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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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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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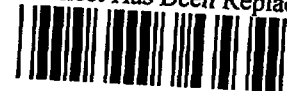


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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

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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IMPROVEMENT IN INJECTION MOLDING APPARATUS

ABSTRACT

5 An integrated circuit encapsulation apparatus comprises a molding press, which has a mold defining a cavity adapted to receive an integrated circuit die and an attached leadframe for encapsulation thereof. The press 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, a spring-loaded bearing system is provided for easy removal of the mold.

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Figure 2

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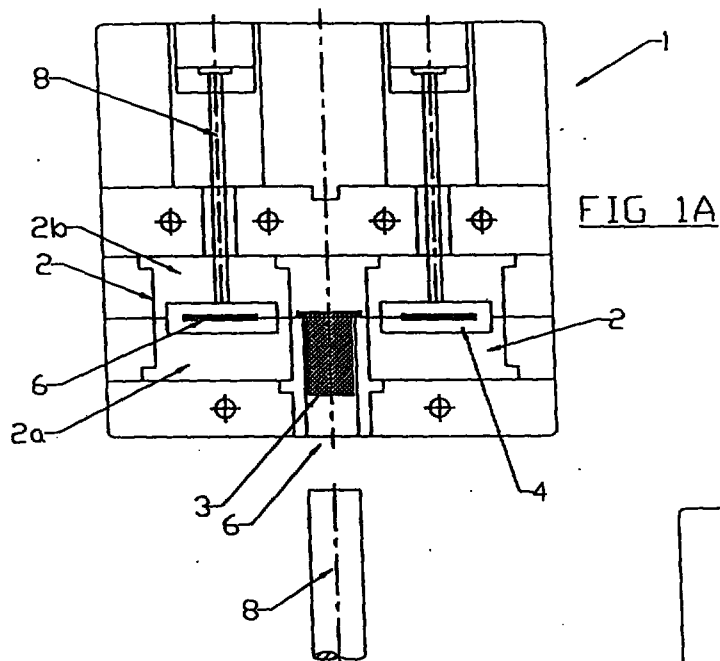


FIG 1B

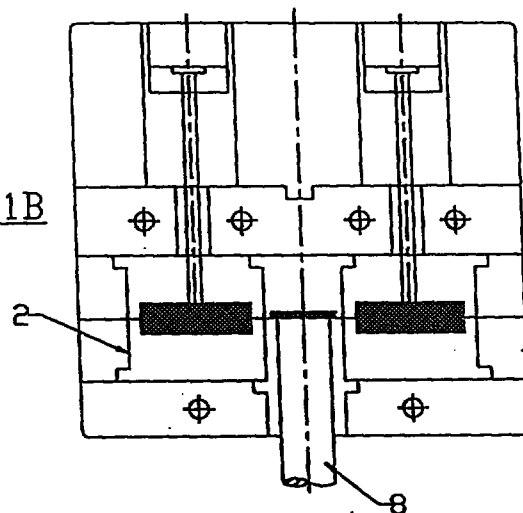
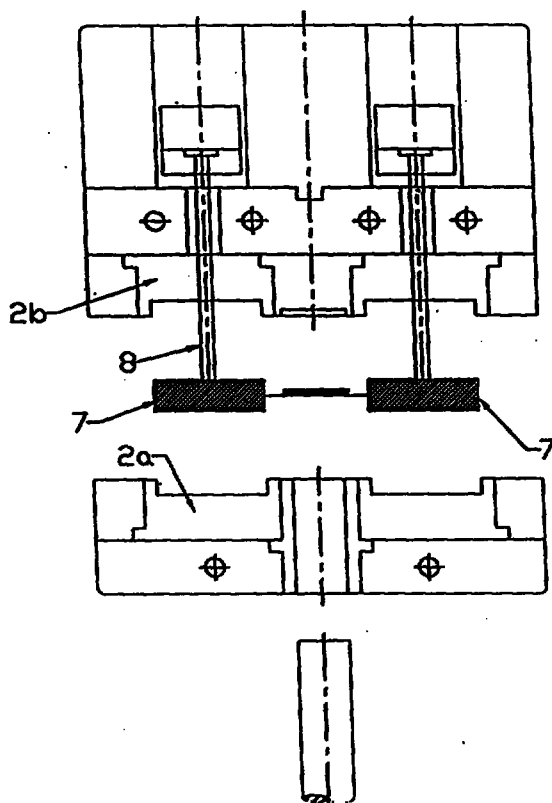
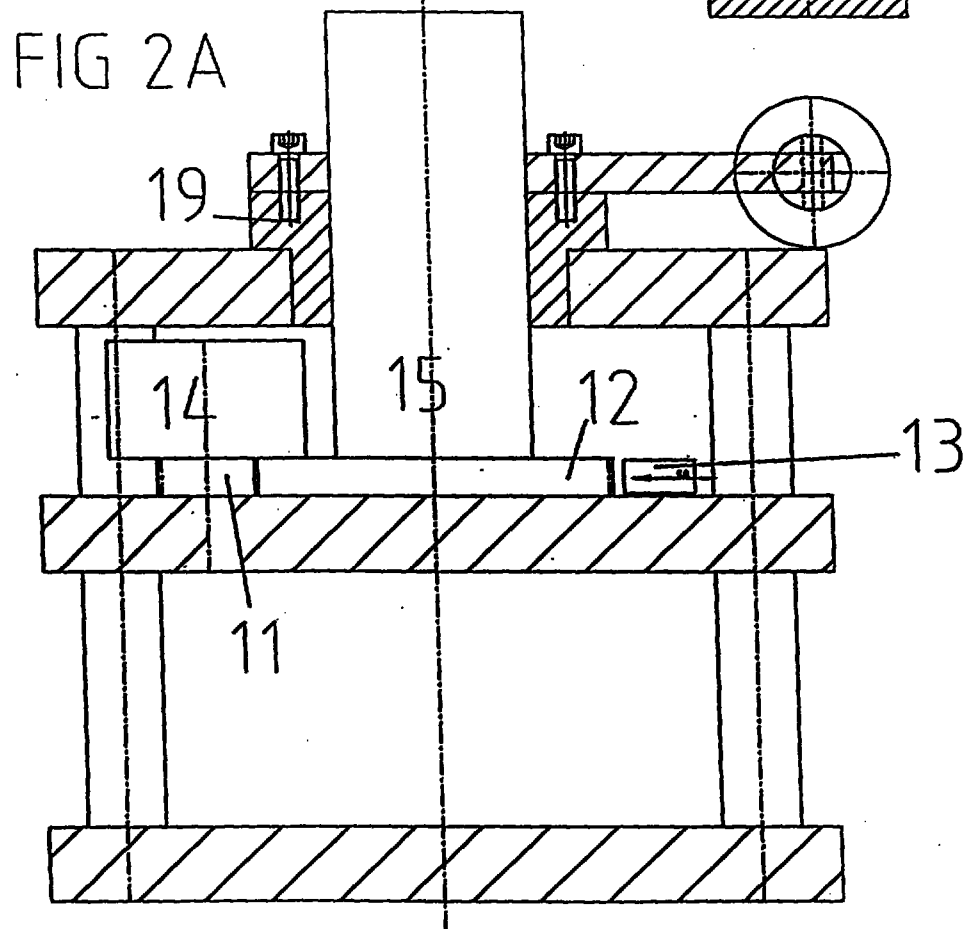
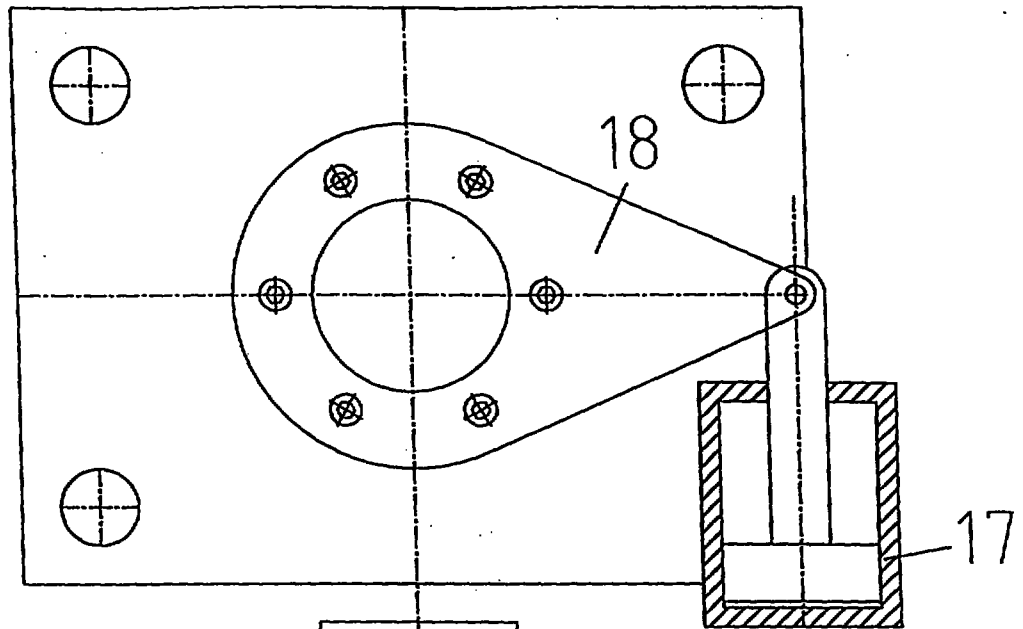


