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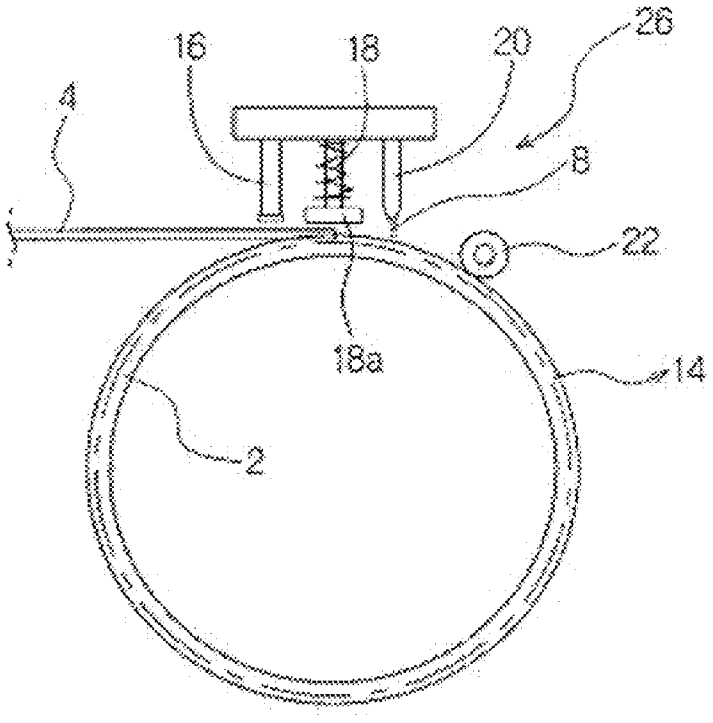
(54) Title: METHOD AND DEVICE FOR MANUFACTURING PLASTIC MULTIPLE-WALLED TUBE AND PLASTIC-WALLED THEREOF



(57) Abstract: Provided are a method and device for manufacturing a plastic multi-walled tube, and a plastic multi-walled tube manufactured thereby. The method includes: forming a spiral cylindrical frame with a plastic pipe (2) extruded from a plastic extruder; filling a liquefied reinforcement resin (8) between the adjacent pipes (2) constituting the spiral cylindrical frame and press-forming the re¬ inforcement resin; and forcedly inserting an epoxy-resin coated iron core (4) into the rein¬ forcement resin (8) to bury the iron core (4) in the reinforcement resin (8). Therefore, the coated iron core (4) is perfectly adhered to the reinforcement resin (8) to reinforce stiffness of the plastic multi-walled tube.

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Description

METHOD AND DEVICE FOR MANUFACTURING PLASTIC MULTIPLE-WALLED TUBE AND PLASTIC WALLED THEREOF

Technical Field

[1] The present invention relates to a plastic multi-walled tube, and more particularly, to a method and device for manufacturing a plastic multi-walled tube, and a plastic multi-walled tube manufactured thereby, capable of perfectly re-adhering the plastic multi-walled tube to a coated iron core to reinforce stiffness.

Background Art

[2] In general, a plastic multi-walled tube is formed of a cylindrical frame by supplying a pipe formed of a thermoplastic resin such as polypropylene, polyethylene, polyvinyl chloride, and so on, in a spiral shape. However, the multi-walled tube formed of plastic only may be readily damaged due to a large load such as an earth pressure, a wheel pressure, and so on.

[3] In order to solve the problems, a reinforcement iron core is inserted between plastic pipes to provide a plastic multi-walled pipe in which stiffness is reinforced.

[4] In the case of a plastic multi-walled tube 100 manufactured by inserting a reinforcement iron core 104 to reinforce the pipe stiffness, as shown in FIG. 1, when a melted reinforcement resin 102 is cooled after primary adhesion with the reinforcement iron core 104, it seems that the reinforcement resin 102 is adhered to the reinforcement iron core 104. However, since the liquefied reinforcement resin 102 is slowly cooled and shrunk, the reinforcement resin 102 may be separated from the reinforcement iron core 104. Then, when an external impact, a load, an earth pressure, a wheel pressure, and so on, are applied to the multi-walled tube 100 during use after construction thereof, since the reinforcement iron core 104 may be readily separated from the reinforcement resin 102, the multi-walled tube 100 fails to perform its function to reduce lifespan of products and increase maintenance cost.

