

INJECTION MOLDING MACHINES

5 The present invention relates to injection molding machines.

 In a previously proposed mold support assembly for use in an injection molding machine, a small size mold (sub-mold) can be installed into a support structure (base mold) of the assembly. In this case, only the
10 small size sub-molds need be exchanged to enable different molding operations to be performed, thereby providing different molds for use in making various kinds of products having different shapes, the common base mold being used for all molding operations. This can enable a
15 manufacturing cost for the mold to be reduced.

 Heretofore, a rotary fastening mechanism, a clamp mechanism, etc. have been considered for use in installing the small size mold. However, in the case of installing the sub-mold with such a rotary fastening
20 mechanism or clamp mechanism, the installation work takes a long time, so a working efficiency of the overall injection molding process can be much reduced. Further, since the installation work is complex, it has heretofore been difficult to fully automate this process.

25 Japanese Laid-Open Patent Publication No. Sho-58-42100 proposes an operation for exchanging a sub-mold in which a mold plate loaded with the sub-mold is pulled out of a support frame for the mold plate. However, since the exchanging operation is carried out while every mold
30 plate loaded with its sub-mold is suspended by a crane or the like and the mold plate is fixed with screws, it also involves time-consuming and complicated work.

 Further, a product eject mechanism may be provided in cases where it may be difficult to take the product
35 out of a cavity. However, in a previously-proposed mechanism only one eject pin penetrating from a base mold through a changeable sub-mold is provided, and the eject

pin is moved to the cavity side to perform a product-ejecting operation (for example, as described in the Japanese Examined Published Patent Publication of No. Sho-58-42100).

5 In this manner, the position at which the eject pin is provided is unchangeable, and thus the ejecting operation must be carried out at this position at all times. Therefore, the position of ejection is sometimes unsuitable for the shape of the cavity of the changeable
10 sub-mold, and thus it frequently occurs that the molded products are not completely ejected out, or are damaged.

 In order to obtain an optimum position for the ejection, it is necessary to reform the base molds. The reforming of the base molds will result in an obstacle to
15 a requirement for reducing the manufacturing cost of the mold, thereby potentially defeating the object of decreasing cost by employing a common base mold.

 Embodiments of the present invention can provide an injection molding machine in which installation of an
20 exchangeable sub-mold can be carried out simply, and/or in which a mold manufacturing cost can be reduced while an optimum ejecting position of a product is obtained.

 An injection molding machine embodying a first aspect of the present invention comprises a number of
25 sub-mold hollows which are formed in at least one of a fixed-side base plate and a movable-side base plate along a thickness direction thereof, a key way formed in a surface direction on the base plate in which the sub-mold hollows are formed, a changeable sub-mold which is
30 detachably mounted in each of the sub-mold hollows, and a comb-shaped fixing key which is detachably engaged with the key way and fixes the changeable sub-mold by engaging with an engaging portion of the changeable sub-mold when inserted into the key way.

35 In such a machine, the changeable sub-mold can be installed and removed through the parting line (PL) plane side, and the fixing of the changeable sub-mold is

carried out by the comb-shaped fixing key which is inserted and pulled out along the surface direction of the base plate, so that the installing work of the changeable sub-mold is carried out in a simple and quick manner.

An injection molding machine embodying a second aspect of the present invention comprises a changeable sub-mold which is detachably mounted in a movable-side mold, a first eject mechanism provided to the changeable sub-mold, and a second eject mechanism provided to the movable-side mold for actuating the first eject mechanism.

In such a machine, the eject mechanism is divided into the first eject mechanism which is provided in the changeable sub-mold and the second eject mechanism which is provided in the movable-side mold, and the first eject mechanism is actuated by the second eject mechanism. Therefore, when the changeable sub-mold is designed, the ejecting position of the first eject mechanism can be set to the optimum position, and thus reduction is manufacturing cost of the mold and the optimum ejecting position can be obtained.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of an injection molding machine embodying the present invention, which view is taken at various positions;

Fig. 2 is a longitudinal-sectional view which is taken along line A-A in Fig. 1;

Fig. 3 is a front view of a runner plate of the machine of Fig. 1;

Fig. 4 is a longitudinal-sectional view showing parts of a mechanism, included in the machine of Fig. 1, for positioning a changeable sub-mold for use with the machine;

Fig. 5 is a cross-sectional view showing parts of an eject mechanism of the Fig. 1 machine;

Fig. 6 is a cross-sectional view showing a separating mechanism which can be included in an injection molding machine.

As shown in Fig. 1 a mold comprises a fixed-side mold P and a movable-side mold Q.

At first, the fixed-side mold P will be hereunder described.

A nozzle bush 2 having a sprue 2a is secured to a fixed-side securing plate 1 through a locating ring 3. A nozzle (not shown) of an injection molding machine is engaged with the nozzle bush 2, and four support shafts 10 are fixedly secured onto the fixed-side securing plate 1 (as shown in Fig. 2). Moreover, a runner lock pin 32 having an under-cut shaped tip portion which reaches a runner portion 8a as described later also projects from the fixed-side securing plate 1.

A spacer plate 5, having a hollow 5a in which a runner plate 6 (described later) is insertably mounted, is fixedly secured onto a receiving plate 4.

