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(54) **Injection mold for aluminum pieces in line**

Spritzgießform für Aluminiumteile in Reihe

Moule à injection pour la fabrication de pièces d'aluminium en ligne

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WO-A1-02/38311 **US-A- 4 589 840**

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Description

Technical Field of the Invention

[0001] The invention is comprised within the field of injection molds for aluminum and specifically molds which allow obtaining several pieces simultaneously according to claim 1. Further specifications are claimed in dependent claims 2-4.

Background of the Invention

[0002] In the process of casting aluminum by injection under pressure, identical pieces are cast at the maximum production rate, forcing the cast metal under high pressures into the metal molds and attempting to minimize the cycle time per piece produced. The mold is formed by two parts which, when they are connected, form a space which the cast aluminum fills. When the aluminum solidifies, the desired piece is obtained. To carry out this process, the two parts of the mold are securely seamed together in order to withstand, without separating, high pressures, which is achieved with the closing force of the injecting machine which must withstand the injection pressure multiplied by the projected area of the piece plus the feed system. When the aluminum has solidified, the two parts of the mold are unlocked and opened to extract the hot cast piece.

[0003] The mold can be simple, i.e., it can allow obtaining one piece in each working cycle, or it can be multiple, with several cavities to obtain several pieces in each working cycle.

[0004] Molds with several cavities for injecting aluminum pieces are normally complex and require a large investment. In a multi-cavity mold, the cavities are placed on the same plane, therefore the projected surface is proportional to the number of cavities and the mold size increases with the number of cavities. In turn, the necessary closing force is multiplied with the closing number, a larger machine with a greater tonnage being necessary (with the subsequent increase in the investment). On the other hand, the placement of movable carriages for obtaining complex geometries is hugely encumbered in multi-cavity molds due to the movement of the carriages of one cavity interfering with the other.

[0005] In the injection of plastic pieces, it is possible to obtain several pieces in line, in one and the same working cycle, i.e., two or more pieces are obtained simultaneously, one after the other. In this sense, molds consisting of more than two mold parts, called sandwich molds, are known. For example, patent document US 7,320,591 describes a device for molding plastic pieces, formed by three plates, a fixed plate, a movable plate and an intermediate plate.

[0006] The advantage of sandwich molds is that the pieces (in patent US 7,320,591) are two in number, which is more than the number of pieces that would be obtained in a mold consisting only of two parts, which allows obtaining more pieces per unit of time.

[0007] Another example of this type of mold is described in patent document US 4,589,840, which describes a plastic injection mold formed by a fixed mold, a movable mold and an intermediate mold. The injection nozzle is located in the fixed mold, and the plastic reaches each of the cavities through multiple feeding conduits, which cavities will form the pieces to be obtained. The plastic is heated at high temperatures and branches out from the feeding conduit, connected to the injection nozzle, in order to fill each of the cavities.

[0008] Therefore, it would be desirable to have a sandwich-type injection mold that is suitable for obtaining two or more aluminum pieces simultaneously without having to use molds that are too bulky and expensive and that, as mentioned, multiply the machine requirements in terms of plate size and closing force, in turn reducing the possibility of placing multiple or movable carriages, as occurs with the usual multiple cavity molds.

[0009] WO-A-02/38311 discloses a pressure die-casting machine comprising, on a supporting frame fixed to the ground, a casting assembly associated with an injector assembly and with extraction elements. The casting assembly has two coupled dies (16, 19) which have, during closure, aligned directions and opposite orientations, and are adapted to produce optionally two synchronized castings. The two dies comprise a common intermediate complementary die portion adapted to form, on mutually opposite faces, the half-shells related to each one of the two dies, the intermediate complementary die being fixed to the supporting frame at least during a period of time that covers that of the casting operation.

Description of the Invention

[0010] The object of the invention is an injection mold for aluminum pieces as defined in claim 1, which can manufacture several pieces in line simultaneously. The mold of the invention comprises:

- a fixed part with a first plate comprising a first cavity part,
- a movable part with a second plate comprising a second cavity part,
- at least one intermediate part with a third plate comprising a third cavity part and a fourth cavity part,
- coupling means configured such that the fixed part, the movable part and the intermediate part can occupy a coupling position such that between the first cavity part and the third cavity part there is defined a first space corresponding with the geometry of at least one first piece to be obtained and, between the second cavity part and the fourth cavity part there is defined a second space corresponding with the geometry of at least one second piece to be obtained,
- injection means configured to inject cast aluminum in the first and second spaces through an injection conduit.

[0011] The first plate comprises a first hole traversing the first cavity part and the third plate comprises a third hole traversing the third and fourth cavity parts. On the other hand, the movable part has a protuberance which, in the coupling position, is partially housed in the first and third holes to define a feeding conduit communicating the first and second spaces, the injection means being configured to inject cast aluminum in the feeding conduit and in that the feeding conduit is dimensionally configured so that the cast aluminum completely fills the first and second spaces, such that the cast aluminum can solidify in the first and second spaces and inside the feeding conduit.

[0012] The first hole, the third hole, the injection conduit and the protuberance can be aligned in the coupling position.

[0013] Once the cast aluminum is solidified, the first piece and the second piece are obtained, connected through the solidified aluminum inside the feeding conduit.

[0014] In order for the cast aluminum to completely fill the first and second spaces, it is necessary for the feeding conduit to be sized depending on the characteristics of the pieces to be obtained so as to allow the aluminum to flow quickly to the first and second spaces and to be able to completely fill said spaces before the aluminum starts to solidify. The feeding conduit actually operates by holding the cast aluminum for enough time so as to completely fill the first and second spaces before the aluminum solidification process occurs.

[0015] Once the cast aluminum has solidified, the pieces must be demolded. To that end, the mold can comprise demolding means comprising movement means configured to separate the movable part with respect to the intermediate and fixed parts, such that between the movable part and the intermediate part there is a first separation distance which allows demolding the second piece and between the intermediate part and the fixed part, there is a second separation distance which allows demolding the first piece.

[0016] The movement means can comprise at least one tie rod configured to pull on the intermediate part, the mentioned tie rod comprising at one end at least a first stop, linked to the movable part, such that the movement of the movable part drags the tie rod until it reaches the first separation distance and in that the tie rod comprises a second stop which, once the first separation distance is reached, contacts with the intermediate part, such that the movement of the movable part drags the intermediate part, separating it from the fixed part.

[0017] The first separation distance will be enough so as to allow that, for example, robotized means can be moved into the space created and extract the second piece obtained.

[0018] To guide the movement of the intermediate part, the movement means can comprise at least one guide, and the guide can comprise a third stop configured to limit the second separation distance. Like the first distance, this second distance will be enough so as to allow demolding the first piece obtained and the length of the tie rod and the distance to the stop will be sized so as to make it possible to extract both pieces with manual or automatic means sequentially or simultaneously.

[0019] When the second stop of the tie rod collides with a projection of the intermediate part, the movement of the movable part produces the movement of the intermediate part and therefore the separation of the intermediate part with respect to the fixed part.

[0020] However, as previously indicated, after the injected aluminum solidifies, the pieces are connected through the solidified aluminum inside the feeding conduit. Therefore, in order to carry out the demolding, it is necessary to separate the first piece and the second piece.

[0021] The mold is configured to separate the first piece from the second piece and from the solidified aluminum inside the feeding conduit in order to separate the pieces.

[0022] The first piece to be obtained is connected to the feeding conduit through a feeding branch. The mentioned branch has a width and is connected to the feeding conduit at a sharp angle, such that when the movement means separate the movable part with respect to the intermediate and fixed parts the mentioned feeding branch fractures due to shear stress, thus being separated from the feeding conduit. Once separated from the solidified aluminum inside the feeding conduit, the branch is connected to the first piece.

[0023] The sharp angle formed between the feeding conduit and the branch allows that, when the movement means separate the movable part with respect to the intermediate and fixed parts, the mentioned feeding branch is fractured by shear stress, such that the first piece is separated from the feeding conduit which is dragged together with the second piece.

