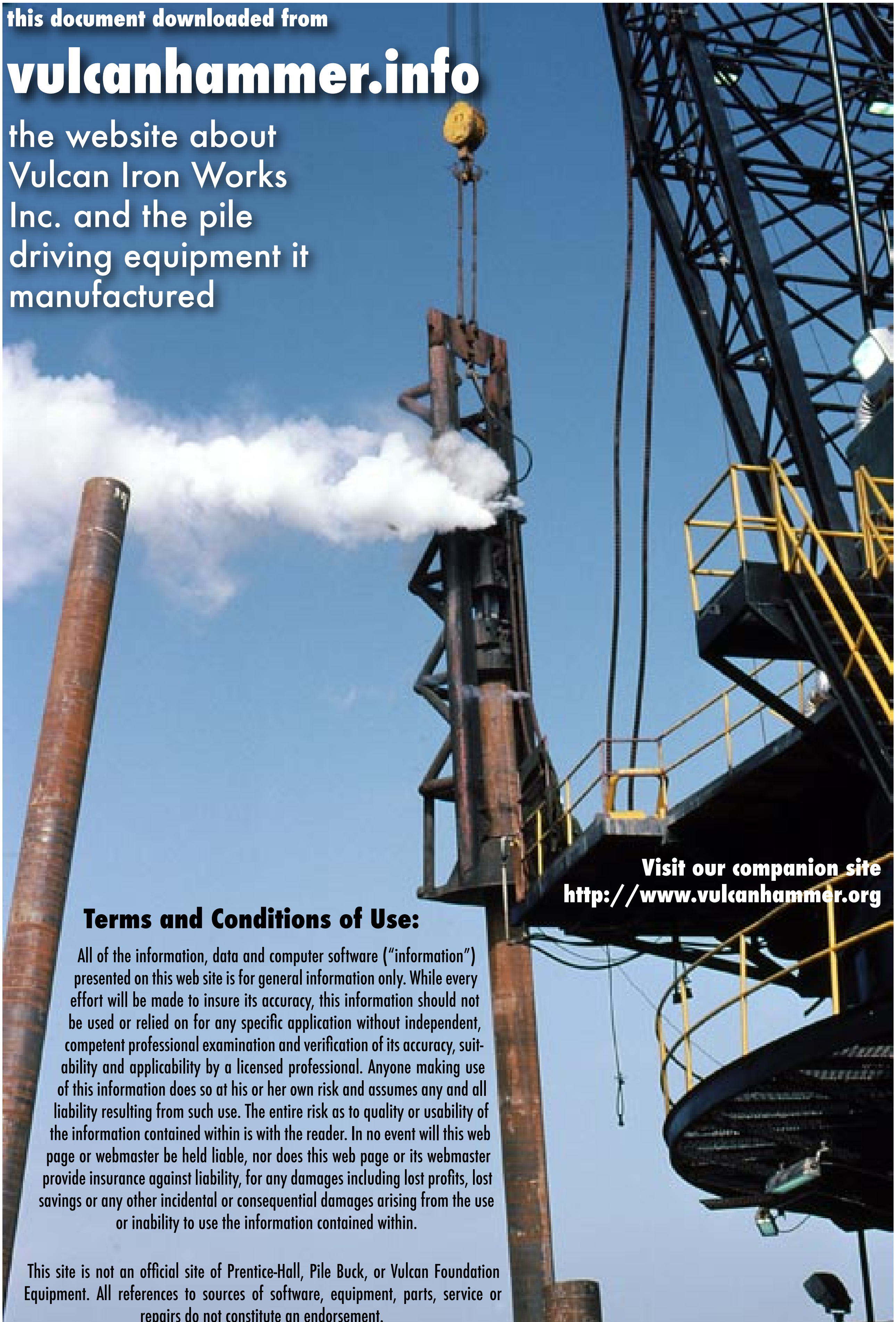

MANDREL FOR DRIVING PILE SHELLS

Filed Dec. 23, 1964 2 Sheets-Sheet 1

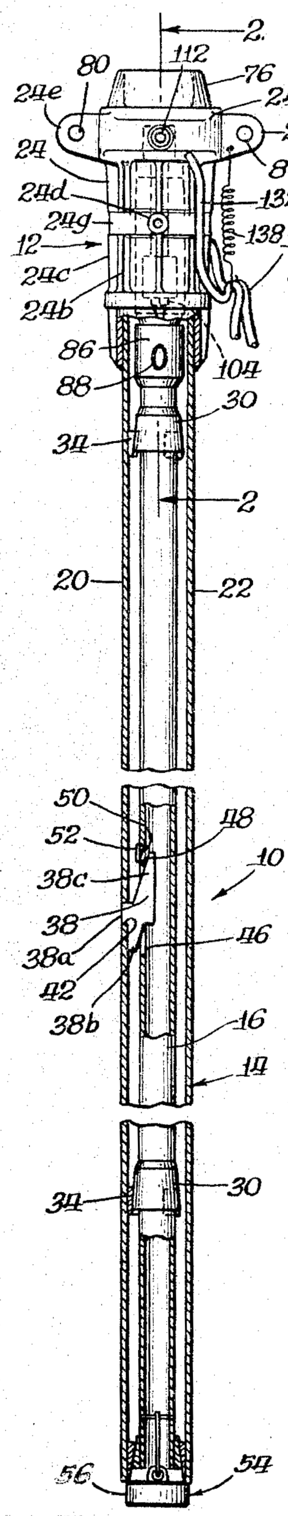

Fig. 1.