A fixed-side base plate 7 is disposed in the right side of the spacer plate 5, as shown in Fig. 1, in such a manner as to be freely slidably supported by the support shafts 10. Four sub-mold hollows 7b which are cut out in the fixed-side base plate 7 in the direction of the thickness of the fixed-side plate 7 so as to have the same rectangular cross-sectional shape, are arranged at predetermined intervals in two columns (stages) in the up-and-down direction and in two rows in the left-and-right direction in Fig. 2. For the convenience of description, the sub-mold hollow at the upper left side in Fig. 2 is represented by 7b1, and likewise the sub-mold hollows at the lower left side, at the upper right side and at the lower right side in Fig. 2 are represented by 7b2, 7b3, 7b4, respectively.

A centering pin 21 is provided at the upper left side and lower right side of each sub-mold hollow 7b on the fixed-side base plate 7 as shown in Fig. 2. Each

centering pin 21 is freely movably engaged on the fixed-side base plate 7 so as to be protectable from the fixed-side base plate 7, and is urged from the rear end thereof by a press spring 29 as shown in Fig. 4. The tip portion
5 21a of each centering pin 21 has a tapered structure.

The positioning of the fixed-side sub-mold 8 is performed through engagement of a front flange 8d of the fixed-side changeable sub-mold 8 with the centering pin 21. In addition, a permanent magnet 22 is embedded into
10 the fixed-side base plate 7 at the upper right side and at the lower left side of each sub-mold hollow 7b as shown in Fig. 2, and the permanent magnets 22 are brought into contact with the front flange 8d of the fixed-side changeable sub-mold 8, as shown in Fig. 4 adjacent to the
15 spacer plate 5 (mold member 5 confronted to the back surface of the fixed-side changeable sub-mold).

Three key ways each having a substantially rectangular cross-sectional shape 7a are formed at upper and lower portions in the surface direction on the rear
20 face of the fixed-side base plate 7. For the convenience of description, the key way at the left side of Fig. 2 is represented by 7a1, and the key ways at the middle position and at the right side of Fig. 2 are represented by 7a2 and 7a3, respectively. As shown in Fig. 1 and
25 Fig. 2, each key way 7a is designed so as to be partly overlapped with the sub-mold hollows 7b at the upper and lower sides, and especially the key way 7a2 is overlapped with all of the sub-mold hollows 7b. At such overlapped regions 7c, a key for securing (a securing key) 9 fixedly
30 engages with a rear flange 8e of the changeable sub-mold 8 as described later.

On the fixed-side plate 7 are fixedly mounted four guide shafts 11 for guiding a movable-side base plate 16. Further, spacers 12 are fixedly secured to the upper and
35 lower ends of the fixed-side base plate 7, whereby when a mold closing of the fixed-side and movable-side molds is carried out, the spacers 12 will be brought into contact

with the movable-side base plate to prevent an excessive force from occurring between a fixed-side changeable sub-mold 8 and a movable-side changeable sub-mold 17. In addition, the fixed-side base plate 7 is connected to the movable-side mold Q through a limiting bolt (not shown in the drawings). When the movable-side mold Q is moved away from the fixed-side mold P over a predetermined distance, the fixed-side base plate 7 will follow the movement of movable-side mold Q through the limiting bolt, and will be moved away from the spacer plate 5.

The runner plate 6 is fixedly secured onto a center portion of the back surface of the fixed-side base plate 7, disposed so as to be overlapped with all of the four sub-mold hollows 7b as shown in Fig. 2. Fig. 3 is a front view showing the runner plate 6 which is viewed from the left side in Fig. 1, and the runner plate 6 is formed with a longitudinal runner 6b having a predetermined length in the up-and-down direction and lateral runners 6a extending from both ends of the longitudinal runner 6b in the left-and-right direction. The runner plate 6 has substantially the same thickness as the spacer plate 5, and is fixedly secured onto the fixed-side base plate 7 by screws through fitting holes 6c. In a case where melted material is injected from the sprue 2a located in the center position of the apparatus to gates 8c, since the runner plate 6 is disposed in such a manner that it is overlapped with the sub-mold hollows 7b and the melted material flows over the runner plates 6, the runner plate 6 is overlapped with the changeable sub-mold 8 and thus the melted material can be prevented from entering gaps between the sub-mold hollows 7b and the changeable sub-mold 8.

Each fixed-side changeable sub-mold 8 includes the above-mentioned front flange 8d and a rear flange 8e. As shown in Fig. 1, the front flange 8d is engagedly supported on the front surface of the fixed-side base plate 7 while the rear flange 8e is engagedly supported

by the securing key 9 which is inserted into the key ways 7a, so that the fixed-side changeable sub-mold 8 is fixedly installed into the base plate 7. For convenience of description, the changeable sub-mold 8 which are inserted into and pulled out of the sub-molds hollows 7b1, 7b2, 7b3. and 7b4 are represented in Fig. 2 by 81, 82, 83, and 83, respectively. As shown in Fig. 4, the front flange portion 8d is also formed in the upper and lower portions, and a centering hole 8f is formed on the front flange 8d in such a position as to be confronted with the centering pin 21 when the fixed-side changeable sub-mold 8 is installed into the fixed-side base plate 7. A cavity 8b is formed in the front surface of the fixed-side changeable sub-mold 8, and is combined with a cavity 17a of the movable-side changeable sub-mold 17 to form a molded product. A runner 8a is formed on the back surface of the fixed-side changeable sub-mold 8; still further, three runners 8g are formed so as to extend from the ends of the runners 8a to the front surface of the fixed-side changeable sub-mold 8 as shown in Fig. 2, and the tips of the runners 8g serve as gates 8c.

The fixed-side securing key 9 will be next described.