Disclosure of Invention

Technical Problem

[5] An object of the present invention is to provide a method and device for manufacturing a plastic multi-walled tube, and a plastic multi-walled tube manufactured thereby, capable of forcedly inserting an epoxy resin-coated iron core into a reinforcement resin of a plastic multi-walled tube to increase stiffness, and strongly adhering the epoxy resin-coated iron core to the reinforcement resin using the epoxy

resin to perform perfect adhesion therebetween.

Technical Solution

[6] According to an aspect of the present invention, a method of manufacturing a plastic multi-walled tube includes: forming a spiral cylindrical frame with a plastic pipe extruded from a plastic extruder; filling a liquefied reinforcement resin between the adjacent pipes constituting the spiral cylindrical frame and press-forming the reinforcement resin; and forcedly inserting an epoxy-resin coated iron core into the reinforcement resin to bury the iron core in the reinforcement resin.

Advantageous Effects

[7] According to the present invention, a plastic multi-walled tube is formed of a pipe and a reinforcement resin, and a coated iron core is forcedly inserted into the reinforcement resin to securely adhere the coated iron core to the reinforcement resin. As a result, the coated iron core cannot be readily separated from the reinforcement resin even under a large load, an earth pressure, or a wheel pressure after construction to maximize stiffness of the tube. In addition, high stiffness of the plastic multi-walled tube lengthens its lifespan and secures safe and convenient use for a long time after construction to reduce resource consumption and exchange/management cost.

Brief Description of the Drawings

[8] FIG. 1 is a partially-cut perspective view of a conventional plastic multi-walled tube;

[9] FIG. 2 is a partially-cut perspective view of a plastic multi-walled tube in accordance with an exemplary embodiment of the present invention;

[10] FIGS. 3 to 4 are cross-sectional views of coated iron cores having various shapes in accordance with an exemplary embodiment of the present invention;

[11] FIG. 7 is a flowchart of a method of manufacturing a plastic multi-walled tube in accordance with an exemplary embodiment of the present invention;

[12] FIGS. 8 to 13 are cross-sectional views showing process steps in accordance with an exemplary embodiment of the present invention;

[13] FIGS. 14 and 15 show a process of inserting a coated iron core in accordance with an exemplary embodiment of the present invention; and

[14] FIGS. 16 and 17 are schematic views for explaining an apparatus for manufacturing a plastic multi-walled tube.

[15] * Description of Major Symbol in the above Figures

[16] A: Plastic multi-walled tube 2: Pipe

[17] 4: Coated iron core 20: Plastic extruder

[18] 8: Reinforcement resin 10, 22: Water-cooled upper roller

[19] 10a: Scribing line 12: Lower roller

[20] 14: Groove 16: Fan heater

[21] 18: Support 18a: Semi-oval member

[22] 24: Primary former 26: Secondary former

Best Mode for Carrying Out the Invention

[23] Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

Mode for the Invention

[24] FIG. 2 is a partially-cut perspective view of a plastic multi-walled tube in accordance with an exemplary embodiment of the present invention, and FIGS. 3 to 6 are cross-sectional views of epoxy resin-coated iron cores having various shapes in accordance with an exemplary embodiment of the present invention.

[25] As shown in FIG. 2, a plastic multi-walled tube A in accordance with an exemplary embodiment of the present invention is formed by continuously extruding a pipe 2 from a plastic extruder and winding the pipe 2 in a spiral shape to form a cylindrical frame, filling a liquefied reinforcement resin 8 between the adjacent pipes 2 using the plastic extruder and press-rolling them, applying heat around the reinforcement resin 8, and to the interior of a groove 14 and a coated iron core using a fan heater 16 to insert the coated iron core 4, and re-filling the liquefied reinforcement resin 8 using the plastic extruder 20 and press-rolling to integrally adhere the pipe 2 and the coated iron core 4 to the reinforcement resin 8.

[26] In addition, as shown in FIG. 3, the coated iron core 4 buried in the reinforcement resin 8 may be configured to have a circular cross-section. In another modification, as shown in FIGS. 4 and 5, the coated iron core 4 may be configured to have a rectangular shape, and more particularly, to have an H-beam or I-beam shaped cross-section in order to more widen a contact surface with the reinforcement resin 8. Further, as shown in FIG. 6, at least two coated iron cores 4 may be inserted depending on the size or thickness of the pipe 2.

[27] FIG. 7 is a flowchart of a method of manufacturing a plastic multi-walled tube in accordance with an exemplary embodiment of the present invention.

[28] Hereinafter, a method of manufacturing a plastic multi-walled tube A in accordance with an exemplary embodiment of the present invention will be described in detail.

