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**Legault**

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(54) **WICK DRAIN SHOE ASSEMBLIES, SYSTEMS, AND METHODS**

(71) Applicant: **American Piledriving Equipment, Inc.**, Kent, WA (US)

(72) Inventor: **Eric C. Legault**, Kirkland Lake (CA)

(73) Assignee: **AMERICAN PILEDRIVING EQUIPMENT, INC.**, Kent, WA (US)

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(51) **Int. Cl.**
***E02D 3/10*** (2006.01)
*E02B 11/02* (2006.01)

(52) **U.S. Cl.**
CPC ..... ***E02D 3/103*** (2013.01); *E02B 11/02* (2013.01)

(58) **Field of Classification Search**
CPC ..... E02D 3/10; E02D 3/103; E02D 5/72
USPC ..... 405/50, 253, 255
See application file for complete search history.

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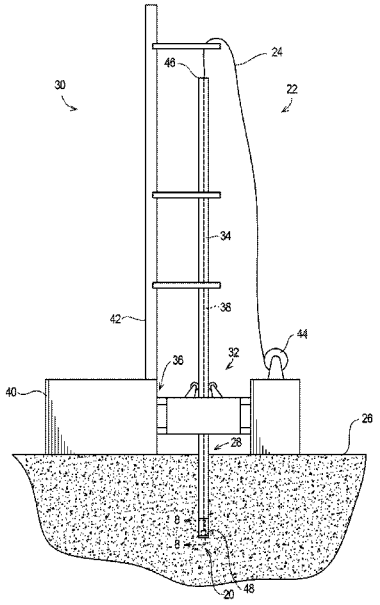
*Primary Examiner* — Frederick L Lagman
(74) *Attorney, Agent, or Firm* — Schacht Law Office, Inc.; Michael R. Schacht

(57) **ABSTRACT**

A wick drain shoe assembly adapted to be connected to a free end of a length of wick drain material and driven by a mandrel of a wick drain insertion system comprises a base portion, an extension portion secured to the base portion, and a wick drain shoe gasket. The wick drain material is connected to the wick drain shoe by securing the free end to the extension portion. The base portion is sized and dimensioned to engage the mandrel such that displacement of the mandrel in a first direction causes displacement of the wick drain shoe in the first direction. The wick drain shoe gasket is arranged between the mandrel and the base portion.

