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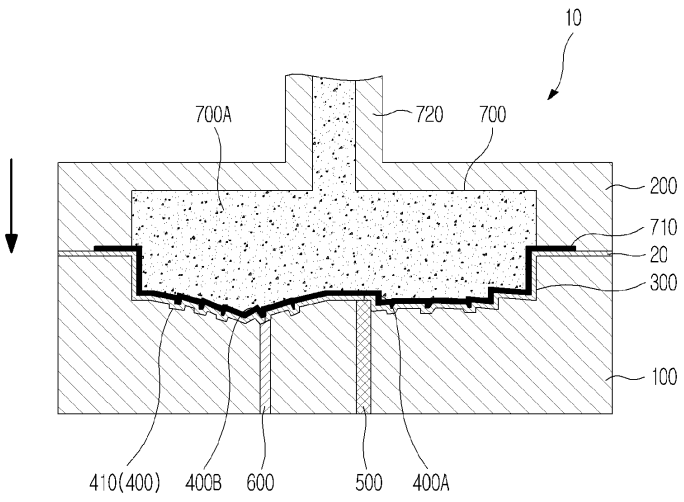
(54) Patterning apparatus and patterning method using the same

(57) A patterning apparatus (10) includes a first die (100) and a second die (200) to press a metal member (20), a liquid type medium containing unit (700) to contain a liquid type medium (700A), a three-dimensional forming unit (300) formed at at least one of the first (100) and second (200) dies, the three-dimensional forming unit (300) contacting the metal member when the medium presses the metal member (20), and a pattern processing unit (400) formed at the three-dimensional forming unit (300). A patterning method includes providing a metal member (20) to a first die (100), moving a second die (200) downward to the top of the metal member (20), providing a liquid type medium (700A) to the metal member (20), pressing the metal member (20) using the medium (700A) such that the metal member (20) contacts a three-dimensional forming unit (300) formed at at least one of the first (100) and second (200) dies, and pressing the metal member (20) such that the metal member (20) contacts a pattern processing unit (400) formed at the three-dimensional forming unit (300).

FIG. 2



EP 2 314 461 A2

Description

[0001] This application claims the benefit of Korean Patent Application No. 2009-0099104, filed on October 19, 2009 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

1. Field

[0002] Embodiments of the present invention relate to a patterning apparatus that simultaneously performs three-dimensional forming and pattern processing of a metal member and a patterning method using the same.

2. Description of the Related Art

[0003] In recent years, there has been requested a scheme to accurately form various patterns, for example a complicated real pattern such as a leather pattern or a silk pattern, at a metal member having a predetermined thickness so as to decorate mobile devices, MP3 players, portable multimedia players (PMP), home appliance products, etc.

[0004] To this end, there has been generally used a method of forming an irregular pattern at a metal member through separate post processing, to exhibit three-dimensional texture, before or after pressing the metal member.

[0005] Before pressing, a complicated real pattern may be directly formed at a sheet type metal member. In this case, an inherent form of the real pattern may be damaged due to pressure applied during pressing. For this reason, the metal member is pressed, and then a simple pattern is formed at the sheet type metal member using a physical method.

[0006] Also, the metal member may be chemically processed after pressing the metal member. For example, the pressed metal member may be patterned by etching. In this case, simple three-dimensional patterns may be formed at the metal member; however, complicated real patterns, such as a leather pattern or a silk pattern, may not be formed at the metal member. Furthermore, etching uses strong acid, which is not environmentally friendly.

[0007] It is an aspect of the present invention to provide a patterning apparatus that elaborately forms various complicated patterns at a metal member and a patterning method using the same.

[0008] It is another aspect of the present invention to provide a patterning apparatus that simultaneously performs forming and pattern processing of a metal member and a patterning method using the same.

[0009] Additional aspects of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0010] In accordance with one aspect of the present invention, a patterning apparatus includes a first die and a second die to press a metal member in a supported state, a liquid type medium containing unit to contain a liquid type medium which presses the metal member, a three-dimensional forming unit formed at at least one of the first and second dies, the three-dimensional forming unit contacting the metal member when the liquid type medium presses the metal member, and a pattern processing unit formed at the three-dimensional forming unit.

[0011] The metal member may include a metal sheet, the three-dimensional forming unit may be formed at the first die, which fixedly supports the metal sheet, and the liquid type medium containing unit may be formed at the second die, which is opposite to the first die, to press the metal sheet to the pattern processing unit.

[0012] The metal member may include a metal tube, the three-dimensional forming unit may be formed at at least one of the first and second dies, and the liquid type medium containing unit may be formed at each side of the first die, which supports the metal tube, to press the metal tube to the pattern processing unit.

[0013] The pattern processing unit may include a real pattern, such as a leather pattern or a silk pattern.

[0014] The pattern processing unit may include a unit pattern repetitively formed in a uniform shape.

[0015] The pattern processing unit may be provided with a heating unit to partially heat the metal member.

[0016] The pattern processing unit may be provided with a cooling unit to partially cool the metal member.

[0017] The patterning apparatus may further include at least one heater to heat at least one of the first and second dies.

[0018] The metal member may be heated to a predetermined temperature.

[0019] The patterning apparatus may further include a heater to directly heat the metal member.

[0020] The cooling unit may be formed at a protruding region of the pattern processing unit.

[0021] The heating unit may be formed at a depressed region of the pattern processing unit.

[0022] The metal member may be used for a home appliance casing, an MP3 player casing, a PMP casing, or a mobile phone casing.

[0023] In accordance with another aspect of the present invention, a patterning method includes providing a metal member to a first die, moving a second die downward to a top of the metal member, providing a liquid type medium to the metal member, pressing the metal member using the liquid type medium such that the metal member contacts a three-dimensional forming unit formed at at least one of the first and second dies, and pressing the metal member such that the metal member contacts a pattern processing unit formed at the three-dimensional forming unit.

[0024] Providing the metal member to the first die may include providing a metal sheet to the first die.

[0025] Providing the metal member to the first die may include providing a metal tube to the first die.

[0026] Pressing the metal member using the liquid type medium such that the metal member contacts the three-dimensional forming unit formed at at least one of the first and second dies may include pressing the metal sheet downward using the liquid type medium such that the metal sheet contacts a three-dimensional forming unit formed at the top of the first die.