[29] The method of manufacturing a plastic multi-walled tube A generally includes a primary forming process and a secondary forming process.

[30] A pipe 2 is continuously extruded from a plastic extruder 20 to be wound in a spiral shape to form a spiral cylindrical frame. At this time, a liquefied reinforcement resin 8 is discharged from the plastic extruder 29 to be filled between the pipes 2 constituting the spiral cylindrical frame (S1 of FIG. 7).

[31] Then, as shown in FIGS. 8 to 16, 17, the liquefied reinforcement resin 8 is press-rolled to adhere the reinforcement resin 8 to the pipe 2 using upper and lower rollers 10 and 12. At this time, a scribing line 10a projecting around a centerline of the upper roller 10 forms a groove 14 at an upper part of the reinforcement resin 8 (S2 of FIG. 7), thereby completing a manufacturing process of the plastic multi-walled tube in a primary former 24.

[32] At this time, at least one groove 14 may be formed in the reinforcement resin 8 according to the size of the plastic multi-walled tube and operation conditions. In addition, an operator first sets the thickness and depth of a coated iron core 4 formed by the scribing line 10a to form the groove 14 in the reinforcement resin 8.

[33] Next, the plastic multi-walled tube is cut into predetermined lengths (S3 of FIG. 7), and then is naturally cooled for a certain time to be cured (S4 of FIG. 7). Curing through natural cooling may be performed for 15 to 24 hours, while the curing time can be somewhat different according to seasonal temperatures.

[34] The groove 14 functions as a guide to locate the coated iron core 4.

[35] Describing an iron core coated with epoxy resin, the epoxy resin as one part epoxy is classified into about 70 kinds according to properties such as appearance, clay, curing temperature, time, and so on, and characteristics of cured materials such as operation performance, adhesion, thermal resistance, and so on. When preliminary heat is applied to the epoxy resin-coated iron core and the multi-walled tube, the epoxy resin functions as an adhesive agent. Among the epoxy resins, T□B□2275 (Product Name) having a best adhesion strength of 370kgt/cm^2 is an epoxy resin most preferable to be coated on the iron core. In addition, since the epoxy resin-coated iron core is cured after a curing time of about 40 minutes at a temperature of 150℃, an operator must previously prepare the coated iron core before a secondary forming process of the multi-walled tube.

[36] After rotatably fixing the multi-walled tube to a secondary former 26, a fan heater 16 slowly applies heat around the groove 14 formed at the upper part of the reinforcement resin 8 and to the coated iron core 4, and the iron core 4 is pressed by a post 18 biased downward by a spring and then forcedly inserted into the reinforcement resin 8 by a member of a semi-oval shape 18a installed at a lower end of the post 18 such that the coated iron core 4 is buried therein (S5 of FIG. 7).

[37] At this time, when high heat is applied to the cooled reinforcement resin 8 and the groove 14 by the fan heater 16, variation in properties may abruptly occurs such that the reinforcement resin 8 is melted to cause deformation thereof. Therefore, the temperature of the fan heater 16 is preferable within a range of 70 to 120℃, while the temperature heated by the fan heater 16 may be varied depending on seasons. At this time, the epoxy resin-coated iron core 4 is heated again to slightly melt the epoxy resin

such that the epoxy resin functions as a strong adhesive agent.

[38] In addition, a cross-section of the semi-oval shape 18a may have a ")" shape to suppress repulsion of the pressed coated iron core 4.

[39] Meanwhile, the liquefied reinforcement resin 8 is refilled into a space generated by burying the coated iron core 4 using the plastic extruder 20 (S6 of FIG. 7), and the liquefied reinforcement resin 8 is press-rolled by a water-cooled upper roller 22 (S7 of FIG. 7) to complete a process in the secondary former 26, thereby forming the plastic multi-walled tube A.

[40] In step S7, since little heat is transferred to a part of the reinforcement resin 8 formed in the plastic resin multi-walled tube A to maintain the cured state, the lower roller may not be used.

[41] While this invention has been described with reference to exemplary embodiments thereof, it will be clear to those of ordinary skill in the art to which the invention pertains that various modifications may be made to the described embodiments without departing from the spirit and scope of the invention as defined in the appended claims and their equivalents.

Claims

[1] A method of manufacturing a plastic multi-walled tube, comprising: forming a spiral cylindrical frame with a plastic pipe (2) extruded from a plastic extruder; filling a liquefied reinforcement resin (8) between the adjacent pipes (2) constituting the spiral cylindrical frame and press-forming the reinforcement resin; and forcedly inserting an epoxy-resin coated iron core (4) into the reinforcement resin (8) to bury the iron core (4) in the reinforcement resin (8).