**18 Claims, 6 Drawing Sheets**



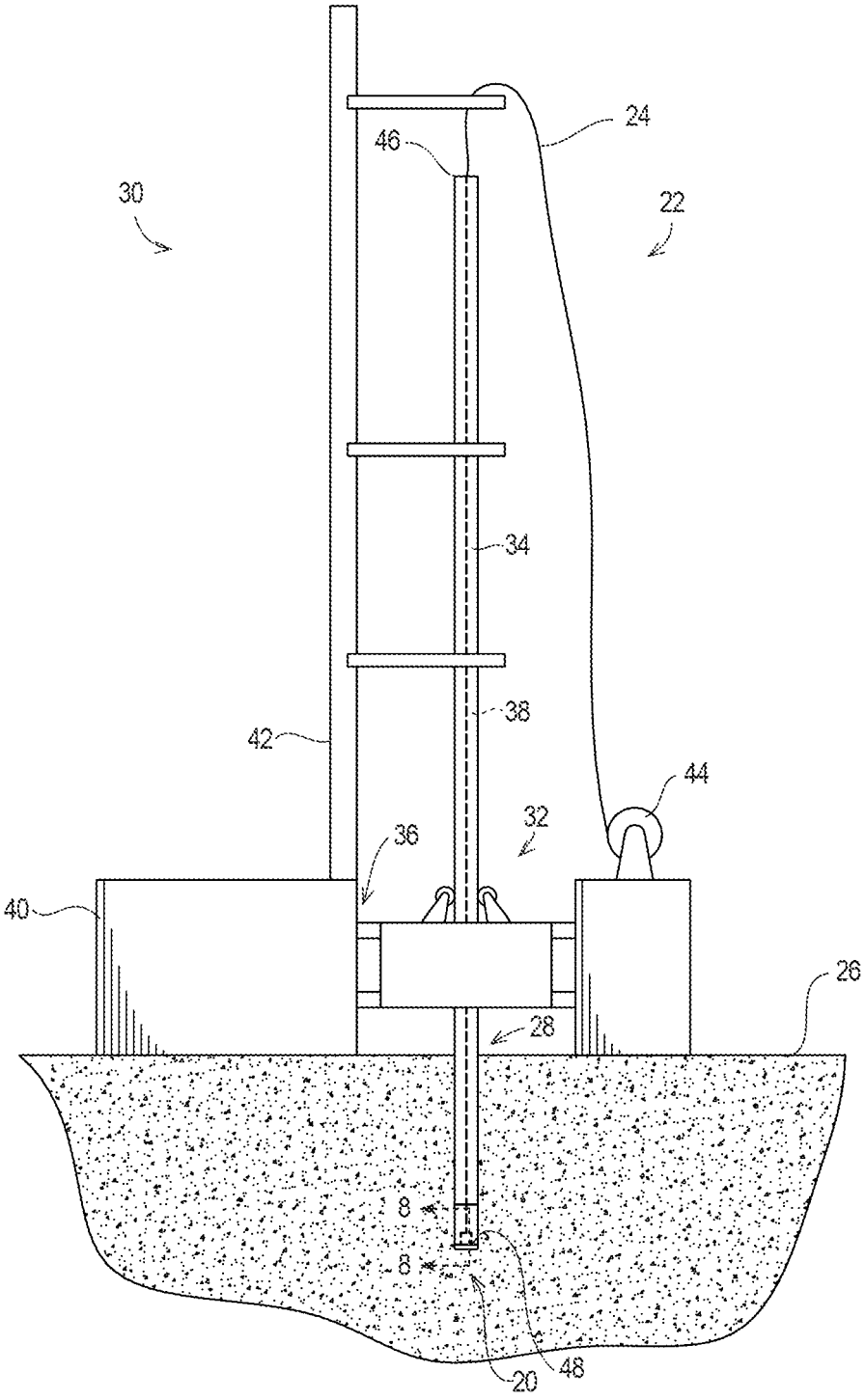



FIG. 1

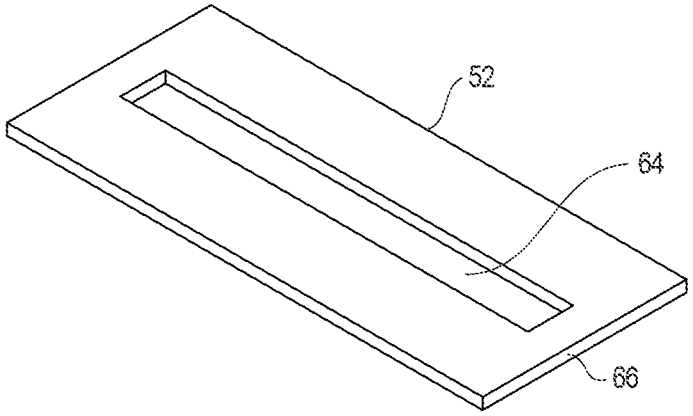



FIG. 2

