

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 745 727 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.12.1996 Bulletin 1996/49

(51) Int. Cl.⁶: **D21J 5/00**

(21) Application number: **96107110.7**

(22) Date of filing: **06.05.1996**

(84) Designated Contracting States:
DE FR GB NL

(30) Priority: **02.06.1995 SG 9500579**

(71) Applicant: **Broadway Holdings Pte Ltd.**
Singapore 629824 (SG)

(72) Inventors:
• **Koo, Xian Shuen**
Singapore 530238 (SG)
• **Wong, Sheung Sze**
Singapore 1026 (SG)

(74) Representative: **Meddle, Alan Leonard**
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
80801 München (DE)

(54) Pulp moulding method and apparatus with forced drying

(57) The present invention provides a method of moulding a product from pulp using a mould having a male mould part presenting a moulding surface defining the shape of the moulded product and a female mould part having a mould cavity corresponding in shape to the moulding surface, which method comprises immersing the moulding surface of the male mould part in a pool of pulp, drawing a layer of pulp solids onto the moulding surface by applying suction to the moulding surface through the male mould part, inserting the male mould part into the mould cavity of the female mould part, drying the layer of pulp solids on the moulding surface by applying suction to the moulding surface through the male mould part while applying compressed air to the layer of pulp solids through the female mould part, transferring the dried moulded product from the moulding surface of the male mould part to the mould cavity of the female mould part by applying suction to the moulded product through the female mould part while applying compressed air to the moulding surface through the male mould part, withdrawing the male mould part from the mould cavity of the female mould part and discharging the moulded product from the mould cavity of the female mould part.

EP 0 745 727 A2

Description

THIS INVENTION relates to improvements in or relating to the moulding of a product from pulp, particularly paper pulp, and concerns a method and apparatus for moulding a product from such pulp.

Moulded paper pulp has been used for many years in the manufacture of egg trays and in recent times the method of manufacturing such egg trays has been improved to enable the moulding of products which have a complex shape and can be used as protective packaging for other frangible products.

At present, the moulding of paper pulp to produce products, such as egg trays, is performed using either a rotary moulding apparatus or a reciprocating moulding apparatus. In both cases, pulp solids are deposited on a moulding surface of a male mould part of the moulding apparatus by immersing the male mould part in a pool of pulp and applying suction to the moulding surface to draw the pulp solids onto a wire mesh former covering the moulding surface. Thereafter, the male mould part is brought into a position spaced apart from a female mould part and excess moisture is removed from the pulp solids on the male mould part by continuing to apply suction to the moulding surface through the male mould part. When the pulp solids have been dried to the required extent, the moulded product is transferred from the moulding surface of the male mould part to a complementary mould cavity of the female mould part by engaging the male mould part in the mould cavity of the female mould part and applying a forced airflow to the moulding surface through the male mould part while applying suction to the moulding surface through the female mould part. The male mould part is then retracted from the female mould part, leaving the moulded product in the mould cavity. The male mould part is then ready to be immersed in the pool of pulp again, while the moulded product is released from the mould cavity of the female mould part for further drying in order to produce the final moulded product.

This known moulding method has various drawbacks, one of which is that the removal of moisture from the pulp solids on the moulding surface of the male mould part by suction prior to the transfer of the moulded product to the mould cavity of the female mould part results in relatively long cycle times and high energy consumption. This is because suction has to be applied to the moulding surface through the male mould part for a long time before a significant amount of moisture is removed. Typically, this removal of moisture requires the application of suction for six to twelve seconds in the known method.

It is an object of the present invention to provide a pulp moulding method and apparatus which provide an extremely short cycle time and high energy efficiency compared with the known pulp moulding methods and apparatus.

Accordingly, in one aspect thereof, the present invention provides a method of moulding a product from

pulp using a mould having a male mould part presenting a moulding surface defining the shape of the moulded product and a female mould part having a mould cavity corresponding in shape to the moulding surface, which method comprises immersing the moulding surface of the male mould part in a pool of pulp, drawing a layer of pulp solids onto the moulding surface by applying suction to the moulding surface through the male mould part, drying the layer of pulp solids on the moulding surface by applying suction to the moulding surface through the male mould part while directing a forced flow of drying fluid onto the layer of pulp solids, transferring the dried moulded product from the moulding surface of the male mould part to the mould cavity of the female mould part with the male mould part inserted in the female mould part by applying suction to the moulded product through the female mould part while applying pressure to the moulding surface through the male mould part, withdrawing the male mould part from the mould cavity of the female mould part and discharging the moulded product from the mould cavity of the female mould part.

