

**MOLD STRUCTURE WITH AN EJECTING TUBE FOR EJECTING A MOLDED
PRODUCT AND PERMITTING AIRFLOW**

This invention relates to a mold, and more particularly
to a mold structure that includes an ejecting tube for
5 ejecting a molded product and permitting airflow.

A conventional mold structure includes an upper mold
unit, a lower mold unit, an air passage unit, and an ejecting
unit. The upper and lower mold units are interconnected
so as to define a mold cavity therebetween. The upper mold
10 unit is formed with a feeding port communicated with the
mold cavity. The air passage unit includes an air passage
communicated with the mold cavity, and a plurality of
venting tubes communicated with the air passage and a
pneumatic device. The pneumatic device is operable to draw
15 air from the mold cavity thereinto via the air passage unit.
As such, a molding material fed through the feeding port
can be drawn to fill within the mold cavity. The ejecting
unit includes a movable seat disposed movably within the
lower mold unit, and a plurality of ejecting rods having
20 lower ends connected fixedly to the movable seat. Upper
ends of the ejecting rods are disposed outwardly of the
mold cavity. After a molded product is formed within the
mold cavity, the upper mold unit is removed from the lower
mold unit. Subsequently, a driving device (such as a
25 hydraulic device) is operated so as to move the movable
seat and the ejecting rods upwardly in the lower mold unit.
Hence, the upper ends of the ejecting rods move into the

mold cavity to thereby remove the molded product from the lower mold unit.

The aforesaid conventional mold structure suffers from the following disadvantages:

- 5 (1) Since the air passage unit is disposed in proximity to a left end of the mold cavity, when a portion of the mold cavity has a complicated shape, it is difficult for the molding material to reach a molding surface defining this portion of the mold
10 cavity. To enable the molding material to reach the molding surface, it is necessary to increase a pressure for pouring the molding material into the mold cavity. When an increasing pressure is applied between the upper and lower mold units,
15 veins may be formed in the mold structure where the upper and lower mold units are interconnected. Due to the presence of the veins, when molding, burr edges are formed on the molded product. Furthermore, when the pressure applied is
20 excessive, the upper and lower mold units easily deform, thereby resulting in difficulties in removing the upper and lower mold units from each other and reducing the service life of the upper and lower mold units. To solve this problem, the
25 upper and lower mold units can be made of a high-strength metal. However, this increases the manufacturing costs of the upper and lower mold

units.

- (2) If the mold structure has a plurality of mold cavities, the number of the mold cavities can be reduced so as to allow the molding material to fill completely the mold cavities. However, this reduces significantly the production capacity of the mold structure.

The object of this invention is to provide a mold structure that can overcome the above-mentioned disadvantages associated with the prior art.

According to this invention, a mold structure includes an ejecting tube disposed movably within a venting hole in a lower mold unit and having an ejecting end. The ejecting tube is communicated with an air chamber in the lower mold unit and a mold cavity. A pneumatic device is operable to draw air from the mold cavity into the ejecting tube. The ejecting tube is operable to move within the venting hole between a retracted position whereat the ejecting end is disposed outwardly of the mold cavity, and an ejecting position whereat the ejecting end is moved into the mold cavity so as to allow a molded product to be removed from the lower mold unit. The pneumatic device is also operable to introduce compressed air therefrom into the mold cavity via the air chamber and the ejecting tube.

These and other features and advantages of this invention will become apparent in the following detailed description of a preferred embodiment of this invention,

with reference to the accompanying drawings, in which:

Fig. 1 is a schematic block diagram of the preferred embodiment of a mold structure according to this invention, illustrating how the preferred embodiment is connected to a pneumatic device and a hydraulic device;

Fig. 2 is a perspective view of an upper mold unit of the preferred embodiment;

Fig. 3 is a bottom view of the upper mold unit of the preferred embodiment;

Fig. 4 is a sectional view taken along Line 4-4 in Fig. 3;

Fig. 5 is a sectional view of an upper ejecting unit of the preferred embodiment when an ejecting rod of the upper ejecting unit is disposed in a retracted position;