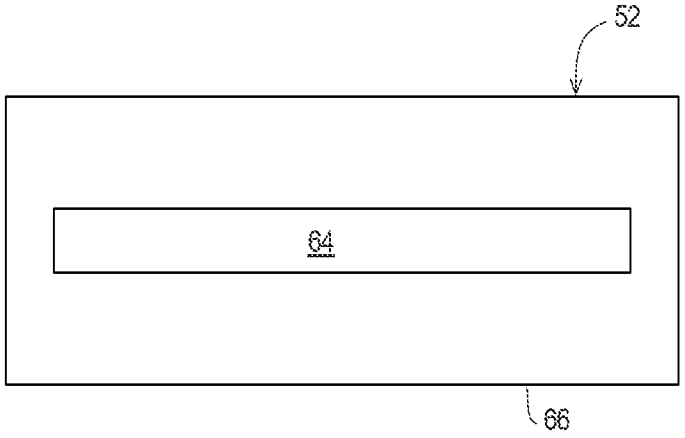



FIG. 3

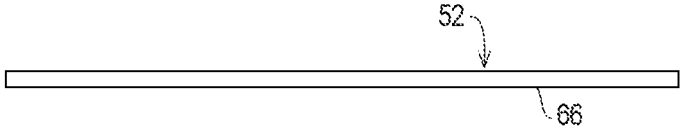



FIG. 4

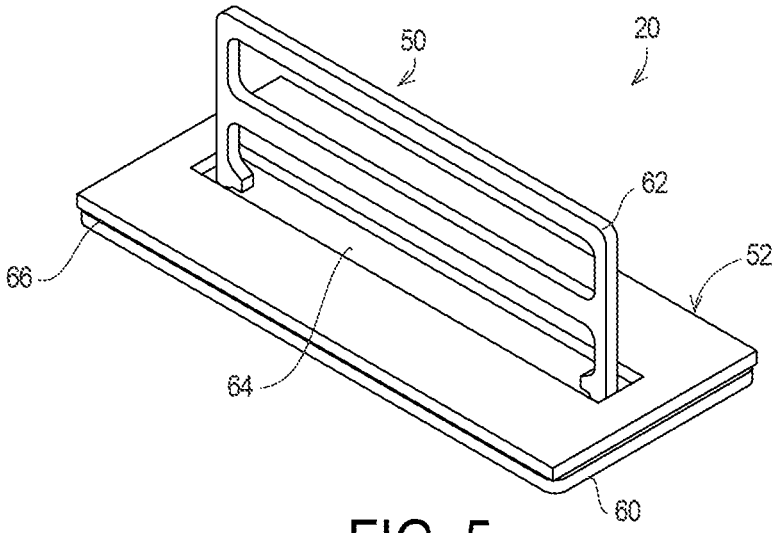