FIG 1C





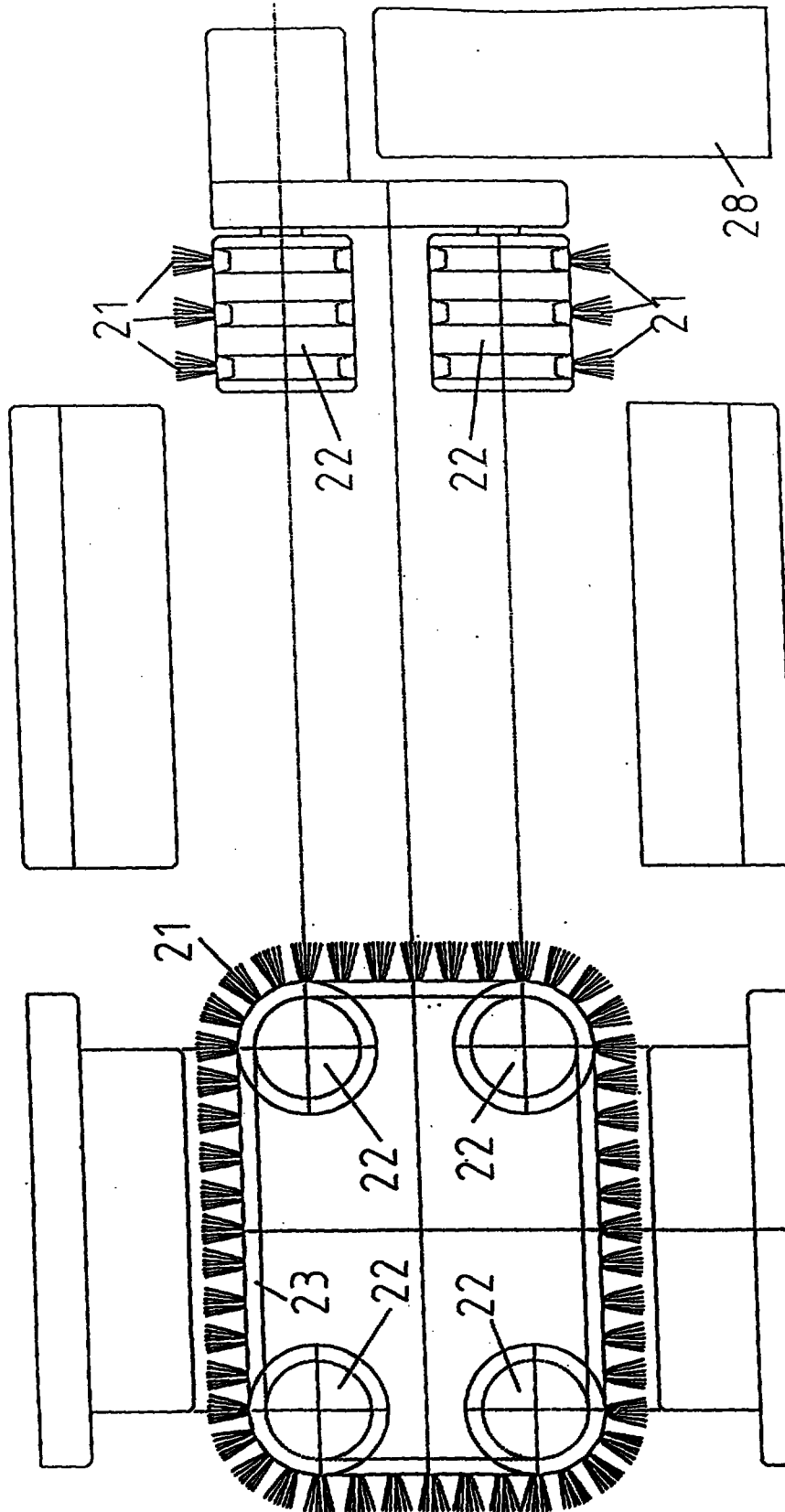


FIG 3B

FIG 3A



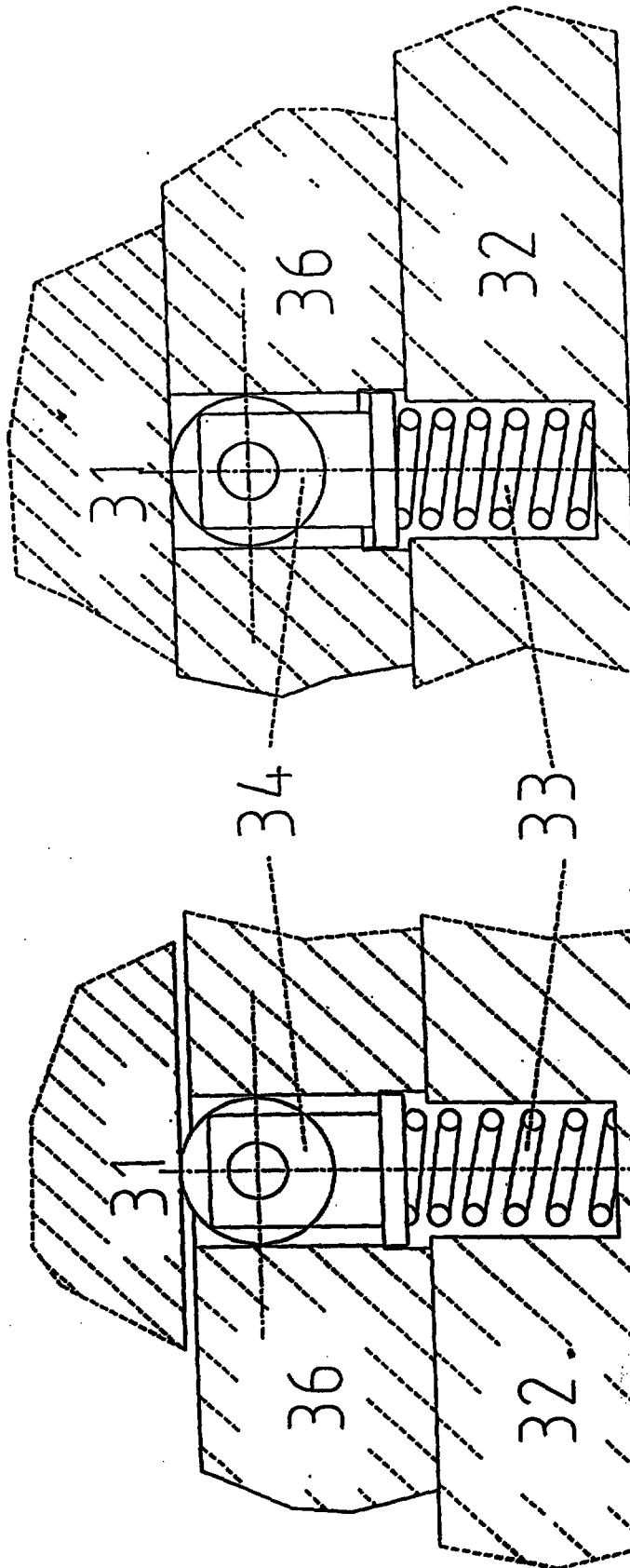


FIG 4B

FIG 4A

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INJECTION MOLDING APPARATUS

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

In the electronics manufacturing industry, a high degree of cleanliness is required to prevent contamination of circuitry and devices, which may cause subsequent electronic failure. A common way of packaging electronic integrated circuits is by encapsulating the prefabricated integrated circuit and a portion of the attached leadframe in a plastics material. Typically this is performed utilising injection molding apparatus, often of the transfer mold variety. Known injection molding equipment employs hydraulic presses, and it is not uncommon for hydraulic fluids to leak from the hydraulic presses, which may contaminate the molds and molded products. Although cleansing of the molds is performed regularly, the cleaning techniques are not always effective in removing contaminating 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.

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 a molding product, the molding apparatus comprising: first and second platens which are movable relative to one another so as to allow respective mold parts mounted thereon to be moved between open and closed configurations; and

an electro-pneumatic drive mechanism comprising: a threaded screw member coupled to one of the first and second platens; a motor, preferably an electric motor, coupled to drive the threaded screw member by way of a gear mechanism for moving the first and second platens relative to one another; and a linear motion mechanism, preferably a pneumatic cylinder mechanism, for driving the screw thread of the threaded member separately from said motor.

The present invention is particularly well adapted for use in an integrated

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circuit encapsulation process.

Preferably, the mold is provided with a spring-loaded bearing system for easy removal of the mold from the press.