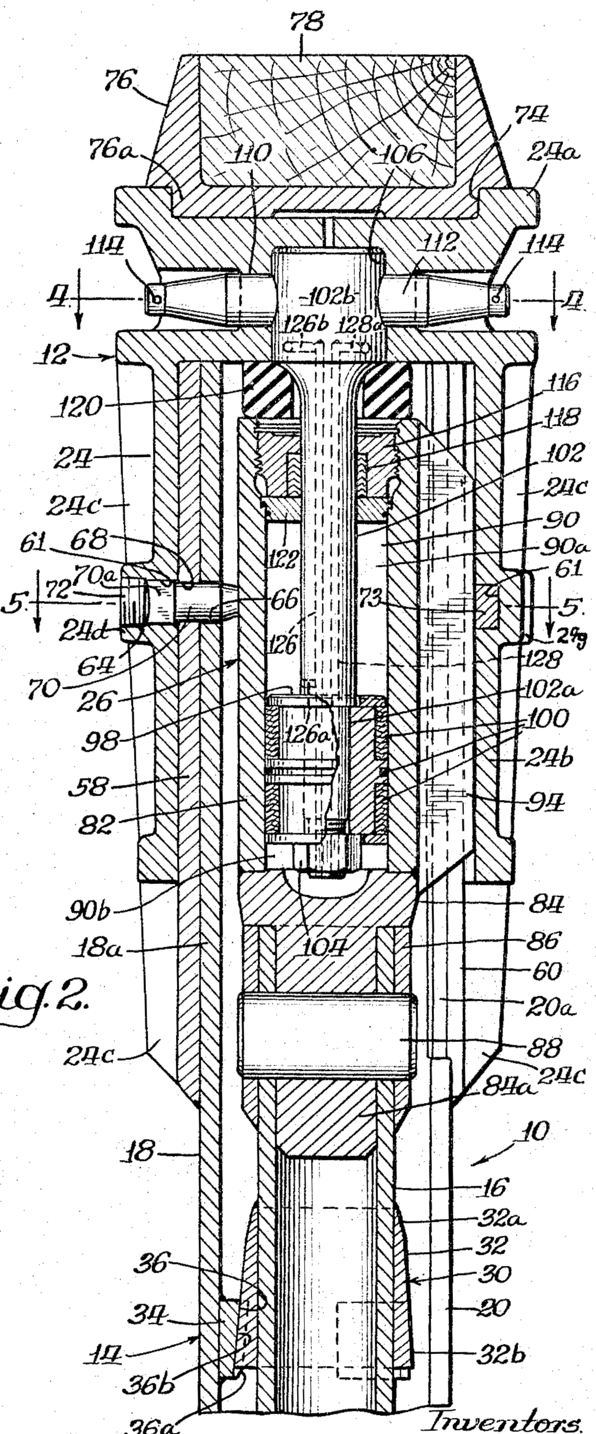

Fig. 2.

Inventors.
Henry G. Warrington
Campbell V. Adams
By: Mason, Kolehmainen, Rathburn & Wyss
Attys.