[0027] Pressing the metal member using the liquid type medium such that the metal member contacts the three-dimensional forming unit formed at at least one of the first and second dies may include pressing the metal tube upward and downward using the liquid type medium such that the metal tube contacts three-dimensional forming units formed at the top of the first die and at the bottom of the second die.

[0028] Pressing the metal member such that the metal member contacts the pattern processing unit formed at the three-dimensional forming unit may include pressing the metal sheet such that the metal sheet contacts a real pattern formed at the three-dimensional forming unit.

[0029] Pressing the metal member such that the metal member contacts the pattern processing unit formed at the three-dimensional forming unit may include pressing the metal tube such that the metal tube contacts a real pattern formed at the three-dimensional forming unit.

[0030] These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIGS. 1 to 3 are views illustrating a patterning apparatus according to an embodiment of the present invention;

FIGS. 4 to 7 are views illustrating unit patterns of a pattern processing unit of the present invention; and

FIGS. 8 to 10 are views illustrating a patterning apparatus according to another embodiment of the present invention.

[0031] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0032] FIGS. 1 to 3 are views illustrating a patterning apparatus according to an embodiment of the present invention.

[0033] As shown in FIGS. 1 to 3, a pattern apparatus 10 includes a first die 100 and a second die 200 to press a metal sheet 20 in a supported state.

[0034] The second die 200 is located above the first die 100 in a vertically movable manner. The second die 200 is moved downward such that the metal sheet 20 is pressed between the first die 100 and the second die 200. According to die structure, however, the first die 200 may be moved upward such that the metal sheet 20 is pressed between the first die 100 and the second die 200.

[0035] The first die 100 is provided at the top thereof, which faces the second die 200, with a three-dimensional forming unit 300 configured in a depressed shape. The three-dimensional forming unit 300 is provided with a pattern processing unit 400 which may have various three-dimensional patterns.

[0036] The pattern processing unit 400 may include a complicated real pattern 410, such as a leather pattern or a silk pattern. Forms of the real pattern 410 are not restricted. The real pattern 410 may be configured in various forms as needed.

[0037] Also, as shown in FIGS. 4 to 7, the pattern processing unit 400 may include a plurality of repetitive unit patterns 420, 430, 440, and 450, each of which is configured in a three-dimensional uniform shape. Each of the unit patterns 420, 430, 440, and 450 may be configured in a uniform shape. Alternatively, at least two kinds of shapes may be combined to form each of the unit patterns 420, 430, 440, and 450 as needed. For example, the unit patterns 420, 430, 440, and 450 may be configured in a hemispherical shape 420 as shown in FIG. 4, a quadrangular shape 430 as shown in FIG. 5, a triangular shape 440 as shown in FIG. 6, and a trapezoidal shape 450 as shown in FIG. 7.

[0038] Also, the pattern processing unit 400 may be provided with a cooling unit 500 and a heating unit 600, which will be described later. In the drawing, a single cooling unit 500 and a single heating unit 600 are mounted at the first die 100. Alternatively, either the cooling unit 500 or the heating unit 600 may be mounted at the first die 100 depending upon the form of the pattern processing unit 400; otherwise, a plurality of cooling units 500 and a plurality of heating units 600 may be mounted at the first die 100.

[0039] The second die 200 is provided with a liquid type medium containing unit 700 to contain a liquid type medium 700A. The liquid type medium containing unit 700 is closed by a diaphragm 710 mounted at the bottom of the second die 200.

[0040] The liquid type medium containing unit 700 is connected to a supply pump (not shown) via a supply pipe 720. Upon driving the supply pump, the liquid type medium 700A is supplied to the liquid type medium containing unit 700 in a pressurized state. As the liquid type medium 700A is supplied to the liquid type medium containing unit 700, the diaphragm 710 swells downward to press the metal sheet 20.

[0041] Also, a heater (not shown) may be mounted at the second die 200 to heat the second die 200, and thus the liquid type medium 700A, to a predetermined temperature. As the liquid type medium 700A is heated to the predetermined temperature by the heater, the diaphragm 710, which presses the metal sheet 20, may have the same temperature as the liquid type medium 700A.

[0042] The cooling unit 500 partially cools the metal sheet 20 to increase strain resistance at the cooled region and thus prevent partial damage to the metal sheet 20 during forming and pattern processing of the metal sheet

20. Also, the heater 600 partially heats the metal sheet 20 to decrease strain resistance at the heated region and thus prevent partial damage to the metal sheet 20 during forming and pattern processing of the metal sheet 20.

[0043] Also, a heater (not shown) may be mounted at the first die 100 to heat the first die 100 to a predetermined temperature such that the cooling unit 500 has a lower temperature than the first die 100 and the heating unit 600 has a higher temperature than the first die 100.

[0044] Instead of providing the heater at the first die 100 and the second die 200, however, the metal sheet 20 may be used in a heated state or the metal sheet 20 may be directly heated by a heater (not shown).

[0045] Specifically, a coolant is contained in the cooling unit 500, and a heater (not shown) is mounted in the heating unit 600. Between the cooling unit 500 and the first die 100 and between the heating unit 600 and the first die 100 may be a heat insulation material (not shown) to keep the cooling unit 500 and the heating unit 600 at a predetermined temperature.

[0046] In particular, the cooling unit 500 may be mounted at an upwardly protruding region 400A of the pattern processing unit 400, i.e., a region of the pattern processing unit 400 where the metal sheet 20 first contacts the pattern processing unit 400. Also, the heating unit 600 may be mounted at a downwardly depressed region 400B of the pattern processing unit 400, i.e., a region of the pattern processing unit 400 where the metal sheet 20 last contacts the pattern processing unit 400. In this way, the cooling unit 500 and the heating unit 600 are provided to effectively perform forming and patterning processing of the metal sheet 20.

[0047] Meanwhile, the cooling unit 500 and the heating unit 600 may be provided such that the cooling unit 500 and the heating unit 600 advance to and retreat from the first die 100. In this case, the cooling unit 500 and the heating unit 600 may be implemented by a punch, thereby effectively performing forming and pattern processing of the metal sheet 20.

[0048] The metal sheet 20 may be formed of aluminum or alloys thereof, copper or alloys thereof, steel or alloys thereof, zinc or tin coated aluminum, copper, steel, zinc or tin alloys, stainless steel, etc. The materials for the metal sheet 20 may be appropriately selected as needed.