Fig. 5A is a schematic view illustrating an annular gap formed between a venting tube and an ejecting block of the upper ejecting unit of the preferred embodiment;

Fig. 6 is a perspective view of a lower mold unit of the preferred embodiment;

Fig. 7 is a top view of the lower mold unit of the preferred embodiment;

Fig. 8 is a sectional view taken along Line 8-8 in Fig. 7;

Fig. 9 is a sectional view of a lower ejecting unit of the preferred embodiment when an ejecting end is contracted;

Fig. 9A is a schematic view illustrating a cross-shaped

slit formed in the ejecting end of the preferred embodiment;

Fig. 10 is a schematic, partly exploded, partly sectional view of the preferred embodiment, illustrating how air is drawn from a mold cavity;

5 Fig. 11 is a fragmentary sectional view of the preferred embodiment, illustrating the retracted position of the ejecting rod;

Fig. 12 is a fragmentary sectional view of the preferred embodiment, illustrating contraction of the ejecting end;

10 Fig. 13 is a schematic, partly exploded, partly sectional view of the preferred embodiment, illustrating how compressed air is introduced into the mold cavity;

Fig. 14 is a fragmentary sectional view of the preferred embodiment, illustrating an ejecting position of the
15 ejecting rod;

Fig. 15 is a sectional view of the upper ejecting unit of the preferred embodiment when the ejecting rod is disposed in the ejecting position;

Fig. 16 is a fragmentary sectional view of the preferred
20 embodiment when the ejecting end is expanded; and

Fig. 17 is a sectional view of the lower ejecting unit of the preferred embodiment when the ejecting end is expanded.

Referring to Figs. 1, 2, 6, and 10, the preferred
25 embodiment of a mold structure (M) according to this invention includes a mold seat 2 and an ejecting assembly. The mold seat 2 includes a pair of upper and lower mold

units 20, 40. The ejecting assembly includes a plurality of upper ejecting units 30 (only one is shown in Figs. 1 and 10), and a plurality of lower ejecting units 50 (only one is shown in Figs. 1 and 10). The upper mold unit 20 includes an upper mold half 21, an upper mold core 22, an upper air passage unit 23 (see Fig. 14) consisting of an upper air chamber 231 and a venting hole 232 communicated with the upper air chamber 231, and a tube-retaining member 24. The lower mold unit 40 includes a lower mold half 41, a lower mold core 42, a lower air passage unit 43 consisting of a lower air chamber 431 and a venting hole 432 communicated with the lower air chamber 431, and a movable member 44. A pneumatic device 60 can be connected to the mold seat 2 such that the upper and lower air chambers 231, 431 are communicated therewith via the venting holes 232, 432, respectively. A hydraulic device 70 can be connected to the lower ejecting units 50 for moving the same vertically.

With further reference to Figs. 3, 4, 5, and 5A, the upper mold half 21 includes four parallel positioning pins 211 inserted respectively into four positioning holes 411 in the lower mold half 41 in a known manner, and a feeding port 212 permitting a molding material to be fed into the upper mold half 21 therethrough. The upper and lower mold cores 22, 42 are formed respectively with upper and lower molding surfaces 221, 421 defining a mold cavity therebetween. The upper mold core 22 is further formed

with a plurality of vertical tube-receiving holes 222 disposed between and communicated with the mold cavity and the upper air chamber 231. The tube-receiving holes 222 are formed respectively at positions in the molding surface 221 difficult for the molding material to reach. Each of the upper ejecting units 30 includes a venting tube 31 disposed within the corresponding tube-receiving hole 222 and communicated with the mold cavity, an ejecting rod 32, and a coiled compression spring 33. The tube-retaining member 24 is attached fixedly to a top surface of the upper mold core 22 such that movement of the venting tubes 31 relative to the upper mold core 22 is prevented. The upper air chamber 231 is defined between the tube-retaining member 24 and the upper mold half 21. The tube-retaining member 24 is formed with a plurality of holes 241 having upper ends communicated with the upper air chamber 231, and lower ends communicated respectively with the venting tubes 31. Each of the venting tubes 31 has an enlarged upper end 311 fitted within an enlarged end of the corresponding tube-receiving hole 222, and an axial central hole 312 that is formed therethrough and that has an outwardly diverging frustoconical hole end 313 disposed in proximity to the mold cavity, and an enlarged hole portion 314 disposed in proximity to the frustoconical hole end 313. Each of the ejecting rods 32 is disposed movably within the frustoconical hole end 313 and the enlarged hole portion 314 of the corresponding central hole 312, and has a