[0024] The mold comprises locking means for locking the intermediate part configured to limit the movement of the mentioned intermediate part at the start of the movement of the movable part. These locking means can comprise a first step which is in the tie rod, a spring configured to push the mentioned first step against the intermediate part and a second step arranged in the tie rod and configured to contact with a third step of the movable part when the movement of the movable part reaches a distance which is equivalent to the width of the feeding branch.

[0025] Once the cast aluminum has been cut, it is separated from the first piece, and the movable part continues moving until the tie rod collides with the second stop, at which time the first separation distance is reached.

[0026] In the coupling position of the intermediate, movable and fixed parts, the intermediate part exerts pressure on the tie rod in the area corresponding to the first step. At this time the cast aluminum is injected into the first and second spaces. Once the aluminum has solidified, the first piece and the second piece are connect-

ed through the solidified aluminum inside the feeding conduit.

[0027] When the movement means separate the movable part with respect to the intermediate and fixed parts, the solidified aluminum inside the feeding conduit is sheared. The spring presses against the intermediate part for the purpose of keeping it connected to the fixed part during the movement of the movable part and thus being able to fracture the solidified aluminum. The movable part is moved, i.e., it is separated with respect to the intermediate part a distance which is equivalent to the width n of the branch. With this small movement the solidified aluminum inside the feeding conduit is fractured and the first piece is thus separated from the second piece and from the solidified aluminum.

[0028] During the injection, the pressure which the mold has to withstand is very high, therefore it is required that all the parts are perfectly locked so that the cast aluminum flows through the feeding conduit and reaches the first and second spaces. To that end, in addition to the coupling means, the mold can comprise connecting means configured to lock the fixed part, the movable part and the intermediate part when the cast aluminum is injected.

[0029] The connecting means can comprise a locking element which moves in a direction perpendicular to the movement of the movable part, comprising a protuberance fitting in a housing of the intermediate part. The protuberance is inserted in the housing of the intermediate part in the coupling position such that the parts are locked. When the movement means begin to separate the movable part with respect to the intermediate and fixed parts, a rod integral with the movable part can move through an oblique conduit of the locking element such that in the movement of the movable part, the rod slides through the oblique conduit, causing the locking element to come out of position.

Description of the Drawings

[0030] To complete the description being made and for the purpose of aiding to better understand the features of the invention according to a preferred embodiment thereof, a set of drawings is attached as an integral part of said description in which the following is shown with an illustrative and non-limiting character:

- Figure 1 shows a perspective view of the mold object of the invention, with the movable part separated from the intermediate part and the intermediate part separated from the fixed part.
- Figure 2 shows a section view of the mold in the coupling position of the parts and with the solidified aluminum inside the feeding conduit and in the first and second spaces.
- Figure 3 shows a section view of the mold once the movable part has been separated from the intermediate part the first separation distance.
- Figure 4 shows a section view of the mold in which the intermediate part has been separated from the fixed part the second separation distance.
- Figure 5 shows a detail of the connection of the feeding conduit and the feeding branch of the first piece.
- Figure 6 shows a section view of the sequence of movements of the movable part with respect to the intermediate and fixed parts.
- Figure 7 shows a section view of Figure 1.
- Figure 8 shows a perspective view of an example of pieces to be obtained.

Preferred Embodiment of the Invention

[0031] As is observed in Figure 1, the mold comprises a movable part (2), a fixed part (1) and an intermediate part (3). The fixed part (1) comprises a first plate (11) in turn comprising a first hole (111) traversing a first cavity part (12). The intermediate part (3) comprises a third plate (31) in turn comprising a third hole (311) traversing a third cavity part (32) and a fourth cavity part (33). The movable part (2) comprises a second plate (21) having a protuberance (23), which can be partially housed in the first hole (111) and third hole (311) to define a feeding conduit (7).

[0032] Figure 5 shows the feeding conduit (7) which is connected to a first space and to a second space through feeding branches (9, 9'), respectively. The first space is defined by the first cavity part (12) and the third cavity part (32) corresponding with the geometry of a first piece (A), whereas the second space is defined between the fourth cavity part (33) and the second cavity part (22) corresponding with the geometry of a second piece (B). The cast aluminum is injected into these two spaces to form the pieces (A) and (B), which will be connected through the solidified aluminum in the feeding conduit (7).

[0033] The feeding conduit (7) has to be dimensionally configured so that the cast aluminum completely fills the first and second spaces, such that the cast aluminum can solidify in the first and second spaces and inside the feeding conduit (7). To facilitate filling the first and second spaces with the cast aluminum, the mold can comprise a first feeding branch (9) which is connected to the first space and a second branch (9') connected to the second space. The first branch (9) can also be connected to the feeding conduit (7) at a sharp angle, such that once the aluminum is injected, the first piece (A) is connected to the solidified aluminum inside the feeding conduit (7) through the solidified aluminum inside the branch (9).

[0034] Figure 2 shows the movable part (2), the intermediate part (3) and the fixed part (1) coupled together to cause the cast aluminum to be injected through an injection conduit (4). The pressure which the mold must withstand at the time of the injection is very great, therefore the mold can comprise connecting means which allow keeping the intermediate part (3), fixed part (1) and movable part (2) locked in the coupling position. As seen

in this Figure 2, these connecting means can comprise a locking element (16) having a boss (17) which is fitted in a housing (18) of the intermediate part (3).

[0035] The aluminum is injected through the injection conduit (4) which can be aligned with the feeding conduit (7), such that the aluminum flows from the injection conduit (4), completely filling the first and second spaces through the feeding conduit (7).

[0036] Once the aluminum has been injected and solidified, the pieces (A) and (B) obtained are demolded. Figure 1 shows this demolding position, in which the parts have been separated, i.e., the movable part (2) separated with respect to the intermediate part (3) and fixed part (1), and the intermediate part (3) separated with respect to the fixed part (1). The movable part (2) is separated from the intermediate part (3) a first separation distance, which is a distance that is suitable so as to allow demolding the second piece (B), whereas the intermediate part (3) is separated from the fixed part (1) a second separation distance, which is the distance suitable so as to allow demolding the first piece (A).

[0037] However, as discussed, these pieces (A) and (B) are connected by the solidified aluminum inside the feeding conduit (7), therefore in order to demold the pieces (A) and (B), it is necessary to separate them.

[0038] To that end, the mold is configured to separate the first piece (A) from the second piece (B) and from the solidified aluminum inside the feeding conduit (7). As discussed, the first piece (A) is be connected to the feeding conduit (7) through the feeding branch (9) which is connected, at a sharp angle, to the mentioned feeding conduit (7). This branch (9) has a width and is configured so that when movement means, not depicted in the figures, separate the movable part (2) with respect to the intermediate part (3) and fixed part (1), the mentioned feeding branch (9) fractures due to shear stress. In other words, when the movable part (2) is separated from the intermediate part (3) the feeding branch (9) fractures due to shear stress, being separated from the solidified aluminum inside the feeding conduit (7). After the fracture, the first piece (A) is separated from the solidified aluminum inside the feeding conduit (7), which is dragged together with the second piece. When the demolding is carried out, what is obtained is the first piece (A) together with the solidified aluminum in the branch (9), and on the other hand, the second piece is obtained together with the solidified aluminum inside the branch (9') and the solidified aluminum inside the feeding conduit (7).

[0039] However, in order for the cutting to be done easily but precisely, the mold comprises locking means for locking the intermediate part (3) configured to limit the movement of the mentioned part (3) at the start of the movement of the movable part (2), for the purpose of keeping the intermediate part (3) connected to the fixed part (1).

[0040] As is observed in Figure 6, these locking means can comprise a first step (8) arranged in a tie rod (5), a spring (13) configured to push the mentioned step (8) against the intermediate part (3) and a second step (14) arranged in the tie rod (5) which contacts with a third step (15) of the movable part (2) when the movement of the movable part (2) reaches a distance which is equivalent to the width of the feeding branch (9).

