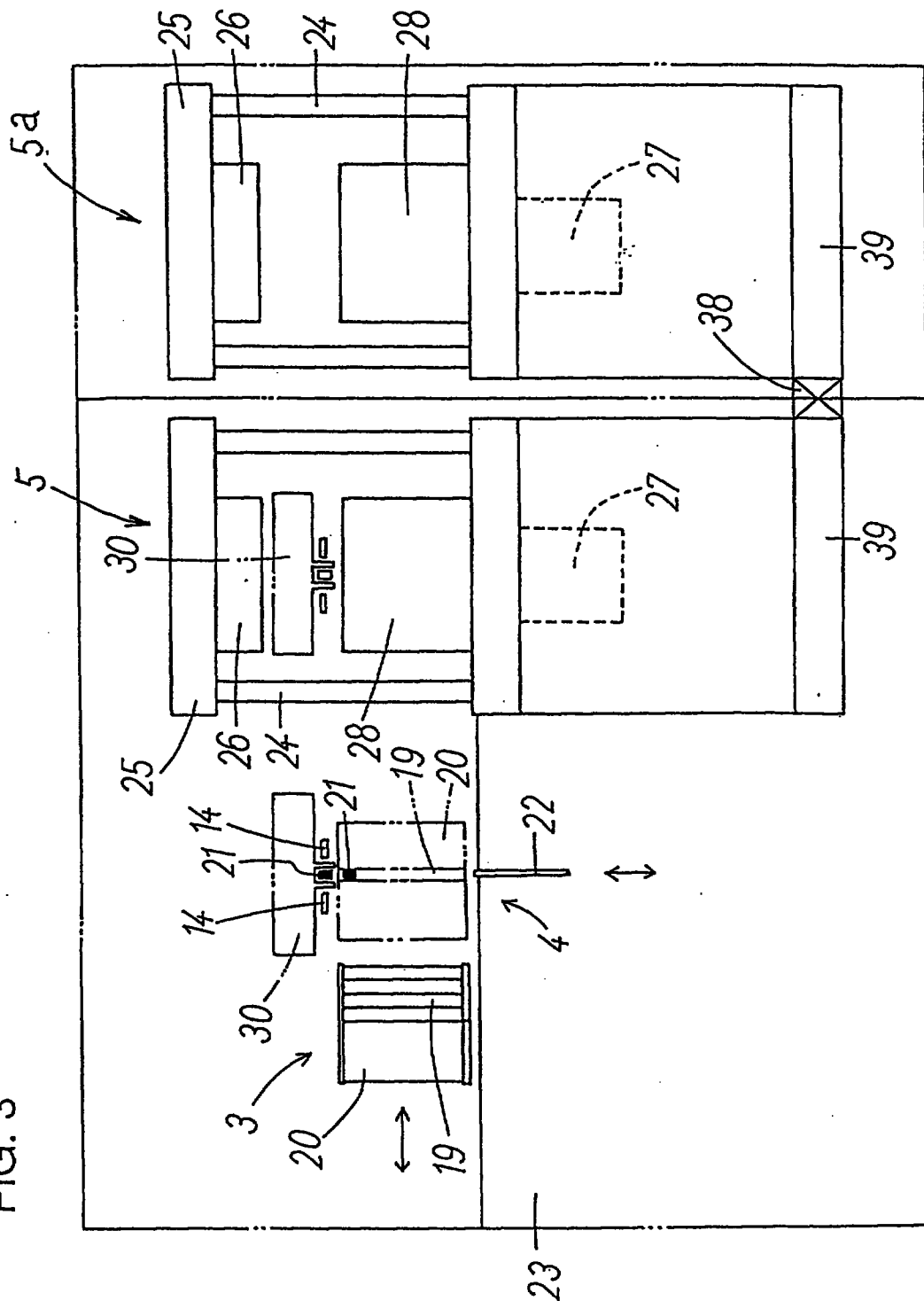
FIG. 2



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Date: 26 OCT 1996

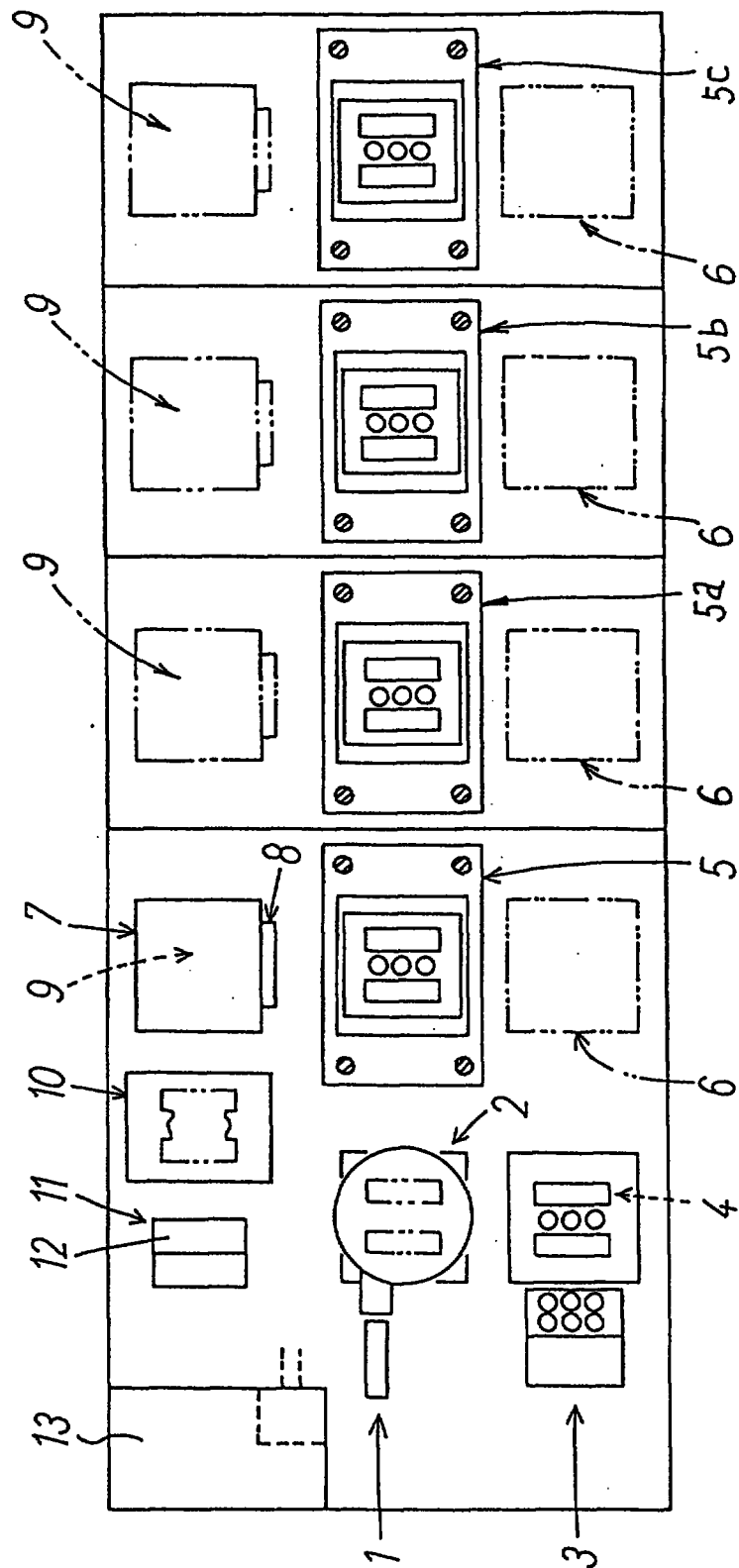
FIG. 3



This is the replacement sheet

Date: 26 OCT 1996

FIG. 4