[0049] Therefore, various complicated patterns, such as the real pattern 410, are directly formed at the first die 100 with the result that three-dimensional pattern processing is not limited. Also, three-dimensional forming and pattern processing of the metal sheet 20 are simultaneously performed with the result that post processing is not necessary, thereby reducing costs.

[0050] In addition, a casing exhibiting an excellent design and improved durability may be manufactured through the three-dimensional forming and pattern processing of the metal sheet 20. The casing may include a home appliance casing, an MP3 player casing, a PMP casing, or a mobile phone casing.

[0051] Hereinafter, a method of forming a pattern at the metal sheet will be described with reference to FIGS. 1 to 3.

[0052] First, the metal sheet 20 is fixedly disposed between the first die 100 and the second die 200, which have been heated to a predetermined temperature, the diaphragm 710 is brought into contact with the metal sheet 20, and the metal sheet 20 is heated to a predetermined temperature. The metal sheet 20 exhibits relatively high thermal conductivity, and therefore, the metal sheet 20 is heated to the predetermined temperature within a short time.

[0053] When the temperature of the metal sheet 20 reaches the predetermined temperature, the liquid type medium 700A is supplied to the liquid type medium containing unit 700 by the supply pump (not shown) to press the metal sheet 20 downward via the diaphragm 710.

[0054] The pattern processing unit 400 is formed at the three-dimensional forming unit 300 of the first die 100. Consequently, three-dimensional forming of the metal sheet 20 by the three-dimensional forming unit 300 and three-dimensional pattern processing of the metal sheet 20 by the pattern processing unit 400 are simultaneously performed. When the diaphragm 710 presses the metal sheet 20 and thus a portion of the metal sheet 20 contacts the cooling unit 500, the contact portion of the metal sheet 20 is cooled by the cooling unit 500 with the result that the contact portion of the metal sheet 20 has higher strength than the remaining portion of the metal sheet, and therefore, strain resistance is increased at the contact portion of the metal sheet 20. Consequently, the portion of the metal sheet 20 in contact with the cooling unit 500 has increased tension resistance against the remaining portion of the metal sheet 20, thereby preventing damage to the metal sheet 20.

[0055] In this way, the portion having the increased tension resistance is mounted at the upwardly protruding region 400A of the pattern processing unit 400, thereby preventing damage to the metal sheet 20 and forming a micro protruding pattern at the metal sheet 20.

[0056] Also, the liquid type medium 700A is supplied to the liquid type medium containing unit 700 by the supply pump (not shown) such that the metal sheet 20 is pressed downward by the diaphragm 710. As a result, the metal sheet 20 contacts the remaining portion of the pattern processing unit 400 excluding the cooling unit 500.

[0057] At this time, the metal sheet does not contact the micro depressed region 400B of the pattern processing unit 400 with the result that a liquid type medium 700A may be resupplied to the liquid type medium containing unit 700. The metal sheet 20 contacting the depressed region 400B has increased ductility due to heat from the heating unit 600 with the result that strain resistance of the metal sheet 20 is decreased, thereby preventing damage to the metal sheet 20. Also, the metal sheet 20 is easily brought into contact with the depressed region 400B of the pattern processing unit 400 to form a micro depressed pattern at the metal sheet 20.

[0058] Meanwhile, the cooling unit 500 and the heating unit 600 may advance to or retreat from the first die 100 in a state in which the metal sheet 20 is in contact with the pattern processing unit 400 such that the cooling unit 500 and the heating unit 600 are implemented by a punch, thereby more effectively performing forming and pattern processing of the metal sheet 20.

[0059] When forming and pattern processing of the metal sheet 20 are completed, pressurization of the liquid type medium 700A in the liquid type medium containing unit 700 is released, and then the second die 200 is moved upward to remove the metal sheet 20.

[0060] In the patterning apparatus 10 with the above-stated construction, the liquid type medium 700A is supplied to the liquid type medium containing unit 700, and then the metal sheet 20 is pressed downward via the diaphragm 710. Alternatively, the liquid type medium 700A may be supplied to the liquid type medium containing unit 700 such that the liquid type medium 700A directly presses the metal sheet 20.

[0061] Another embodiment of the present invention will be described with reference to FIGS. 8 to 10. Components of this embodiment identical to those of the previous embodiment are denoted by the same reference numerals, and a description thereof will not be given. FIGS. 8 to 10 are views illustrating a patterning apparatus according to another embodiment of the present invention

[0062] A patterning apparatus 10' includes a first die 100 and a second die 200 disposed above the first die 200 such that the second die 200 is movable downward to press a metal tube 20' in a supported state together with the first die 100. According to die structure, the first die 100 may be moved vertically in the same manner as in the patterning apparatus according to the previous embodiment of the present invention.

[0063] At opposite sides of the first die 100, corresponding to opposite ends of the metal tube 20', are provided liquid type medium containing units 700' to contain a liquid type medium 700'A.

[0064] Each of the liquid type medium containing units 700' has an actual punch 710' mounted therein. The actual punches 710' are inserted into the opposite ends of the metal tub 20' to supply the liquid type medium 700'A to the metal tube 20' in the axial direction. The actual punches 710' are coupled to tip ends of actuating rods 720' of the respective liquid type medium containing units 700'.

[0065] Three-dimensional forming units 300' are formed at the top of the first die 100 and the bottom of the second die 200. Each of the three-dimensional forming unit 300' is provided with a pattern processing unit 400' which may have various patterns.

[0066] Each of the pattern processing units 400' may include a complicated real pattern, such as a leather pattern or a silk pattern, in the same manner as in the previous embodiment. Forms of the real pattern are not restricted. The real pattern may be configured in various forms as needed.

[0067] Each of the pattern processing units 400' may include a plurality of repetitive unit patterns (not shown), each of which is configured in a uniform shape. Each of the unit patterns may be configured in a uniform shape. Alternatively, at least two kinds of shapes may be combined to form each of the unit patterns as needed.

[0068] Also, each of the pattern processing units 400' 400 may be provided with a cooling unit 500 and a heating unit 600 to prevent partial damage to the metal tube 20' during forming and pattern processing of the metal tube 20'.

[0069] Hereinafter, a method of forming a pattern at the metal tube will be described with reference to FIGS. 8 to 10.