[0041] In Figure 6, three phases are depicted corresponding with the phase for the injection, phase for the fracture or separation of the pieces (A) and (B) and phase for the movement of the movable part (2) with respect to the intermediate part (3) and fixed part (1) until reaching a first separation distance which allows demolding the second piece (B).

[0042] In the phase for the injection of the aluminum in the first and second spaces through feeding conduit (7), coupling means, not depicted in the figures, couple the movable part (2), intermediate part (3) and fixed part (1), such that the spring (13) is compressed and the second step (14) is not in contact with the step (15) of the movable part (2). When the movement means start to separate the movable part (2) with respect to the intermediate part (3), the spring (13) pushes the first step (8) against the intermediate part (3) so that said part (3) is connected to the fixed part (1) and, the second step (14) contacts with the third step (15) of the movable part (2). This movement covers a distance which is equivalent to the width of the feeding branch (9). At this time the first piece (A) is already separated from the solidified aluminum inside the feeding conduit (7) and from the second piece (B).

[0043] Subsequently the movement means continue to separate the movable part (2) from the intermediate part (3) until reaching the first separation distance. The first separation distance is reached when a second stop (52) of the tie rod (5) contacts with the intermediate part (3). The second stop (52) can collide, for example, with a boss arranged in the intermediate part (3) such that the movable part (2) drags the intermediate part (3), separating it with respect to the fixed part (1).

[0044] Figure 3 shows how the movable part (2) has reached the first separation distance. The pieces (A) and (B) have been separated and the piece to be demolded is a piece formed by the second piece (B) and the solidified aluminum inside the feeding conduit (7). In this position the second stop (52) has collided with the boss of the intermediate part (2). When the movement means continue to push the movable part (2), the intermediate part (3) is dragged to be separated with respect to the fixed part (1). The second separation distance is reached when a third stop (61) of guides (6) collides with the intermediate part (3). This position is shown in Figure 4. Once the second separation distance has been reached, the first piece (A) can be demolded.

Claims

1. Injection mold for aluminum pieces comprising:

- a fixed part (1) with a first plate (11) comprising a first cavity part (12),
- a movable part (2) with a second plate (21) comprising a second cavity part (22),
- at least one intermediate part (3) with a third plate (31) comprising a third cavity part (32) and a fourth cavity part (33),
- coupling means configured such that the movable part (2), the fixed part (1) and the intermediate part (3) can occupy a coupling position such that between the first cavity part (12) and the third cavity part (32) there is defined a first space corresponding with the geometry of at least one first piece (A) to be obtained and between the second cavity part (22) and the fourth cavity part (33), there is defined a second space corresponding with the geometry of at least one second piece (B) to be obtained,
- injection means configured to inject cast aluminum in the first and second spaces through an injection conduit (4),

wherein the first plate (11) comprises a first hole (111) traversing the first cavity part (12) and the third plate (31) comprises a third hole (311) traversing the third cavity part (32) and the fourth cavity part (33);

wherein

the movable part (2) comprises a protuberance (23) which, in the coupling position, is partially housed in the first and third holes (111, 311) to define a feeding conduit (7) communicating the first and second spaces, the injection means being configured to inject cast aluminum in the feeding conduit (7), and in that the feeding conduit is dimensionally configured so that the cast aluminum completely fills the first and second spaces, such that the cast aluminum can solidify in the first and second spaces and inside the feeding conduit (7);

wherein the first space is connected to the feeding conduit (7) through a feeding branch (9), which is connected to the mentioned feeding conduit (7)

at a sharp angle the feeding branch (9) having a width;

and wherein the injection mould further comprises locking means for locking the intermediate part (3) configured to limit the movement of the mentioned intermediate part (3) at the start of the movement of the movable part (2), and movement means for separating the moveable part (2) from the intermediate part (3) and fixed part (1);

wherein

it comprises demolding means comprising said movement means configured to separate the movable part (2) with respect to the intermediate part (3) and fixed part (1), such that between the movable part (2) and the intermediate part (3) there is a first separation distance which allows demolding the second piece (B), and between the intermediate part (3) and the fixed part (1) there is a second separation distance which allows demolding the first piece (A), **characterized in that** the movement means comprise at least one tie rod (5) configured to pull on the intermediate part (3), the mentioned tie rod (5) comprising at one end at least a first stop (51) linked to the movable part (2), such that the movement of the movable part (2) drags the tie rod (5) until reaching the first separation distance, and **in that** the tie rod (5) comprises at least a second stop (52) which contacts with the intermediate part (3), such that the movable part (2) drags the intermediate part (3) separating it from the fixed part (1) and **in that** the locking means for locking the intermediate part (3) comprise:

- a first step (8) arranged in the tie rod (5),
- a spring (13) configured to push the mentioned first step (8) against the intermediate part (3),
- a second step (14) arranged in the tie rods (5) and configured to contact with a third step (15) of the movable part (2) when the movement of the movable part (2) reaches a distance equivalent to the width of the feeding branch (9).

2. Injection mold for aluminum pieces according to claim 1, **characterized in that** in the coupling position the first hole (111), the third hole (311), the injection conduit (4) and the protuberance (23) are aligned.

3. Injection mold for aluminum pieces according to any of the previous claims, **characterized in that** the movement means comprise at least one guide (6) configured to guide the movement of the intermediate part (3), and **in that** the guide comprises at least one third stop (61) configured to limit the second separation distance.

4. Injection mold for aluminum pieces according to any of the previous claims, **characterized in that** it comprises connecting means configured to lock the fixed part (1), the movable part (2) and the intermediate part (3) when the cast aluminum is injected, the mentioned connecting means comprising:

- a locking element (16) which moves in a direction perpendicular to the movement of the movable part (2), comprising a boss (17) fitting in a housing (18) of the intermediate part (3),
- a rod (19) integral with the movable part (2)

which can move through an oblique conduit of the locking element (16), such that when the movement means separated the movable part (2) with respect to the intermediate part (3) and fixed part (1), the rod (19) slides through the oblique conduit, causing the locking element (16) to come out of position.

Patentansprüche

1. Spritzgiessform für Aluminiumteile die aufweist:

- einen feststehenden Teil (1) mit einer ersten Platte (11) aufweisend eine erste Teilkavität (12),
- einen beweglichen Teil (2) mit einer zweiten Platte (21) aufweisend eine zweite Teilkavität (22),
- zumindest ein Zwischenteil (3) mit einer dritten Platte (31) aufweisend eine dritte Teilkavität (32) und eine vierte Teilkavität (33)
- Kopplungsmittel, die so gestaltet sind, dass der bewegliche Teil (2), der feststehende Teil (1) und der Zwischenteil (3) eine Kopplungsposition einnehmen können, sodass zwischen der ersten Teilkavität (12) und der dritten Teilkavität (32) ein erster Raumbereich definiert ist, welcher mit der Geometrie von zumindest einem erhaltbaren ersten Teil (A) übereinstimmt und zwischen der zweiten Teilkavität (22) und der vierten Teilkavität (33) ein zweiter Raumbereich definiert ist, welcher mit der Geometrie von zumindest einem erhaltbaren zweiten Teil (B) übereinstimmt,
- Einspritzmittel zum Einspritzen von Gussaluminium in den ersten und den zweiten Raumbereich durch einen Spritzkanal (4),