MANDREL FOR DRIVING PILE SHELLS

Filed Dec. 23, 1964 2 Sheets-Sheet 2

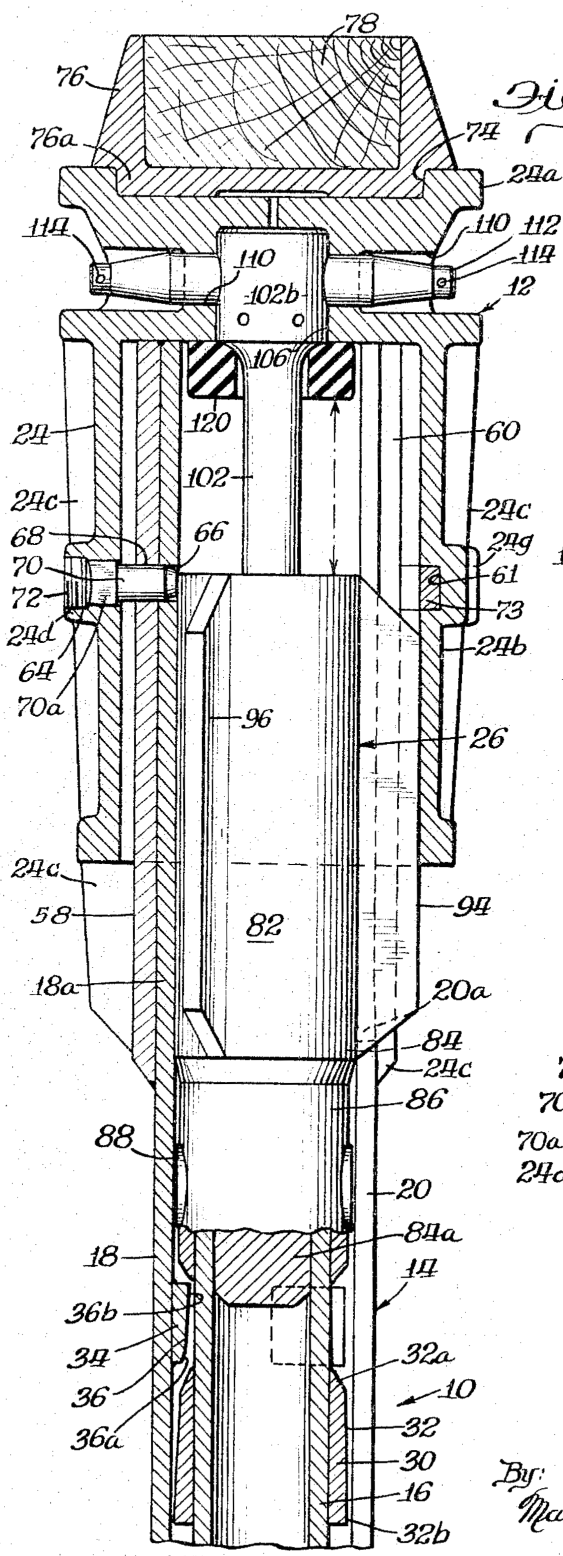

Fig. 3.

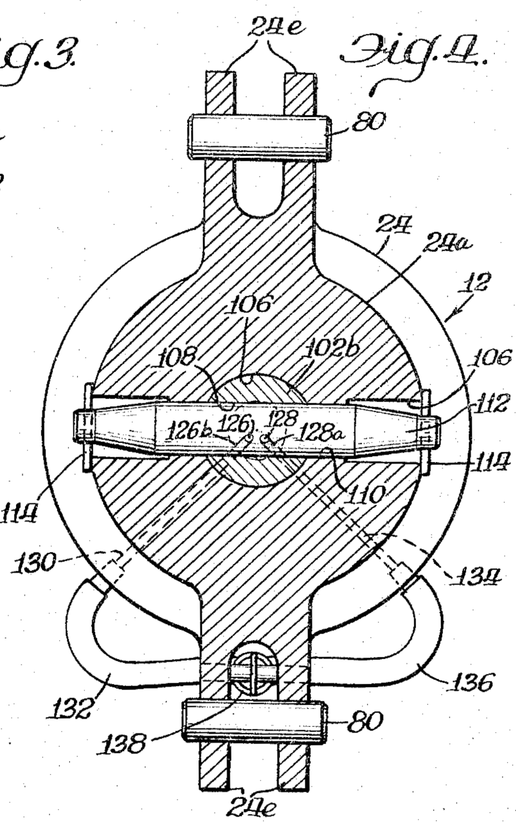

Fig. 4.

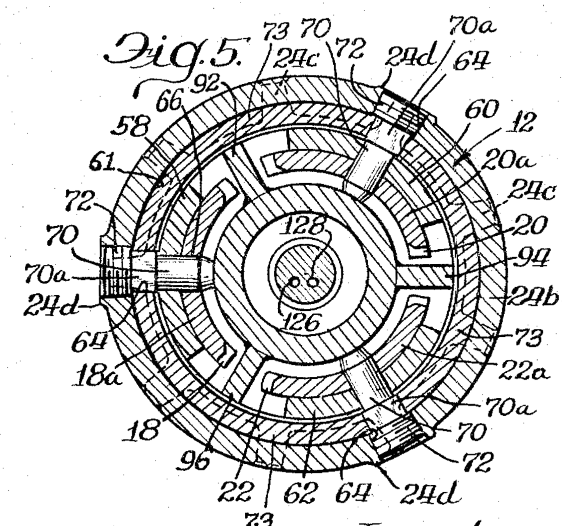

Fig. 5.

Inventors:
Henry G. Warrington
Campbell V. Adams
By: Mason, Kolehmainen, Rathburn & Wyss
Attys.

United States Patent Office

3,329,216

Patented July 4, 1967

3,329,216

MANDREL FOR DRIVING PILE SHELLS

Henry G. Warrington, Palm Beach, Fla., and Campbell V. Adams, Chattanooga, Tenn., assignors to Vulcan Iron Works Inc., Chattanooga, Tenn., a corporation of Illinois

Filed Dec. 23, 1964, Ser. No. 420,529
7 Claims. (Cl. 173—132)

The present invention relates to mandrels and more particularly to a novel expandable and collapsible mandrel for driving pile shells.