[0070] First, the metal tube 20' is fixedly disposed between the first die 100 and the second die 200, which have been heated to a predetermined temperature, and then the second die 200 is moved downward such that the second die 200 is coupled to the first die 100. At the same time, the actual punches 710' of the liquid type medium containing units 700' are moved to the opposite ends of the metal tube 20' in the axial direction.

[0071] As a result, the actual punches 710' are inserted into the metal tube 20' through the opposite ends thereof to seal the metal tube 20'. In this state, the liquid type medium 700'A is supplied into the metal tube 20' through the actual punches 710' to expand the metal tube 20' in correspondence to the three-dimensional forming units 300' formed at the first die 100 and the second die 200. At the same time, a complicated real pattern, such as a leather pattern or a silk pattern, is formed at the metal tube 20' in correspondence to the pattern processing units 400' formed at the three-dimensional forming units 300'.

[0072] When forming and pattern processing of the metal tube 20' are completed, pressurization of the liquid type medium 700'A in each of the liquid type medium containing units 700' is released, and then the second die 200 is moved upward to remove the metal tube 20'.

[0073] In the patterning apparatus with the above-stated construction and the patterning method using the same, various complicated patterns are three-dimensionally and elaborately formed at the metal member using the liquid type medium, and, in addition, forming and pattern processing of the metal member are simultaneously performed.

[0074] As is apparent from the above description, various complicated patterns are directly provided at the die, and therefore, patterns are not restricted. Also, three-dimensional forming and pattern processing of the metal member are simultaneously performed, thereby reducing costs.

[0075] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles of the invention, the scope of which is defined

in the appended claims.

Claims

1. A patterning apparatus comprising:

   a first die and a second die to press a metal member in a supported state;
   a liquid type medium containing unit to contain a liquid type medium which presses the metal member;
   a three-dimensional forming unit formed at at least one of the first and second dies, the three-dimensional forming unit contacting the metal member when the liquid type medium presses the metal member; and
   a pattern processing unit formed at the three-dimensional forming unit.

2. The patterning apparatus according to claim 1, wherein
   the metal member comprises a metal sheet,
   the three-dimensional forming unit is formed at the first die, which fixedly supports the metal sheet, and
   the liquid type medium containing unit is formed at the second die, which is opposite to the first die, to press the metal sheet to the pattern processing unit.

3. The patterning apparatus according to claim 1, wherein
   the metal member comprises a metal tube,
   the three-dimensional forming unit is formed at at least one of the first and second dies, and
   the liquid type medium containing unit is formed at each side of the first die, which supports the metal tube, to press the metal tube to the pattern processing unit.

4. The patterning apparatus according to claim 1, wherein the pattern processing unit comprises a real pattern, such as a leather pattern or a silk pattern.

5. The patterning apparatus according to claim 1, wherein the pattern processing unit comprises a unit pattern repetitively formed in a uniform shape.

6. The patterning apparatus according to claim 1, wherein the pattern processing unit is provided with a heating unit to partially heat the metal member, wherein the heating unit is preferably formed at a depressed region of the pattern processing unit.

7. The patterning apparatus according to claim 1, wherein the pattern processing unit is provided with a cooling unit to partially cool the metal member, wherein the cooling unit is preferably formed at a protruding region of the pattern processing unit.

8. The patterning apparatus according to claim 1, further comprising at least one heater to heat at least one of the first and second dies.

9. The patterning apparatus according to claim 1, wherein the metal member is heated to a predetermined temperature.

10. The patterning apparatus according to claim 1, further comprising a heater to directly heat the metal member.

11. The patterning apparatus according to claim 1, wherein the metal member is used for a home appliance casing, an MP3 player casing, a PMP casing, or a mobile phone casing.

12. A patterning method comprising:

    providing a metal member to a first die;
    moving a second die downward to a top of the metal member;
    providing a liquid type medium to the metal member;
    pressing the metal member using the liquid type medium such that the metal member contacts a three-dimensional forming unit formed at at least one of the first and second dies; and
    pressing the metal member such that the metal member contacts a pattern processing unit formed at the three-dimensional forming unit.

13. The patterning method according to claim 12, wherein providing the metal member to the first die comprises providing a metal sheet to the first die, and wherein:

    pressing the metal member using the liquid type medium such that the metal member contacts the three-dimensional forming unit formed at at least one of the first and second dies preferably comprises pressing the metal sheet downward using the liquid type medium such that the metal sheet contacts a three-dimensional forming unit formed at a top of the first die; or
    pressing the metal member such that the metal member contacts the pattern processing unit formed at the three-dimensional forming unit preferably comprises pressing the metal sheet such that the metal sheet contacts a real pattern formed at the three-dimensional forming unit.

14. The patterning method according to claim 12, wherein providing the metal member to the first die comprises providing a metal tube to the first die, wherein:

    pressing the metal member using the liquid type medium such that the metal member contacts

the three-dimensional forming unit formed at at least one of the first and second dies preferably comprises pressing the metal tube upward and downward using the liquid type medium such that the metal tube contacts three-dimensional forming units formed at a top of the first die and at a bottom of the second die; or

pressing the metal member such that the metal member contacts the pattern processing unit formed at the three-dimensional forming unit preferably comprises pressing the metal tube such that the metal tube contacts a real pattern formed at the three-dimensional forming unit.

