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[54] EXPANDABLE CORE FOR CASTING CONCRETE PIPE

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[52] **U.S. Cl.**.....**249/179,** 25/128 RR, 249/152

[51] **Int. Cl.**.....**B28b 7/30**

[58] **Field of Search**.....249/179, 178, 175, 180–183, 249/142, 146, 152, 153, 48, 50; 25/128 RR, 128 K, 128 R, 128 S, 128.1; 18/DIG. 10, 45 M

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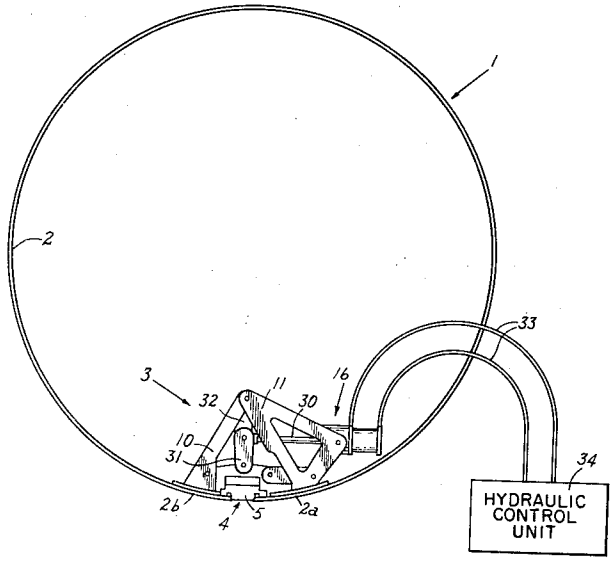
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Assistant Examiner—Dewalden W. Jones
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[57] **ABSTRACT**

An expandable core for casting concrete pipe is disclosed having a cylindrical core member with a longitudinal slot-like opening in its periphery. Core gate means and rigid links are pivotally interconnected and are mounted on the interior of the core member to straddle the slot-like opening. An overcenter linkage system is connected to the core gate means and driven by fluid or mechanical means to selectively expand the core member, simultaneously pivot the core gate into the slot-like opening and lock the core in this expanded position so that concrete may be cast therearound. To separate the core from concrete cast therearound, the fluid or mechanical means may be selectively operated to drive the overcenter linkage means so as to pivot the core gate means out of the slot-like opening and collapse the core.