One method of forming a concrete pile is to drive a relatively thin walled mold, called a pile shell, into the earth and then to fill the pile shell with concrete. Since the completed concrete pile is dependent upon the concrete rather than the pile shell for its strength, it is not necessary to use heavy weight pile shells. From a cost-saving standpoint, it is desirable to employ inexpensive light weight pile shells that are not sufficiently strong by themselves to withstand the forces required to drive the pile shells into the ground. Thus, it is necessary to use a mandrel within the pile shell to transmit the driving force to the pile shell and to prevent deformation or collapse of the pile shell as it is driven.

A mandrel for pile shells customarily is inserted into the pile shell in a relatively small diameter collapsed condition and is then expanded to bear against the wall of the pile shell during the driving operation. After the pile shell is driven, the mandrel is collapsed and removed from the pile shell. In the past difficulty has been encountered in expanding and collapsing such mandrels and particular difficulty has been encountered in collapsing mandrels after the driving forces have firmly wedged the mandrel against the wall of the pile shell.

In conventional mandrels several elongated plates or leaves are expanded against the interior of the pile shell in various manners. In one type of mandrel, the leaves or plates are forced outwardly by an inflatable flexible inner core supplied with pressurized fluid. This type of mandrel is unsatisfactory because although hydraulic pressure causes expansion of the mandrel, no positively acting means are provided to cause collapse of the mandrel after the pile shell is driven. Additionally, the inherent weakness of the flexible inner core limits the force with which the pile shell engaging plates may be expanded, especially since the inflatable core acts directly without the aid of any mechanical advantage, and also diminishes in effectiveness due to pulsations induced therein by the reciprocation of driving means.

In another type of mandrel used in the past, wedge means or the like are used between adjacent leaves or between the leaves and a rigid core to force the leaves outwardly and inwardly in response to relative longitudinal movement of the leaves with respect to one another or of the leaves with respect to the core. The longitudinal movement for collapsing the mandrel is customarily achieved by lifting a single leaf or a rigid core and relying upon weight or friction to hold the other elements stationary against the action of the wedges. This action is not always dependable because, after being tightly wedged against the wall of a pile shell during the driving operation, the mandrel often cannot be disengaged by weight and friction alone.

Accordingly, it is an object of the invention to provide an improved mandrel which does not suffer from the above-mentioned disadvantages.

Another object is to provide an improved mandrel having novel means for expanding and collapsing the pile shell engaging leaves in an effective dependable fashion.

It is another object to provide an improved mandrel of the type having several pile shell engaging leaves ex-

pandable and collapsible away from and toward a rigid core and having improved apparatus for causing relative longitudinal movement of the rigid core with respect to the leaves in order to expand and collapse the leaves.

It is yet another object of the invention to provide an improved mandrel wherein the pile shell engaging leaves and stem, as well as the pile shell, are able to rotate with respect to the head of the mandrel.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In brief, a mandrel embodying the present invention includes an elongated core receivable in a pile shell and a driving head positioned at the top of the core for receiving hammer blows or other driving forces. Several elongated leaf members are slidably attached to the driving head so that they surround the core and so that they are free to expand and collapse away from and towards the core. A system of wedges is located between the core and the leaves for expanding or collapsing the leaves in response to axial upward or downward movement of the core with respect to the leaves. In order to move the core up and down with respect to the driving head, a cylinder defining member is attached to the core and a piston forming opposed pressure chambers in the cylinder is connected to the driving head by means of a piston rod. Passageways formed in the driving head and the piston rod allow pressurized fluid to enter one chamber to move the core in one direction with respect to the driving head to expand the leaves and to enter the opposed chamber to move the core in the other direction to collapse the leaves. Furthermore, the leaves are slidably connected to the driving head so that during the driving operation the core, leaves and shell may rotate with respect to the driving head.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIG. 1 is an elevational view, partly in section, with certain portions broken away, of a mandrel embodying the present invention, the mandrel being illustrated in the expanded condition;

FIG. 2 is an enlarged fragmentary sectional view taken along line 2—2 of FIG. 1 assuming that FIG. 1 shows the complete structure;

FIG. 3 is an enlarged fragmentary partly sectional view of the apparatus shown in FIG. 1 but with the mandrel being shown in the collapsed condition;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 assuming that FIG. 2 shows the complete structure; and

FIG. 5 is a sectional view taken along line 5—5 of FIG. 2, again assuming that FIG. 2 shows the complete structure.