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

Figures 1A, 1B and 1C are respective cross-sectional views through an exemplary molding press illustrating the operation for encapsulating an integrated circuit and leadframe;

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

Figures 3A and 3B show an elevation and side cross-sectional elevation respectively of a mold brushing system; and

Figures 4A and 4B are cross-sectional views showing a spring-loaded bearing system for removing the mold.

15 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.

20 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 9. 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
25 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 10, 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
5 the encapsulating process.

In order to move the mold parts 2a, 2b towards and away from each other between the open and closed configurations illustrated in Figures 1C and 1A, respectively, a driving mechanism is required. The upper and lower mold parts 2a, 2b are respectively mounted on upper and lower platens 16a, 16b of the molding
10 press, and the upper and lower platens are movable relative to one another along linear guide rods 20 (see Figure 2B). Typically hydraulic driving mechanisms have been employed for movement of the molding press platens, and in the electronics encapsulation industry, at least, such driving mechanisms are subject to disadvantages as discussed hereinabove. However, hydraulic driving mechanisms have persisted
15 even in the electronics encapsulation industry because other characteristics of the hydraulic systems make them well suited to the requirements for driving molding presses. In particular, hydraulic systems are able to easily provide a sufficient range of relative movement of the platens to permit access to the mold cavities when separated, and also enable generation of a sufficiently large clamping force between
20 the mold parts when the press is closed.

