SUMMARY

[0005] In the manufacturing method by the RTM method, resin may be injected (poured) at high pressure in order to impregnate the inner part of the resin layer (bundle) of the preform with the resin. When the resin is injected at high pressure, the pressure tends to concentrate on the gate (hereinafter this may be called a resin inlet), so that a pressure difference between the vicinity of the gate (resin inlet) and the flow end of the resin becomes large, and the preform may be deformed at a high-pressure area.

[0006] In view of the above problems, the present disclosure provides a method for manufacturing a fiber reinforced resin molded article capable of distributing the pressure without concentration on the vicinity of the resin inlet and so preventing the deformation of a preform, and such a manufacturing device thereof.

[0007] According to one aspect of the present disclosure, a method for manufacturing a fiber reinforced resin molded article to form a preform including a fiber layer on an outer surface of a liner, impregnate the fiber layer of the preform with resin, and cure the resin, and the method includes: a step of preparing a mold including a first mold and a second mold; a step of placing the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap; a step of pouring the resin from a resin inlet toward the second gap in the mold; a step of separating at least a part of the first mold facing the preform from the preform to define a third gap between the at least a part of the first mold and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and a step of bringing the second mold and the at least a part of the first mold together close to the preform for compressive filling with the resin in the mold, wherein in the step of separating at least a part of the first mold from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, the second mold is brought close to the preform.

[0008] According to another aspect of the present disclosure, a method for manufacturing a fiber reinforced resin molded article to form a preform including a fiber layer on an outer surface of a liner, impregnate the fiber layer of the preform with resin, and cure the resin, and the method includes: a step of preparing a mold including a first mold and a second mold, the first mold having a moving core that is disposed to face the preform and moves relative to the preform so as to increase and decrease a gap defined between the moving core and the preform; a step of placing the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the

second mold and the preform, the second gap being larger than the first gap; a step of pouring the resin from a resin inlet toward the second gap in the mold; a step of separating the moving core from the preform to define a third gap between the moving core and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and a step of bringing the second mold and the moving core together close to the preform for compressive filling with the resin in the mold, wherein in the step of separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, the second mold is brought close to the preform.

[0009]

[0010] In some embodiments, in the step of separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, the moving core is separated from the preform while detecting a pressure of the resin poured between the second mold and the preform.

[0011] In some embodiments, in the step of bringing the second mold and the moving core together close to the preform for compressive filling with the resin in the mold, the second mold and the moving core are brought together to the preform so that a pressure of the resin poured between the moving core and the preform agrees with a pressure of the resin poured between the second mold and the preform.

[0012] According to another aspect of the present disclosure, a device is for manufacturing a fiber reinforced resin molded article to form a preform including a fiber layer on an outer surface of a liner, impregnate the fiber layer of the preform with resin, and cure the resin, and the device includes: a mold including a first mold and a second mold; a driving mechanism configured to drive the mold in an opening direction and a closing direction; a resin pouring mechanism configured to pour the resin from a resin inlet into the mold; and a control device configured to control operating states of the driving mechanism and the resin pouring mechanism. The control device is configured to control the driving mechanism to place the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap; control the resin pouring mechanism to pour the resin from the resin inlet toward the second gap in the mold; control the driving mechanism to separate at least a part of the first mold facing the preform from the

preform to define a third gap between the at least a part of the first mold and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and control the driving mechanism to bring the second mold and the at least a part of the first mold together close to the preform for compressive filling with the resin in the mold, wherein the control device is configured to, when separating at least a part of the first mold from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, control the driving mechanism to bring the second mold close to the preform.

[0013] According to another aspect of the present disclosure, a device is for manufacturing a fiber reinforced resin molded article to form a preform including a fiber layer on an outer surface of a liner, impregnate the fiber layer of the preform with resin, and cure the resin, and the device includes: a mold including a first mold and a second mold, the first mold having a moving core that is disposed to face the preform and moves relative to the preform so as to increase and decrease a gap defined between the moving core and the preform; a driving mechanism configured to drive the mold in an opening direction and a closing direction; a resin pouring mechanism configured to pour the resin from a resin inlet into the mold; and a control device configured to control operating states of the driving mechanism and the resin pouring mechanism. The control device is configured to control the driving mechanism to place the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap; control the resin pouring mechanism to pour the resin from the resin inlet toward the second gap in the mold; control the driving mechanism to separate the moving core from the preform to define a third gap between the moving core and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and control the driving mechanism to bring the second mold and the moving core together close to the preform for compressive filling with the resin in the mold, wherein the control device is configured to, when separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, control the driving mechanism to bring the second mold close to the preform.