16 Claims, 5 Drawing Figures



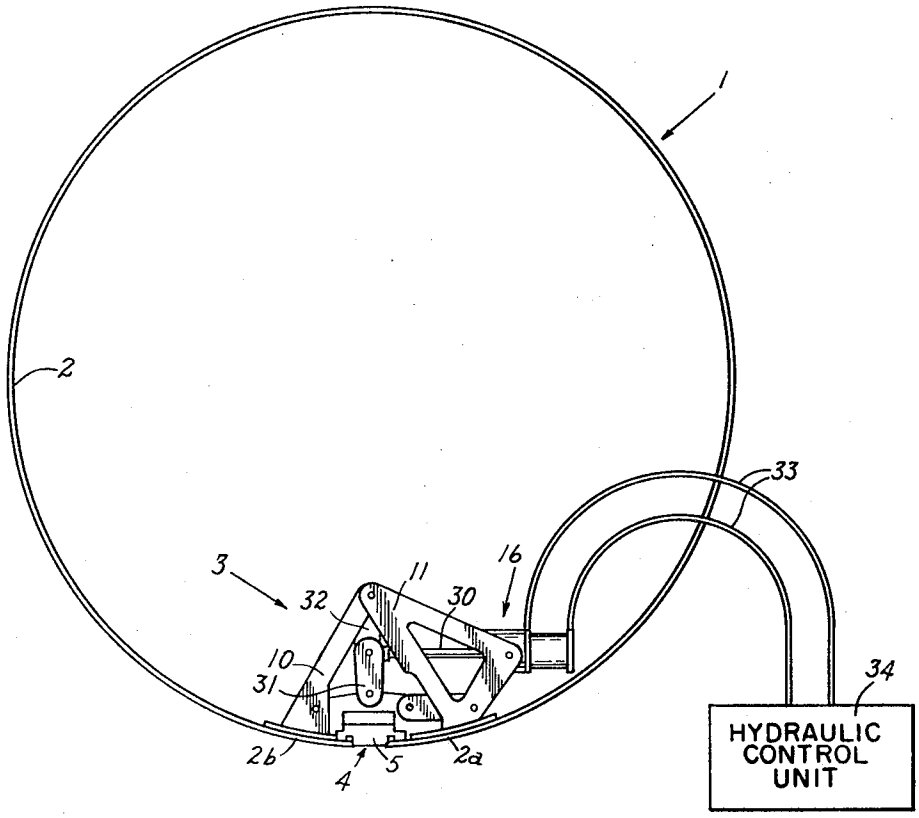


FIG. 1

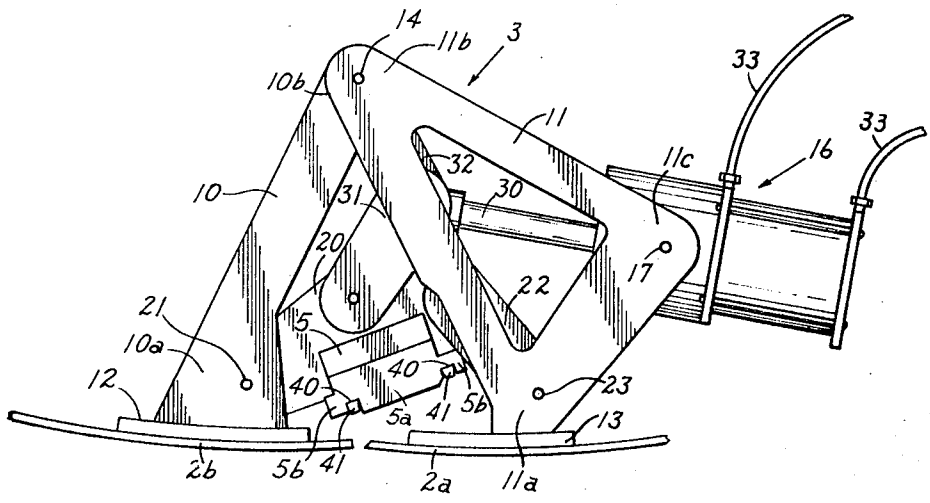


FIG. 2

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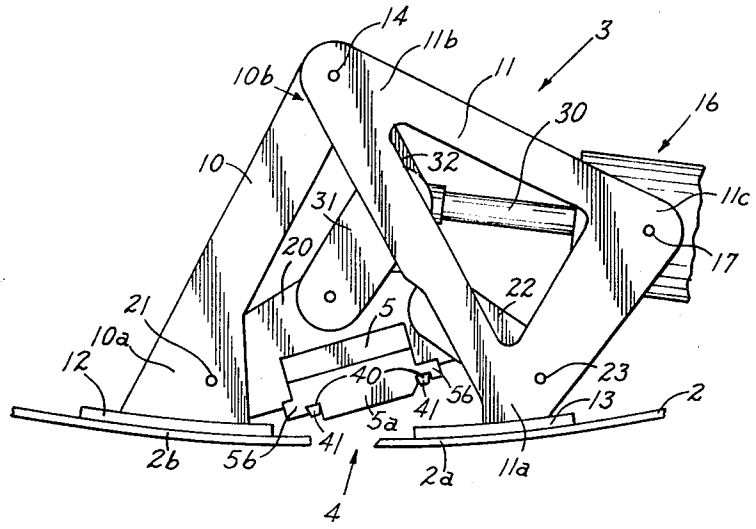


