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IMPROVEMENT IN INJECTION MOLDING APPARATUS

This invention relates to improvement in apparatus for injection molding, for example, for encapsulating integrated circuits.

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In the electronics industry, a high degree of cleanliness is required to prevent contamination of circuitry and devices, which may cause subsequent electronic failure. Known injection molding equipment employs hydraulic presses which may leak hydraulic fluids and cleaning techniques which are not always effective in removing debris from the molds. Furthermore, removal of molds for cleaning is often difficult and time consuming. It is an object of the present invention to overcome these problems.

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Accordingly the present invention provides an injection molding apparatus, comprising a molding press adapted to receive a mold having a cavity shaped for the formation of the molding product, characterised in that, the molding press is activated by electro pneumatic action.

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The present invention also provides an integrated circuit encapsulation apparatus, comprising a molding press, adapted to receive a mold defining a cavity adapted to receive an integrated circuit die and an attached leadframe for encapsulation thereof which is provided with an integrated mold brushing unit, which has transversely rotating brushes, and travels over the mold faces to remove debris. In a further refinement of this form of the invention, a spring-loaded bearing system is provided for easy removal of the mold.

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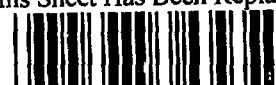
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The invention is described in greater detail below by way of example only, with reference to the accompanying drawings in which:

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Figures 1A, 1B and 1C show an exemplary molding press illustrating the operation for encapsulating an integrated circuit and leadframe;

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Figures 2A and 2B show a plan and elevation view respectively of an electro pneumatic press;

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Figures 3A and 3B show an elevation and side elevation respectively of the mold brushing system; and

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Figures 4A and 4B show the spring-loaded system for removing the mold.

Figures 1A, 1B and 1C are cross-sectional views of an exemplary transfer molding press 1 adapted to receive two molds 2. Each mold 2 is arranged within the molding press 1, and comprises upper and lower mold parts 2a, 2b which fit together to define a mold cavity 4.

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The molding press 1 is shown in Figure 1A in a closed position, having been loaded with integrated circuit leadframes 6 within the respective mold cavities 4, and a pellet of encapsulating material 3 in a gangpot 6. Encapsulation of the integrated circuits 6 is achieved by heating the encapsulating material pellet 3 and pressing it within the gangpot using a transfer plunger 8, which causes the pellet 3 to liquefy and flow into the mold cavities 4 through small passages between the gangpot and the mold cavities (see Figure 1B). After allowing the encapsulating material to solidify again, the molding press 1 is opened (Figure 1C), wherein the mold parts 2a, 2b are separated. The encapsulated integrated circuits 7 are lifted from the mold cavity by way of ejector pins 8, so as to expose them for removal from the molding press. After removal of the encapsulated integrated circuits 7, the open molding press is ready to receive new leadframe inserts 6 and encapsulating material pellet 3 to repeat the encapsulating process.

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Referring to Figures 2A and 2B, a ball-screw 15 is mounted on a large gear 12, which is driven by a smaller gear 11 mounted on a server motor 14. To close and clamp the mold, an interlocking device 13 engages the large gear 12 and a pneumatic cylinder 17 applies torque to the ball-screw nut 19 by a lever arm 18



which applies the clamping force. To open the mold, the process is reversed.

5 In Figure 3A, heat resistant brushes 21 are mounted on V-belts 23 which run
on pulleys 22. A motor 28 drives the pulleys 22 through a drive mechanism 26.
When the mold is opened, the brushing unit translates in a forward direction across
the mold-face and then reverses brushing any debris away from the mold. The
rotation of the brushes about a horizontal axis as the translation occurs provides a
10 more effective cleaning action than that of known cleaning methods which have
brushes rotating about vertical axes.

 In Figures 4A and 4B, a roller-bearing system 34 is mounted in the press-table
36 and is loaded with a spring 33 set in the base plate 32. When the mold 31 is
15 loaded, it depresses the spring 33 and sits in contact with the press table 36. When
the press is released, the spring 33 uncoils and raises the mold above the press table
36 allowing easy removal. The temperature of the mold which can be as high as
180°C makes mold changing a difficult operation and this system increases the speed
of changing considerably.

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 The above detailed description is by way of example only, and is not intended
to limit the scope of the invention which is defined in the following claims.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. An injection molding apparatus comprising a molding press adapted to receive a mold having a cavity shaped for the formation of the molding product characterised in that, the molding press is activated by electro pneumatic action.
2. Molding apparatus according to claim 1, in which the mold is provided with a spring-loaded bearing system for easy removal of the mold.
3. An integrated circuit encapsulation apparatus comprising a molding press adapted to receive a mold defining a cavity adapted to receive an integrated circuit die and an attached leadframe for encapsulation thereof characterised in that the molding press is activated by electro pneumatic action.
4. The apparatus of claim 3 which is provided with an integrated mold brushing unit which has transversely rotating brushes and travels over the mold faces to remove debris.
5. The apparatus of claim 3 which is further provided with a spring-loaded bearing system for easy removal of the mold.

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