FIG. 1

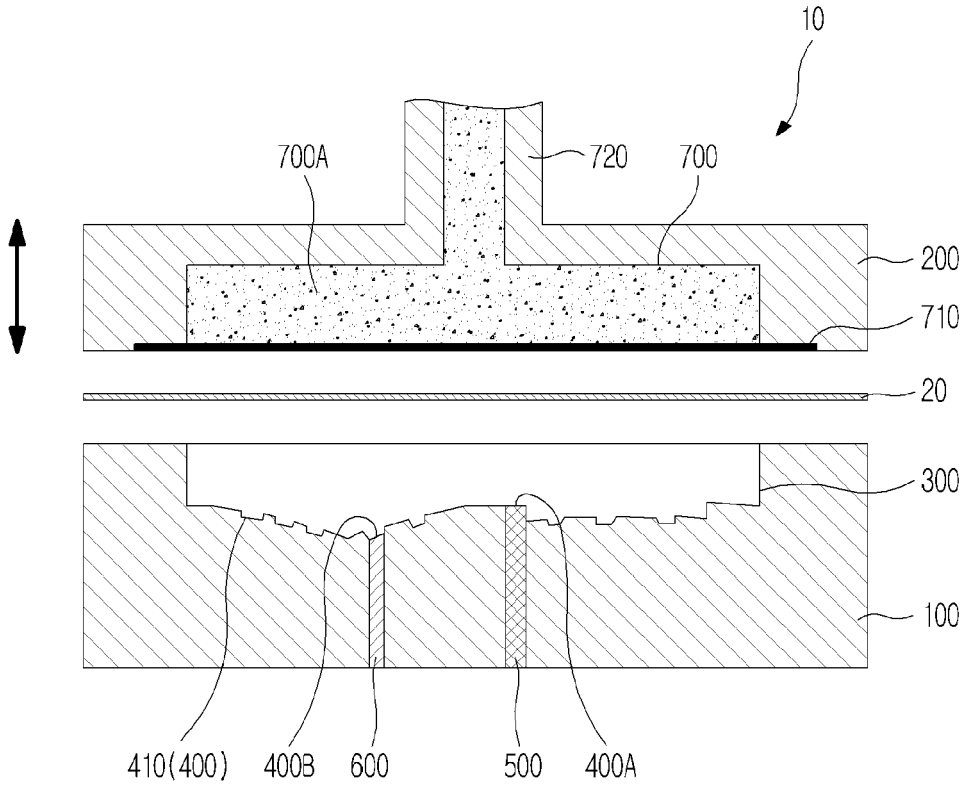


FIG. 2

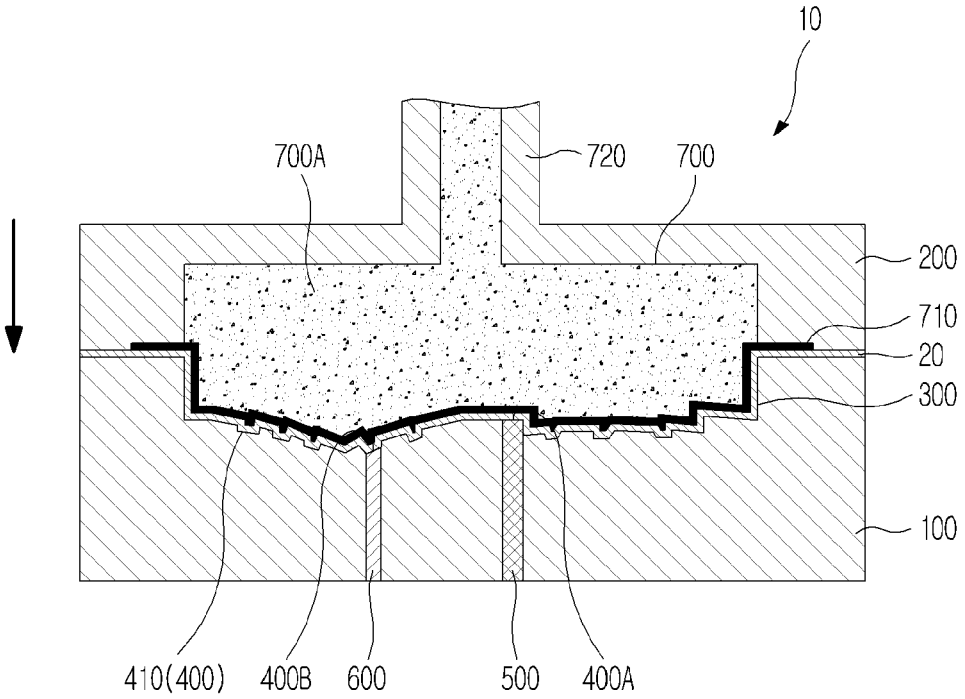


FIG. 3

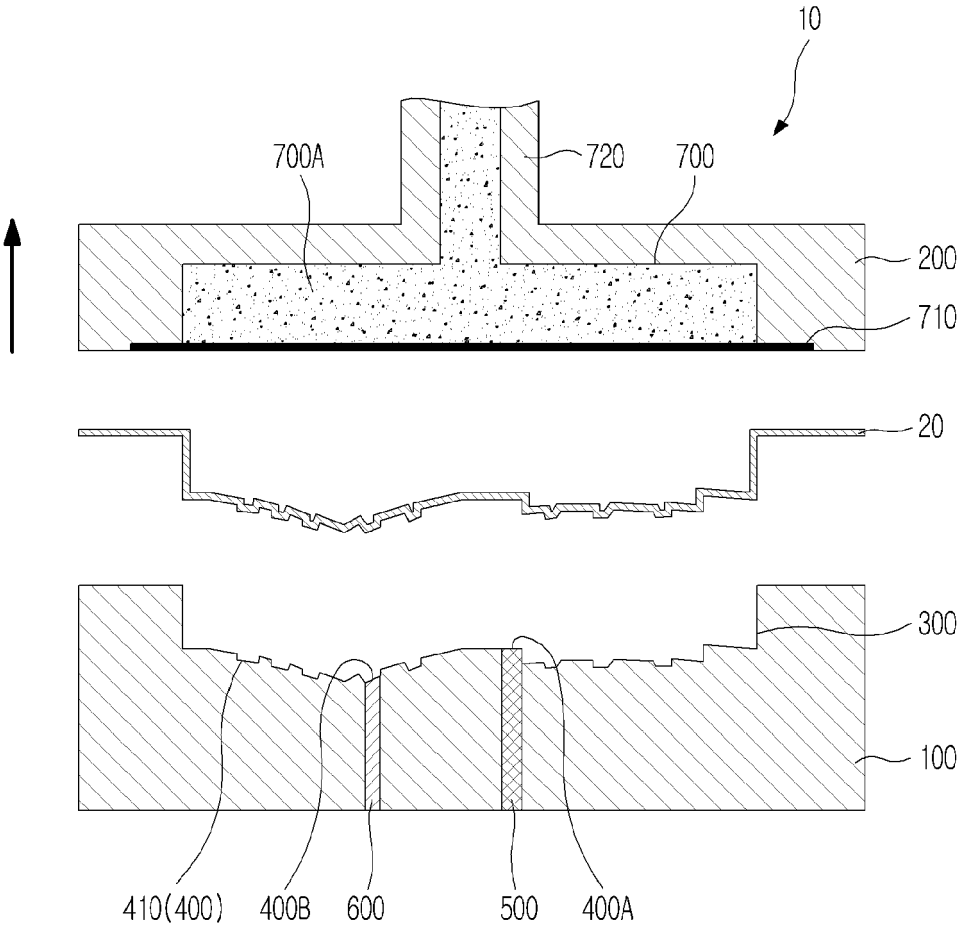


FIG. 4