FIG. 3

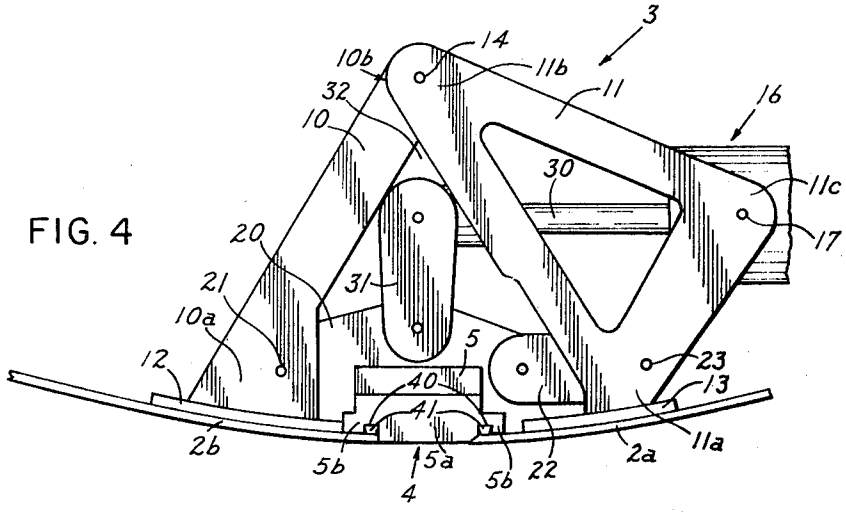


FIG. 4

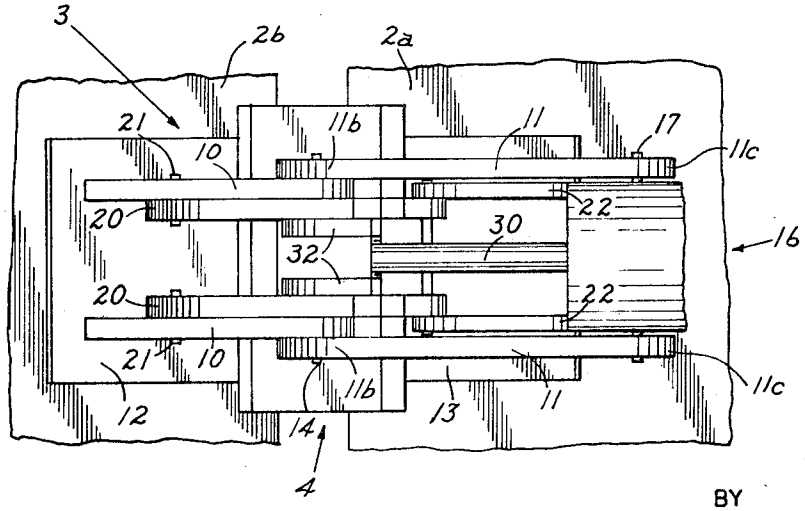


FIG. 5

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EXPANDABLE CORE FOR CASTING CONCRETE PIPE

The present invention relates to pipe molding apparatus, and more particularly to an improved core, with novel core gate means, suitable for use in casting sections of concrete pipe.

In some methods of casting concrete pipe sections, cylindrical cores are employed as the inner mold forms for defining the inner dimensions of the concrete pipe sections cast. These cores used are generally of an expandable-collapsible type so that after a pipe section is cast and cured around the core in its expanded position, the core may be selectively collapsed in order to separate the core from the section of concrete pipe.

One form of such a core heretofore used for molding concrete pipes consisted of a steel cylinder with a longitudinal slot cut therein and a core gate hinged to the inside of the core. The core gate served to close the longitudinal slot cut in the core and in order to insert the core gate in the slot it was necessary to first expand the core to its cylindrical shape. Once the core was expanded, the core gate was secured in the slot. Thereafter, concrete was poured therearound to cast a section of concrete pipe. An outer mold form was placed around the core to define the outside shape of the concrete pipe section cast.