wobei

- die erste Platte (11) eine erste Bohrung (111) aufweist, welche die erste Teilkavität (12) durchsetzt und die dritte Platte (31) eine dritte Bohrung (311) aufweist, welche die erste und die vierte Teilkavität (32) durchsetzt;
- der bewegliche Teil (2) einen Vorsprung (23) aufweist, welcher in der Kopplungsposition teilweise in der ersten und der dritten Bohrung (111,311) angeordnet ist, um einen Zuführkanal (7) zu definieren, der den ersten und den zweiten Raumbereich verbindet, wobei die Einspritzmittel derart ausgebildet sind, dass sie Gussaluminium in den Zuführkanal (7) einspritzen, und der Zuführkanal (7) so dimensioniert ist, dass das Gussaluminium den ersten und den zweiten Raumbereich vollständig ausfüllt, so dass das Gussaluminium im ersten und zweiten Raumbereich und im Zuführkanal (7) erstarren kann;
- der erste Raumbereich mit dem Zuführkanal (7) über einen Zuführzweig (9) verbunden ist, der mit dem Zuführkanal (7) über einen spitzen Winkel verbunden ist und der Zuführzweig (9) eine Breite aufweist; und
- die Spritzgiessform weiterhin Schließmittel zum Fixieren des Zwischenteils (3) aufweist, die so gestaltet sind, dass sie bei Beginn der Bewegung des beweglichen Teils (2) die Bewegung des Zwischenteils (3) begrenzen, und Bewegungsmittel aufweist, um das beweglichen Teil (2) von dem Zwischenteil (3) und dem festen Teil (1) zu trennen;
- die Spritzgiessform Entformungsmittel aufweist, welche die Bewegungsmittel enthalten, um das bewegliche Teil (2) von dem Zwischenteil (3) und dem festen Teil (1) zu trennen, derart, dass zwischen dem Zwischenteil (3) und dem festen Teil (1) ein erster Abstand gebildet wird, welcher die Entformung des zweiten Teils (B) erlaubt und zwischen dem Zwischenteil (3) und dem festen Teil (1) ein zweiter Abstand gebildet wird, welcher die Entformung des ersten Teils (A) erlaubt, **dadurch gekennzeichnet,**
- **dass** die Bewegungsmittel zumindest eine Zugstange (5) aufweist, die dazu vorgesehen ist, um an dem Zwischenteil (3) zu ziehen, wobei die Zugstange (5) an einem Ende einen ersten Anschlag (51) aufweist, der mit dem beweglichen Teil (2) derart verbunden ist, , dass eine Bewegung des beweglichen Teils (2) die Zugstange (5) soweit zieht, bis der erste Abstand erreicht ist, und
- **dass** die Zugstange (5) zumindest einen zweiten Anschlag (52) aufweist, welcher am Zwischenteil (3) anschlägt, derart, dass das bewegliche Teil das Zwischenteil (3) zieht und es vom festen Teil (1) trennt, und
- **dass** die Schließmittel zum Fixieren des Zwischenteils (3) aufweisen:

  - eine an der Zugstange (5) angeordnete erste Stufe (8), ,
  - eine Feder (13), um die erste Stufe (8) gegen das Zwischenteil (3) zu drücken,
  - eine an der Zugstange (5) angeordnete zweite Stufe (14), die so ausgebildet ist, dass sie mit einer dritten Stufe (15) des beweglichen Teils (2) in Kontakt kommt, wenn die Bewegung des beweglichen Teils (2) einen Abstand erreicht, welcher der Breite des Zuführzweigs (9) entspricht.

2. Spritzgiessform für Aluminiumteile nach Anspruch 1, **dadurch gekennzeichnet, dass** in der Kopplungsposition die erste Bohrung (111), die dritte Bohrung (311), der Zuführkanal (4) und der Vorsprung

(23) miteinander fluchten.

3. Spritzgiessform für Aluminiumteile nach einem der voranstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Bewegungsmittel zumindest eine Führung (6) aufweisen, die geeignet ist, die Bewegung des Zwischenteils (3) zu führen, und dass die Führung (6) zumindest einen dritten Anschlag (61) aufweist, welcher den zweiten Abstand begrenzt.

4. Spritzgiessform für Aluminiumteile nach einem der voranstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Spritzgiessform Verbindungsmittel aufweist, die geeignet sind, das feste Teil (1), das bewegliche Teil (2) und das Zwischenteil (3) zu spannen, wenn das Gussaluminium eingespritzt wird, wobei die Verbindungsmittel aufweisen:

- ein Spannelement (16), welches in einer Richtung senkrecht zur Bewegung des beweglichen Teils (2) bewegt wird, und einen Vorsprung (17) aufweist, welcher in eine Aufnahme (18) des Zwischenteils (3) passt,
- eine Stange (1), die Bestandteil des beweglichen Teils (2) ist und durch einen schrägen Kanal des Spannelements (16) derart beweglich ist, dass wenn die Bewegungsmittel das bewegliche Teil (2) vom Zwischenteil (3) und vom festen Teil (1) trennen, die Stange (19) durch den schrägen Kanal gleitet, wodurch das Spannelement (16) außer Position gelangt.

Revendications

1. Moule à injection pour des pièces d'aluminium, comprenant :

- une partie fixe (1) avec une première plaque (11) comprenant une première partie de cavité (12),
- une partie mobile (2) avec une deuxième plaque (21) comprenant une deuxième partie de cavité (22),
- au moins une partie intermédiaire (3) avec une troisième plaque (31) comprenant une troisième partie de cavité (32) et une quatrième partie de cavité (33),
- des moyens de couplage configurés de sorte que la partie mobile (2), la partie fixe (1) et la partie intermédiaire (3) puissent occuper une position de couplage de sorte qu'entre la première partie de cavité (12) et la troisième partie de cavité (32) soit défini un premier espace correspondant à la géométrie d'au moins une première pièce (A) à obtenir et entre la deuxième partie de cavité (22) et la quatrième partie de cavité (33) soit défini un deuxième espace correspondant à la géométrie d'au moins une seconde pièce (B) à obtenir,
- des moyens d'injection configurés pour injecter de l'aluminium fondu dans les premiers et deuxièmes espaces par un conduit d' injection (4),

dans lequel la première plaque (11) comprend un premier trou (111) traversant la première partie de cavité (12) et la troisième plaque (31) comprend un troisième trou (311) traversant la troisième partie de cavité (32) et la quatrième partie de cavité (33) ;
dans lequel
la partie mobile (2) comprend une protubérance (23) qui dans la position de couplage est partiellement logée dans les premiers et troisièmes trous (111, 311) pour définir un conduit d'amenée (7) faisant communiquer les premiers et deuxièmes espaces, les moyens d'injection étant configurés pour injecter de l'aluminium fondu dans le conduit d'amenée (7), et en ce que les dimensions du conduit d'amenée sont configurées de sorte que l'aluminium fondu remplisse complètement les premiers et deuxièmes espaces de sorte que l'aluminium fondu puisse se solidifier dans les premiers et deuxièmes espaces et à l'intérieur du conduit d' amenée (7) ;
dans lequel le premier espace est relié au conduit d'amenée (7) par une branche d'amenée (9) qui est reliée au conduit d'amenée mentionné (7) selon un angle aigu, la branche d'amenée (9) présentant une largeur ;
et dans lequel le moule d'injection comprend en outre des moyens de verrouillage pour verrouiller la partie intermédiaire (3) configurée pour limiter le mouvement de la partie intermédiaire mentionnée (3) au début du mouvement de la partie mobile (2), et des moyens de déplacement pour séparer la partie mobile (2) de la partie intermédiaire (3) et de la partie fixe (1) ;
dans lequel
il comprend des moyens de démoulage comprenant lesdits moyens de déplacement configurés pour séparer la partie mobile (2) par rapport à la partie intermédiaire (3) et à la partie fixe (1) de sorte qu'entre la partie mobile (2) et la partie intermédiaire (3) soit prévue une première distance de séparation qui permet le démoulage de la seconde pièce (B) et entre la partie intermédiaire (3) et la partie fixe (1) soit prévue une seconde distance de séparation qui permet le démoulage de la première pièce (A),
caractérisé en ce que les moyens de déplacement comprennent au moins une tige de raccordement (5) configurée pour tirer sur la partie intermédiaire (3), la tige de raccordement mentionnée (5) comprenant sur une extrémité au

moins une première butée (51) liée à la partie mobile (2) de sorte que le mouvement de la partie mobile (2) traîne la tige de raccordement (5) jusqu'à atteindre la première distance de séparation, et **en ce que** la tige de raccordement (5) comprend au moins une deuxième butée (52) qui touche la partie intermédiaire (3) de sorte que la partie mobile (2) tire la partie intermédiaire (3) en la séparant de la partie fixe (1) et **en ce que** les moyens de verrouillage pour verrouiller la partie intermédiaire (3) comprennent :
- un premier gradin (8) disposé dans la tige de raccordement (5),
- un ressort (13) configuré pour pousser le premier gradin mentionné (8) contre la partie intermédiaire (3),
- un deuxième gradin (14) disposé dans les tiges de raccordement (5) et configuré pour toucher un troisième gradin (15) de la partie mobile (2) lorsque le mouvement de la partie mobile (2) atteint une distance équivalente à la largeur de la branche d'amenée (9).