[2] A method of manufacturing a plastic multi-walled tube, comprising:
(S1) filling a liquefied reinforcement resin (8) between pipes (2) constituting a spiral cylindrical frame using a plastic extruder (20);
(S2) press-rolling the liquefied reinforcement resin (8) using upper and lower rollers (10, 12), the upper roller (10) having a scribing line (10a) formed around its center part to form a groove (14) at an upper part of the reinforcement resin (8);
(S3) cutting a plastic multi-walled tube (A) into predetermined lengths;
(S4) curing the plastic multi-walled tube (A) for a certain time through natural cooling;
*(S5) applying preliminary heat around a coated iron core (4) and the groove (14) using a fan heater (16), and forcedly inserting the coated iron core (4) using a post (18) biased by a spring and a member of a semi-oval shape (18a) installed at a lower end of the post (18) to bury the iron core (4) into the reinforcement resin (8);
(S6) refilling the liquefied reinforcement resin (8) onto the buried coated iron core (4) using the plastic extruder (20); and
(S7) press-rolling the liquefied reinforcement resin (8) using a water-cooled upper roller (22).

[3] The method according to claim 1, wherein a groove (14) is formed in the reinforcement resin (8) to guide the coated iron core (4) having a thickness corresponding to the depth of the groove (14) while press-forming the reinforcement resin (8).

[4] The method according to claim 2, wherein, in step S4, the reinforcement resin (8) is cured through natural cooling for a certain time.

[5] The method according to claim 2, wherein, in step S5, a temperature range of preliminary heat applied to the reinforcement resin (8) cooled by the fan heater (16), the groove (14), and the epoxy resin coated iron core (4) is 70 to 120℃.

[6] An apparatus for manufacturing a plastic multi-walled tube by extruding a pipe to form a spiral cylindrical frame using a plastic extruder, comprising:

a primary former (24) for filling a liquefied reinforcement resin (8) between the pipes (2) of the spiral cylindrical frame to press-form the reinforcement resin using a plastic extruder (20); and

a secondary former (26) for forcedly inserting a coated iron core (4) into the press-formed reinforcement resin and refilling the liquefied reinforcement resin onto the inserted coated iron core using the plastic extruder to bury the coated iron core in the reinforcement resin.

[7] The apparatus according to claim 6, wherein the primary former (24) comprises:

the plastic extruder (20) for injecting the liquefied reinforcement resin (8) between the pipes (2) of the spiral cylindrical frame; and

a roller part for forming a groove (14) having a thickness and depth in the reinforcement resin (8) through press-forming using a lower roller (12) and an upper roller (10) having a scribing line (10a).

[8] * The apparatus according to claim 6, wherein the secondary former (26) comprises:

a fan heater (16) for applying preliminary heat around the set groove (14);

the plastic extruder (20) comprising a post (18) biased by a spring to forcedly insert the coated iron core (4), and a member of a semi-oval shape (18a) installed at a lower end of the post (18) to inject the liquefied reinforcement resin (8) onto the buried coated iron core (4); and

a water-cooled upper roller (22) for rolling an upper surface of the reinforcement resin (8).

[9] A plastic multi-walled tube formed by the method according to claim 1.

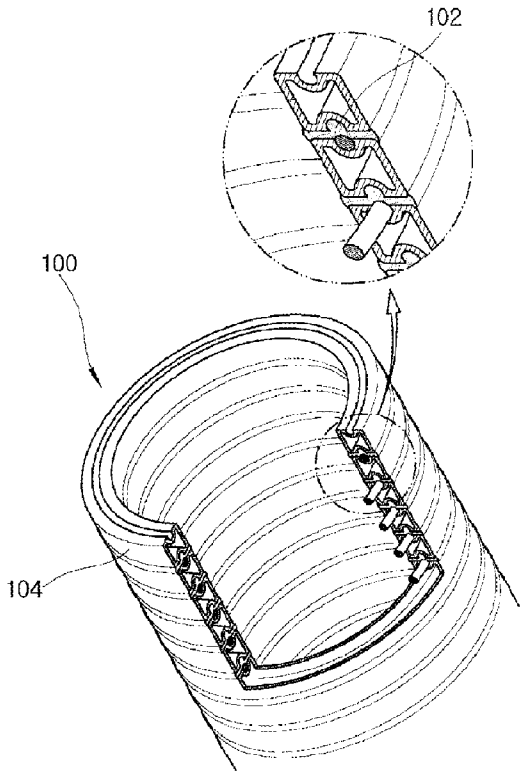
[10] A plastic multi-walled tube formed by the apparatus according to claim 6.