Disadvantages inherent with such prior art cores were that the operations of expanding the core member, closing the core gate in the slot and securing the core gate therein generally had to be done manually and, as a consequence, were quite time consuming. For example, large diameter cores of the type above-described generally had a ladder mounted in their interior so that a workman with a hammer could climb into the inside of the core member. The core member was then expanded by the workman by appropriately driving steel wedges. Once the core was sufficiently expanded, the core gate was manually closed by the workman and steel wedges were placed to hold the core gate closed in the core member slot.

It is, accordingly, an object of the present invention to provide an improved selectively expandable core which is suitable for use in casting concrete pipe sections and which includes means operable to easily and quickly position the core in its expanded position so as to obviate the aforementioned disadvantages of prior art cores.

It is, further, an object of the present invention to provide an improved core as set forth having a longitudinal slot-like opening and means for selectively expanding the core while simultaneously closing the slot-like opening.

It is, additionally, an object of the present invention to provide an improved core as set forth having a core gate means for closing the slot-like opening in the core which is powered to simultaneously expand the core and close the core gate, and which includes overcenter locking means for locking the core in its expanded position.

It is another object of the present invention to provide novel means for selectively expanding a core having a longitudinal slot-like opening therein while simultaneously closing the slot-like opening of the core.

It is still another object of the present invention to provide novel fluid or mechanically powered means for selectively expanding and closing a core as set forth.

In accomplishing these and other objects, there has been provided in accordance with the present invention a cylindrical core having a core member or shell and core gate means. The core member has a longitudinal slot-like opening cut therein and the core gate means includes a core gate pivotally mounted on the inside of the core member adjacent the slot for closing the slot whenever the core member is expanded to its cylindrical shape. Mechanical means are included for expanding the core to widen its slot while simultaneously pivoting the core gate therein. Overcenter linkage means are included in the mechanical means for locking the core gate in the slot whereby to lock the core member in its expanded position. Selectively operable fluid or mechanical means are included for operating the mechanical means whereby to permit the selective expansion or contraction of the core member.

Thus, an improved core with a core gate means is provided which is selectively operable to expand the core member to widen its slot, simultaneously pivot the core gate therein and lock the core in its expanded position.

A better understanding of the present invention may be had from the following detailed description when read in conjunction with the accompanying drawings, in which:

FIG. 1 is an end view of a core according to the present invention in its expanded position;

FIG. 2 is an end view of a portion of the core of FIG. 1 showing in particular the core gate means thereof with the core member in a collapsed position;

FIG. 3 is a view of FIG. 2 showing the core member partially expanded;

FIG. 4 is a view of FIG. 2 showing the core member fully expanded; and

FIG. 5 is a top view of the portion of the core shown in FIG. 2.

Referring to the drawings in more detail, there is shown in FIG. 1 a core generally indicated by the numeral 1. The core 1 includes a substantially cylindrically shaped core member or shell 2 and a core gate means 3 mounted on the core member 2. The core 1 has a longitudinally running slot-like opening 4 defined therein, and the core gate means 3 is mounted within the core 2 so as to extend over the slot 4. In FIG. 1, the core member 1 is shown in its expanded position with a gate portion 5 positioned by the core gate means 3 within the slot 4.

The core member 2 is preferably made from a steel cylinder or other resilient material and may be formed by cutting a longitudinal running strip of a predetermined width from such a cylinder. The portion of the core 1 adjacent the slot-like opening 4 is shown in more detail in FIGS. 2–5 and includes mounting plates 12 and 13 secured to the inner surfaces of the sides 2*b* and 2*a* of the core member 2 symmetrically on each side of the slot 4. Flat rigid members 11 are mounted on the mounting plate 13 in a spaced apart relationship along the longitudinal dimension of the core 2. The members may be triangular and are shown with corners 11*a*, 11*b* and 11*c*. The members 11 are mounted with on the plate 13 at their corners 11*a* so that the plane of each member 11 makes substantially a right angle with the cylindrical surface of the core 2 and the corners 11*b* of the members 11 are positioned over the slot 4. A shaft 14 is mounted to extend along the longitudinal dimension of the core 2 between the corners 11*b*. Hydraulic cylinder means 16 are pivotally mounted on pins 17 at the corners 11*c* of the triangular members 11.