The molding press driving mechanism of the present invention is able to provide the range of movement and force requirements of the molding press, but without the deleterious effects which can result from the prior art hydraulic driving systems. A particular preferred form of the molding press driving mechanism is
25 illustrated in Figures 2A and 2B, in plan and cross-sectional elevation views, respectively. Representations of the upper and lower mold press platens are shown at 16a and 16b (Figure 2B), mounted for relative movement along guide rods 20. In this for of the driving mechanism, it is the upper platen 16a which is in fact movable

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along the guide rods 20, to effect displacement relative to the lower platen 16b which is fixed to the guide rods. The driving mechanism comprises an electro-pneumatic system, since the two operative components are an electrically activated motor, preferably a servo motor, and a pneumatically motivated cylinder and piston
5 arrangement.

The upper platen 16a has a screw 15, preferably an elongate ball-screw, mounted thereon, centrally arranged on top of the platen and rotatable about a central axis. The ball-screw 15 extends parallel to the guide rods 20 away from the lower platen 16b, and has an external screw thread formed thereon. A fixed frame plate 40
10 is mounted at the top of the guide rods 20 having a central aperture aligned with the ball-screw 15. Within the central aperture is mounted a flange member 42 which is fixed to prevent movement thereof relative to the frame plate 40 in the axial direction of the ball-screw, but to allow rotational movement about the ball-screw axis. The flange member 42 has a circular internally threaded opening, and the ball-screw 15
15 extends through the opening with the internal and external screw threads of the ball-screw and flange member interfitting. Accordingly, relative rotational movement between the ball-screw 15 and flange member 42 is translated into axial movement of the ball-screw relative to the frame plate, the direction of rotation determining the direction of axial movement. In view of the construction, therefore, relative rotational
20 movement between the ball-screw 15 and the flange member results in relative linear movement of the upper platen 16a, with respect to the lower platen 16b, along the guide rods 20.

As mentioned, the electro-pneumatic driving mechanism provides two active components, namely a motor 14, preferably an electric servo motor, and a pneumatic
25 piston and cylinder arrangement 17. Both the electric and pneumatic active components operate upon the ball screw arrangement above described, but provide different functions. In particular, the servo motor 14 is arranged to provide the required range of relative movement of the platens to permit sufficient access to the



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mould cavities when separated, whilst the pneumatic piston and cylinder is arranged to provide a sufficiently large clamping force between the mold parts when the press is closed.

Adjacent the top of the upper platen 16a, a driving mechanism comprises a gear cog 12 being mounted for axial movement with the ball-screw 15. The gear cog 12 intermeshes with a driving cog 11 which is driven by the servo motor 14 mounted on the upper platen 16a. Accordingly, driving the servo motor 14 rotates the driving cog 11 which thereby causes rotational movement of the gear cog 12 and ball screw 15. As discussed above, this rotational movement results in linear axial movement of the ball-screw 15 and upper platen 16a, relative to the lower platen 16b. Thus, by controllably driving the servo motor 14, the upper platen 16a can be moved relative to the lower platen 16b to, in use, open and close the molds of the molding press. Whilst the ball-screw 15 is driven by the servo motor 14 the flange member 42 of course remains stationary.

When the molds of the molding press are positioned in the closed configuration by action of the servo motor 14, it is then desired to ensure that sufficient clamping force is applied between the upper and lower mold parts. This function is provided by the pneumatic cylinder and piston arrangement 17. A lever arm 18 is fitted to the flange member 42 by way of connecting bolts 19, and a movable end of the piston of the cylinder and piston arrangement 17 is coupled to the end of the lever arm 18. This arrangement enables movement of the piston by action of increased pneumatic pressure in the cylinder 17 to be translated to rotational movement of the lever arm 18, and thus to the flange member 42. An interlocking device 13 is also provided adjacent the gear cog 12, which is operable to interlock with the gear cog 12 to prevent rotation thereof as well as the ball screw 15. Thus, motion of the piston 17 which results in rotational movement of the lever arm 18 and flange member is translated to axial movement of the ball screw 15. However, because of the nature of the mechanism the pneumatic cylinder is only able to produce a small rotational



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movement of the flange member 42, which results in only a small axial movement of the upper platen, although significant clamping force can nevertheless be generated.

Utilising the construction of the driving mechanism illustrated in Figures 2A and 2B, the servo motor 14 is able to be controlled so as to move the upper and lower platens 16a, 16b apart and together between open and closed configurations of the molds. When the servo motor is controlled so as to configure the molds into a closed configuration, then the pneumatic cylinder 17 can be activated by increasing the gas pressure therein so as to rotate the flange member relative to the ball screw 15. This action, combined with activation of the interlocking device 13 to prevent rotation of the ball screw 15 enables a clamping pressure to be applied by the pneumatic cylinder 17.

Although, it has been described above that a pneumatically motivated cylinder and piston arrangement is employed, it is understood that other arrangements, such as ball screw, can be used to translate linear movement to rotational movement of the lever arm.

In Figure 3A, heat resistant brushes 21 are mounted along a series of parallel endless 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 rotate in one direction is movable axially of the pulleys 22 (ie. transverse to the movement of brushes 21) across the mold-face brushing any debris away from the mold and then rotate in the other direction during the returning stroke of the cleaning process. The rotation of the brushes about a horizontal axis as the translation occurs provides a 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

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tightened, it depresses the spring 33 and sits in contact with the press table 36. When the mold 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. As shown in Figure 4A, the strength of springs 33 is such as to elevate the mold 31 by pressure of the bearings 34 to about 1mm above the surface of the press table 36. It will be immediately apparent that the bearings 34 may be of a form comprising rollers, or incorporating a ball bearing to allow two dimensional relative movement between the press table and mold, as will be appreciated by those skilled in the art. It is of course obvious that the roller-bearing system would be incorporated in the lower platen 16b, and that the base plate 32 and press table 36 may comprise components thereof.

Although it has been described above that the driving mechanism takes the form of gears, it is appreciated that the driving mechanism can be in other forms such as belts and chains.

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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Claims:

1. An injection molding apparatus comprising a molding press adapted to receive a mold having a cavity shaped for the formation of a molding product, the molding apparatus comprising: first and second platens which are movable relative to one another so as to allow respective mold parts mounted thereon to be moved between open and closed configurations; and

an electro-pneumatic drive mechanism comprising: a threaded screw member coupled to one of the first and second platens; an electric motor coupled to drive the threaded screw member by way of a first driving mechanism for moving the first and second platens relative to one another; and a second driving mechanism for driving the screw thread of the threaded member separately from said electric motor.

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 from the platen.

3. Molding apparatus as claimed in claim 1, wherein the threaded screw member is mounted to the first platen for movement thereof in the axial direction of the screw member.