[0014]

[0015] In some embodiments, the device further includes a pressure sensor configured to detect a pressure of the resin poured between the second mold and the preform. The control device is configured to, when separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and

What is claimed is:

1. A method for manufacturing a fiber reinforced resin molded article, the method including forming a preform including a fiber layer on an outer surface of a liner, impregnating the fiber layer of the preform with resin, and curing the resin, comprising:

a step of preparing a mold including a first mold and a second mold;

a step of placing the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap;

a step of pouring the resin from a resin inlet toward the second gap in the mold;

a step of separating at least a part of the first mold facing the preform from the preform to define a third gap between the at least a part of the first mold and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and

a step of bringing the second mold and the at least a part of the first mold together close to the preform for compressive filling with the resin in the mold,

wherein

in the step of separating at least a part of the first mold from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, the second mold is brought close to the preform.

2. A method for manufacturing a fiber reinforced resin molded article, the method including forming a preform including a fiber layer on an outer surface of a liner, impregnating the fiber layer of the preform with resin, and curing the resin, comprising:

a step of preparing a mold including a first mold and a second mold, the first mold having a moving core that is disposed to face the preform and moves relative to the preform so as to increase and decrease a gap defined between the moving core and the preform;

a step of placing the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap;

a step of pouring the resin from a resin inlet toward the second gap in the mold;

a step of separating the moving core from the preform to define a third gap between the moving core and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and

a step of bringing the second mold and the moving core together close to the preform for compressive filling with the resin in the mold,

wherein

in the step of separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, the second mold is brought close to the preform.

3. The method for manufacturing a fiber reinforced resin molded article according to claim 2, wherein

in the step of separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, the moving core is separated from the preform while detecting a pressure of the resin poured between the second mold and the preform.

4. The method for manufacturing a fiber reinforced resin molded article according to claim 2, wherein

in the step of bringing the second mold and the moving core together close to the preform for compressive filling with the resin in the mold, the second mold and the moving core are brought together to the preform so that a pressure of the resin poured between the moving core and the preform agrees with a pressure of the resin poured between the second mold and the preform.

5. A device for manufacturing a fiber reinforced resin molded article to form a preform including a fiber layer on an outer surface of a liner, impregnate the fiber layer of the preform with resin, and cure the resin, the device comprising:

a mold including a first mold and a second mold;

a driving mechanism configured to drive the mold in an opening direction and a closing direction;

a resin pouring mechanism configured to pour the resin from a resin inlet into the mold; and

a control device configured to control operating states of the driving mechanism and the resin pouring mechanism,

the control device being configured to

control the driving mechanism to place the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap;

control the resin pouring mechanism to pour the resin from the resin inlet toward the second gap in the mold;

control the driving mechanism to separate at least a part of the first mold facing the preform from the preform to define a third gap between the at least a part of the first mold and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and

control the driving mechanism to bring the second mold and the at least a part of the first mold together close to the preform for compressive filling with the resin in the mold.

wherein

the control device is configured to, when separating at least a part of the first mold from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, control the driving mechanism to bring the second mold close to the preform.

6. A device for manufacturing a fiber reinforced resin molded article to form a preform including a fiber layer on an outer surface of a liner, impregnate the fiber layer of the preform with resin, and cure the resin, the device comprising:

a mold including a first mold and a second mold, the first mold having a moving core that is disposed to face the preform and moves relative to the preform so as to increase and decrease a gap defined between the moving core and the preform;

a driving mechanism configured to drive the mold in an opening direction and a closing direction;

a resin pouring mechanism configured to pour the resin from a resin inlet into the mold; and

a control device configured to control operating states of the driving mechanism and the resin pouring mechanism,

the control device being configured to

control the driving mechanism to place the preform between the first mold and the second mold so as to define a first gap between the first mold and the preform and a second gap between the second mold and the preform, the second gap being larger than the first gap;

control the resin pouring mechanism to pour the resin from the resin inlet toward the second gap in the mold;

control the driving mechanism to separate the moving core from the preform to define a third gap between the moving core and the preform, the third gap being larger than the first gap, to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform; and

control the driving mechanism to bring the second mold and the moving core together close to the preform for compressive filling with the resin in the mold.

wherein

the control device is configured to, when separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, control the driving mechanism to bring the second mold close to the preform.

7. The device for manufacturing a fiber reinforced resin molded article according to claim 6, further comprising a pressure sensor configured to detect a pressure of the resin poured between the second mold and the preform, wherein

the control device is configured to

when separating the moving core from the preform to charge the resin, which was poured toward the second gap in the mold, into between the first mold and the preform, control the driving mechanism to separate the moving core from the preform while detecting a pressure of the resin with the pressure sensor.

8. The device for manufacturing a fiber reinforced resin molded article according to claim 6, further comprising:

a first pressure sensor configured to detect a pressure of the resin poured between the moving core and the preform; and a second pressure sensor configured to detect a pressure of the resin poured between the second mold and the preform, wherein

the control device is configured to

when bringing the second mold and the moving core together close to the preform for compressive filling with the resin in the mold, control the driving mechanism to bring the second mold and the moving core together to the preform so that a pressure of the resin detected by the first pressure sensor agrees with a pressure of the resin detected by the second pressure sensor.