Referring now to the drawings, and particularly to FIG. 1 thereof, there is illustrated a mandrel **10** embodying the present invention. The mandrel **10** includes a head portion **12** and an elongated body portion **14** receivable within a pile shell. The body portion **14** includes a rigid core **16** and three arcuate leaves **18**, **20** and **22** for engaging a pile shell (FIGS. 1, 2, and 5) and arranged to expand and contract toward and away from the core **16**. The head portion **12** of the mandrel **10** supports the body portion **14** and includes a member **24** having an integral blow receiving portion *24a* for receiving a succession of driving forces which are transmitted to the pile shell by the mandrel **10** and a depending skirt or sleeve portion *24b*. Interconnecting the mandrel head portion **12** and the rigid core 16 is a novel fluid assembly 26 (FIGS. 2 and 3) for raising and lowering the core 16 relative to the head portion 12 in order to expand and collapse the arcuate leaves 18, 20 and 22 in a manner to be described hereinafter.

The body portion 14 of the mandrel 10 is capable of radially expanding and collapsing and is inserted into a pile shell in the collapsed condition (FIG. 3), after which it is expanded against the inner wall of the pile shell and maintained thus (FIGS. 1, 2, 4 and 5) while the mandrel and pile shell are being driven into the ground. After the pile shell is driven, the mandrel is collapsed and withdrawn and the pile is formed by completely filling the embedded pile shell with concrete. The rigid core 16 is in the form of an elongated hollow tube and is substantially encircled by the leaves 18, 20 and 22. Each leaf has a cross section in the form of a segment of a circle (FIG. 5), and the several leaves in the expanded condition are adapted to bear against a substantial portion of the inner wall of a cylindrical pile shell. The core 16 and the leaves 18, 20 and 22 are formed of a strong metal such as steel and may be produced in a variety of sizes to conform to various sizes of pile shells which may vary widely in diameter such as from twelve to sixteen inches and also vary in length such as from thirty to one hundred feet or longer.

In order to expand and collapse the leaves 18, 20 and 22 away from and toward the rigid core 16, a system of wedge surfaces is positioned between the core 16 and the leaves 18, 20 and 22. This system comprises a series of annular pressure cones 30 which embrace and are firmly secured to the core 16 at spaced intervals along its length. Each pressure cone, as best shown in FIGS. 2 and 3 of the drawings, includes a wedge surface 32 having a beveled guiding portion 32*a* and a gently inclined wedge portion 32*b* offset at a suitable angle from the surface of the core 16. Each leaf 18, 20 and 22 is provided with a cooperating series of leak blocks 34 having wedge surfaces 36. The wedge surfaces 36 include beveled guide portions 36*a* and inclined wedge portions 36*b*.

When the mandrel 10 is inserted into the pile shell, it is in the collapsed condition illustrated in FIG. 3 in which the leaf blocks 34 are slightly spaced from the pressure cones 30 and the leaves 18, 20 and 22 nestle closely against the rigid core 16. To expand the leaves 18, 20 and 22 outwardly against the pile shell wall, the core 16 is raised relative to the leaves 18, 20 and 22 from the position shown in FIG. 3 to that shown in FIG. 2 by the fluid assembly 26, preferably hydraulic, described in detail hereinafter. When the core 16 is raised with respect to the leaves 18, 20 and 22, the cooperating surfaces 32 and 36 engage one another and the leaves are forced outwardly away from the core 16. In the illustrated embodiment, the surfaces 32 and 36 are arranged so that in order for the leaves to move radially sufficiently from the collapsed to the expanded position to engage the pile shell, the core 16 moves a much greater distance axially with respect to the leaves 18, 20 and 22, the magnitude of the radial force induced thereby being substantially in direct proportion to the vertical movement of core. Thus, a considerable mechanical advantage aids the leaves 18, 20 and 22 as they bear against the wall of the pile shell.

For the purpose of aiding in the collapse of the mandrel 10 after use thereof, the system of wedge surfaces also includes several collapsing hooks 38, one or more of which is secured to each of the leaves 18, 20 and 22 but only one of which is illustrated (FIG. 1) associated with leaf 20. Each collapsing hook 38 has a mounting portion 38*a* received in an associated opening 42 defined in the associated leaf. Each collapsing hook 38 also includes a portion 38*b* engaging the inside wall of the associated leaf beneath each opening 42. The portions 38*a* and 38*b* are preferably welded around their perimeters or otherwise firmly secured to the associated leaf. Each hook 38 is also provided with an arm portion 38*c* receivable in an associated narrow elongated slot 46 in the core 16. It will be understood that the core 16 will be provided with as many slots 46 as there are collapsing hooks 38 associated with the leaves 18, 20 and 22 and, of course, these slots will be disposed around the surface of core 16. Each arm portion 38*c* has a wedge surface 48 engageable with a cooperating wedge surface 50 comprising a bevel at the top of the slot 46. In order to reinforce the wedge surfaces 50, a support block 52 is secured to the outer surface of the core 16 adjacent the top of each of the slots 46 provided therein.