Flat rigid members 10 are mounted on the mounting plate 12 in a spaced apart relationship along the longitudinal dimension of the core 2. The members 10 have ends 10*a* and 10*b*. The ends 10*a* are mounted on the plate 12 with the plane of each member 10 making a substantially right angle with the cylindrical surface of the core 2. The ends 10*b* of the members 10 are positioned just inside the triangular members 11 and are pivotally mounted on the shaft 14.

The core gate 5 for closing the slot 4 is mounted on a pivotal block 20. The block 20 forms part of the core gate means 3 and is pivotally mounted at one end on a shaft 21 which extends longitudinally between the ends 10*a* of the members 10. Rigid links 22 are pivotally connected on each side of the other end of the block 20. The links 22 are pivotally mounted on a shaft 23 which extends between the corners 11a of the rigid members 11. The links 22 and the block 20 straddle the slot-like opening 4 and are appropriately dimensioned so that the gate 5 may be pivoted down into the slot 4, as shown in FIG. 4. It is noted that the gate 5 is appropriately dimensioned to just fill the widened slot 4 in FIG. 4.

As shown in the drawings, the gate portion 5 is designed with an outward projecting portion 5*a* for positioning between the edges of the core member 2 when the core member 2 is expanded. The outer face of the portion 5*a* of the gate portion 5 may be constructed to conform with the contour of the outer surface of the cylindrical core 2. The side of portion 5*a* adjacent the mounting plate 12 is made substantially perpen-

dicular to the face of the portion 5*a*, while the other side of the portion 5*a* is beveled at an angle, such as 30°. The edges of the core 2 are shaped to conform with the angle of the sides of the portion 5*a*. The purpose of beveling the edge of the core member 2 and the side of the gate portion 5*a* adjacent the mounting plate 13 is to permit the gate portion 5 to be pivotal in and out of the slot 4 without hitting or hanging up on the adjacent edge of the core member 2. The edges 5*b* of the gate portion 5 extend over the inner surfaces of the core 2 and are dimensioned to fit between the mounting plates 12 and 13 when the core member 2 is expanded. Longitudinal grooves 40 are formed in the gate 5 adjacent each side of the gate portion 5*a*. These grooves 40 are filled with strips of a sealing material or gasket means 41, such as rubber, in order to insure that the slot 4 is sealed by closing the gate 5.

The hydraulic cylinder means 16 pivotally mounted between corners 11*c* of the support members 11 has a piston 30. Hydraulic lines 33 are connected to the cylinder means 16 and are run longitudinally along the core member 2 out one end thereof. The hydraulic lines 33 are connected at their other ends to a conventional hydraulic control unit or means 34 which is shown representatively in FIG. 1. The control means 34 is selectively operable to control the flow of hydraulic fluid to the hydraulic cylinder means 16, thereby to control the movement of the piston 30. The piston 30 has its end connected to an overcenter linkage system formed by links 31 and 32. The links 31 are pivotally mounted between the end of the piston 30 and the block 20 while the links 32 are pivotally mounted between the shaft 14 and the end of the piston 30. As is hereinafter explained, the expansion and contraction of the core 2 is selectively controlled by controlling the movement of the piston 30 through the hydraulic control unit 34.

In operation, the cylindrical core 1 may be installed within an outer pipe molding form so that a concrete pipe section may be cast by pouring concrete between the core 1 and the outer mold form. The outer molding form may be, for example, a vertical structure in which case the core 1 is placed vertically on end within the outer molding form. At the time of installing the core 1 within the molding form, the core 1 may be in its contracted position shown in FIG. 2.