frustoconical ejecting block 321 disposed at an end thereof proximate to the mold cavity and within the frustoconical hole end 313 of the corresponding central hole 312, and a stop block 322 disposed at an opposite end thereof. Each
5 of the compression springs 33 is disposed within the corresponding enlarged hole portion 314, is sleeved on the corresponding ejecting rod 32, and has two ends abutting respectively against the corresponding stop block 322 and a shoulder 315 of the corresponding venting tube 31 defining
10 an end of the corresponding enlarged hole portion 314 so as to bias the corresponding stop block 322 away from the shoulder 315. As such, each of the ejecting rods 32 is biased by the corresponding spring 33 to a retracted position shown in Figs. 5, 11, and 14 whereat the
15 corresponding ejecting block 321 is disposed outwardly of the mold cavity and whereat the corresponding ejecting block 321 is received almost fittingly within the corresponding frustoconical hole end 313, that is, an annular gap (I) (see Fig. 5A) serving as an air passage
20 is formed between the corresponding ejecting block 321 and a wall of the corresponding venting tube 31 defining the corresponding frustoconical hole end 313, and has a radial width of about 0.03 to 0.05 mm. As such, upon actuation of the pneumatic device 60, air can be drawn from the mold
25 cavity into each of the venting tubes 31 via a space between the corresponding ejecting block 321 and the corresponding venting tube 31, or compressed air can be introduced into

the mold cavity through the upper air passage unit 23 and the corresponding venting tube 31 so as to move the corresponding ejecting block 321 to an ejecting position shown in Figs. 14 and 15 whereat the corresponding
5 ejecting block 321 is moved into the mold cavity, thereby facilitating removal of a molded product from the molding surface 221 of the upper mold core 22.

With additional reference to Figs. 6, 7, 8, 9, and 9A, the lower mold core 42 is further formed with a plurality
10 of vertical guide holes 422 disposed between the mold cavity and the lower air chamber 431. The guide holes 422 are formed respectively at positions in the molding surface 421 difficult for the molding material to reach.

The movable member 44 can be driven by the hydraulic
15 device 70 to move vertically within a chamber 412 in the lower mold half 41. The movable member 44 includes a horizontal upper plate 441, a horizontal middle plate 442, and a horizontal lower plate 443. The upper plate 441 has a plurality of vertical counterbores 436 formed
20 therethrough. Each of the counterbores 436 has a small-diameter bore portion 437 extending downwardly from a top surface of the upper plate 441, and a large-diameter bore portion 438 extending upwardly from a bottom surface of the upper plate 441 and connected to the small-diameter
25 bore portion 437. The middle plate 442 has a top surface connected fixedly to and abutting against the bottom surface of the upper plate 441, and a plurality of vertical

through holes 444 (only one is shown in Fig. 8) formed through the middle plate 442. The lower plate 443 has a top surface connected fixedly to and abutting against a bottom surface of the middle plate 442, and cooperates with the middle plate 442 so as to define the lower air chamber 431 therebetween. The lower air chamber 431 is communicated with lower ends of the through holes 444 in the middle plate 442.