After the pile shell has been driven and it is desired to remove the mandrel 10, the core 16 is retracted from the position shown in FIGS. 1 and 2 and returned to the position shown in FIG. 3 by the fluid assembly 26. When this occurs, the wedge surfaces 32 and 36 become disengaged, and the wedge surface 48 of the collapsing hook 38 engages the cooperating wedge surface 50 and the associated leaf is pulled inwardly toward the core 16. Similar collapsing hooks on leaves 18 and 22 (not shown) simultaneously cause their collapse, and the mandrel 10 may then readily be withdrawn from the pile shell.

It should be understood that FIG. 1 is a broken view and a substantial portion of the body 14 of the mandrel 10 has been omitted for purposes of simplification. The mandrel 10 may have several pressure cones 30 spaced along its length, each leaf having a leaf block 34 for each pressure cone 30. In addition, each leaf may have several collapsing hooks 38, each cooperating with a slot 46 in the core 16.

Preferably, although forming no part of the present invention, the lower portion of the body 14 of the mandrel 10 carries a driving shoe assembly 54 (FIG. 1) including a driving shoe 56 extending down to or slightly below the bottom of the pile shell during the pile driving operation.

For the purpose of relating the leaves 18, 20 and 22 to head portion 12 of the mandrel 10, the head portion includes the member 24 referred to above including the integral blow receiving portion 24*a* and the depending skirt or sleeve portion 24*b*. Each of the arcuate leaves 18, 20 and 22 has a short portion at the upper end which is slightly narrower, designated as 18*a*, 20*a* and 22*a*, receivable within the skirt portion 24*b*. As illustrated, arcuate strengthening or reinforcing plates 58, 60 and 62 are disposed between the inside wall of the skirt or sleeve portion 24*b* and the arcuate leaves 18, 20 and 22, respectively. To strengthen the skirt portion 24*b*, a plurality of integral ribs 24*c* are provided around the periphery. So that the reinforcing plates 58, 60 and 62 are held in place and to secure each arcuate leaf to member 24, three enlarged integral bosses 24*d* are spaced around a large rib or collar 24*g* on the skirt portion 24*b* and each boss is provided with an opening 64 aligned with a corresponding opening 66 formed in the leaf portions 18*a*, 20*a* and 22*a* and a corresponding opening 68 formed in the reinforcing plates 58, 60 and 62. Within the annular rib or collar 24*g*, the skirt or sleeve portion 24*b* is provided with an annular generally rectangular recess 61 joining with the openings 64. A leaf supporting pin 70 is slidably received through each of the sets of the openings 64, and the pins 70 include generally rectangular head portions 70*a* that lie snugly within the recess 61. The pins 70 extend inwardly through the openings 66 and 68, and are prevented from moving out of the openings 64 by means of threaded plugs 72 inserted therein. Because of the sliding fit between the pins 70 and the openings 66 and 68, the arcuate leaves 18, 20 and 22 as well as the reinforcing plates 58, 60 and 62 are free to expand and collapse about the core 16 between the two different positions thereof, shown in FIGS. 2 and 3 of the drawings.

In accordance with a feature of the invention, the leaves 18, 20 and 22, as well as the core 16, are allowed to rotate with respect to the head portion 24 while the pile shell is being driven. One type of pile shell has helical corrugations therearound in order to provide for firm contact with the mandrel, and these corrugations tend to induce rotations in the mandrel. Thus, it is desirable to allow the mandrel to be free to rotate, and accordingly the pins **70** ride slidably in the recess **61**. In order to maintain the proper distance between the pins **70** and thus between the leaf members **18**, **20** and **22**, arcuate spacers **73** are carried in the recesses **61** between the head portions **70***a* of the pins **70**. With regard to FIGS. 2, 3 and 5 of the drawings, the mounting pins **70**, spacers **73** and leaves **18**, **20** and **22** are illustrated with the pins **70** in axial alignment with the openings **64**, but it should be understood that the pins **70** and spacers **73** can slidably rotate to any position along the continuous annular recess **61**.

The blow receiving portion **24***a* of member **24** is illustrated as having a shallow recess **74** formed therein to receive a cooperating projection **76***a* on a driving ring **76** which preferably receives a cushion block **78** formed of wood or other suitable material. The upper ends of leaf portions **18***a*, **20***a* and **22***a* and the associated supporting plates **58**, **60** and **62** abut against the underside of the blow receiving portion **24***a* so as to transmit the pile driving blows directly to the ends of the leaves rather than through the pins **70**. The pins **70**, however, are important when relative movement between core **16** and the leaves **18**, **20** and **22** is desired. So that the mandrel may be supported and moved by a crane or similar device the member **24** is provided with integrally spaced pairs of ears **24***e* (FIGS. 1 and 4) for receiving pins **80** for attaching a cable or the like. Thus, the mandrel **10** may readily be lifted into and out of pile shells.

