

PATENT SPECIFICATION (11)

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(54) IMPROVEMENTS IN THE MANUFACTURE OF CONCRETE PRODUCTS

(71) We, HUMES LIMITED, a company incorporated under the laws of the State of Victoria, Commonwealth of Australia, of 185 William Street, Melbourne, in the State of Victoria, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the manufacture of concrete products, such as concrete pipes. More particularly, it relates to an improved mould for manufacturing concrete products by a centrifugal process and to a method of manufacturing concrete products in which the mould or form is removed from the green product and prior to the curing steps.

It is well known in the art to demould pipes immediately after formation and particularly in the vertical cast and packer head processes. In these, the pipe is produced in various forms of mould from one-piece moulds, which are non-opening and which are removed vertically, to multi-piece moulds which are opened horizontally.

This general process, although desirable, has not been useful with pipes which are formed by centrifugal moulding processes, as such forms of moulding produce a very high bond force at the surface of the mould. Forces of this type require high stripping loads and these loads cause damage to the "green" pipe. The damage is normally in the form of cracking of the pipe, particularly when a mould is opened, spilling the concrete, or by displacement or relative movement of the pipe reinforcement.

An object of the present invention is to provide a mould for manufacturing concrete products, such as pipes, which can be satisfactorily removed immediately after the moulding process and whilst the pipe is green. It is another object of the invention to provide a method of manufacturing concrete products using such a mould.

The invention consists in a mould for manufacturing a concrete pipe or other concrete product, comprising a hollow, rigid, outer mould member for moulding an outer

surface of the product, said outer mould member having an internal surface of substantially cylindrical configuration (as herein defined) and being open at opposite ends, and a flexible lining for the internal surface of the rigid mould member, said lining being also open at opposite ends and being attached at one end to one end of the rigid mould member.

Conveniently, the mould includes a first pallet releasably secured to the end of the rigid mould member at or adjacent the attached end of the flexible lining, and a second pallet releasably secured to the opposite end of the mould member and having the opposite end of the lining also attached thereto. The rigid mould member may be a multi-piece mould, each piece having a flexible lining portion attached at one end to one end of said piece.

The invention also consists in a method of manufacturing a concrete pipe or other concrete product using the mould described above, comprising the steps of placing concrete within the mould, spinning the mould to form a green product, releasing the rigid mould member from the pallets, and stripping the mould member from the green product by moving the mould member axially away from the first pallet, thereby causing the flexible lining to form a U-shaped loop which peels progressively from the surface of the green product so that the stripping force is applied over only a small part of the total area of the green product at any time during the peeling step, and curing the green product.

The rigid mould member is preferably disposed substantially vertically and is moved vertically away from the first pallet during the stripping step so that the flexible lining is peeled upwardly. In this respect, the spinning step may be effected with the rigid mould member disposed substantially horizontally, and then the mould member is tilted into the substantially vertical position prior to the stripping step.

The rigid mould member preferably has a slight taper to aid the peeling, although it can be straight-sided. Moreover, the inven-

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tion extends to moulds of cylindrical configuration other than those of essentially uniform circular cross-section throughout their length and is, for example, applicable to a mould which forms an enlarged socket such as is typical in a rubber ring joint pipe. In this specification and the following claims, the term "substantially cylindrical configuration", is intended to include a tapered mould configuration and cylindrical mould configurations which are not of uniform circular cross-section throughout their length, as well as truly cylindrical configurations.

The invention also extends to substantially cylindrical concrete products other than concrete pipes.

Preferably, a lubricant may be provided between the rigid mould member and its inner, flexible lining.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings, in which:—

Figure 1 shows a mould enclosing a green pipe;

Figure 2 shows the mould part-way through removal thereof; and

Figure 3 shows the return of the mould before the next formation process.