The securing key (the key for securing) 9 is constructed as a comb-shaped key by connecting the three keys 91, 92, and 93, insertable respectively into the key ways 7a1, 7a2, and 7a3 at the upper portions thereof, with a connecting member 9g as shown in Fig. 2. Each of the keys 91, 92, and 93 is formed with a flange portion at the engaging side of the key with the changeable sub-mold 8 as shown in Fig. 1, and the flange portion serves to engagedly support the rear flange 8e of a fixed-side changeable sub-mold 8. Further, the keys 91, 92, and 93 are formed with cutout portions 9a at the same height position at the engaging side of the mold 8. The length of each cutout groove is slightly longer than the

longitudinal (up-and-down) length of the changeable sub-molds 81, 82, and the width of the cutout portion 9a is set such that when the cutout portion 9a is located at the position of the changeable sub-molds 81, 82, it will release the engagement of the rear flange 8e with the keys 91, 92, and 93. Further, the length of the fixing portion at the tip portion of each key 91, 92, 93, which portion serves to fix the changeable sub-molds 83, 84, is set to be shorter than a gap interval between the upper and lower changeable sub-molds 81 and 83 or a gap interval between the upper and lower changeable sub-molds 82 and 84. Therefore, when the securing key 9 is moved by a certain distance, the fixing portion for the changeable sub-molds 83, 84 will be moved to the gap interval between the upper and lower changeable sub-molds 81 and 83 or to the gap interval between the upper and lower changeable sub-molds 82 and 84, and in addition the cutout portion 9a is moved to the position of the changeable sub-molds 81, 82, so that the engagement between the changeable sub-molds 81, 82, 83, and 84 and the keys 91, 92, and 93 is released.

The movable-side mold Q will be next described.

In Fig. 1, a movable-side securing plate 13 is installed onto a movable member (not shown) of the injection molding machine and is movable forwards and backwards to and from the fixed-side mold P.

A spacer block 14, a receiving plate 15 and a movable-side base plate 16 are fixedly secured to the securing plate 13.

Like the base plate 7 of the fixed-side mold P, four sub-mold hollows 16b are formed along its thickness direction on the movable-side base plate 16. In addition, on the movable-side base plate 16 two centering pins are diagonally installed in upper and lower positions of each hollow 16b (not shown). The structure of the centering pin is identical to that of the centering pin 21 of the fixed-side mold P. Further, like

the fixed-side mold P, in the movable-side base plate 16 the permanent magnets are diagonally embedded at the upper and lower positions of each hollow 16, which positions correspond to counter positions to those of the above centering pins (not shown). The receiving plate 15 (mold member 15) confronts the back surface of the movable-side changeable sub-mold.

On the back surface of the movable-side base plate 16, like the fixed-side mold P, three key ways each having substantially rectangular cross-sectional shape 16a are formed in the up-and-down direction.

Each movable-side changeable sub-mold is constructed by fixedly securing a bottom plate 17g, a receiving plate 17h, a spacer plate 17f, a first mold plate 17i, and a second mold plate 17j to one another in this order. The bottom plate 17g is longer in the right-and-left direction relatively to the receiving plate 17h, and this longer part serves as the rear flange. Further, the second mold plate 17j is longer in the left-and-right and up-and-down directions relatively to the bottom plate 17g and so on, and this longer part serves as the front flange. In addition, the centering hole is formed at such a position as to be confronted with the above centering pin (not shown).

A cavity 17a is formed on the front surface of the second mold plate 17j, and a core pin 17b is also secured thereto.

A first eject mechanism for the product is provided at the movable-side changeable sub-mold 17. The first eject mechanism has a structure in which first eject plates 17c, 17d and first pins 17e, which are fixed on the first eject plates 17d, are placed within a space formed in the spacer plate 17f, and the first eject pins 17e are freely slidably moved along through holes connecting the space and the cavity 17a. Further, a return spring comprising a compression spring is provided between the first eject plate 17d and the first mold

plate 17i within the space of the spacer plate 17f (not shown), and serves to urge the first eject pins 17e and the first eject plates 17c, 17d in a receding (retraction) direction thereof. Moreover, the through
5 holes 17k are formed through the bottom plate 17g and the receiving plate 17h at such a position as to be confronted with the first eject plate 17c. The eject pin 17e is allowed to go ahead by passing the eject pin 19e of a second eject mechanism (described later) through the
10 through hole 17k to press the eject plate 17c. In this way, since the first eject mechanism is provided with independent construction, it is possible to set the eject pins 17e at the optimum positions in accordance with the shape of the cavity 17a. A sensor pin 33 is fixed on the
15 eject plates 17c and 17d and projects rearwardly therefrom, and as shown in Fig. 5 is designed in such a manner that it extends through a through hole drilled in both of the receiving plate 17h and the bottom plate 17g and its tip confronts a detect sensor 26 such as a
20 contactless switch which is provided to the receiving plate 15. When the eject plates 17c and 17d are moved backwardly, the tip of the sensor pin 33 approaches the detect sensor 26, so that the backward movement of the eject pin 17e is detected.

25 Like the fixing key 9 of the fixed-side mold P, the movable-side fixing key 18 is also constructed as a comb-shaped key by connecting three keys to one another at their upper ends (not shown). In addition, the same construction as the fixing key of the fixed-side mold P
30 is made for the fixing key 18 in the following respects: a flange portion is formed at an engagedly supporting side of the fixing key 18 for the sub-mold 17, the rear flange portion of the sub-mold 17 is engagedly supported by this flange portion, and a cutout portion having
35 predetermined length and width is formed at a predetermined position at the engagedly supporting side of the fixing key 18 for the sub-mold 17.