In accordance with the present invention, the mandrel **10** is equipped with the novel fluid assembly **26** for producing relative axial movement between the core **16** and the leaves **18**, **20** and **22** resulting in the expansion and collapsing of the mandrel **10**. To this end the fluid assembly **26** effectively joins the upper end of the core **16** to the driving head **12** and includes a sleeve member **82** open at the top and closed at the bottom by a connecting member **84** suitably welded or otherwise secured to the sleeve member. The connecting member **84** includes a depending circular portion **84***a* snugly receivable within the upper end of core **16**. To secure the connecting member **84** to the core **16**, an annular reinforcing member **86** encircles the upper end of the core **16** and a heavy key **88** extends through aligned openings in core **16**, depending portion **84***a* and reinforcing member **86**. With this arrangement the sleeve member **82** is securely connected to the core **16**. The sleeve member **82** effectively defines a piston or cylinder chamber **90** therein.

For the purpose of holding sleeve member **82** in concentric relationship relative to skirt portion **24***b* of member **24**, a plurality of spacing fins **92**, **94** and **96** are provided secured as by welding or the like to the exterior wall of sleeve member **82**, as best shown in FIG. 5 of the drawings. These spacing fins **92**, **94** and **96** extend outwardly between the leaves **18**, **20** and **22** and between plates **58**, **60** and **62** to abut the inner wall of skirt portion **24***b* of member **24**.

Slidably received within piston or cylinder chamber **90** is a piston **98** dividing the chamber into a pair of opposed pressure chamber portions **90***a* and **90***b*. Preferably piston **98** is provided with means such as piston rings or sealing members generally designated as **100** which effectively isolates chamber portions **90***a* and **90***b* from one another. To transmit the fluid forces applied to piston **98**, as described hereinafter, a piston rod **102** is suitably secured to piston **98** and extends out of the upper open end of sleeve member **82**, as viewed in FIG. 2 of the drawings. As illustrated, piston rod **102** has a portion of reduced cross section **102***a* extending through piston **98** and a nut **104** is threaded onto a threaded end of portion **102***a*.

Since the piston cylinder defined by sleeve member **82** is secured to core **16**, obviously the piston rod must be connected to the leaves **18**, **20** and **22** through member **24** to utilize the fluid assembly **26** to produce relative axial movement between core **16** and the leaves **18**, **20** and **22**. To this end, the portion **24***a* is provided with a generally axial recess **106** receiving an enlarged end **102***b* of piston rod **102**. This enlarged end **102***b* is provided with an opening **108** (FIG. 4) aligned with an opening **110** in portion **24***a* of member **24** to receive a force transmitting pin **112** (FIGS. 1, 2 and 3). Suitable lock pins **114** (FIG. 4) hold the force transmitting pin **112** within the aligned openings **108** and **110**.

In order to seal the pressure chamber portion **90***a* and to permit reciprocal movement of piston rod **102**, the upper open end of sleeve member **82** is closed by a gland member **116** (FIG. 2) having a suitable sealing member **118** associated therewith surrounding piston rod **102**. Preferably gland member **116** is threaded into the mouth or open end of the sleeve member **82**. Thus, the fluid assembly **26** includes two relatively movable groups of parts, one including the cylinder defined by sleeve member **82** secured to the core **16** and the other including the piston **98** and the piston rod **102** fixed to the member **24**. Preferably an annular cushioning element **120** surrounding the piston rod **102** outside piston chamber **90** prevents the piston **98** from striking the bottom of the cylinder defined by sleeve or skirt member **82**. A retainer **122** is provided to secure sealing packing in place (FIG. 2).

With regard to the fluid assembly **26**, it should be understood that the core **16** as well as the cylinder defined by sleeve member **82** can not only move axially up and down with respect to the driving head **24**, but also can rotate about the shaft **102**. Thus, when the leaves are expanded against a pile shell, the shell, the leaves and the core are able to rotate together. In view of this feature of the invention, there is no tendency for the pile shell to slip on the leaf members due to the rotational forces to which the pile shell is subjected during the driving operation.

For the purpose of supplying fluid under pressure to chamber portions **90***a* and **90***b* to produce relative movement of the piston **98** and the cylinder defining the piston chamber **90**, the piston rod **102** is provided with a pair of longitudinally extending passageways **126** and **128** best shown in FIG. 2 of the drawings. The passageway **126** is illustrated as supplying the chamber portion **90***a* and is provided with a lateral extension **126***a* terminating in chamber **90** immediately above the piston **98**, as viewed in FIG. 2 of the drawings. The passageway **128** is illustrated as supplying chamber portion **90***b* and its lower end terminates in chamber **90***b* at the end of piston rod **102** to which the nut **104** is secured. The other ends of the passageways **126** and **128** are adapted to be selectively connected to a source of fluid under pressure (not shown). To this end, the upper end of passageway **126** is provided with a lateral extension **126***b* disposed in the enlarged end **102***b* of piston rod **102**. This lateral extension **126***b* is in turn connected to a passageway **130** defined within the portion **24***a* of member **24** below the force transmitting pin **112** as viewed in FIG. 4 of the drawings. The passageway **130** is in turn connected by a suitable flexible conduit **132** to the source of fluid under pressure through suitable control valves (not shown). Similarly, the upper end of passageway **128** is provided with a lateral extension **128***a* which in turn is connected to a passageway **134** defined within the portion **24***a* of member **24** as best shown in FIG. 4 of the drawings, and this passageway in turn is connected by a flexible conduit **136** and suitable control means (not shown) to a source of fluid under pressure. To prevent strain on the flexible conduits **136** and **132**, they are preferably supported by spring means **138**, best shown in FIG. 1 of the drawings.