In Figure 1, the pipe 7 is shown rather schematically with reinforcement 11. As illustrated, the pipe has been formed between a top pallet 4 and a bottom pallet 6 and with a flexible lining or member 2 which abuts an outer, rigid mould member 1. Again this pipe is shown in a vertical position but it is to be understood that the actual formation of the pipe could be either vertical or horizontal.

The mould member or mould 1 may preferably be tapered but it can if required be parallel sided.

The mould 1 has at its upper end a ring or a series of clips 9 which enables the flexible member 2 to be clamped between the mould 1 and the upper pallet 4. The lower end of the flexible member is affixed to the lower end of the mould 1 in any required way. As shown there is an extension 12 which extends part-way up the outer surface of the mould 1 and between which and the mould 1 the lower end of the flexible member is clamped.

The bottom pallet 6 is provided with a ring or series of clips 8 whereby this extension 12 can be connected to the lower pallet.

In this embodiment of the invention, when the pipe 7 has been formed, for example, in the horizontal position, the assembly is located vertically and the mould 1 is moved upwardly relatively to the lower pallet 6 and the ring or clips 8 which if in the form of clips must be released before movement. If required the top pallet 4 can be held down during the stripping so the pipe 7 is not

lifted. As this movement continues the flexible member 2 moves upwardly over itself so that a loop 10 is formed and at any moment the stripping force is basically at the position of this loop 10. That is, the force is over only a small part of the total area of the pipe and it is such that the pipe 7 tends not to crack and there tends to be no movement of the reinforcement 11 relative to the concrete of the pipe 7. This upward movement continues until the pipe 7 is completely stripped at which time the upper pallet 4 can be removed from the upper end thereof.

In order to facilitate stripping a lubricant may be provided between the flexible member 2 and the rigid mould 1.

The upper pallet 4 can be removed from the green pipe 7 which is left on the lower pallet 6 and its ring 8 and can be located over another lower pallet 6 on which reinforcement 11 is located at which time the mould 1 is moved downwardly as is illustrated in Figure 3 until it reaches the position shown in Figure 1 at which time the mould 1 can be attached as by clips 8 to the pallet 6 and the assembled mould can be moved to a station at which a pipe 7 can be formed.

If desired the flexible member 2 can be inflated by air pressure to assist its lowering. A seal is placed across the top pallet 4 and mould top 9 and air admitted through a connection in one of these seals. This gives the flexible member 2 some stiffness and avoids obtaining wrinkles in the flexible member during the lowering. Air pressure is released progressively as the initially pressurised volume reduces.

Although the invention has been described as applied to a single cylindrical mould the same concept could be applied to a mould which can be split, provided that the movement of the mould is such that it can effect a peeling action of the flexible lining member(s) 2 associated with the mould parts.

The invention may also be applied to a process where a peeling action is used for part of the stripping and the remainder of the stripping is done without peeling.

WHAT WE CLAIM IS:—

1. A mould for manufacturing a concrete pipe or other concrete product, comprising a hollow, rigid, outer mould member for moulding an outer surface of the product, said outer mould member having an integral surface of substantially cylindrical configuration (as hereinbefore defined) and being open at opposite ends, and a flexible lining for the internal surface of the rigid mould member, said lining being also open at opposite ends and being attached at one end to one end of the rigid mould member.

2. A mould as claimed in claim 1, including a first pallet releasably secured to

tion extends to moulds of cylindrical configuration other than those of essentially uniform circular cross-section throughout their length and is, for example, applicable to a mould which forms an enlarged socket such as is typical in a rubber ring joint pipe. In this specification and the following claims, the term "substantially cylindrical configuration", is intended to include a tapered mould configuration and cylindrical mould configurations which are not of uniform circular cross-section throughout their length, as well as truly cylindrical configurations.

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The mould member or mould 1 may preferably be tapered but it can if required be parallel sided.