This is the replacement sheet

Date: 26 OCT 1996

FIG. 6A

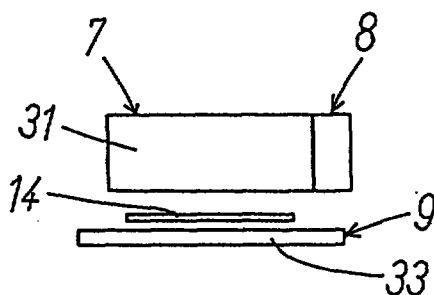


FIG. 6B

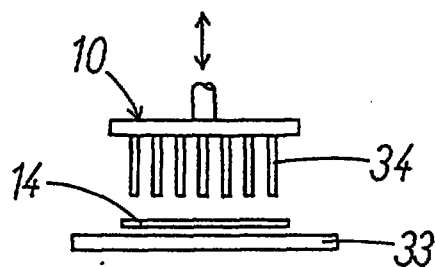


FIG. 6C

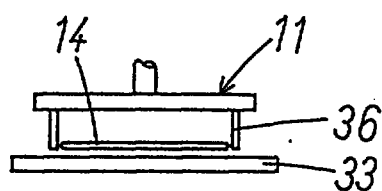
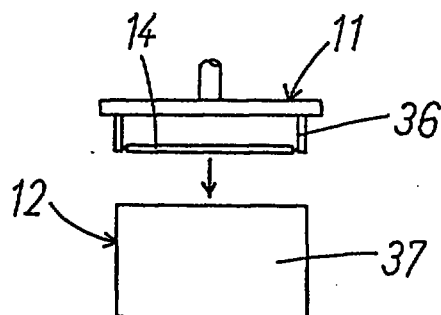