[11] The plastic multi-walled tube according to claim 9, wherein the coated iron core (4) has a rectangular shape.

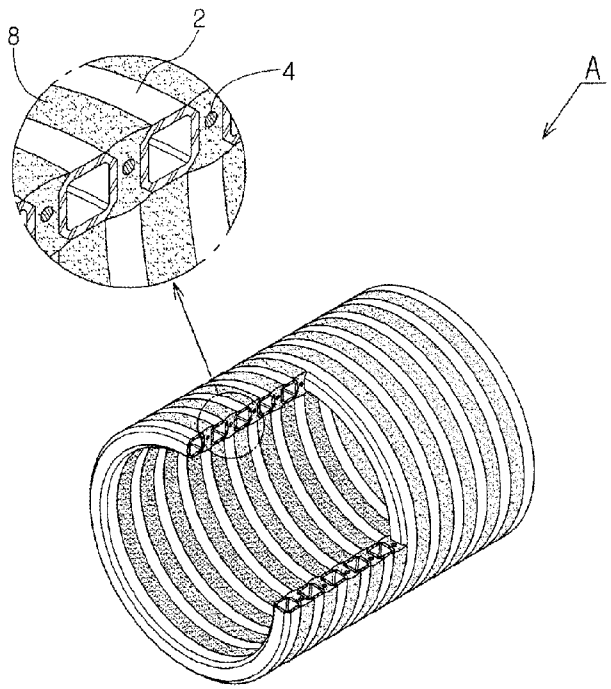
[12] The plastic multi-walled tube according to claim 9, wherein the coated iron core (4) has an "H" shape.

[13] The plastic multi-walled tube according to claim 9, wherein the coated iron core (4) has an "I" shape.

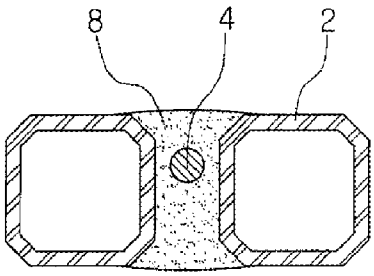
[Fig. 1]



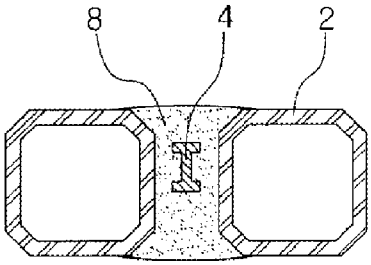
[Fig. 2]



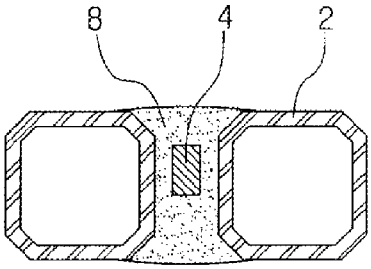
[Fig. 3]



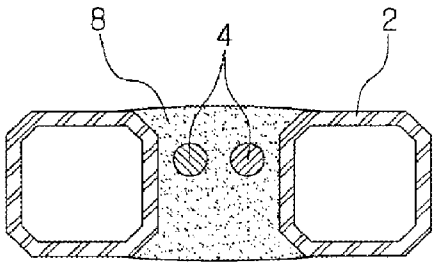
[Fig. 4]