2. Moule d'injection pour des pièces d'aluminium selon la revendication 1, **caractérisé en ce que** dans la position de couplage, le premier trou (111), le troisième trou (311), le conduit d'injection (4) et la protubérance (23) sont alignés.

3. Moule d'injection pour des pièces d'aluminium selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens de déplacement comprennent au moins un guidage (6) configuré pour guider le mouvement de la partie intermédiaire (3) et **en ce que** le guidage comprend au moins une troisième butée (61) configurée pour limiter la deuxième distance de séparation.

4. Moule d'injection pour des pièces d'aluminium selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il comprend des moyens de raccordement configurés pour verrouiller la partie fixe (1), la partie mobile (2) et la partie intermédiaire (3) lorsque l'aluminium fondu est injecté, les moyens de raccordement mentionnés comprenant :

- un élément de verrouillage (16) qui se déplace dans une direction perpendiculaire au mouvement de la partie mobile (2), comprenant un bossage (17) s'insérant dans un logement (18) de la partie intermédiaire (3),
- une tige (19) formée intégralement avec la partie mobile (2) qui peut se déplacer par un conduit oblique de l'élément de verrouillage (16) de sorte que lorsque les moyens de déplacement séparent la partie mobile (2) par rapport à la partie intermédiaire (3) et à la partie fixe (1), la tige (19) glisse par le conduit oblique, causant la sortie de l'élément de verrouillage (16) hors de sa position.