FIG. 5

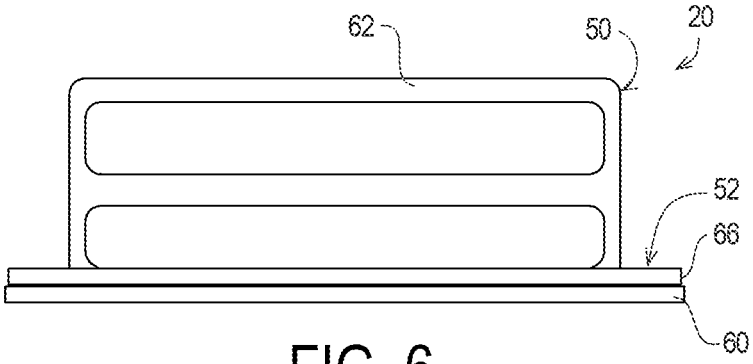



FIG. 6

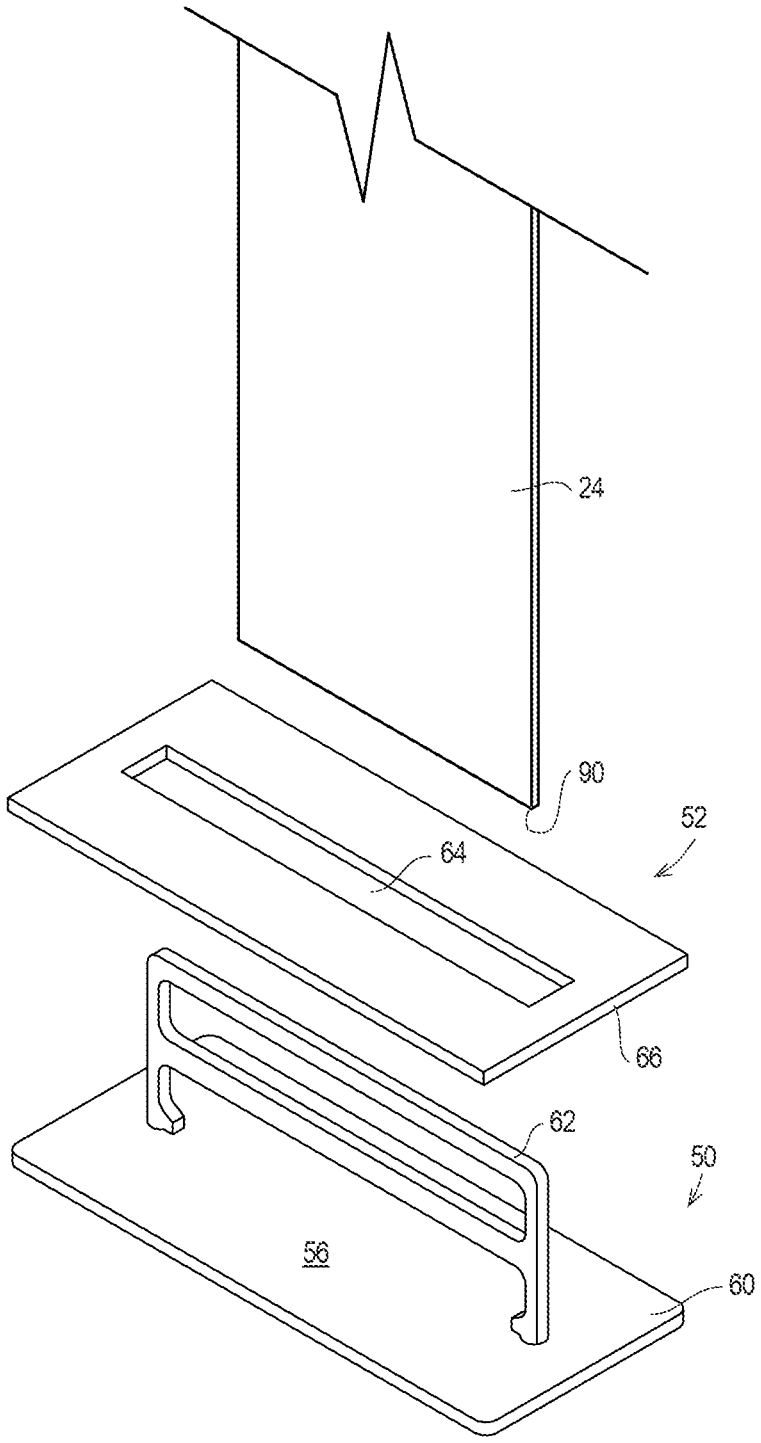
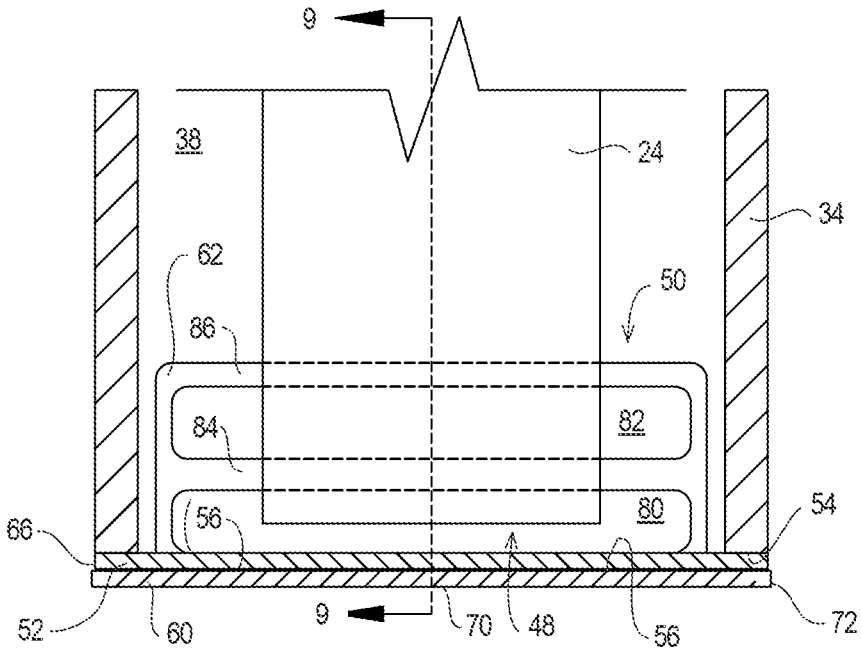