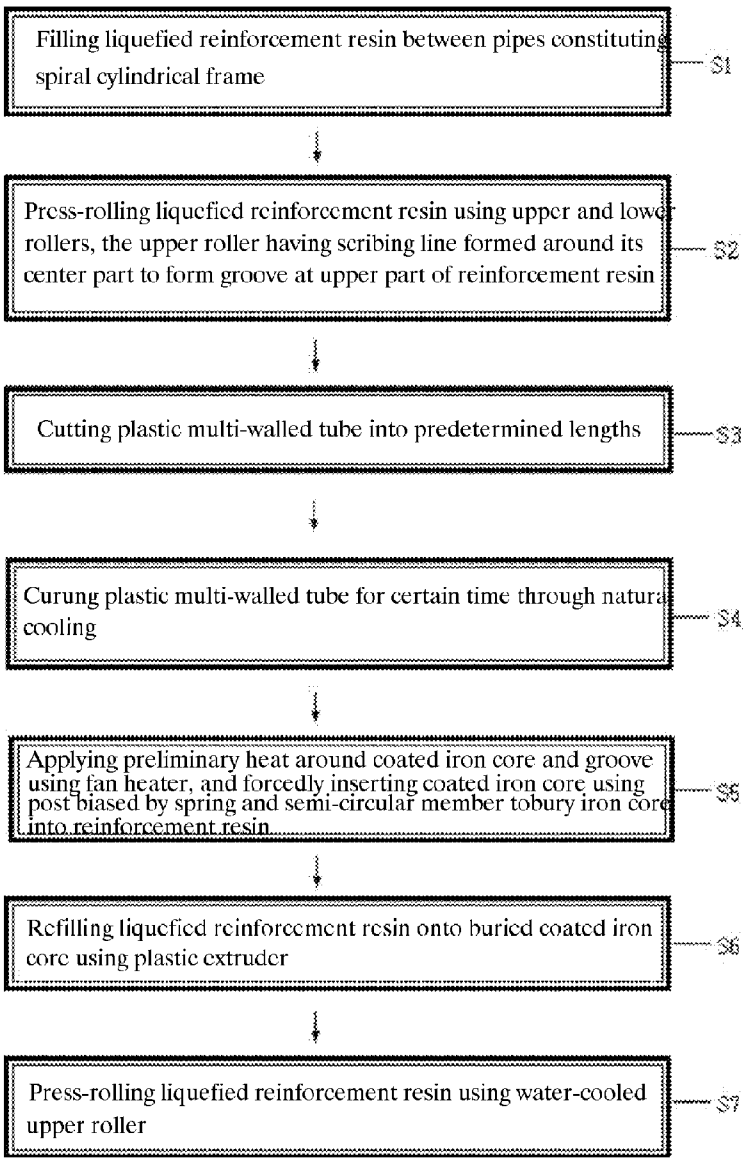
[Fig. 5]



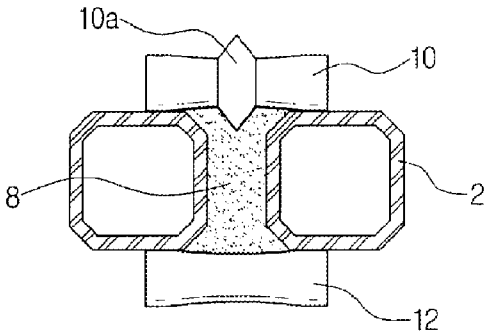
[Fig. 6]



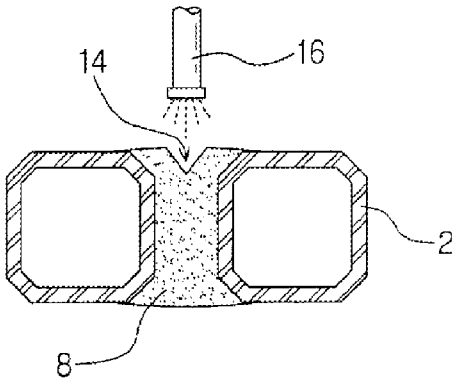
[Fig. 7]


Filling liquefied reinforcement resin between pipes constituting spiral cylindrical frame
S1
Press-rolling liquefied reinforcement resin using upper and lower rollers, the upper roller having scribing line formed around its center part to form groove at upper part of reinforcement resin
S2
Cutting plastic multi-walled tube into predetermined lengths
S3
Curung plastic multi-walled tube for certain time through natural cooling
S4
Applying preliminary heat around coated iron core and groove using fan heater, and forcedly inserting coated iron core using post biased by spring and semi-circular member tobury iron core into reinforcement resin
S5
Refilling liquefied reinforcement resin onto buried coated iron core using plastic extruder
S6
Press-rolling liquefied reinforcement resin using water-cooled upper roller
S7

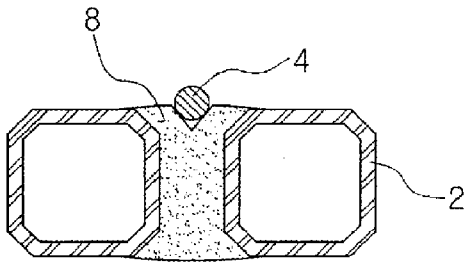
[Fig. 8]