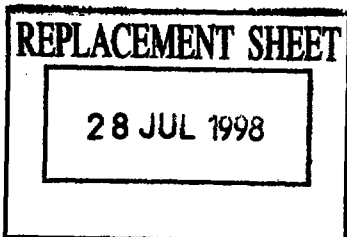
4. Molding apparatus as claimed in claim 3, wherein the pneumatic cylinder mechanism is arranged to apply torque to a flange member threadedly interengaged with the screw member so as to apply a clamping force between the mold parts when in the closed configuration.

5. Molding apparatus as claimed in any preceding claim, further provided with an integrated mold brushing unit which has transversely rotating brushes and travels over the mold faces to remove debris.

6. Molding apparatus as claimed in claim 1, wherein said first driving mechanism

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is in the form of gears.

7. Molding apparatus as claimed in claim 1, wherein said first driving mechanism is in the form of belts.

8. Molding apparatus as claimed in claim 1, wherein said first driving mechanism
5 is in the form of chains.

9. Molding apparatus as claimed in claim 1, wherein said second driving mechanism is a pneumatic cylinder.

10. Molding apparatus as claimed in claim 1, wherein said second driving mechanism is a ball screw.

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INJECTION MOLDING APPARATUS**Abstract**

An integrated circuit encapsulation apparatus comprises a molding press, which has a mold defining a cavity adapted to receive an integrated circuit die and an attached leadframe for encapsulation thereof. The molding press is operable by an electro-pneumatic driving mechanism which utilises a geared servo motor for opening and closing the mold, and a pneumatic cylinder for providing clamping pressure. Both the servo motor and pneumatic cylinder act upon a threaded screw member for movement of the molding press. The press 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, a spring-loaded bearing system is provided for easy removal of the mold.

Figures 2A and 2B

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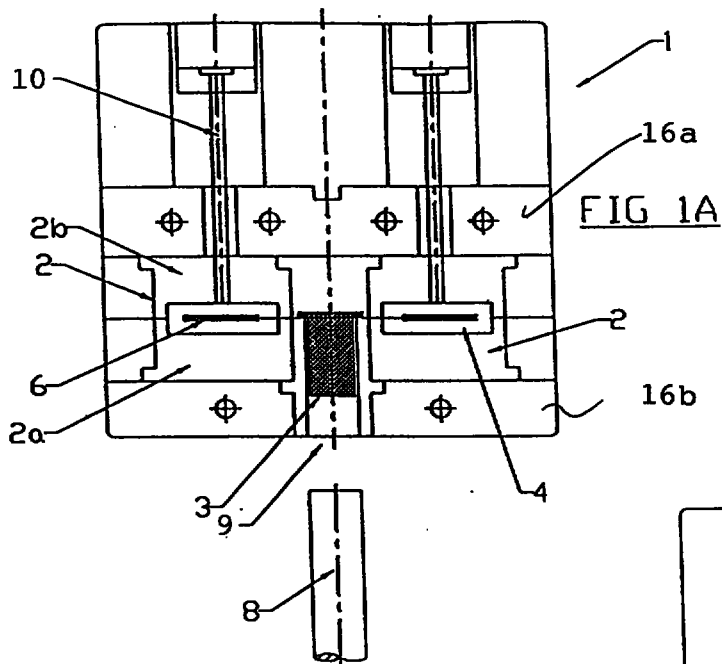


FIG 1B

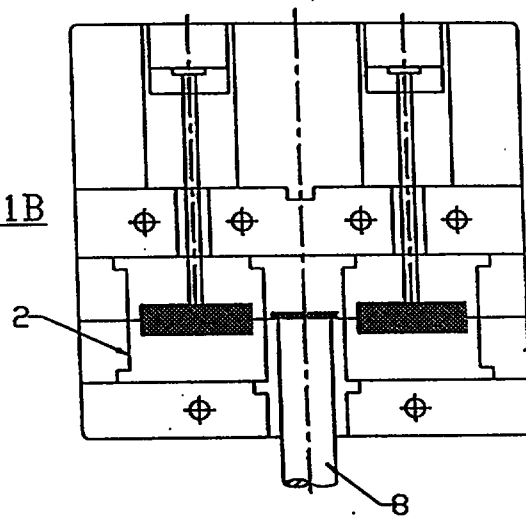
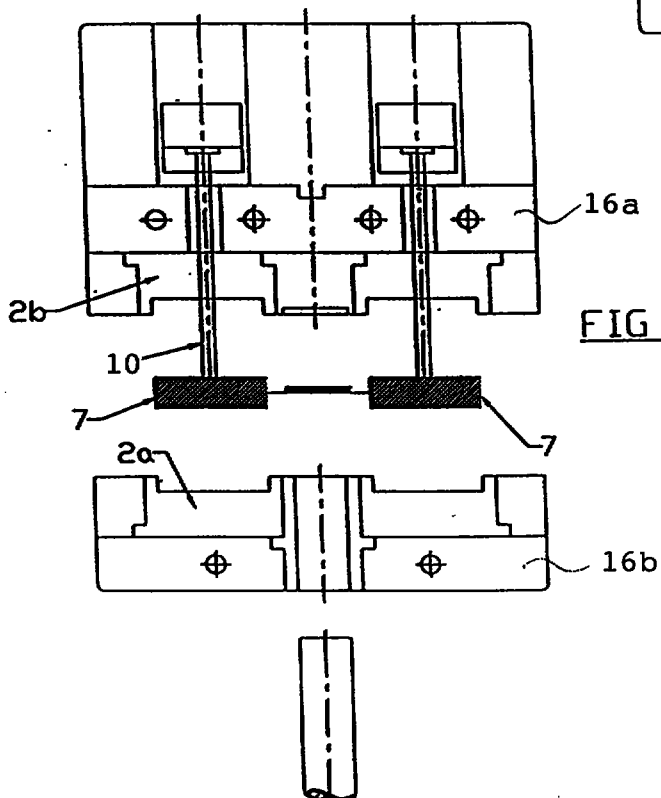