According to another aspect of the invention, there is provided apparatus for moulding a product from pulp, comprising a male mould part presenting a moulding surface defining the shape of the product, a female mould part having a mould cavity corresponding in shape to the moulding surface, means for immersing the moulding surface of the male mould part in a pool of pulp, means for applying suction to the moulding surface through the male mould part to draw a layer of pulp solids onto the moulding surface, means for drying the layer of pulp solids on the moulding surface by applying vacuum to the moulding surface through the male mould part while directing a forced flow of drying fluid onto the layer of pulp solids, means for transferring the dried moulded product to the mould cavity of the female mould part with the male mould part in the female mould part by applying suction to the moulded product through the female mould part while applying pressure to the moulding surface through the male mould part, means for withdrawing the male mould part from the mould cavity and means for discharging the moulded product from the mould cavity of the female mould part.

In order that the invention may be more readily understood, a pulp moulding apparatus and method embodying the present invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which the single figure is a schematic diagram showing a comparison between a known pulp moulding method and apparatus and a pulp moulding method and apparatus embodying the present invention.

Referring to the drawing, a known rotary or reciprocating pulp moulding apparatus comprises a male mould part 1 having a moulding surface 2 defining the shape of a product to be moulded. The male mould part 1 has an airflow connection 3 which communicates with

the moulding surface 2 via a multiplicity of passages (not shown) in the male mould part 1.

The known apparatus further comprises a female mould part 4 having a mould cavity 5 with a shape which is complementary to that of the moulding surface 2 of the male mould part 1. The female mould part 4 has an airflow connection 6 which communicates with the surface of the mould cavity 5 via a multiplicity of passages (not shown) in the female mould part.

The described known moulding apparatus is used in a known moulding method, in which the moulding surface 2 of the male mould part 1 is first immersed in a pool of pulp and suction is then applied to the moulding surface 2 by applying a vacuum to the airflow connection 3 to draw a layer of pulp solids 7 onto a wire mesh former (not shown) covering the moulding surface 2. The formation of the required layer 7 of pulp solids on the moulding surface 2 requires the application of vacuum to the connection 3 for about five to nine seconds.

Once the required layer 7 of pulp solids have been deposited on the moulding surface 2, the male mould part is withdrawn from the pool of pulp and moved into the vicinity of the mould cavity 5 of the female mould part 4. With the male mould part 1 spaced from the surface of the mould cavity 5 of the female mould part 4, vacuum is applied to the moulding surface through the male mould part 1 in order partially to dry the pulp on the moulding surface 2. Adequate drying of the layer 7 of pulp on the moulding surface in this way requires the application of vacuum to the airflow connection 3 of the male mould part for about six to twelve seconds.

Once sufficient moisture has been removed from the layer 7 of pulp on the moulding surface 2, the male mould part 1 is fully inserted into the mould cavity 5 of the female mould part 4 and the moulded product 8 is transferred from the moulding surface 2 to the mould cavity 5 by applying vacuum to the airflow connection 6 of the female mould part while delivering a forced airflow to the product 8 by applying compressed air to the airflow connection 3 of the male mould part 1. The operation of transferring the partially dried moulded product 8 from the moulding surface 2 to the mould cavity 5 occupies about .5 to 1.5 seconds.

The compressed air supply is then disconnected from the male mould part 1 and the male mould part is withdrawn from the mould cavity 5 of the female mould part 4, leaving the moulded product 8 in the mould cavity where it is held under the action of the vacuum which is still applied to the airflow connection 6 of the female mould part 4.

The moulded product may then be discharged from the mould cavity 5 of the female mould part 4 onto a conveyer belt or other receiving surface by exchanging the vacuum at connection 6 for compressed air.

The partially dried product discharged from the female mould part 4 may then be dried by passing it through a drying oven or placing it in a drying room.

The male mould part 1 may again be immersed in the pool of pulp whilst the moulded product 8 is being discharged from the female mould part 4.