Each of the lower ejecting units 50 is configured as an ejecting tube, and is disposed movably within the corresponding guide hole 422. The ejecting tubes 50 extend respectively through the small-diameter bore portions 437. Each of the ejecting tubes 50 has an ejecting end 501 proximate to the mold cavity, and a coupling end 502 that has an outer diameter greater than that of the remaining portion of the corresponding ejecting tube 50, that is distal from the mold cavity, that is fitted within the corresponding large-diameter bore portion 438, that is anchored between the upper and middle plates 441, 442, and that is communicated with an upper end of the corresponding through hole 444 in the middle plate 442. As such, the ejecting tubes 50 are connected fixedly to the movable member 44. The hydraulic device 70 is operable so as to move each of the ejecting tubes 50 within the corresponding guide hole 422 between a retracted position shown in Figs. 10 and 12 and an ejecting position shown in Figs. 13 and 16. In the retracted position, the ejecting end 501 of the

corresponding ejecting tube 50 is disposed outwardly of the mold cavity. In the ejecting position, the ejecting end 501 of the corresponding ejecting tube 50 is moved into the mold cavity so as to remove the molded product from the lower mold core 42.

Each of the ejecting tubes 50 includes a rigid tube body 51 and an end piece 52 that is made of steel spring. Each of the tube bodies 51 has an axial central hole 511 formed therethrough and having a threaded hole portion 512. Each of the end pieces 52 has an externally threaded section 521 engaging the corresponding threaded hole portion 512, an exposed section 522 formed integrally with the externally threaded section 521 and disposed outwardly of the corresponding tube body 51, and an axial central hole 523 formed therethrough. Each of the exposed sections 52 is formed with a cross-shaped slit 524 formed therethrough along axial and radial directions thereof so as to divide the corresponding exposed section 522 into four pivotable portions 522' (see Fig. 9A), which have free ends constituting the corresponding ejecting end 501. When each of the ejecting tubes 50 is disposed in the retracted position, the corresponding ejecting end 501 is contracted such that each of two intersecting slit portions (II) (see Fig. 9A) of the corresponding slit 524 has a width of about 0.03 to 0.05 mm, and serves as an air passage. Since the ejecting tubes 50 are communicated with the mold cavity and the lower air chamber 431, when the molding material

is fed into the mold cavity, the pneumatic device 60 can be operated to draw air from the mold cavity into the ejecting tubes 50 so as to facilitate flow of the molding material to cause the same to contact the molding surface 421 of the lower mold core 42. The pneumatic device 60 is also operable to introduce compressed air therefrom into the mold cavity via the lower air passage unit 43 and the ejecting tubes 50 so as to facilitate removal of the molded product from the molding surface 421 of the lower mold core 42. When the compressed air flows through the end pieces 52, the free ends of the pivotable portions 522' of each of the end pieces 52 are moved radially away from each other, as shown in Fig. 17, that is, the ejecting ends 501 are expanded. Thus, a rate of which the compressed air flows into the mold cavity through the end pieces 52 is increased.

CLAIMS:

1. A mold structure adapted to permit a molding material to be fed thereinto, the mold structure comprising:

5 a mold seat including a pair of upper and lower mold units having respectively molding surfaces defining a mold cavity therebetween, the lower mold unit further having a lower air chamber adapted to be communicated with a pneumatic device, and at least one guide hole disposed between the mold cavity and the lower air chamber, the guide hole being formed in the molding surface of the lower mold unit at a position difficult
10 for the molding material to reach; and

an ejecting assembly including at least one lower ejecting unit, the lower ejecting unit being configured
15 as an ejecting tube that is disposed movably within the guide hole and that has an ejecting end, the ejecting tube being communicated with the mold cavity and the lower air chamber such that the pneumatic device is operable to draw air from the mold cavity into the
20 ejecting tube so as to facilitate flow of the molding material to cause the molding material to contact the molding surfaces when the molding material is fed into the mold cavity, the ejecting tube being operable to move within the guide hole between a retracted position
25 whereat the ejecting end of the ejecting tube is disposed outwardly of the mold cavity, and an ejecting position whereat the ejecting end of the ejecting tube is moved

into the mold cavity so as to remove a molded product from the lower mold unit when the upper mold unit is removed from the lower mold unit, the pneumatic device being also operable to introduce compressed air therefrom into the mold cavity via the lower air chamber and the ejecting tube so as to facilitate removal of the molded product from the lower mold unit.