In view of the detailed description included above, the operation of the collapsible mandrel of the present invention will readily be understood by those skilled in the art. When it is desired to collapse the mandrel from the expanded condition thereof, shown in FIGS. 1 and 2 of the drawings, pressurized fluid is introduced into the chamber **90b** through flexible conduit **136**, passageways **134**, **128a** and **128**. This results in downward movement of the member **84** which defines the cylinder or piston chamber **90** and, of course, downward movement of the core **16**, as viewed in FIG. 2 of the drawings. Such downward movement also causes the collapsing hooks **38** to effectively pull the expanded leaves to the collapsed position of FIG. 3 of the drawings. Conversely, when it is desired to expand the mandrel from the condition shown in FIG. 3 to that shown in FIGS. 1 and 2, fluid under pressure is introduced into chamber **90a** through flexible conduit **132** and passageways **130**, **126b**, **126**, and **126a**.

Although there has been illustrated and described a specific embodiment of the present invention, it will be understood that various changes and modifications will occur to those skilled in the art and it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A mandrel for driving pile shells, said mandrel comprising a core, leaf means arranged around and generally parallel with said core, wedge means for expanding and collapsing said leaf means in response to movement of said core with respect to said leaf means, and means responsive to pressurized fluid to move said core with respect to said leaf means to expand and collapse said leaf means.

2. A mandrel for driving pile shells, said mandrel comprising a core, leaf means arranged around and generally parallel with said core, wedge means for expanding and collapsing said leaf means in response to movement of said core with respect to said leaf means, and means including a cylinder and piston responsive to pressurized fluid to move said core with respect to said leaf means to expand and collapse said leaf means.

3. Apparatus for supporting and transmitting driving force to a pile shell, said apparatus comprising an elongated core generally coaxially receivable in a pile shell, a driving head having a blow receiving portion and a supporting portion, leaf means mounted on said supporting portion in parallel telescoping arrangement around said core for radial movement with respect to said supporting portion, first wedge means interposed between said core and said leaf means for expanding said leaf means into abutting relation with the pile shell in response to axial movement of said core in one direction with respect to said leaf means, second wedge means interposed between said core and said leaf means for collapsing said leaf means away from the pile shell in response to axial movement of said core with respect to said leaf means in the other direction, and fluid actuating means for axially moving said core, said actuating means including a first portion mounted on said driving head and a second portion mounted on said core and movable with respect to said first portion.

4. The apparatus defined in claim **3** wherein said second portion includes a cylinder defining block and said first portion includes piston means receivable in said block.

5. Apparatus for supporting and transmitting driving force to a pile shell, said apparatus comprising an elongated core generally coaxially receivable in a pile shell, a driving head having a blow receiving portion and a sleeve portion, means on said sleeve portion defining a continuous annular recess therein, a plurality of leaf members arranged in telescoping arrangement around said core, and supporting means for said leaf members including pin means having head portions slidable in said recess and body portions extending inwardly from said sleeve portion, said leaf members including means defining openings adapted slidably to receive said body portions of said pin means whereby said leaf members are radially movable and rotatable with respect to said driving head.

6. Apparatus for supporting and transmitting driving force to a pile shell, said apparatus comprising an elongated core generally coaxially receivable in a pile shell, a driving head, first supporting means connected between said core and said driving head and permitting said core to move axially and to rotate with respect to said driving head, a plurality of leaf members arranged in telescoping arrangement around said core, and second supporting means connected between said driving head and said leaf members and permitting said leaf members to move radially and to rotate with respect to said driving head.

7. Apparatus as claimed in claim **6** wherein said first supporting means includes a cylinder formed in said core, a piston supported for sliding and rotating movement in said cylinder, a supporting shaft having a first end connected to said piston and having a second end, a recess in said driving head receiving said second end, and means including a pin for releasably holding said second end in said recess.

References Cited

UNITED STATES PATENTS

1,158,839	11/1915	Pierce	173—125
2,881,593	4/1959	Cobi	61—53.72
3,041,839	7/1962	Kupka	61—53.72
3,118,284	1/1964	Cobi	61—53.72
3,131,544	5/1964	Thornley	61—53.72

FRED C. MATTERN, Jr., *Primary Examiner.*

L. P. KESSLER, *Assistant Examiner.*