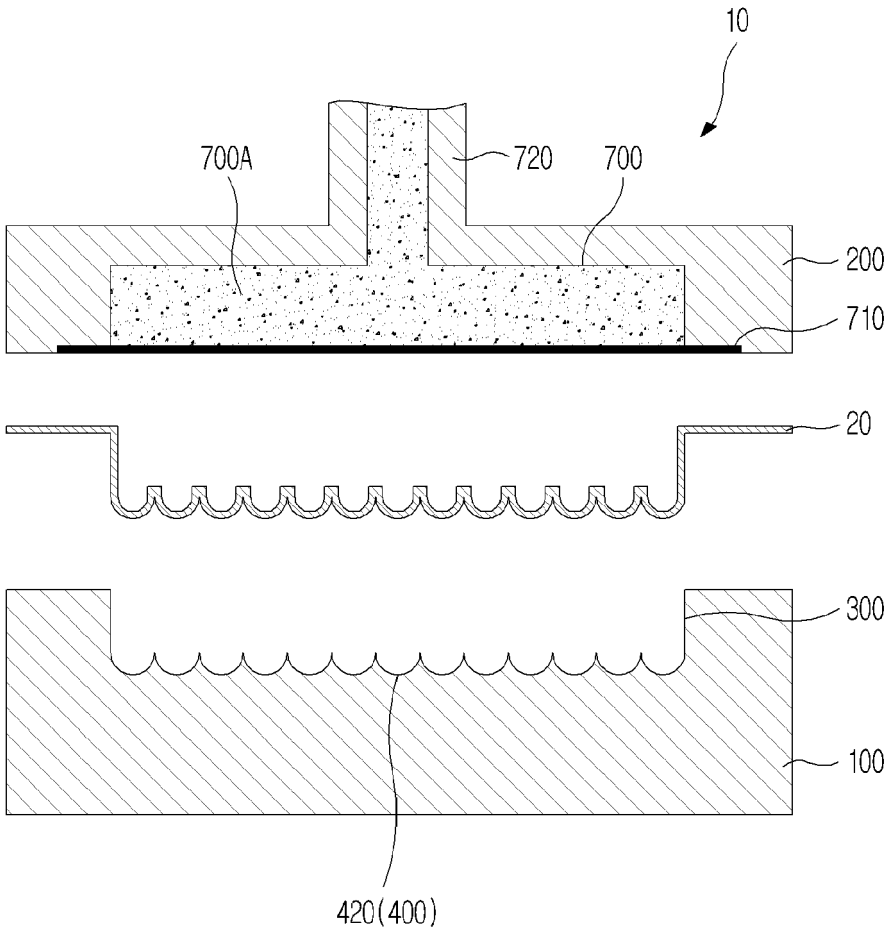


FIG. 5

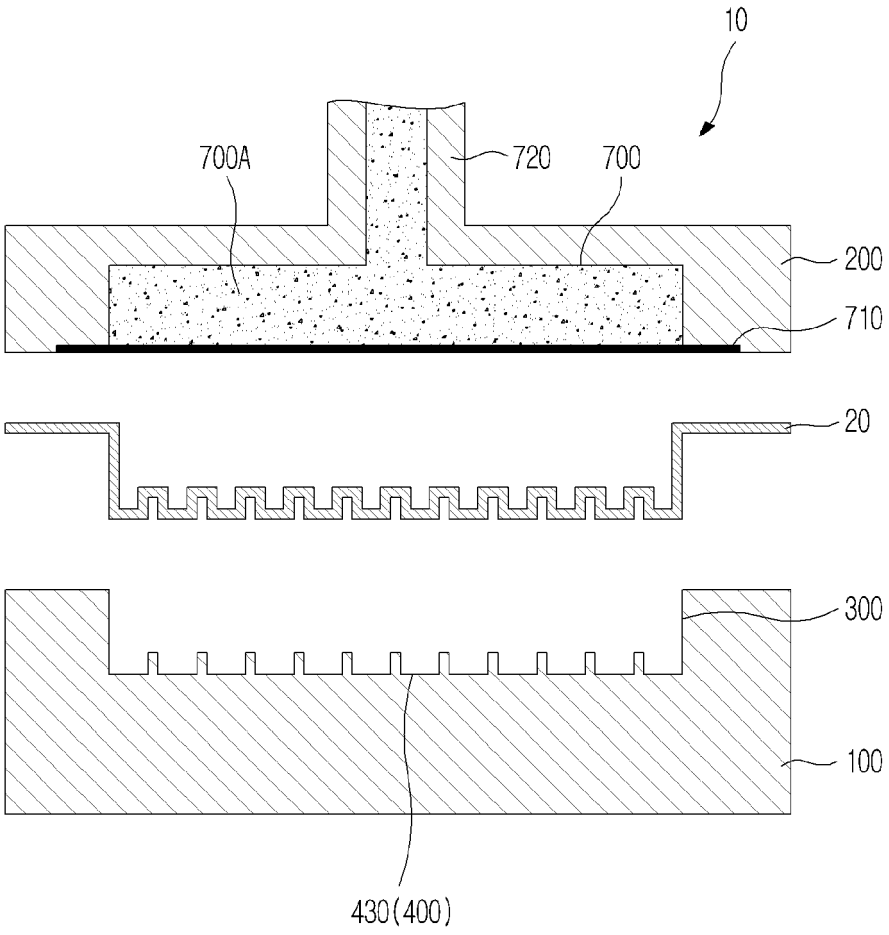


FIG. 6

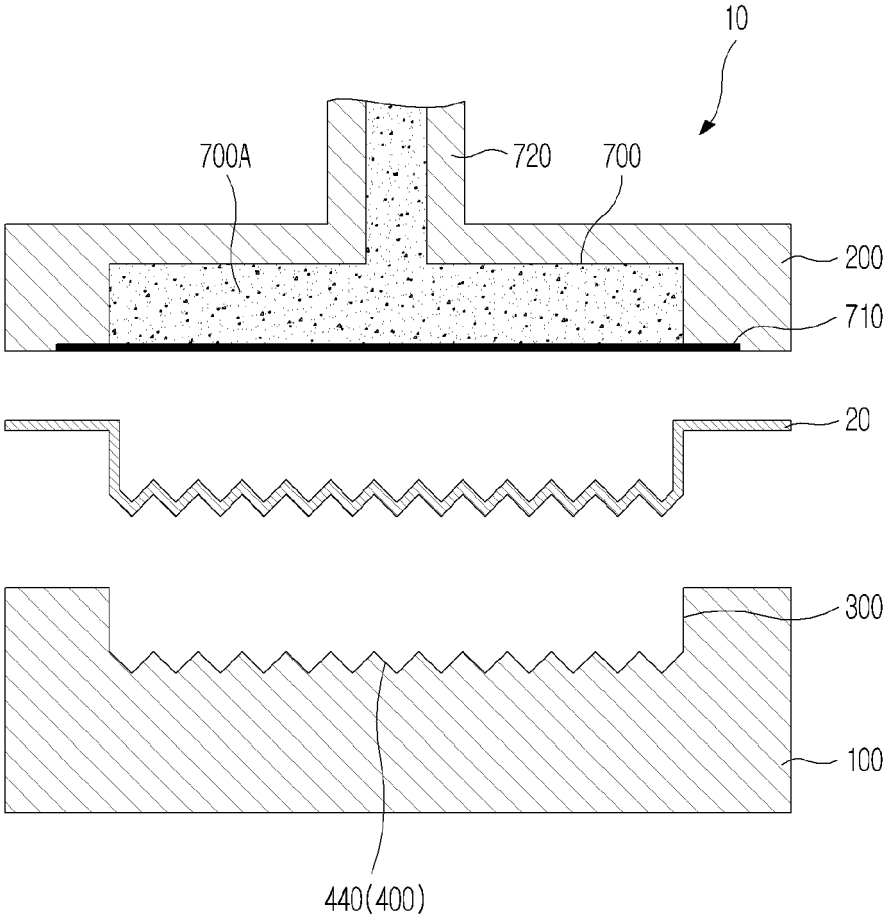


FIG. 7