The mould 1 has at its upper end a ring or a series of clips 9 which enables the flexible member 2 to be clamped between the mould 1 and the upper pallet 4. The lower end of the flexible member is affixed to the lower end of the mould 1 in any required way. As shown there is an extension 12 which extends part-way up the outer surface of the mould 1 and between which and the mould 1 the lower end of the flexible member is clamped.

The bottom pallet 6 is provided with a ring or series of clips 8 whereby this extension 12 can be connected to the lower pallet.

In this embodiment of the invention, when the pipe 7 has been formed, for example, in the horizontal position, the assembly is located vertically and the mould 1 is moved upwardly relatively to the lower pallet 6 and the ring or clips 8 which if in the form of clips must be released before movement. If required the top pallet 4 can be held down during the stripping so the pipe 7 is not

lifted. As this movement continues the flexible member 2 moves upwardly over itself so that a loop 10 is formed and at any moment the stripping force is basically at the position of this loop 10. That is, the force is over only a small part of the total area of the pipe and it is such that the pipe 7 tends not to crack and there tends to be no movement of the reinforcement 11 relative to the concrete of the pipe 7. This upward movement continues until the pipe 7 is completely stripped at which time the upper pallet 4 can be removed from the upper end thereof.

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Although the invention has been described as applied to a single cylindrical mould the same concept could be applied to a mould which can be split, provided that the movement of the mould is such that it can effect a peeling action of the flexible lining member(s) 2 associated with the mould parts.

The invention may also be applied to a process where a peeling action is used for part of the stripping and the remainder of the stripping is done without peeling.

WHAT WE CLAIM IS:—

1. A mould for manufacturing a concrete pipe or other concrete product, comprising a hollow, rigid, outer mould member for moulding an outer surface of the product, said outer mould member having an integral surface of substantially cylindrical configuration (as hereinbefore defined) and being open at opposite ends, and a flexible lining for the internal surface of the rigid mould member, said lining being also open at opposite ends and being attached at one end to one end of the rigid mould member.

2. A mould as claimed in claim 1, including a first pallet releasably secured to





the end of the rigid mould member at or adjacent the attached end of the flexible lining, and a second pallet releasably secured to the opposite end of the mould member and having the opposite end of the lining also attached thereto.

3. A mould as claimed in claim 1 or 2, wherein the rigid mould member is a multi-piece mould, each piece having a flexible lining portion attached at one end to one end of said piece.

4. A method of manufacturing a concrete pipe or other concrete product using the mould claimed in claim 2 or claims 2 and 3, comprising the steps of placing concrete within the mould, spinning the mould to form a green product, releasing the rigid mould member from the pallets, and stripping the mould member from the green product by moving the mould member axially away from the first pallet, thereby causing the flexible lining to form a U-shaped loop which peels progressively from the surface of the green product so that the stripping force is applied over only a small part of the total area of the green product at any time during the peeling step, and curing the green product.

5. A method as claimed in claim 4, wherein the rigid mould member is disposed substantially vertically and is moved vertically away from the first pallet during the stripping step so that the flexible lining is peeled upwardly.

6. A method as claimed in claim 5,

wherein the spinning step is effected with the rigid mould member disposed substantially horizontally, and the mould member is tilted into the substantially vertical position prior to the stripping step.

7. A method as claimed in claim 4, 5 or 6, including the step of holding the second pallet during the stripping step so as to prevent movement of the green product with the rigid mould member.

8. A method as claimed in claim 4, 5, 6 or 7, including the steps of removing the second pallet from the green product, and assembling the rigid mould member, lining and second pallet with another first pallet preparatory to another casting operation.

9. A method as claimed in claim 4, 5, 6, 7 or 8, wherein the flexible lining is positively located prior to placing the concrete within the mould by applying air pressure to the interior of the lining.

10. A method of manufacturing a concrete product, substantially as hereinbefore described with reference to the accompanying drawings.

11. A mould for manufacturing a concrete product, constructed and adapted to be used substantially as hereinbefore described with reference to the accompanying drawings.

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