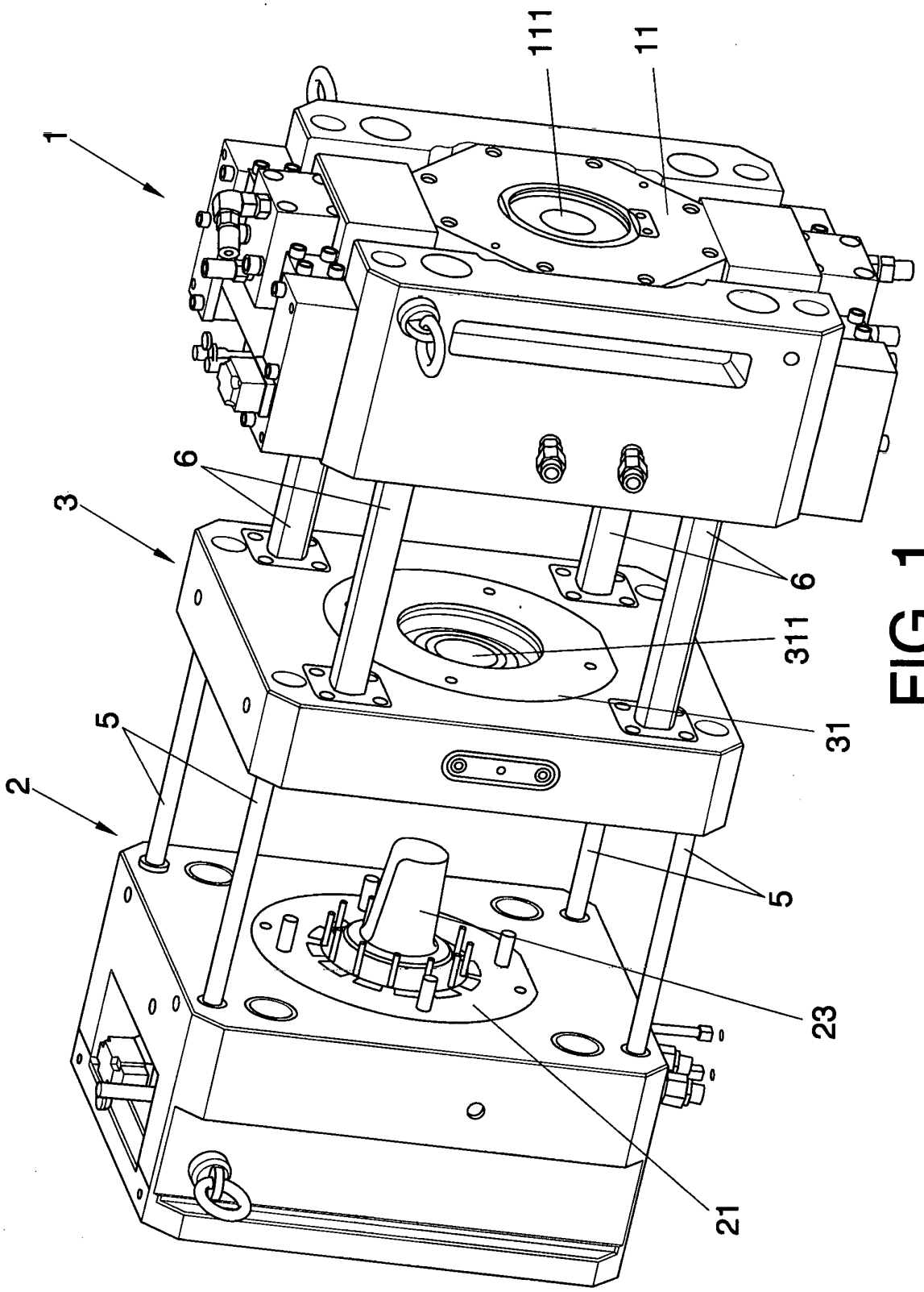


FIG. 1

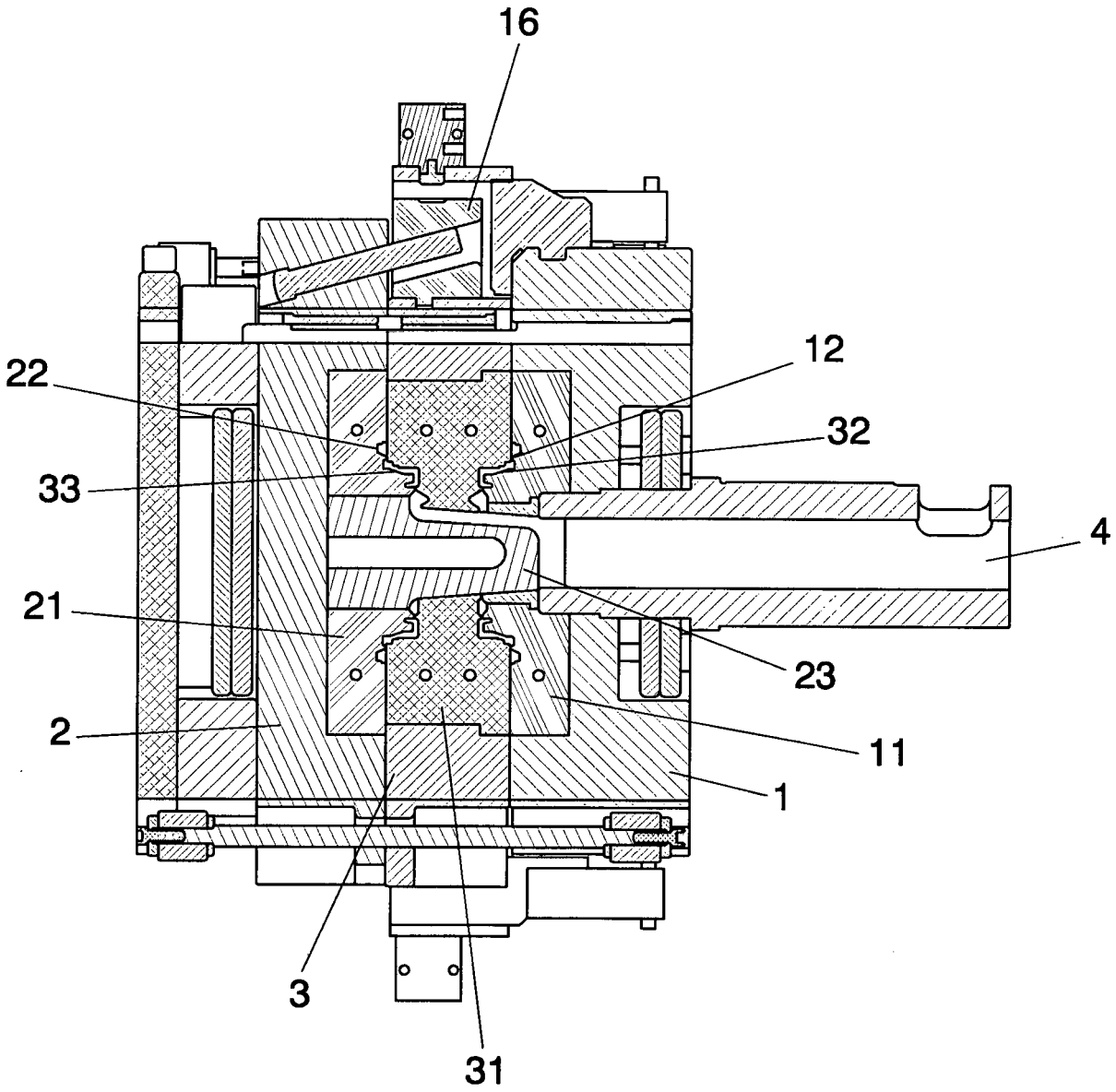


FIG. 2

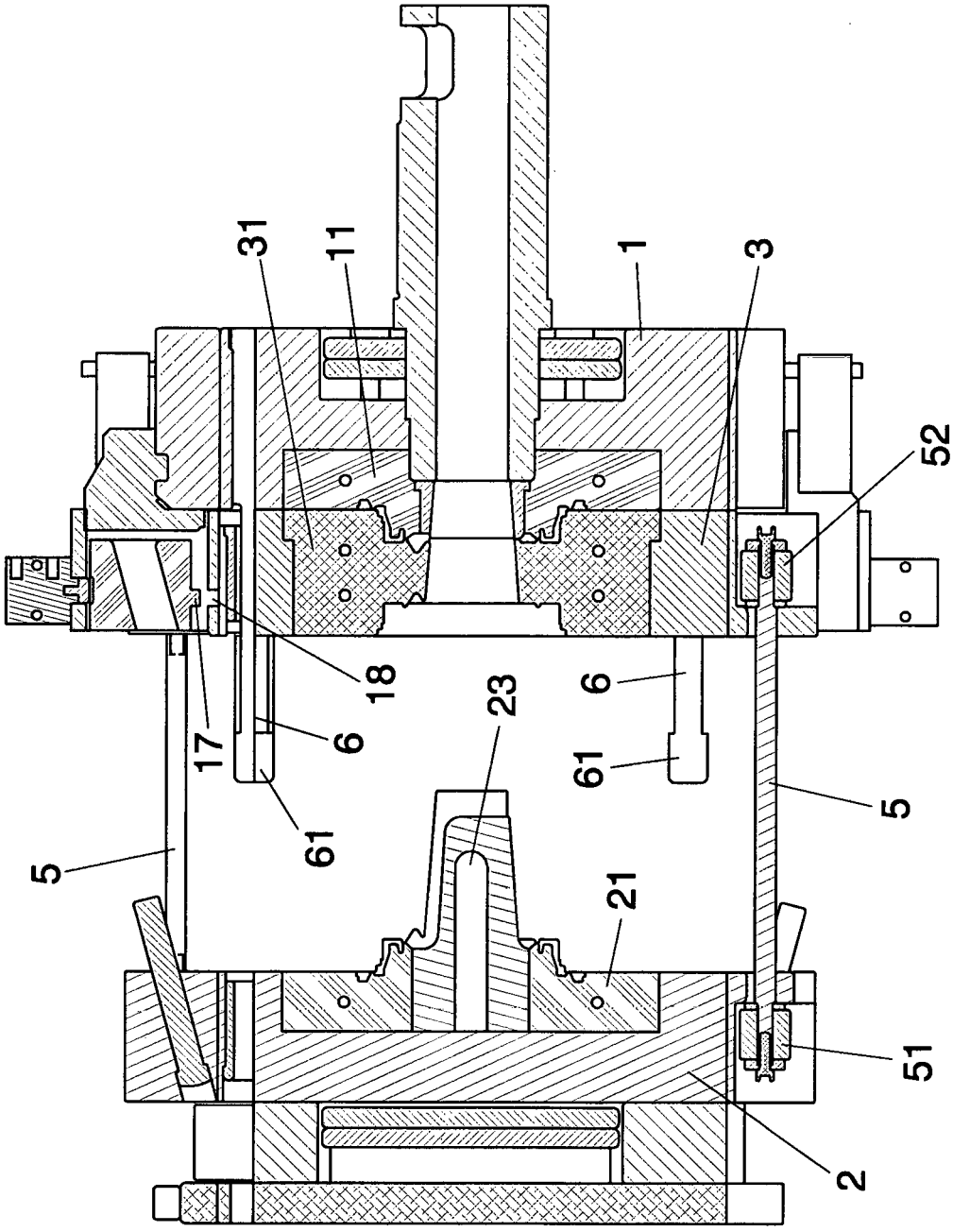


FIG. 3