A second eject mechanism is provided behind the changeable sub-mold 17. The second eject mechanism has the following construction. Second eject plates 19c and 19d and eight second eject pins 19e which are fixed on the second eject plates 19d are placed inside a space formed by a spacer block 14, the receiving plate 15 has through holes 15a corresponding to the through holes 17k of the changeable sub-mold 17, and each pair of the eight eject pins 19e are freely movably inserted into communicating through-holes 15a and 17k which face the corresponding first eject plate 17c of each changeable sub-mold 17.

Further, as shown in Fig. 5, a return pin 23 is fixed in the eject plates 19c, 19d, and a return spring 24 comprising a compression spring is suspended between the eject plate 19d on the return pin 23 and the base plate 16 to urge the eject pin 19e in the receding (retraction) direction thereof. When an eject rod pushes the eject plate 19c through a hole 13a (not shown), the eject pins 19e are allowed to be moved forwardly.

An operation of the injection molding machine of Figs. 1 to 5 will be next described.

In a mold-opened state, fixed-side changeable sub-molds for a desired product 8 are inserted into the fixed-side sub-mold hollows 7b through a PL plane, so that the centering pins 21 are engaged with the centering holes 8f on the front flange 8d of the fixed-side changeable sub-mold 8 and the front flange 8d is attracted by the permanent magnets 22 to prevent the fixed-side changeable sub-mold 8 from falling off. Then, the comb-shaped fixing key 9 is inserted into the key way 7a. In this condition, the flange portion of the fixing key 9 engagedly supports the rear flange portion 8e of the fixed-side changeable sub-mold 8, so that the fixed-side changeable sub-mold is fixedly secured to the fixed-side base plate 7. Since all of the keys 91, 92 and 93 are connected to one another to form the fixing key 9,

all of the fixed-side changeable sub-molds 8 can be fixedly secured by carrying out only one inserting operation of the fixing key 9. Like the fixed-side changeable sub-molds 8, the movable-side changeable sub-molds 17 are fixedly secured to the movable-side base plate 16 by putting the movable-side changeable sub-molds 17 in the movable-side sub-mold hollows 16b and inserting the comb-shaped fixing key 18 into the key ways 16b to thereby fixedly secure the movable-side changeable sub-molds to the movable-side base plate 16. After the movable-side changeable sub-molds 17 are inserted into the sub-mold hollows 16b, the second eject pins 19e are inserted into the through-holes 17k.

When the molds are closed, the spacer 12 is brought into contact with the movable-side base plate 16, and the PL planes of the fixed-side base plate 7 and the movable-side base plate 16 are closed to thereby form cavities 8b, 17a.

Consequently, pellet which is injected through a hopper of the injection molding machine is pushed forwards by a screw in a cylinder. Material which has been heated and melted is poured from a nozzle through the sprue 2a into the runners 6b and 6a of the runner plate 6, passes through the runners 8a and 8g' of the fixed-side changeable sub-mold 8 and flows through the gate 8c into the cavities 8b and 17a. As the runner plate 6 is overlapped with the changeable sub-mold 8, the melted material can be prevented from flowing into the gap between the changeable sub-mold 8 and the sub-mold hollow 7b.

After the material within the cavities 8b, 17a has solidified, the PL planes are opened to a predetermined interval, so that the molded material is separated from the gate 8c and remains in the cavity 17a. On the other hand, upon the opening of the PL planes, the eject rod (not shown in Figs.) enters through the hole 13a and pushes the eject plates 19c, 19d and the eject pins 19e

of the second eject mechanism, so that the eject plates 19c and 19d and the eject pins 19e are forwardly moved. As a result, the eject plates 17c and 17d and the eject pins 17e are pushed by the eject pins 19e to be moved
5 forwardly, and the product in the cavity 17a is ejected.

After ejection of the product, the PL planes are further opened to a predetermined interval, so that the fixed-side base plate 7 is moved away from the spacer plate 5. Upon this action, the undercut portion at the
10 tip of the runner lock pin 32 is pulled out of the solidified material in the runner portion, so that the solidified material falls off naturally and can be removed.

If the same kind of products are required to be
15 produced, before closing the molds, it is confirmed by the retreat detecting sensor 26 whether the first eject pins 17e of the first eject mechanism are moved backwardly. That is, when the molds are closed, the eject rod (not shown) retreats from the through-hole 13
20 at the same time. In association with this retreating movement of the eject rod, the eject plates 19c, 19d and the eject pins 19e of the second eject mechanism are backwardly moved by the urging force of the return spring 24, and the eject plates 17c, 17d and the eject pins 17e
25 are also moved backwardly to a predetermined position by the urging force of another return spring (not shown). At this time, if the eject pins 17e do not retract to the predetermined position and the molds are closed, the eject pins 17e would collide against the fixed-side
30 changeable sub-mold 8. Particularly if there is provided a slide core or the like in the fixed-side changeable sub-mold 8, the eject pins 17e may be damaged. However, since the receding movement (retraction) of the eject pins 17e can be confirmed by means of the detect sensor
35 26, it is possible to protect the eject pins 17e from being damaged. After closing the molds, the injection molding can be carried out with the same process as

described above.