It is noted that when the core 1 is contracted, the piston 30 is retracted in the cylinder means 16 and pulls the links 31 and 32 towards the cylinder means 16. The links 32 simply pivot about the pivot point provided by the shaft 14 to support and guide the path of movement of the end of the piston 30. The movement of the links 31 towards the cylinder means 16 pulls the block 20 to pivot the block 20 about the shaft 21 so as to rotate the gate 5 away from the slot 4. As the block 20 is pivoted away from the slot 4, the links 22 mounted thereon pull the side 2*a* of the core 2 towards the side 2*b* thereof. Thus, with the core member 1 in its collapsed position, the piston 30 is retracted in the cylinder means 16, the gate 5 is pivoted away from the slot 4, and the core sides 2*a* and 2*b* are moved adjacent each other.

Once the collapsed cylindrical core 1 is appropriately positioned within the outer molding form, the core member 2 is selectively expanded by operating the hydraulic control unit 34. The control unit 34 is operated to pump hydraulic fluid in one end of the cylinder means 16 and out the other so as to extend the piston 30 from the hydraulic cylinder 16. As the piston 30 is extended, the core member 1 reaches a semi-expanded position, as shown in FIG. 3. The piston 30, as it is extended, pushes the links 31 and 32 away from the cylinder means 16. As before mentioned, the links 32 simply pivot around the shaft 14 to guide the movement of the end of the piston 30 and it is noted that the shaft 14 serves as a reference point about which the support members 10 and 11 pivot.

As the links 31 and 32 are pushed away from the cylinder means 16 by the action of the piston 30, the links 32 pivot around the shaft 14 to the left and downward as shown in the drawings. As a result, the ends of the links 31 pivotally mounted on the end of the piston 30 move downward, thereby to pivot the block 20 downward. As the block 20 pivots downward, the sides 2*a* and 2*b* of the core member 2 are pivoted away from each other to expand the core member 2 by the action of the links 22. The downward movement of the block 20 forces the links 22 to the right, thereby to expand the core 2. It is noted that with this arrangement of positively expanding the core member 2, a double mechanical advantage is achieved. The first mechanical advantage is achieved by using the overcenter linkage provided by the links 31 and 32 to pivot the block 20 downward by pushing the links 31, 32 sideways. The second mechanical advantage is provided by connecting the block 20 and the links 22 between the support members 10 and 11 so as to form a second linkage system which operates to expand the core member 2 by pushing downwardly on the block 20.

The piston 30 is extended from the cylinder means 16 until it is fully extended, as shown in FIG. 4. With the piston 30 fully extended, the core member 2 has been expanded to receive the gate 5 by the action of the block 20 and links 22, and the gate 5 has been pivoted into the widened slot 4. The full extension of the piston 30 has additionally overcentered the linkage system provided by the links 31 and 32 to a point just to the left of the shaft 14, as shown in FIG. 4, thereby to lock the core member 2 in its expanded position. With the core member 2 expanded, concrete may then be poured between the inner molding form provided by the core 1 and the outer molding form to mold a concrete pipe section.

It is noted that the width and contour of the gate 5 is normally designed so that the expanded core 2 with the slot 4 therein closed by the gate 5 forms a substantially perfect cylindrical surface for casting a pipe section having a predetermined inner dimension. In the case of an exemplary core member constructed to have an outer diameter of 60 inches, the slot 4 and gate portion 5*a* to be fitted therein were made about 2½ inches wide.

Once a concrete pipe section cast around the core 1 has cured, the hydraulic control unit 34 is operated to retract the piston 30 and return the core member to its collapsed position shown in FIG. 2. With core member 1 collapsed, the core member 2 is separated from the cast concrete pipe and the concrete pipe may be removed from around the core member 2. Thus an improved core suitable for molding concrete pipe sections is provided. The core includes selectively operable means which are operable to simultaneously expand the core while pivoting a core gate portion into a slot formed in the core. Power means in the form of a hydraulic or other fluid, or mechanical unit is provided for selectively expanding the core, and an overcenter linkage means is provided for expanding the core and locking it in its expanded position.