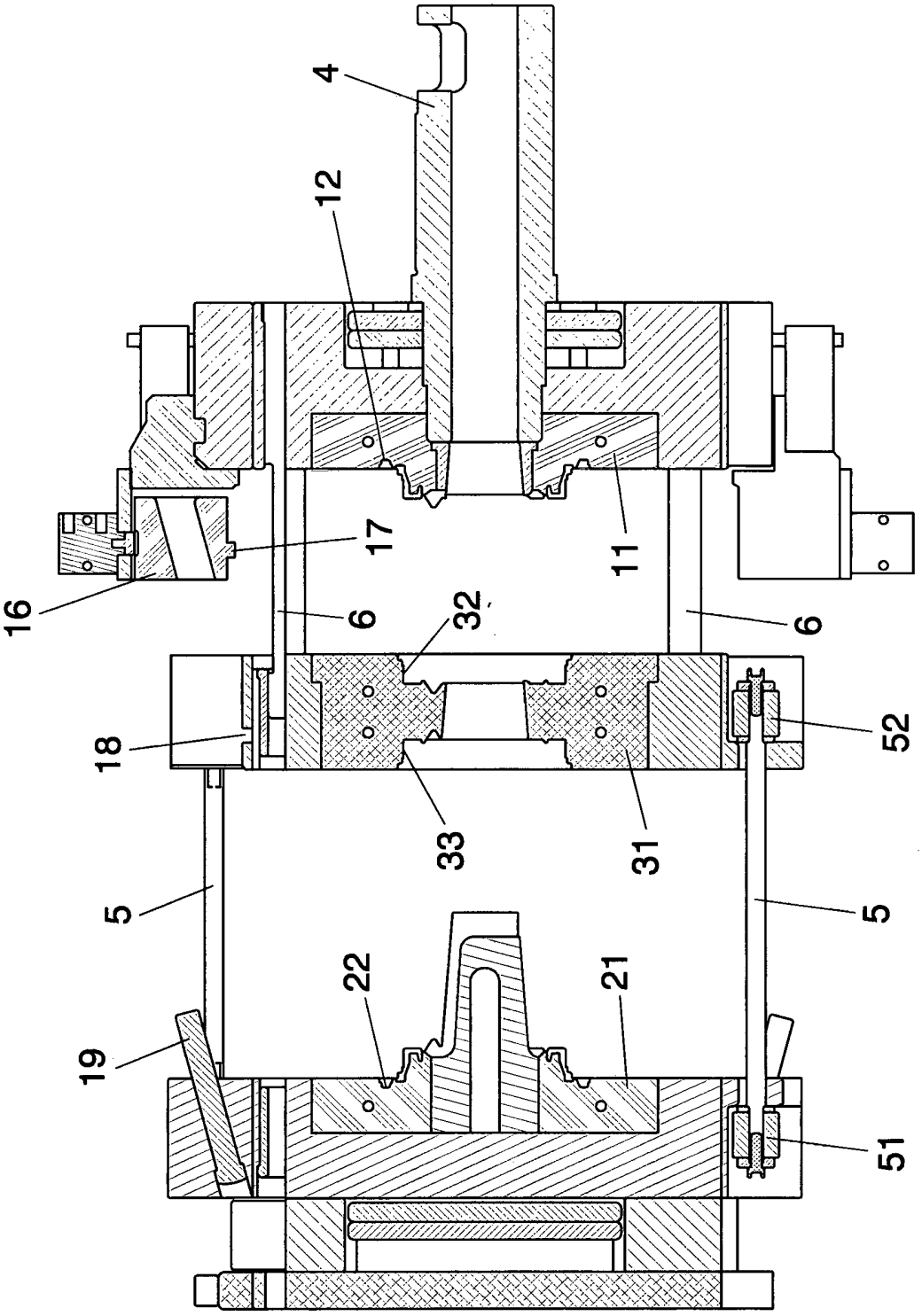


FIG. 4

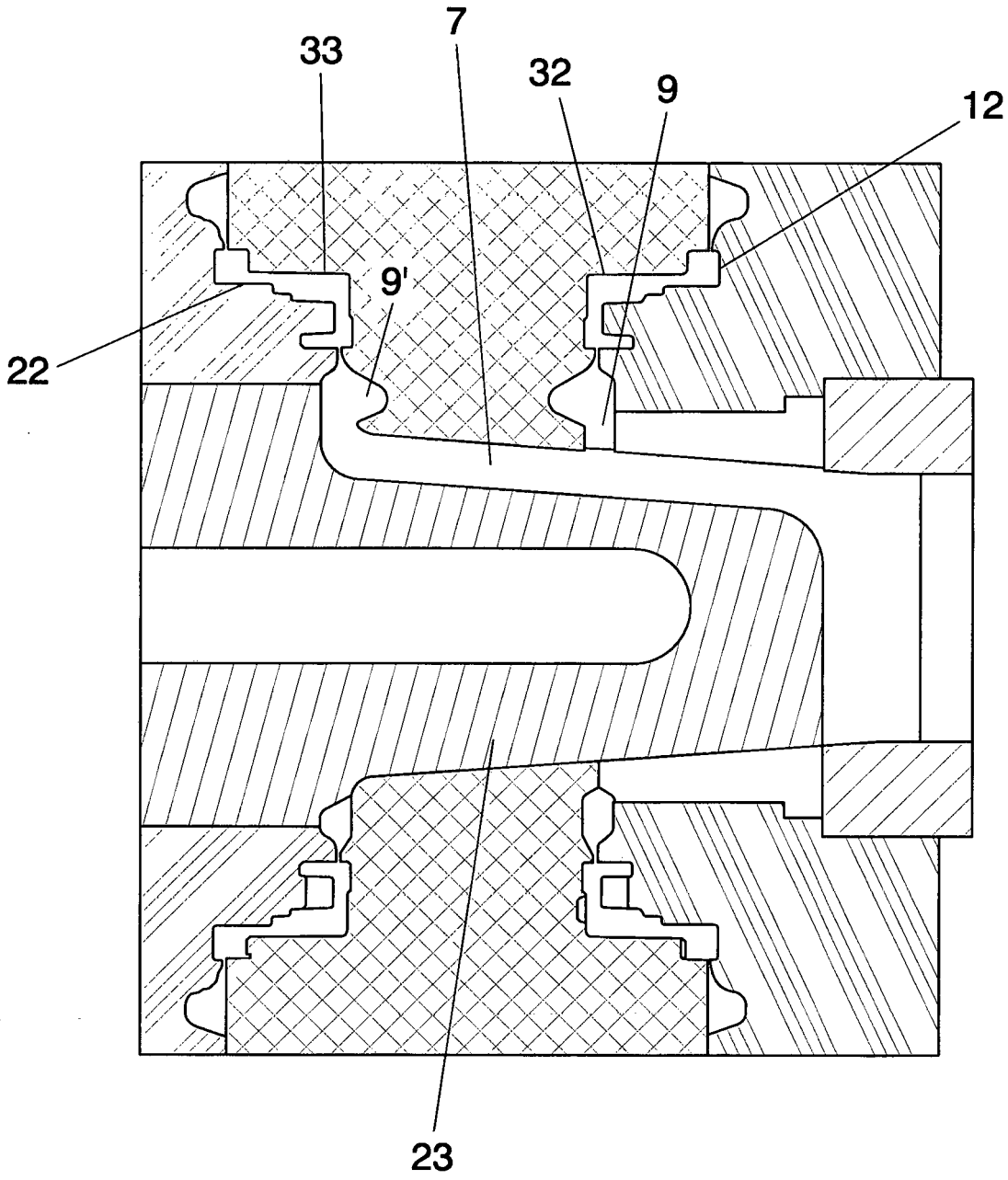
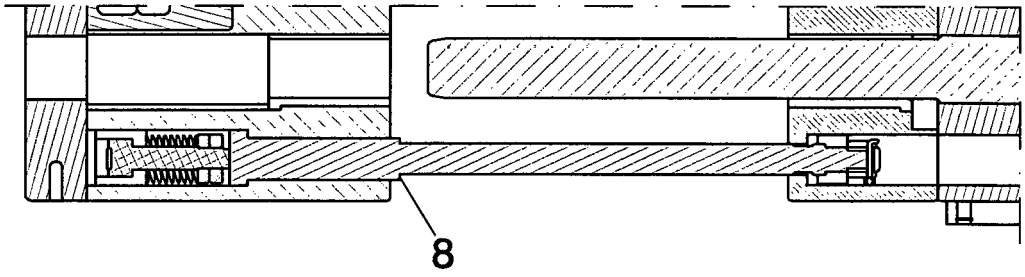
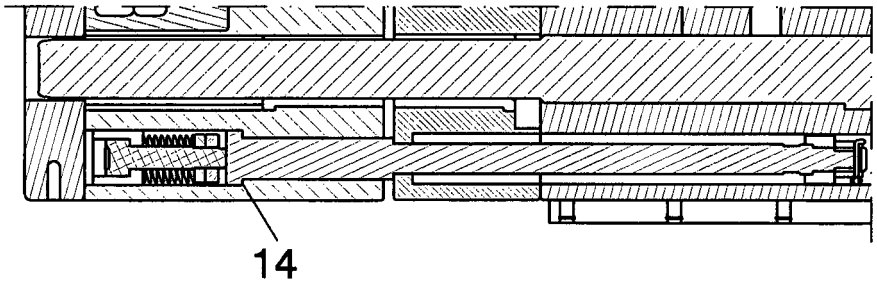