In a case of the exchange of the changeable sub-mold, in an open state of the mold, the comb-shaped fixing key 9 is lifted by a predetermined distance while the mold remains opened, so that the cutout portion 9a is situated in the upper changeable sub-molds 81 and 82, and the part of the fixing key 9 which serves to engagedly support the lower changeable sub-molds 83 and 84 is positioned in the gap between the upper and lower changeable sub-molds. As a result, all of the changeable sub-molds 81 to 84 are released. However, the fixed-side changeable sub-molds 8 are attracted to the base plate 7 by the permanent magnets 22, and thus they are prevented from falling down. Therefore, these fixed-side changeable sub-molds are taken out from the PL plane side. Thereafter, new changeable sub-molds 8 are inserted into the sub-mold hollows 7b and fixed by the fixing key 9 in the same manner as described above. The movable-side changeable sub-molds 17 can be exchanged in the same procedure as used for the fixed-side changeable sub-molds. Since the exchange of the changeable molds 8 and 17 can be carried out by slightly sliding the fixing keys 9 and 18, a time for the exchanging work can be much shortened. In addition, if the first eject pins 17e are set at the optimum position in accordance with the shape of the cavity when the movable-side changeable sub-molds 17 are exchanged, with a simple construction in which it is not necessary to change the position of the second eject pins 19e, the products can be pushed at the proper position and be taken out.

After the exchange of the changeable sub-molds is completed, the injection molding can be carried out again in the same manner as described above.

Other preferred embodiments of the centering portion (centering mechanism) will be next described.

In Fig. 6, a hole 34 of truncated cone shape is formed at a surface portion of the base plate 7 in which

the centering pin 21 is projectably provided, in such a manner as to surround the centering pin 21. A plate spring 27 is provided in the truncated-cone hole 34 which is projected from the surface of the fixed-side base plate 7 in a free state and embedded into the hole 34 in a state where it is compressed by an external force. Therefore, the plate spring 27 can press from the side of the fixed-side base plate 7 the peripheral portion of the centering hole 8f of the fixed-side changeable sub-mold 8 which is engaged with the centering pin 21. There frequently occurs a great adhesive force between the fixed-side changeable sub-mold 8 and the fixed side-base plate 7 due to oil which adheres onto both surfaces thereof and it is often difficult to remove the fixed-side changeable sub-mold in the exchange operation. However, the plate spring 27 enables the centering pin 21 to be easily pulled out of the centering hole 8f, and thus the removal of the changeable sub-mold 8 can be easily performed. Further, in a case where plural centering pins 21 and centering holes 8f are provided at several places, if the changeable sub-mold 8 is not homogeneously pulled out relatively to the centering pins 21, it is impossible to remove the changeable sub-mold 8 because the changeable sub-mold 8 is deviated (tilted or distorted). However, the plate spring 27 enables the changeable sub-molds 8 to be homogeneously pushed out from the centering pins 21, and thus the changeable sub-molds can be moved away from each other while no unsuitable force acts on the changeable sub-molds 8 and 17. If a spring force of the plate springs 27 is less than the attracting force of the permanent magnets 22, the changeable sub-molds 8 can be kept attracted on the surface of the fixed-side base plate 7.

Further, the spring force of the plate spring may be larger than the attracting force of the permanent magnet. In this situation, after the fixing key 9 is pulled out, the plate springs 27 overcome the attracting force of the

permanent magnets 22 and thus jack up the changeable sub-mold 8 off the surface of the fixed-side base plate 7 to make the exchange of the changeable sub-mold 8 easier. Although the fixed-side changeable sub-molds 8 are buoyed
5 from the surface of the fixed-side base plate 7 by the spring force of the plate springs 27, the attracting force of the permanent magnets 22 to the fixed-side changeable sub-molds 8 still remains, and thus the fixed-side changeable sub-molds 8 is prevented from being
10 further moved away from the fixed-side base plate 7 and falling off. The above description relates to a centering arrangement in which the plate spring 27 is provided on the fixed-side base plate. However, the plate springs 27 may be provided on the changeable sub-mold 8 instead of on the base plate. The arrangement can
15 alternatively be applied to the moveable-side. In place of the plate spring 27, any means capable of generating a predetermined press force such as a compression spring may be used as a member having a separating capability.

20 In an injection molding machine embodying the invention, the changeable sub-mold can be installed and removed through the PL plane side, and the fixing of the changeable sub-mold is carried out by the fixing key which is inserted and pulled out along the surface
25 direction of the base plate, so that the exchange work of the changeable sub-mold is very simple and can be performed automatically and remarkably easily by a robot or the like.

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CLAIMS

1. A mold support assembly comprising a first support structure provided at a main face thereof with means for receiving, at respective different predetermined locations, a plurality of removable mold devices formed with respective molding surface portions which, when the assembly is in use, face away from the said first support structure towards a second support structure of the assembly, one of the first and second supporting structures being movable towards the other to bring about closure of respective mold cavities bounded by the said molding surface portions, the said first support structure being provided also with a key-way, extending in a direction substantially parallel to the said main face, for receiving a key member that is movable selectively within the key-way between a mold-locking position, in which the key member serves to prevent removal of the mold devices from the said first support structure, and a mold releasing position, in which such removal is facilitated, and the assembly being provided also with inlet means for enabling molding material to be introduced in a fluid state into the said mold cavities when so closed.
2. A mold device, having a molding surface portion, formed so as to be detachably mountable in a mold support assembly so that the said molding surface portion can provide a boundary of a mold cavity in the assembly when it is in use, which device includes an ejection mechanism having a movable member which can be caused, by selective actuation of a control mechanism of the said assembly, to project through the said molding surface portion to displace therefrom a molded product.
3. An injection molding machine comprising:
a number of sub-mold hollows which are formed in at least one of a fixed-side base plate and a movable-side base plate along a thickness direction thereof;



a key way formed in a surface direction on said base plate in which said sub-mold hollows are formed;

a changeable sub-mold which is detachably mounted in each of said sub-mold hollows; and

5 a comb-shaped fixing key which is detachably engaged with said key way and fixes said changeable sub-mold by engaging with an engaging portion of said changeable sub-mold when inserted into said key way.