10a
10
8
2
12

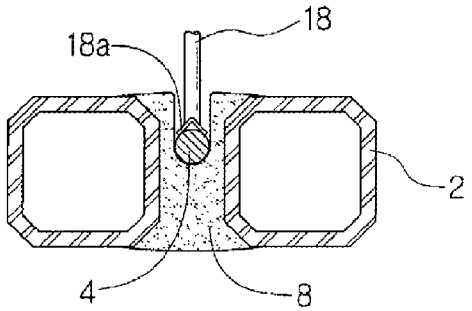
[Fig. 9]



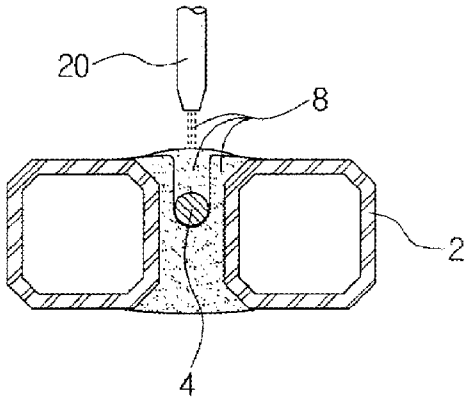
[Fig. 10]



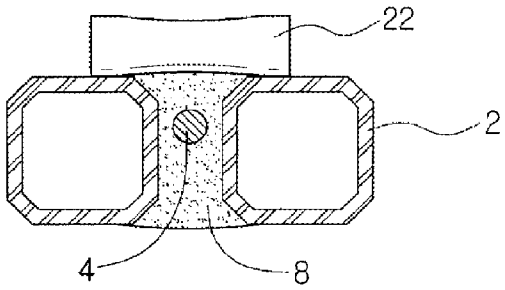
[Fig. 11]



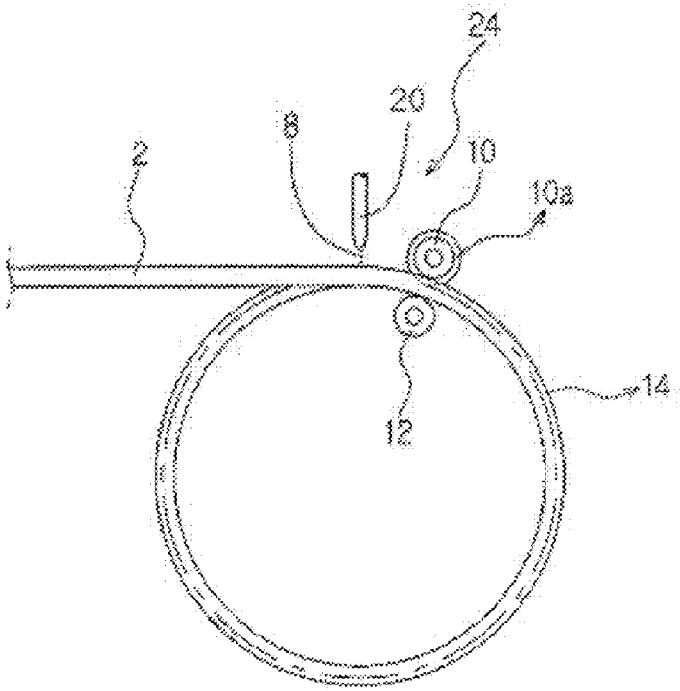
[Fig. 12]



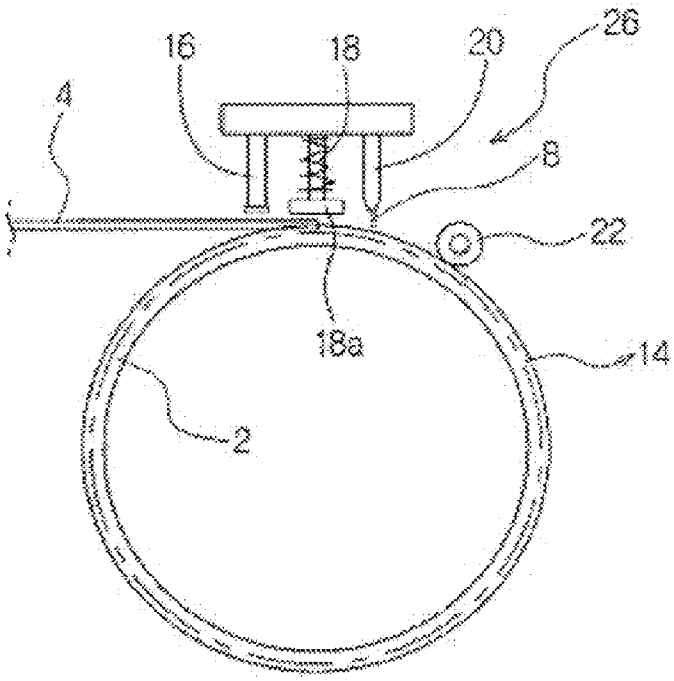
[Fig. 13]