FIG. 5





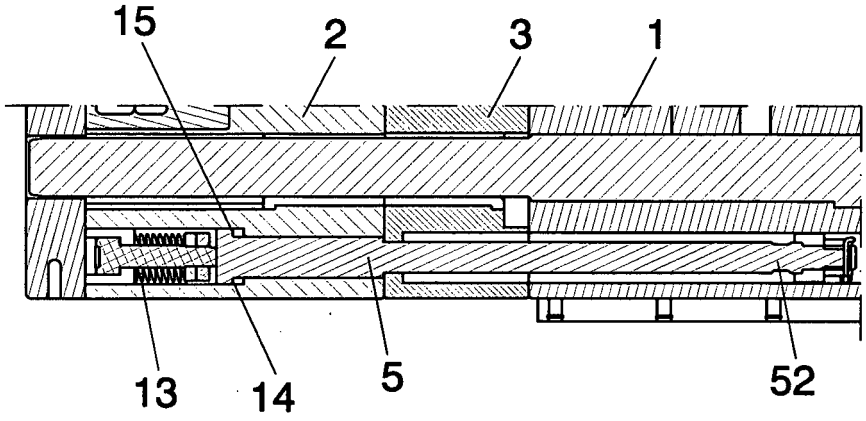


FIG. 6

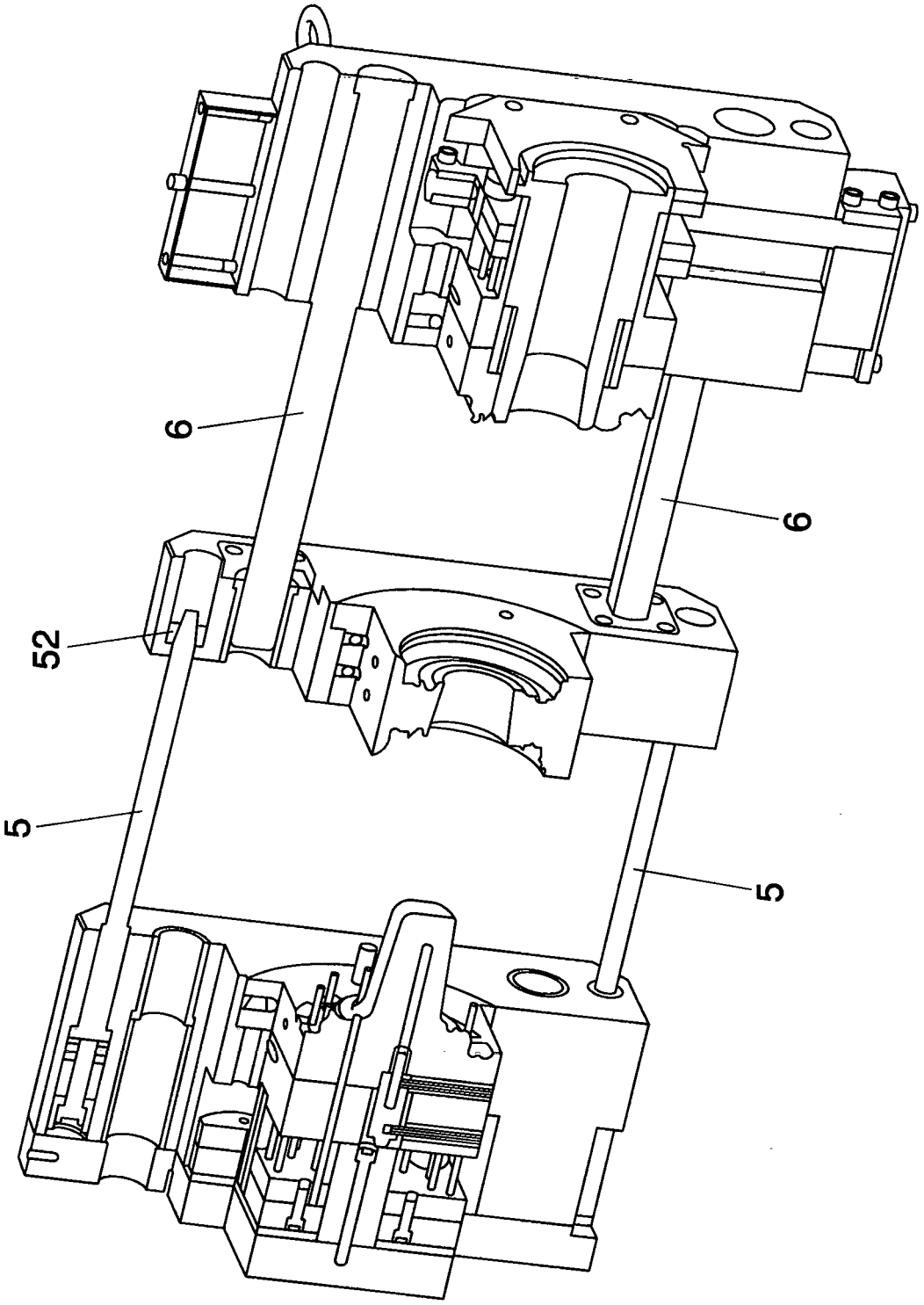


FIG. 7

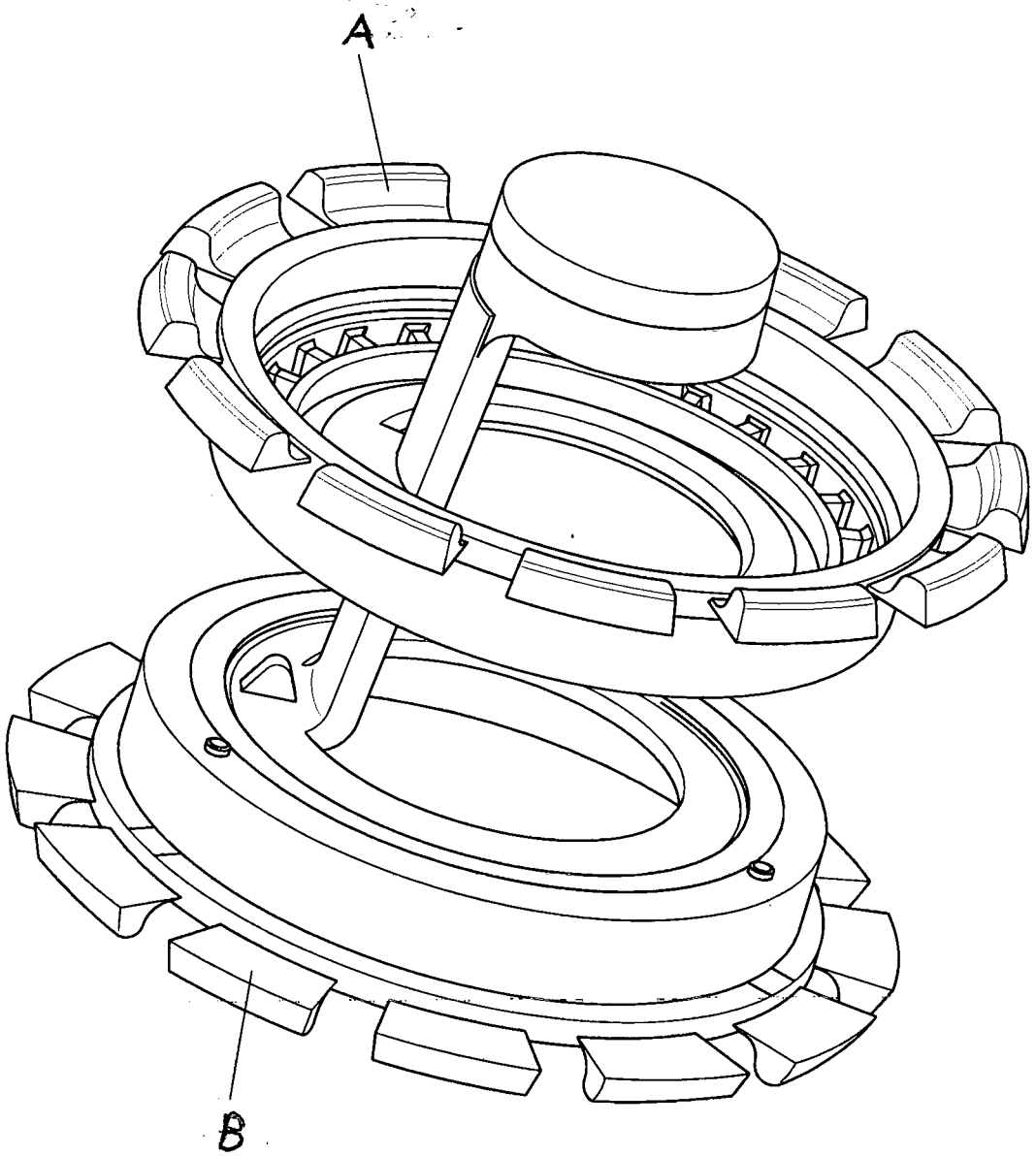


FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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- US 4589840 A **[0007]**
- WO 0238311 A **[0009]**