4. The injection molding machine as claimed in claim 3,
10 wherein plural changeable sub-molds are arranged in a direction of said key way on said base plate, and wherein said fixing key is formed with a cutout portion for releasing the engagement between said fixing key and said engaging portion of said changeable sub-mold when said
15 fixing key is slid by a certain distance.

5. The injection molding machine as claimed in claim 3 or 4, wherein a runner plate formed with runners is fixedly secured onto the back surface of said fixed-side base plate while overlapped with the several changeable
20 sub-molds, and runners of said runner plate and said changeable sub-molds are communicated to each other in an overlapped region.

6. The injection molding machine as claimed in claim 3, 4 or 5, wherein a flange portion contacting with a
25 peripheral portion of each of said sub-mold hollows is provided at a front portion of said changeable sub-mold, and a permanent magnet is provided to at least one of said changeable sub-mold and said base plate at a position where said flange portion is contacted with said
30 base plate, or to at least one of the back surface of said changeable sub-mold and a mold member confronting the back surface of said changeable sub-mold.

7. The injection molding machine as claimed in claim 3, 4, 5 or 6, wherein a flange portion contacting with a
35 peripheral portion of each of said sub-mold hollows is provided to a front portion of said changeable sub-mold, a centering pin is provided to one of said changeable



- sub-mold and said base plate at a position where said flange portion is contacted with said base plate, or to one of the back surface of said changeable sub-mold and a mold member confronting the back surface of said
- 5 changeable sub-mold, a centering hole is formed in the others so as to be confronted with said centering pin, and a spring member is provided in the neighbourhood of said centering pin or said centering hole to supply a separating force of separating said centering pin from
- 10 said centering hole.
8. The injection molding machine as claimed in claim 7, wherein said spring member is a plate spring.
9. An injection molding machine comprising:
- 15 a changeable sub-mold which is detachably mounted in a movable-side mold;
- a first eject mechanism provided to said changeable sub-mold; and
- a second eject mechanism provided to said movable-side mold for actuating said first eject mechanism.
- 20 10. The injection molding machine as claimed in claim 9, wherein said first eject mechanism comprises a first eject plate and a first eject pin fixed to said first eject plate, and said second eject mechanism has a second eject pin, said first eject mechanism being actuated when
- 25 said second eject pin pushes said first eject plate.
11. The injection molding machine as claimed in claim 9 or 10, wherein a detect sensor for detecting a receding movement of said first eject mechanism is provided in said movable-side mold.

ABSTRACT
INJECTION MOLDING MACHINES

5 A mold support assembly for use in an injection
molding machine comprises a first support structure (P)
provided at a main face thereof with means (7b) for
receiving, at respective different predetermined
locations, a plurality of removable mold devices (8)
formed with respective molding surface portions which,
10 when the assembly is in use, face away from the said
first support structure (P) towards a second support
structure (Q) of the assembly, one (Q) of the first and
second supporting structures being movable towards the
other to bring about closure of respective mold cavities
15 (17a) bounded by the said molding surface portions (8),
the said first support structure (P) being provided also
with a key-way (7a), extending in a direction
substantially parallel to the said main face, for
receiving a key member (9) that is movable selectively
20 within the key-way between a mold-locking position, in
which the key member serves to prevent removal of the
mold devices (8) from the first support structure (P) and
a mold-releasing position, in which such removal is
facilitated.

25 Such an assembly can be used to facilitate simple
and quick removal of the mold devices.

A mold device (17) for use in such a machine
preferably includes an ejection mechanism (17c, 17d, 17e)
having a movable member (17e) which can be caused, by
30 selective actuation of a control mechanism (19c, 19d,
19e) of the assembly, to project through a molding
surface portion (17a) of the mold device (17) to displace
therefrom a molded product.

In such an arrangement, the position at which the
35 movable member contacts the molded product can be
selected freely in accordance with the kind of product
being molded. Fig. 1