FIG 1C



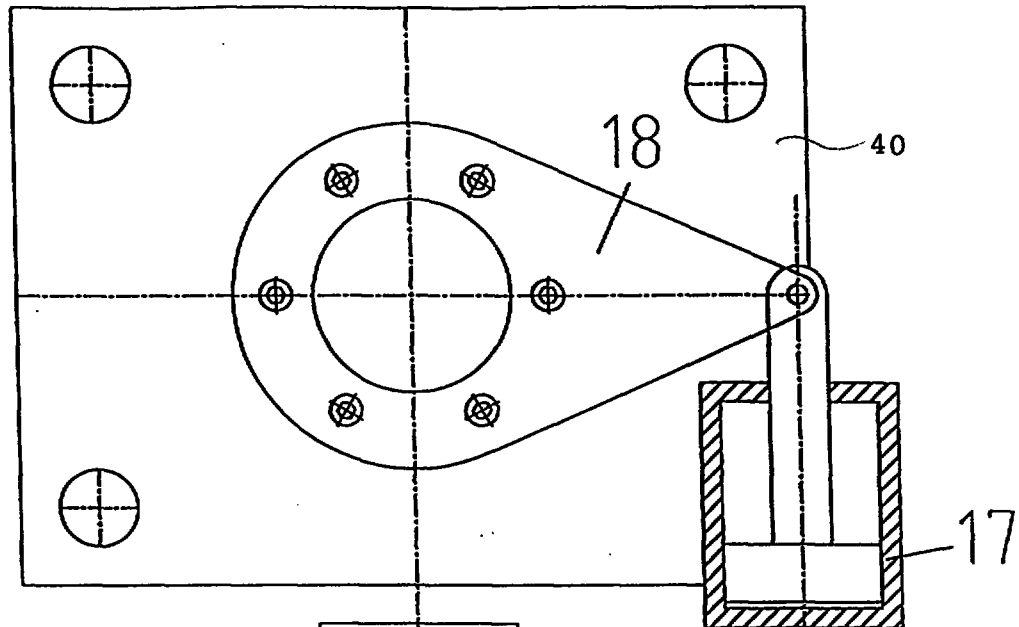


FIG 2A

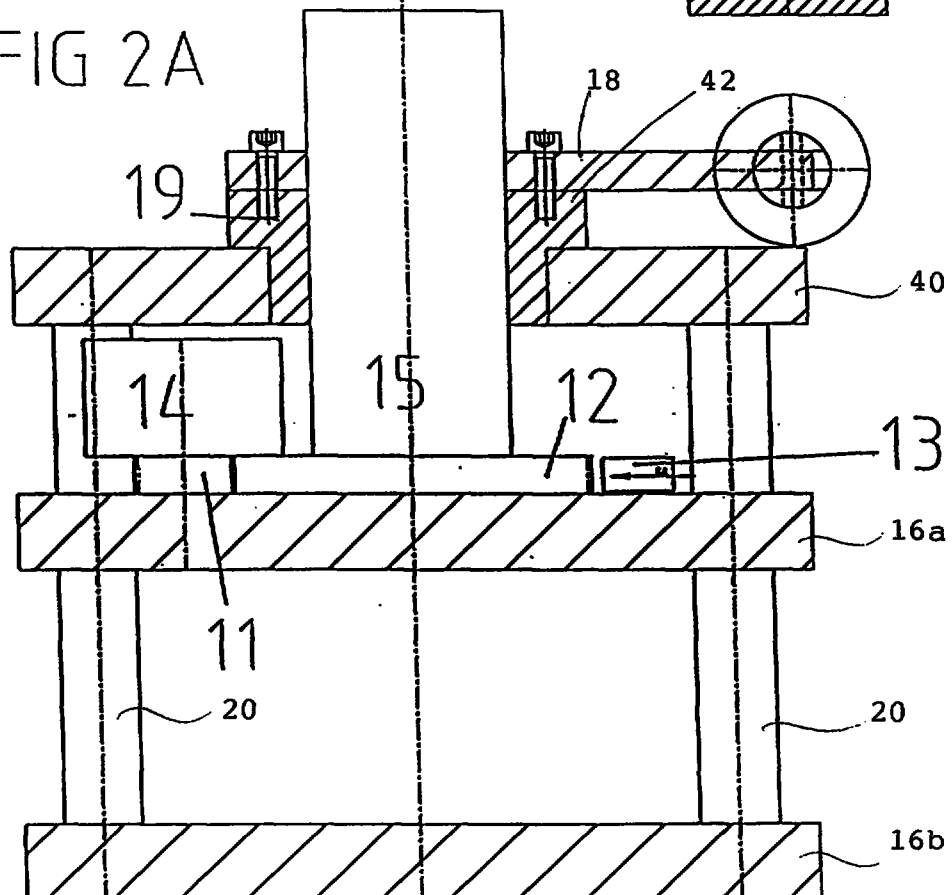


FIG 2B

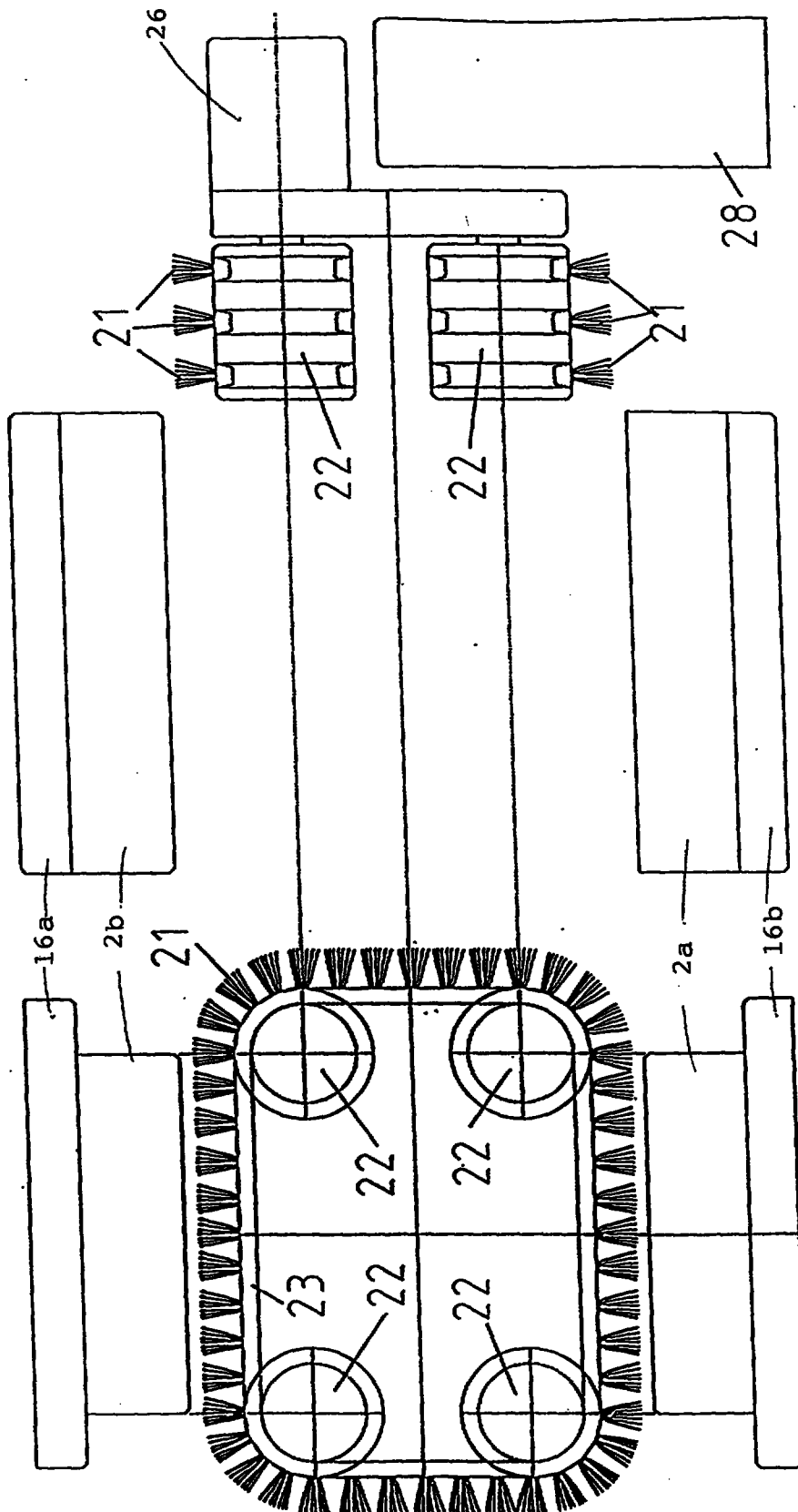


FIG 3B

FIG 3A

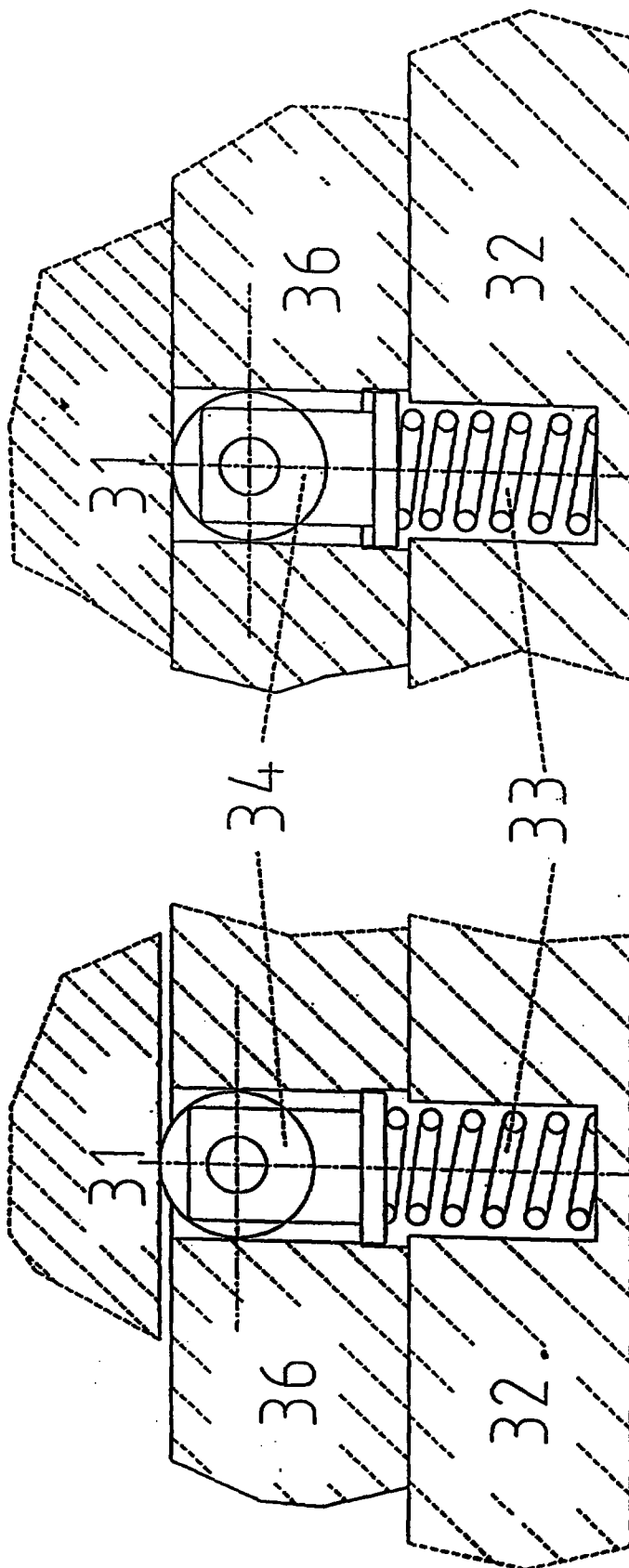


FIG 4B

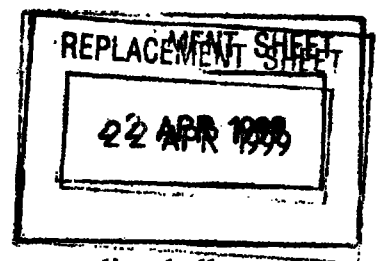
FIG 4A

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along the guide rods 20, to effect displacement relative to the lower platen 16b which is fixed to the guide rods. The driving mechanism comprises an electro-pneumatic system, since the two operative components are an electrically activated motor, preferably a servo motor, and a pneumatically motivated cylinder and piston arrangement.

The upper platen 16a has a screw 15, preferably an elongate ball-screw, mounted thereon, centrally arranged on top of the platen and rotatable about a central axis. The ball-screw 15 extends parallel to the guide rods 20 away from the lower platen 16b, and has an external screw thread formed thereon. A fixed frame plate 40 is mounted at the top of the guide rods 20 having a central aperture aligned with the ball-screw 15. Within the central aperture is mounted a flange member 42 which is fixed to prevent movement thereof relative to the frame plate 40 in the axial direction of the ball-screw, but to allow rotational movement about the ball-screw axis. The flange member 42 has a circular internally threaded opening, and the ball-screw 15 extends through the opening with the internal and external screw threads of the ball-screw and flange member interfitting. Accordingly, relative rotational movement between the ball-screw 15 and flange member 42 is translated into axial movement of the ball-screw relative to the frame plate, the direction of rotation determining the direction of axial movement. In view of the construction, therefore, relative rotational movement between the ball-screw 15 and the flange member results in relative linear movement of the upper platen 16a, with respect to the lower platen 16b, along the guide rods 20.