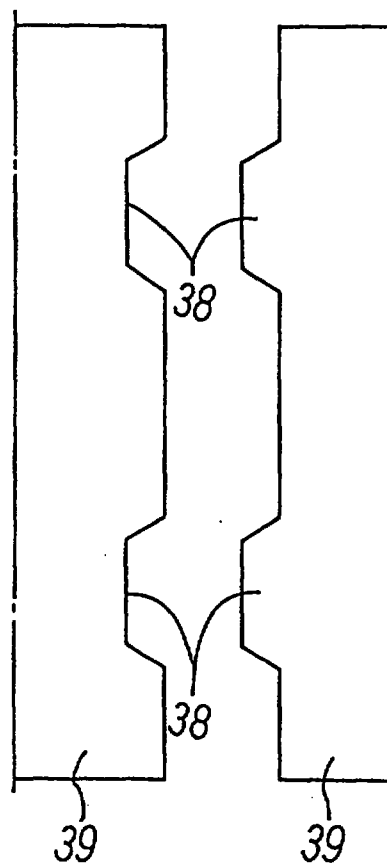
FIG. 6D



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Date: 26 OCT 1996

FIG. 7



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Date: 26 OCT 1996

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WHAT IS CLAIMED IS:

1. A method of molding resin to seal electronic parts for sealing electronic parts being mounted on lead frames with a resin material through a molding unit (5) having a mold (26, 28), resin supply pots (29) being arranged in said mold, resin pressurizing plungers being provided on said pots, cavities being provided in mold surfaces of said mold, and resin passages being provided between said cavities and said pots, said method comprising:

a step of adjusting the number of molding units by detachably mounting an additional molding unit (5a, 5b, 5c) with respect to said molding unit (5) being already provided in an apparatus for molding resin to seal electronic parts;

a step of supplying unsealed lead frames (14) having electronic parts mounted thereon and resin tablets (21) into each said molding unit (5, 5a, 5b, 5c);

a step of molding resin to seal said electronic parts through each said molding unit (5, 5a, 5b, 5c); and

a step of taking out sealed said electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior.

This is the replacement sheet

Date: 18 NOV 1997

REPLACEMENT SHEETS		SG
☐ Description :	paged to paged	
☒ Claim(s) :	paged 36 to paged 42	
☐ Drawing(s) :	paged to paged	
☐ Abstract :	paged to paged	
DATE OF RECEIPT		18 NOV 1997

2. A method of molding resin to seal electronic parts in accordance with claim 1, wherein said step of supplying said unsealed lead frames (14) having electronic parts mounted thereon and said resin tablets (21) into each said molding unit (5, 5a, 5b, 5c) includes:

a step of supplying and setting a number of said unsealed lead frames (14) having electronic parts mounted thereon in prescribed positions of a lead frame supply unit,

a step of transferring said unsealed lead frames (14) being set in said lead frame supply unit (1) to a lead frame aligning unit (2),

a step of aligning said unsealed lead frames (14) being transferred to said lead frame aligning unit (2) with each other along a prescribed direction,

a step of supplying a prescribed number of said resin tablets (21) into a resin tablet discharge unit (4) and aligning the same with each other, and

a step of transferring said unsealed lead frames (14) being set in said lead frame aligning unit (2) and said resin tablets (21) being aligned with each other in said resin tablet discharge unit (4) into a clearance between a fixed mold section (26) and a movable mold section (28) in each said molding unit (5, 5a, 5b, 5c) while supplying said unsealed lead frames (14) into prescribed positions