FIG. 1

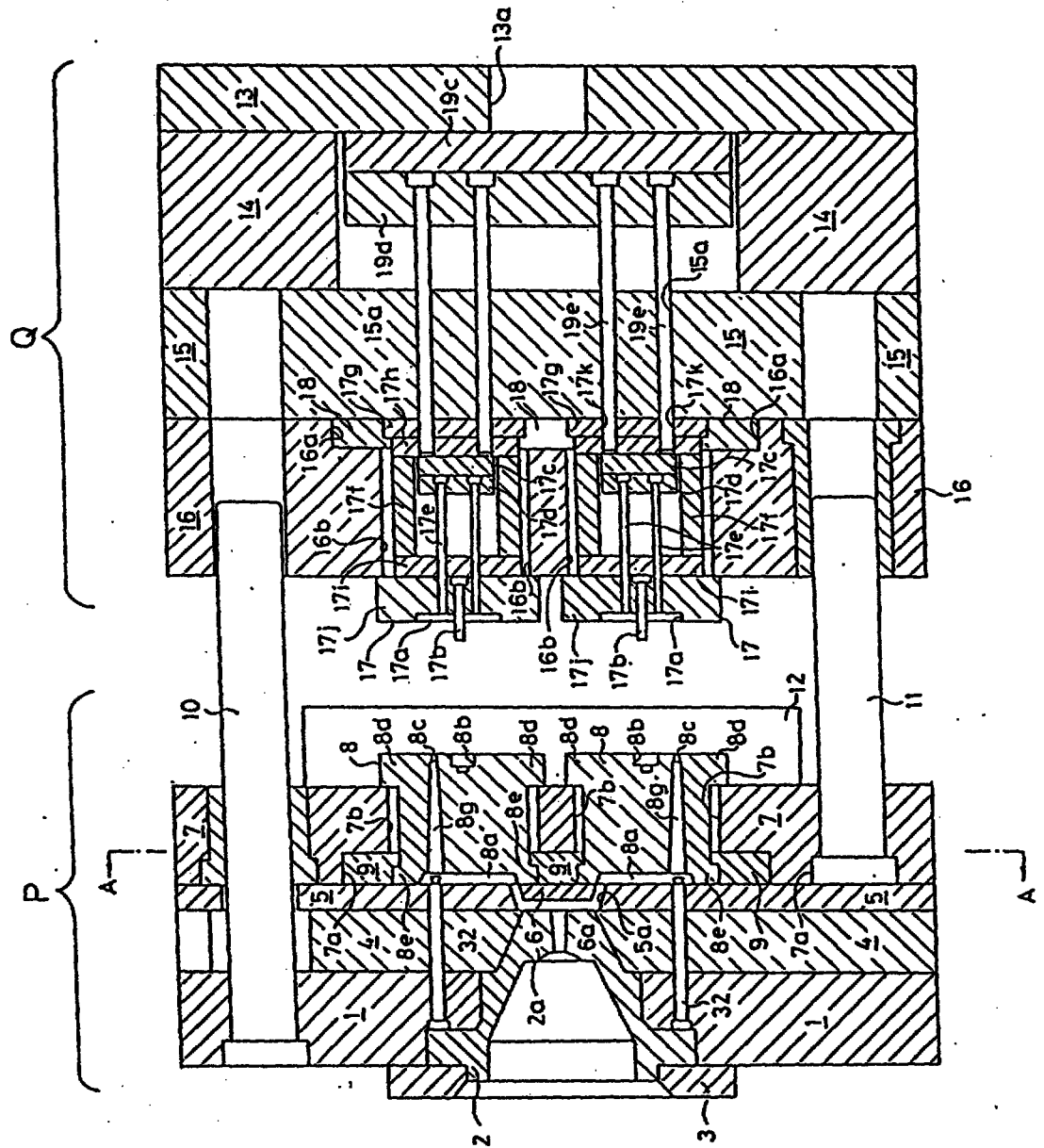


FIG. 2

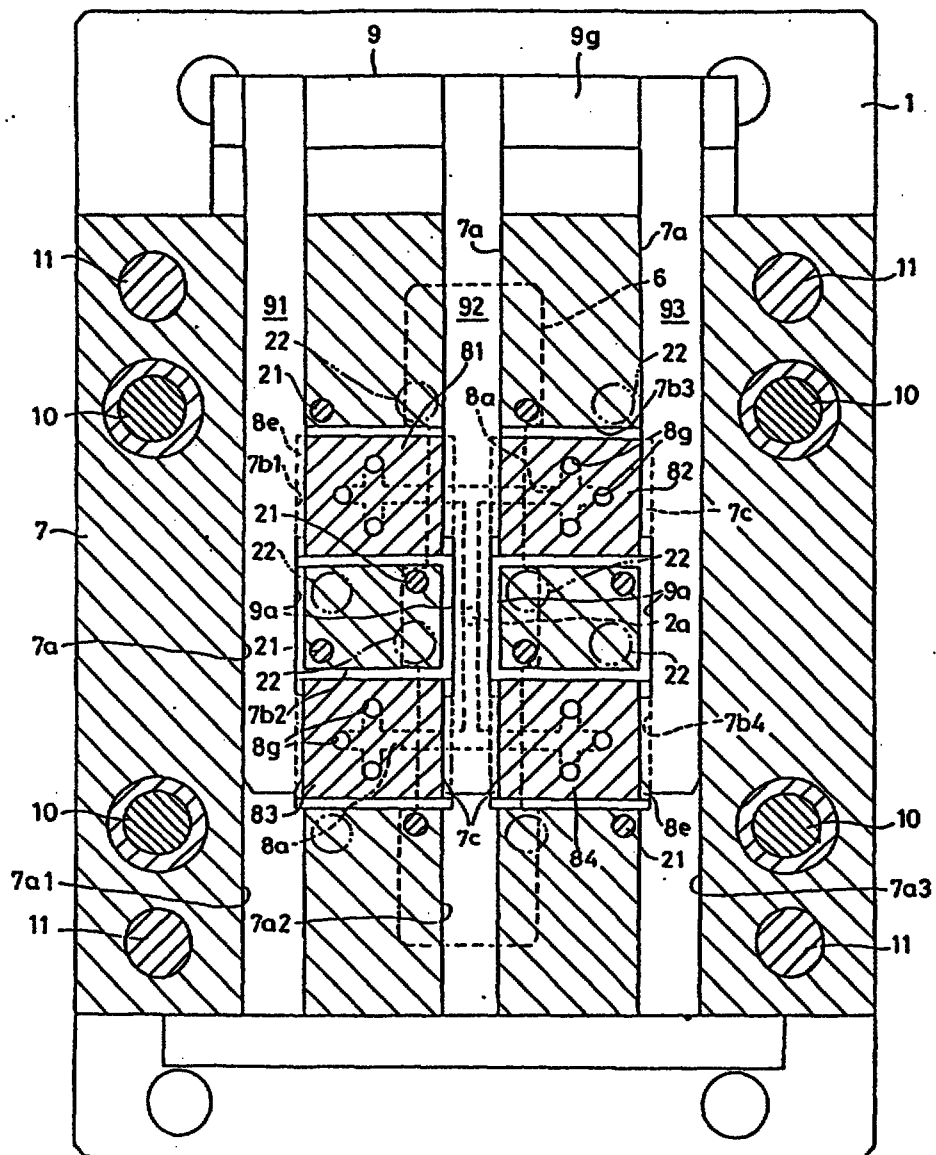


FIG. 3

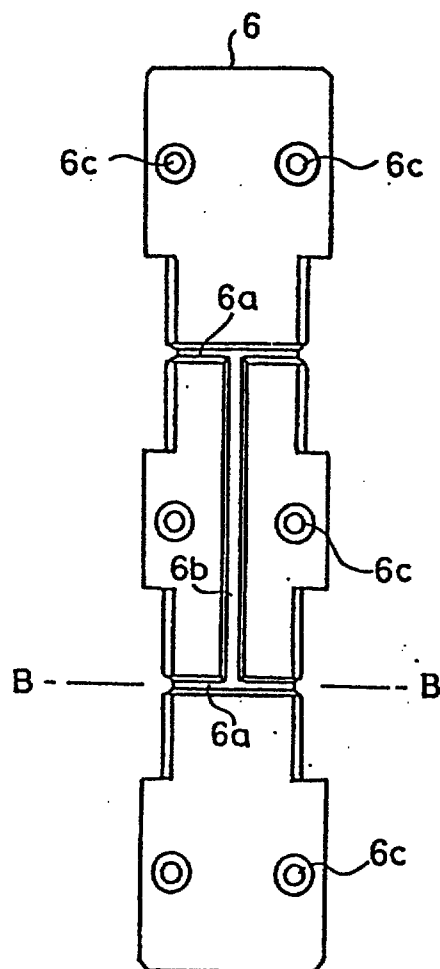