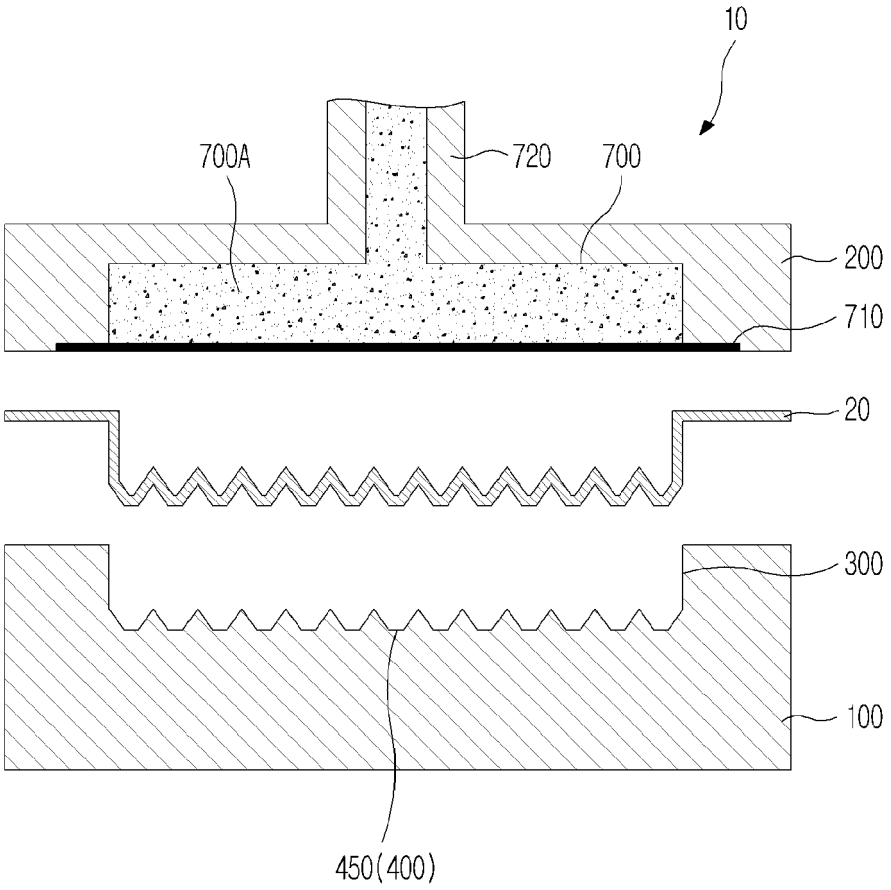


FIG. 8

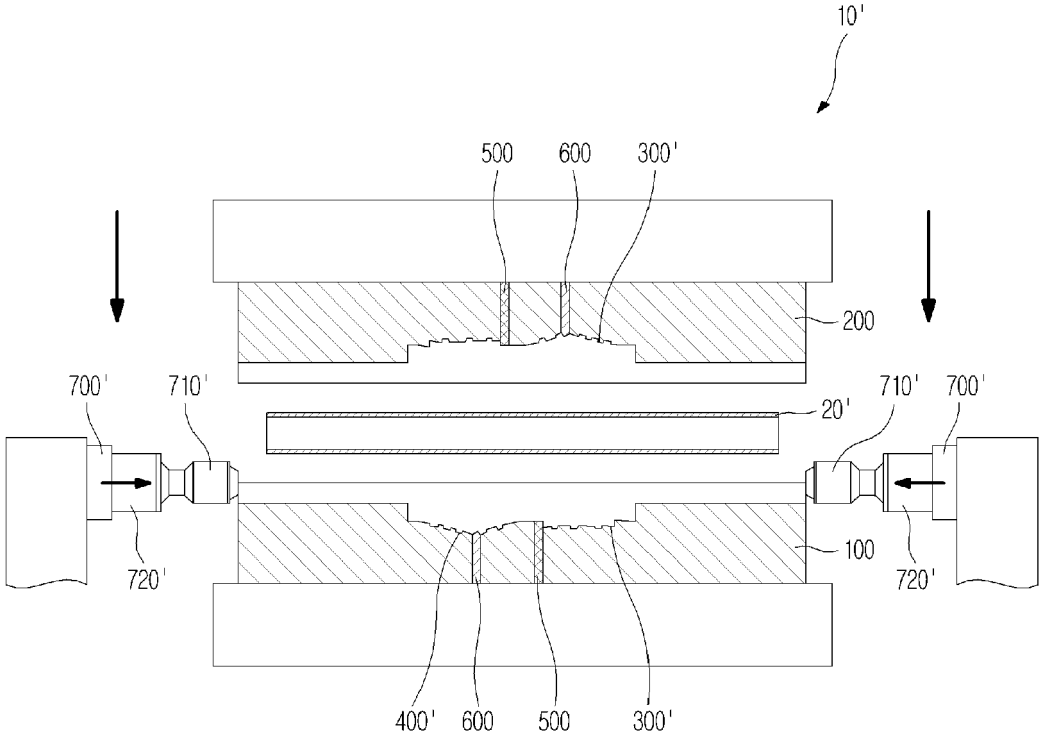


FIG. 9

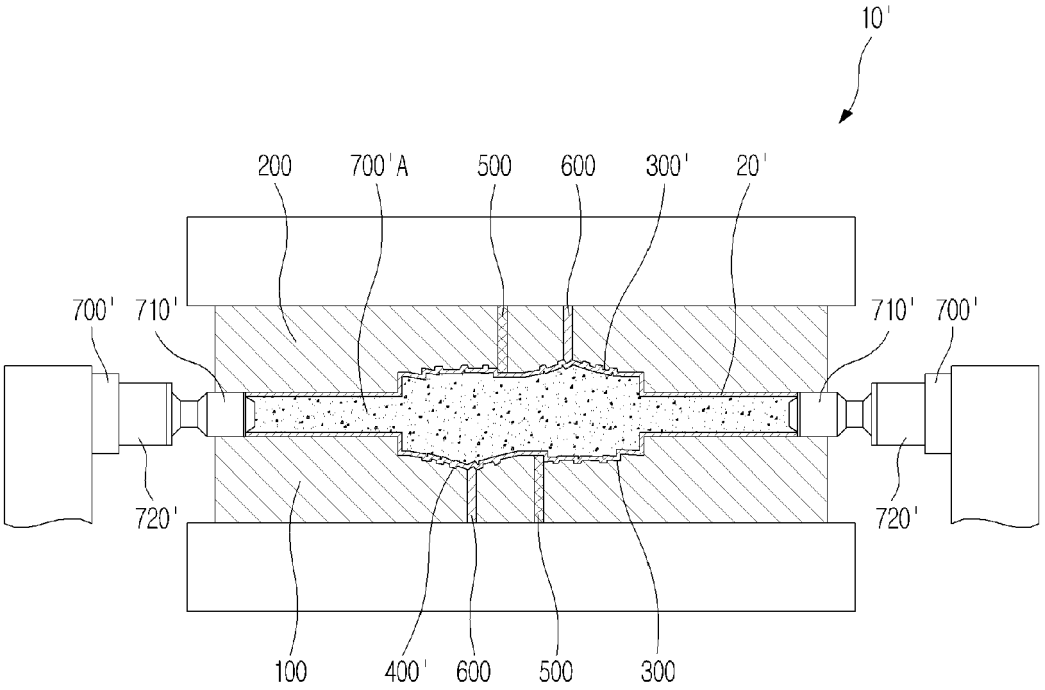

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