I claim:

1. A core for casting concrete pipe, comprising:

a substantially cylindrical core member, said core member being opened longitudinally along its periphery whereby a slot-like opening is defined in said core member along its longitudinal dimension, said core member being made of a resilient material whereby the width of said slot-like opening and the diameter of said core member may be selectively varied by expanding or contracting said core member;

first and second structure mounted on the interior of said core member on opposite sides, respectively, of said slot-like opening;

rigid link means having first and second ends, the first end of said link means being pivotally mounted in said first structure;

core gate means for closing said slot-like opening, said core gate means being pivotally mounted on one side in said second structure to be pivotal towards or away from said slot-like opening and being pivotally connected at its other side to the second end of said link means whereby said core gate means may be pivoted towards or away from said slot-like opening, respectively, to expand said core member and close said slot-like opening or open said slot-like opening and contract said core member; and

selectively operable means for pivoting said core gate means towards or away from said slot-like opening.

2. The invention recited in claim 1, wherein said means for pivoting said core gate means are power driven.

3. The invention recited in claim 1, wherein said means for pivoting said core gate means are driven by fluid power means.

4. The invention recited in claim 1, wherein said means for pivoting said core gate means is an overcenter linkage means, said overcenter linkage means being operable to lock said core member in an expanded position with said core gate closing said slot-like opening.

5. The invention recited in claim 1, wherein said means for pivoting said core gate means includes:

overcenter linkage means pivotally connected to said core gate means, said overcenter linkage means being operable to lock said core member in an expanded position with said core gate closing said slot-like opening; and

means connected to said overcenter linkage means for selectively driving said overcenter linkage means whereby to pivot said core gate means towards or away from said slot-like opening.

6. The invention recited in claim 1, including:

a gate portion mounted on said core gate means, said gate portion being mounted on said core gate means so as to be pivoted into said slot-like opening whenever said core gate is positioned to close said slot-like opening, said gate portion being of a predetermined width so as to substantially fill said slot-like opening whenever pivoted therein; and

gasket means mounted on said core gate means adjacent the sides of said gate portion for sealing said slot-like opening closed.

7. The invention recited in claim 6, wherein:

the edge of said core member adjacent said first structure and the edge of said gate portion which mates therewith are beveled so that said gate portion may be pivoted into and out of said slot-like opening; and

the outer contour of said gate portion is formed to conform with the outer contour of said core member.

8. A core for casting concrete pipe, comprising:

a substantially cylindrical core member, said core member being opened longitudinally along its periphery whereby a slot-like opening is defined in said core member along its longitudinal dimension, said core member being made of a resilient material whereby the width of said slot-like opening and the diameter of said core member may be selectively varied by expanding or contracting said core member;

first and second support structure mounted on the interior of said core member on opposite sides, respectively, of said slot-like opening;

rigid link means having first and second ends, the first end of said link means being pivotally mounted in said first structure;

core gate means for closing said slot-like opening, said core gate means being pivotally mounted on one side in said second structure to be pivotal towards or away from said slot-like opening and being pivotally connected at its other side to the second end of said link means whereby said core gate means may be pivoted towards or away from said slot-like opening, respectively, to expand said core member and close said slot-like opening or open said slot-like opening and contract said core member;

said first and second support structure establishing a pivot point within said core member relative to said slot-like opening;

overcenter linkage means connected between the pivot point established by said support structure and said core gate means for pivoting said core gate means towards or away from said slot-like opening, said overcenter linkage means being operable to lock said core member in an expanded position with said core gate closing said slot-like opening;

selectively operable means connected to said overcenter linkage means for driving said overcenter linkage means whereby to selectively expand and close or open and contract said core member.

9. The invention recited in claim 8, wherein said means for driving said core gate means is a fluid means, said fluid means including;

fluid cylinder means pivotally mounted on said support structure, said cylinder means having a piston, said piston being connected to said overcenter linkage means; and

control means for selectively controlling the operation of said fluid cylinder means.

10. The invention recited in claim 8, including

a gate portion mounted on said core gate means, said gate portion being mounted on said core gate means so as to be pivoted into said slot-like opening whenever said core gate is positioned to close said slot-like opening, said gate portion being of a predetermined width so as to substantially fill said slot-like opening whenever pivoted therein; and

gasket means mounted on said core gate means adjacent the sides of said gate portion for sealing said slot-like opening closed.