2. The mold structure as claimed in Claim 1, wherein the ejecting unit further includes a movable member disposed movably within the lower mold unit and adapted to be driven by a hydraulic device to move vertically within the lower mold unit, the ejecting tube further having a coupling end that is opposite to the ejecting end and that is connected fixedly to the movable member.

3. The mold structure as claimed in Claim 2, wherein the coupling end of the ejecting tube has an outer diameter greater than that of the remaining portion of the ejecting tube, the movable member including:

a horizontal upper plate having a counterbore formed therethrough, the counterbore having a small-diameter bore portion extending downwardly from a top surface of the upper plate, and a large-diameter bore portion extending upwardly from a bottom surface of the upper plate and connected to the small-diameter bore portion, the ejecting tube extending through the small-diameter bore portion, the coupling end of the ejecting tube being fitted within the large-diameter bore portion;

a horizontal middle plate having a top surface connected fixedly to and abutting against the bottom surface of the upper plate such that the coupling end of the ejecting tube is anchored between the upper and middle plates, the middle plate further having a through hole having an upper end communicated with the coupling end of the ejecting tube; and

a horizontal lower plate having a top surface connected fixedly to and abutting against a bottom surface of the middle plate, the lower plate cooperating with the middle plate so as to define the lower air chamber therebetween, the lower air chamber being communicated with a lower end of the through hole in the middle plate.

4. The mold structure as claimed in Claim 1, wherein the ejecting tube defines at least one air passage having a width of about 0.03 to 0.05 mm when in the retracted position.

5. The mold structure as claimed in Claim 1, wherein the ejecting tube includes:

a rigid tube body having an axial central hole that is formed therethrough and that has a threaded hole portion; and

an end piece having an externally threaded section engaging the threaded hole portion of the central hole in the tube body, and an exposed section formed integrally with the externally threaded section and

disposed outwardly of the tube body, the exposed section being formed with at least one slit formed therethrough along axial and radial directions thereof so as to divide the exposed section into a plurality of pivotable portions, the pivotable portions having free ends that constitute the ejecting end and that are moved away from each other such that a rate of which the compressed air flows into the mold cavity through the end piece is increased when the compressed air is introduced into the mold cavity by the pneumatic device.

6. The mold structure as claimed in Claim 5, wherein the end piece is made of spring steel.
7. The mold structure as claimed in Claim 1, wherein the upper mold unit further has an upper air chamber adapted to be communicated with the pneumatic device, and at least one tube-receiving hole disposed between and communicated with the mold cavity and the upper air chamber, the tube-receiving hole in the upper mold unit being formed in the molding surface of the upper mold unit at a position difficult for the molding material to reach, the ejecting assembly further including at least one upper ejecting unit, the upper ejecting unit including:

a venting tube disposed within the tube-receiving hole in the upper mold unit and communicated with the upper air chamber and the mold cavity, the venting tube having an axial central hole that is formed therethrough

and that has an outwardly diverging frustoconical hole
end disposed in proximity to the mold cavity; and

an ejecting rod disposed movably within the
frustoconical hole end and having a frustoconical
5 ejecting block disposed at an end of the ejecting rod
proximate to the mold cavity and within the
frustoconical hole end, the ejecting block being biased
to a position whereat the ejecting block is disposed
outwardly of the mold cavity and whereat the ejecting
10 block is received almost fittingly within the
frustoconical hole end such that air is capable of being
drawn from the mold cavity into the venting tube via
a space between the ejecting block and the venting tube
by the pneumatic device, the ejecting block being
15 movable into the mold cavity when the pneumatic device
is operated to introduce the compressed air into the
mold cavity through the venting tube.

8. The mold structure as claimed in Claim 7, wherein the
central hole in the venting tube further has an enlarged
20 hole portion disposed in proximity to the frustoconical
hole end, the ejecting rod further having a stop block
disposed at an end thereof distal from the mold cavity,
the upper ejecting unit further including a coiled
compression spring that is disposed within the enlarged
25 hole portion, that is sleeved on the ejecting rod, and
that has two ends abutting respectively against the stop
block and a shoulder of the venting tube defining an end

of the enlarged hole portion so as to bias the stop block away from the shoulder.