As mentioned, the electro-pneumatic driving mechanism provides two active components, namely a motor 14, preferably an electric servo motor, and a pneumatic piston and cylinder arrangement 17. Both the electric and pneumatic active components operate upon the ball screw arrangement above described, but provide different functions. Although it has been described that the electric and pneumatic components may operate upon the ball screw arrangement, it is understood that the



electric and pneumatic components may also operate upon corresponding ball nuts threadedly interengaged with the ball screw. In particular, the servo motor 14 is arranged to provide the required range of relative movement of the platens to permit sufficient access to the mould cavities when separated, whilst the pneumatic piston and cylinder is arranged to provide a sufficiently large clamping force between the mold parts when the press is closed.

Adjacent the top of the upper platen 16a, a driving mechanism comprises a gear cog 12 being mounted for axial movement with the ball-screw 15. The gear cog 12 intermeshes with a driving cog 11 which is driven by the servo motor 14 mounted on the upper platen 16a. Accordingly, driving the servo motor 14 rotates the driving cog 11 which thereby causes rotational movement of the gear cog 12 and ball screw 15. As discussed above, this rotational movement results in linear axial movement of the ball-screw 15 and upper platen 16a, relative to the lower platen 16b. Thus, by controllably driving the servo motor 14, the upper platen 16a can be moved relative to the lower platen 16b to, in use, open and close the molds of the molding press. Whilst the ball-screw 15 is driven by the servo motor 14 the flange member 42 of course remains stationary.

When the molds of the molding press are positioned in the closed configuration by action of the servo motor 14, it is then desired to ensure that sufficient clamping force is applied between the upper and lower mold parts. This function is provided by the pneumatic cylinder and piston arrangement 17. A lever arm 18 is fitted to the flange member 42 by way of connecting bolts 19, and a movable end of the piston of the cylinder and piston arrangement 17 is coupled to the end of the lever arm 18. This arrangement enables movement of the piston by action of increased pneumatic pressure in the cylinder 17 to be translated to rotational movement of the lever arm 18, and thus to the flange member 42. An interlocking device 13 is also provided adjacent the gear cog 12, which is operable to interlock with the gear cog 12 to prevent rotation thereof as well as the ball screw 15. Thus, motion of the piston 17

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which results in rotational movement of the lever arm 18 and flange member is translated to axial movement of the ball screw 15. However, because of the nature of the mechanism the pneumatic cylinder is only able to produce a small rotational movement of the flange member 42, which results in only a small axial movement of the upper platen, although significant clamping force can nevertheless be generated.

Utilising the construction of the driving mechanism illustrated in Figures 2A and 2B, the servo motor 14 is able to be controlled so as to move the upper and lower platens 16a, 16b apart and together between open and closed configurations of the molds. When the servo motor is controlled so as to configure the molds into a closed configuration, then the pneumatic cylinder 17 can be activated by increasing the gas pressure therein so as to rotate the flange member relative to the ball screw 15. This action, combined with activation of the interlocking device 13 to prevent rotation of the ball screw 15 enables a clamping pressure to be applied by the pneumatic cylinder 17.

Although, it has been described above that a pneumatically motivated cylinder and piston arrangement is employed, it is understood that other arrangements, such as ball screw, can be used to translate linear movement to rotational movement of the lever arm.

In Figure 3A, heat resistant brushes 21 are mounted along a series of parallel endless 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 rotate in one direction is movable axially of the pulleys 22 (ie. transverse to the movement of brushes 21) across the mold-face brushing any debris away from the mold and then rotate in the other direction during the returning stroke of the cleaning process. The rotation of the brushes about a horizontal axis as the translation occurs provides a more effective cleaning action than that of known cleaning methods which have brushes rotating about vertical axes.

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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 tightened, it depresses the spring 33 and sits in contact with the press table 36. When the mold 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. As shown in Figure 4A, the strength of springs 33 is such as to elevate the mold 31 by pressure of the bearings 34 to about 1mm above the surface of the press table 36. It will be immediately apparent that the bearings 34 may be of a form comprising rollers, or incorporating a ball bearing to allow two dimensional relative movement between the press table and mold, as will be appreciated by those skilled in the art. It is of course obvious that the roller-bearing system would be incorporated in the lower platen 16b, and that the base plate 32 and press table 36 may comprise components thereof.

Although it has been described above that the driving mechanism takes the form of gears, it is appreciated that the driving mechanism can be in other forms such as belts and chains.

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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Claims:

1. An injection molding apparatus comprising a molding press adapted to receive a mold having a cavity shaped for the formation of a molding product, the molding apparatus comprising: first and second platens which are movable relative to one another so as to allow respective mold parts mounted thereon to be moved between open and closed configurations; and
- an electro-pneumatic drive mechanism comprising: a threaded screw member coupled to one of the first and second platens for movement thereof in the axial direction of the screw member; an electric motor coupled to drive the threaded screw member by way of coupling means for moving the first and second platens relative to one another; and a pneumatic cylinder mechanism coupled to the threaded screw member for driving the screw thread of the threaded screw member separately from said electric motor, said pneumatic cylinder mechanism being arranged to apply torque through a lever member to a flange member threadedly interengaged with the screw member so as to apply a clamping force between the mold parts when in the closed configuration.
2. Molding apparatus as claimed in claim 1, wherein the mold is provided with a spring-loaded bearing system for easy removal of the mold from the platen.

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3. Molding apparatus as claimed in any preceding claim, further provided with an integrated mold brushing unit which has transversely rotating brushes and travels over the mold faces to remove debris.

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4. Molding apparatus as claimed in claim 1, wherein the coupling means is in the form of gears.

5. Molding apparatus as claimed in claim 1, wherein the
10 coupling means is in the form of belts.

6. Molding apparatus as claimed in claim 1, wherein the coupling means is in the form of chains.

15 7. Molding apparatus as claimed in claim 1, wherein the flange member has a circular internally threaded opening for threadingly receiving the threaded screw member, the flange member being fixed to prevent movement thereof relative to a frame plate of the molding apparatus in the
20 axial direction of the screw member, but to allow rotation movement about the axis of the screw member.

8. Molding apparatus as claimed in claim 7, wherein the lever member is fixedly connected to the flange member and
25 is adapted to be activated by a piston-rod of the pneumatic cylinder mechanism.