FIG. 4

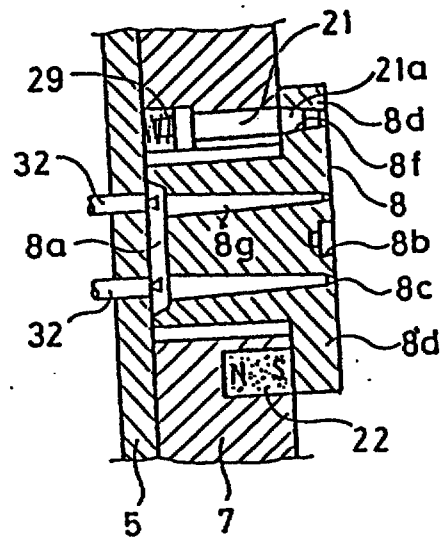


FIG. 5

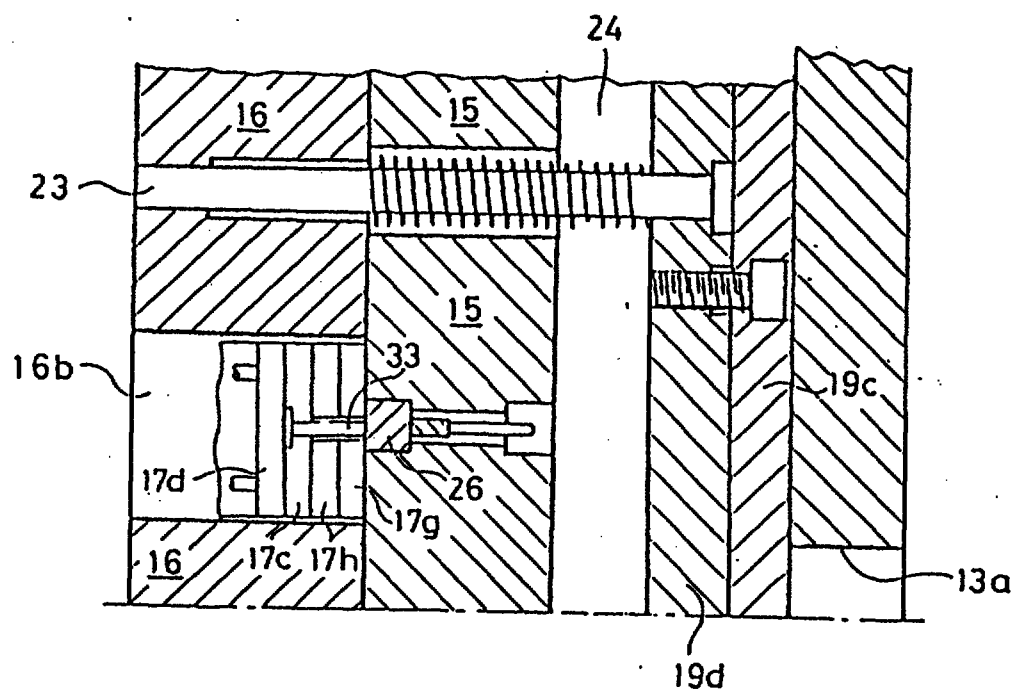


FIG. 6