This is the replacement sheet

Date: 18 NOV 1997



of said cavities in each said molding unit (5, 5a, 5b, 5c) and supplying resin tablets (2) into said pots,

said step of molding resin to seal said electronic components includes:

a step of closing said fixed mold section (26) and said movable mold section (28) while heating, pressurizing and melting said resin tablets (21) in said pots for injecting and charging molten resin materials into said cavities through said resin passages thereby molding resin to seal said electronic parts being engaged in said cavities, and

said step of taking out said sealed electronic parts from each said molding unit (5, 5a, 5b, 5c) to the exterior includes:

a step of taking out said sealed lead frames passing through said resin molding/sealing step from said fixed mold section (26) and said movable mold section (28) to the exterior,

a step of cleaning mold surfaces of said fixed mold section (26) and said movable mold section (28),

a step of transferring said sealed lead frames to a position of a degating unit (10),

a step of removing gate portions from said sealed lead frames in said degating unit (10),

a step of transferring said sealed lead frames

This is the replacement sheet

Date: 18 NOV 1997



passing through said step of removing said gate portions to a lead frame storage unit (12),

a step of picking up said sealed lead frames passing through said step of removing said gate portions in said lead frame storage unit (12) independently of each other, and

a step of storing said sealed lead frames being picked up independently of each other.

3. A method of molding resin to seal electronic parts in accordance with claim 1, wherein said already provided molding unit (5) and said additional molding units (5a, 5b, 5c) are adapted to mold resin for sealing products of types being different from each other,

said step of molding resin to seal said electronic parts through said molding units (5, 5a, 5b, 5c) includes a step of simultaneously sealing products of different types with molded resin in parallel with each other.

4. An apparatus for molding resin to seal electronic parts, comprising:

a molding unit having a mold (26, 28), resin material supply pots being arranged in said mold, resin pressurizing plungers being provided on said pots, cavities being provided in mold surfaces of said mold, and

This is the replacement sheet

Date:

18 NOV 1997



resin passages being arranged between said pots and said cavities;

means for supplying unsealed lead frames (14) having electronic parts mounted thereon and resin tablets (21) into said molding unit (5); and

means for taking out sealed said electronic parts from said molding unit (5) to the exterior,

additional molding units (5a, 5b, 5c) being rendered detachably mountable with respect to already provided said molding unit (5), thereby freely increasing/decreasing the number of said molding units.

5. An apparatus for molding resin to seal

electronic parts in accordance with claim 4, wherein said means for supplying said unsealed lead frames (14) having electronic parts mounted thereon and said resin tablets (21) into each said molding unit (5, 5a, 5b, 5c) includes:

a supply unit (1) for supplying a number of unsealed lead frames (14) having electronic parts mounted thereon,

a lead frame aligning unit (2) for aligning said unsealed lead frames with each other along a prescribed direction,

a resin tablet supply unit (3),

a resin tablet discharge unit (4) for discharging

This is the replacement sheet

Date: 18 NOV 1997



said resin tablets (21) in alignment with each other, and
a loader unit (6) for transferring aligned said lead
frames (14) and said resin tablets (21) to each said
molding unit (5, 5a, 5b, 5c), and

said means for taking out said sealed electronic
parts from each said molding unit (5, 5a, 5b, 5c) to the
exterior includes:

an unloader unit (7) for taking out said sealed lead
frames,

a mold cleaner unit (8),

a sealed lead frame transfer unit (9),

a degating unit (10) for removing gates from said
sealed lead frames,

a pickup unit (11) for picking up degated said sealed
lead frames independently of each other, and

a lead frame storage unit (12) for storing picked-up
said sealed lead frames independently of each other,

said apparatus further comprising a controller unit
(13) for continuously and automatically controlling
operations of respective said units.

6 . An apparatus for molding resin to seal
electronic parts in accordance with claim 4, wherein said
already provided molding unit (5) and said additional
molding units (5a, 5b, 5c) are adapted to mold resin for
sealing different types of products respectively.

This is the replacement sheet



Date:

18 NOV 1997

7. A method of molding resin to seal electronic parts, or an apparatus for molding resin to seal electronic parts, substantially as herein particularly described with reference to the accompanying drawings.



This is the replacement sheet

Date: 18 NOV 1997

- 43 -

METHOD OF AND APPARATUS FOR MOLDING RESIN
TO SEAL ELECTRONIC PARTS

ABSTRACT OF THE DISCLOSURE

A method of and an apparatus for molding resin to seal electronic parts are adapted to seal electronic parts which are mounted on lead frames (14) with molded resin materials through molding units (5, 5a, 5b, 5c). Additional molding units (5a, 5b, 5c) are detachably mounted with respect to an already provided molding unit (5) so that the number of the molding units can be arbitrarily adjusted, thereby enabling arrangement in a resin molding/sealing step, to implement simple response to mass production.

FIGURE 1A & 4