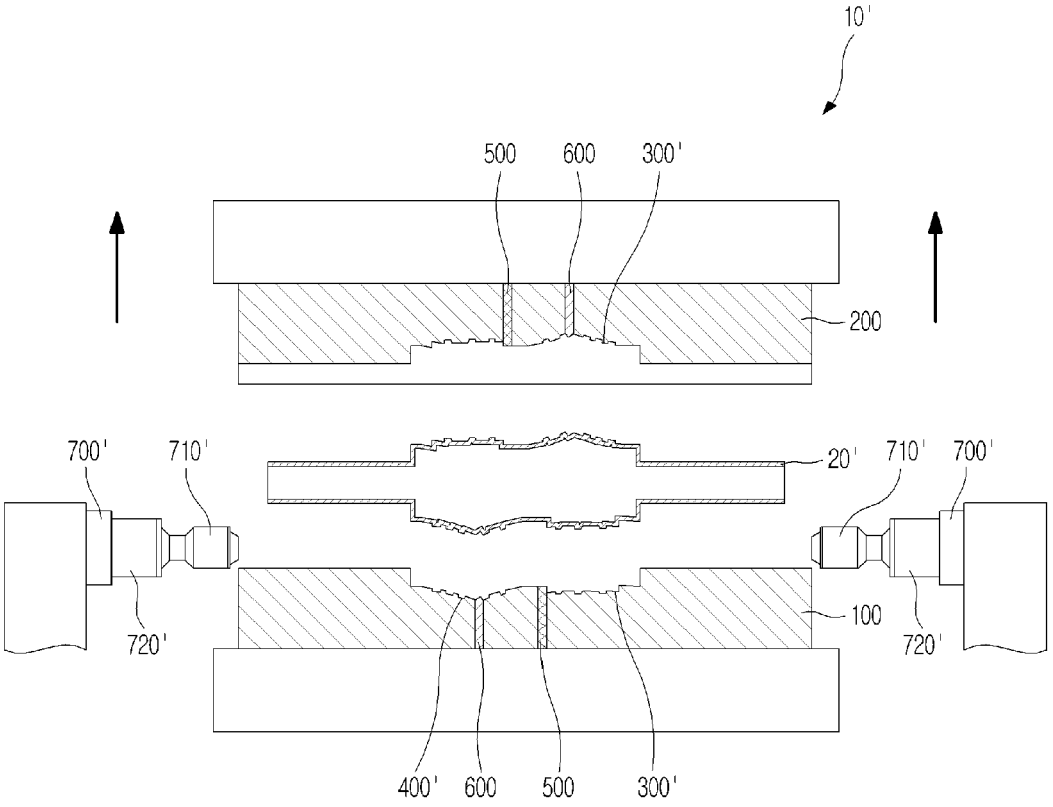
FIG. 10



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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