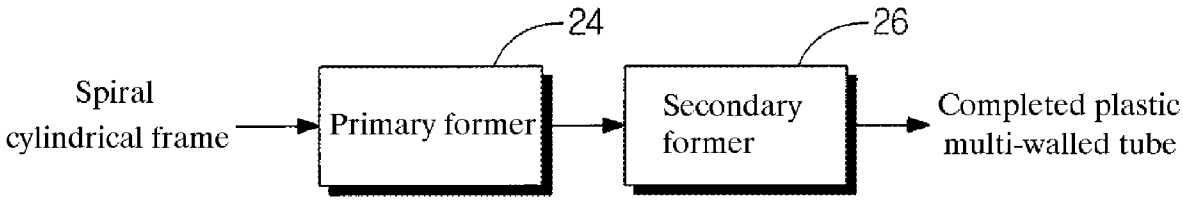
[Fig. 14]



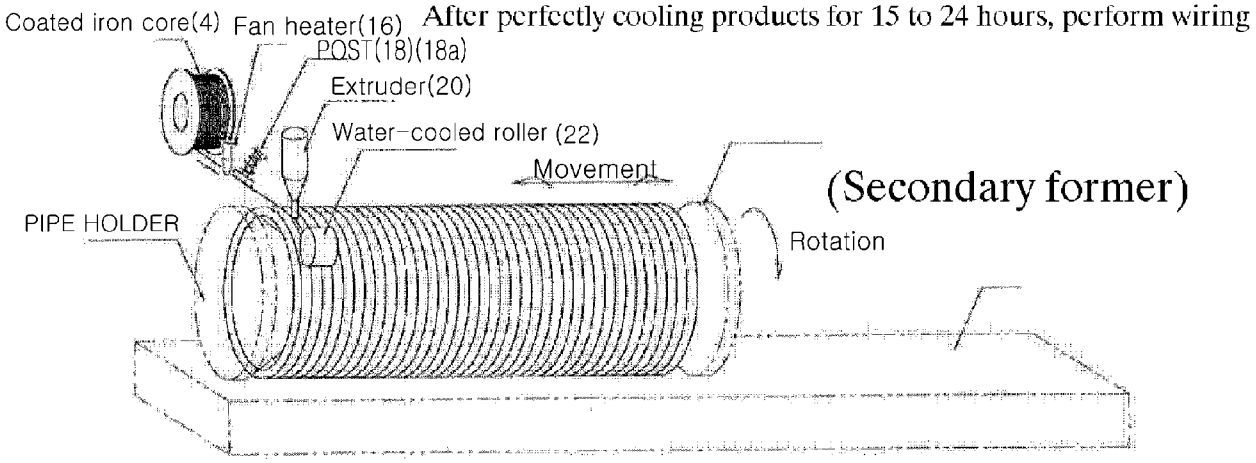
[Fig. 15]


16
18
20
26
4
8
22
18a
14
2

[Fig. 16]


24
26
Spiral cylindrical frame
Primary former
Secondary former
Completed plastic multi-walled tube

[Fig. 17]


Coated iron core(4)
Fan heater(16)
After perfectly cooling products for 15 to 24 hours, perform wiring
POST(18)(18a)
Extruder(20)
Water-cooled roller (22)
Movement
(Secondary former)
PIPE HOLDER
Rotation

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2007/005345

A. CLASSIFICATION OF SUBJECT MATTER

F16L 11/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8: F16L 11/08, F16L 9/12 & F16L 11/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models since 1975
Japanese utility models and applications for utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS (KIPO internal) & key words: "multiple-walled", "coat" & "core"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	KR 1020000075368 A (KIM, YOON SIK) 15 December 2000 See abstract and claims 1 to 3.	1, 9, 11-13 2-8, 10
Y A	KR 1020030017684 A (PARK, HYUNG JIN) 4 March 2003 See abstract and Fig. 4.	1, 9, 11-13 2-8, 10
Y	KR 2019990024231 U (LEE, KANG SOO) 5 July 1999 See abstract and Fig. 5.	11-13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

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