In a pulp moulding method embodying the present invention, as shown in the drawing, the first stage of forming a layer 7 of pulp on the moulding surface 2 of the male mould part 1 is performed in the same manner as in the prior art method.

However, the layer 7 of pulp on the moulding surface 2 is then dried by inserting the male mould part 1 into the mould cavity of the female mould part 4 and by applying vacuum to the airflow connection 3 of the male mould part 1 whilst applying compressed air to the airflow connection 6 of the female mould part 4 so as to apply a forced airflow to the layer 7 through the female mould part 4. This manner of drying the deposited layer of pulp has a remarkable effect upon the drying time which is reduced to about two seconds in a method embodying the present invention, as compared with six to twelve seconds in the known moulding method.

The remaining steps of transferring the partially dried moulded product 8 from the moulding surface 2 of the male mould part 1 to the mould cavity 5 of the female mould part 4, the withdrawal of the male mould part 1 from the mould cavity 5 and the discharge of the moulded product 8 from the female mould part 4 is then carried out in the same manner as in the prior art moulding method.

Given the significantly shorter time required for the process of moisture removal after the depositing of the layer 7 of pulp on the moulding surface 2 of the male mould part 1, a moulding method embodying the present invention provides great savings in the overall cycle time of the method and in the energy consumed during each cycle. Studies have shown that potential savings of more than 35% are obtainable in both cycle time and energy consumption.

Whilst the drying of the layer of pulp on the male mould part is effected using compressed air in the above described embodiment of the invention, it is envisaged that a forced flow of any other suitable moisture-removing fluid, such as dehumidified air or hot air, could be employed instead of compressed air.

Moreover, although the forced flow of drying fluid is directed onto the layer of pulp with the male mould part engaged in the female mould part in the above described embodiment, it is envisaged that the pulp layer on the male member could instead, be enclosed by a simple hollow drying box or chamber and the forced flow of drying fluid directed through this chamber onto the layer of pulp.

Claims

1. A method of moulding a product from pulp using a mould having a male mould part presenting a moulding surface defining the shape of the moulded product and a female mould part having a mould cavity corresponding in shape to the mould-

ing surface, which method comprises immersing the moulding surface of the male mould part in a pool of pulp, drawing a layer of pulp solids onto the moulding surface by applying suction to the moulding surface through the male mould part, drying the layer of pulp solids on the moulding surface by applying suction to the moulding surface through the male mould part while directing a forced flow of drying fluid onto the layer of pulp solids, transferring the dried moulded product from the moulding surface of the male mould part to the mould cavity of the female mould part with the male mould part inserted in the female mould part by applying suction to the moulded product through the female mould part while applying pressure to the moulding surface through the male mould part, withdrawing the male mould part from the mould cavity of the female mould part and discharging the moulded product from the mould cavity of the female mould part.

5

10

15

20

2. A method according to Claim 1, wherein drying of the layer of pulp solids is effected by inserting the male mould part into the female mould part and delivering the forced flow of drying fluid through the female mould part. 25
3. A method according to Claim 1 or 2, wherein the drying fluid is compressed air. 30
4. Apparatus for moulding a product from pulp, comprising a male mould part presenting a moulding surface defining the shape of the product, a female mould part having a mould cavity corresponding in shape to the moulding surface, means for immersing the moulding surface of the male mould part in a pool of pulp, means for applying suction to the moulding surface through the male mould member to draw pulp solids onto the moulding surface, means for drying the pulp solids on the moulding surface by applying vacuum to the moulding surface through the male mould part while directing a forced flow of drying fluid onto to the layer of pulp solids, means for transferring the dried moulded product to the mould cavity of the female mould part with the male mould part inserted in the female mould part by applying suction to the moulded product through the female mould part while applying pressure to the moulding surface through the male mould part, means for withdrawing the male mould part from the mould cavity and means for discharging the moulded product from the mould cavity of the female mould part. 35 40 45 50
5. Apparatus according to Claim 4, comprising means for directing the forced flow of drying fluid to the layer of pulp solids through the female mould part with the male mould part inserted in the female mould part. 55

6. Apparatus according to Claim 4 or 5, wherein the drying fluid is compressed air.
7. A method of moulding a product from pulp substantially as hereinbefore described with reference to the drawing.
8. Apparatus for moulding a product from pulp substantially as hereinbefore described with reference to the drawing.