11. The invention recited in claim 10, wherein;

the edge of said core member adjacent said first structure and the edge of said gate portion which mates therewith are beveled so that said gate portion may be pivoted into and out of said slot-like opening; and

the outer contour of said gate portion is formed to conform with the outer contour of said core member.

12. A core for casting concrete pipe, comprising:

a substantially cylindrical core member, said core being opened longitudinally along its periphery whereby a slot-like opening is defined in said core member along its longitudinal dimension, said core member being made of a resilient material whereby the width of said slot-like opening and the diameter of said core member may be selectively varied by expanding or contracting said core member;

first and second mounting structure mounted on the interior of said core member on opposite sides, respectively, of said slot-like opening;

rigid link means having first and second ends, the first end of said link means being pivotally mounted in said first mounting structure;

core gate means for closing said slot-like opening, said core gate means being pivotally mounted on one side in said second mounting structure to be pivotal towards or away from said slot-like opening and being pivotally connected at its other side to the second end of said link means whereby said core gate means may be pivoted towards or away from said slot-like opening, respectively, to expand said core member and close said slot-like opening or open said slot-like opening and contract said core member;

said first and second mounting structures including first and second support members pivotally connected to each other at a predetermined point relative to said slot-like opening within said core member;

overcenter linkage means connected between said support members at their pivotal point of connection and said core gate means for pivoting said core gate means towards or away from said slot-like opening, said overcenter linkage means being operable to lock said core member in an expanded position with said core gate closing said slot-like opening;

a fluid cylinder means pivotally mounted on said first support member, said cylinder means having a piston, said piston being connected to said overcenter linkage means for driving said overcenter linkage means whereby to expand and close or open and contract said core member; and

control means for selectively controlling the operation of said fluid cylinder means whereby to control the movement of said piston connected to said overcenter linkage means.

13. The invention recited in claim 12, including:

a gate portion mounted on said core gate means, said gate portion being mounted on said core gate means so as to be pivoted into said slot-like opening whenever said core gate is positioned to close said slot-like opening, said gate portion being of a predetermined width so as to substantially fill said slot-like opening whenever pivoted therein and having an outer contour formed to conform with the outer contour of said core member, the edge of said core member adjacent said first mounting structure and the edge of said gate portion which mates therewith being beveled so that said gate portion is pivotal into and out of said slot-like opening; and

gasket means mounted on said core gate means adjacent the sides of said gate portion for sealing said slot-like opening closed.

14. In a core for casting concrete pipe, wherein a cylindrical core member having a longitudinal slot-like opening in its periphery is selectively expanded and said slot-like opening closed so concrete pipe may be cast therearound, the improvement of means for selectively expanding said core member while simultaneously closing said slot-like opening comprising:

core gate means for closing said slot-like opening;

rigid link means having first and second ends, said rigid link means having its first end pivotally connected to one side of said core gate means;

means pivotally mounting the other side of said core gate means and means pivotally mounting the second end of said link means on the interior of said core member on opposite sides, respectively, of said slot-like opening whereby the combination of said core gate means and said link means straddles said slot-like opening and said core gate means may be selectively pivoted towards or away from said slot-like opening, respectively, to expand said core member and close said slot-like opening or open said slot-like opening and collapse said core member; and

selectively operable means for pivoting said core gate means towards or away from said slot-like opening.

15. The invention recited in claim 14, wherein said means for pivoting said core gate means includes an overcenter linkage means connected to said core gate means, said overcenter linkage means being operable to lock said core member in an expanded position with said slot-like opening closed by said core gate means.

16. The invention recited in claim 14, wherein said means for pivoting said core gate means includes:

overcenter linkage means connected to said core gate means, said overcenter linkage means being operable to lock said core member in an expanded position with said slot-like opening closed by said core gate means; and

fluid means connected to said overcenter linkage means for selectively driving said overcenter linkage whereby to pivot said core gate means toward or away from said slot-like opening.

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