FIG. 7


9
38
24
34
62
50
86
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80
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48
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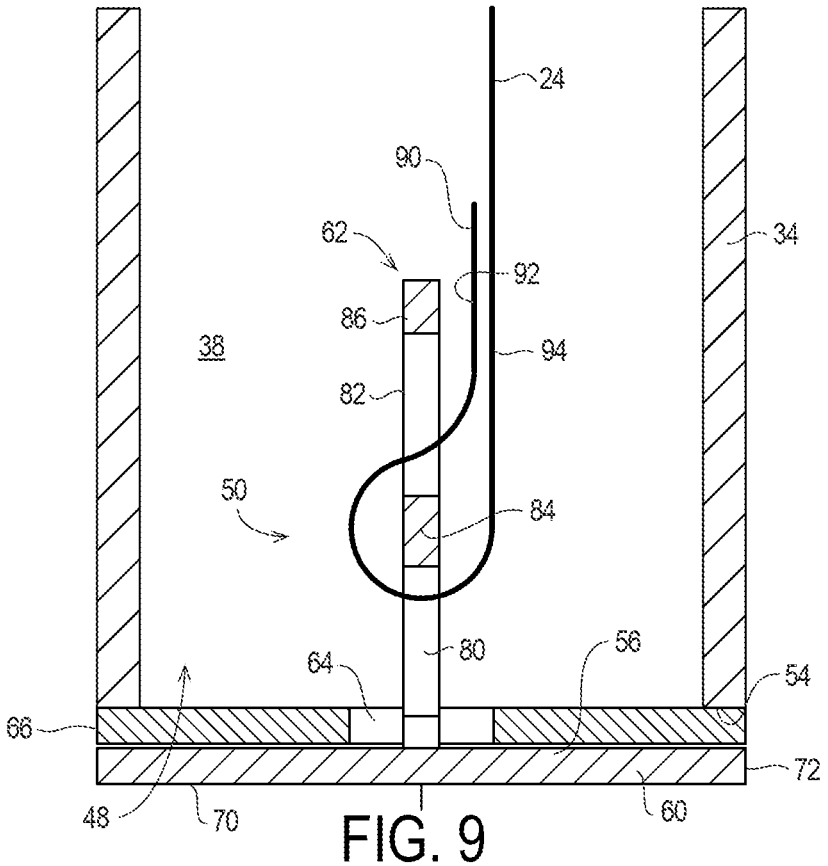
72

FIG. 8


24
90
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48
70
60

FIG. 9

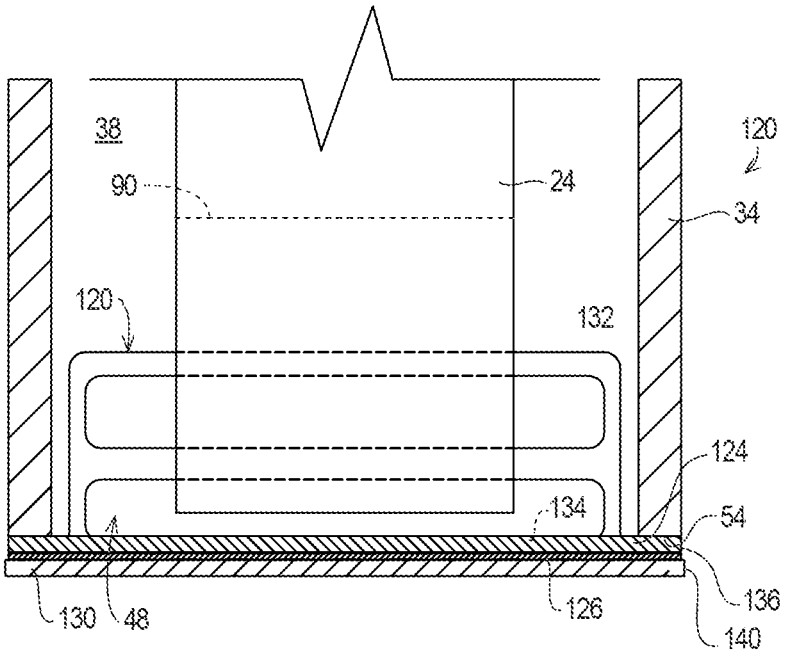
38
90
24
120
34
120
132
124
134
54
136
140
130
48
126

FIG. 10

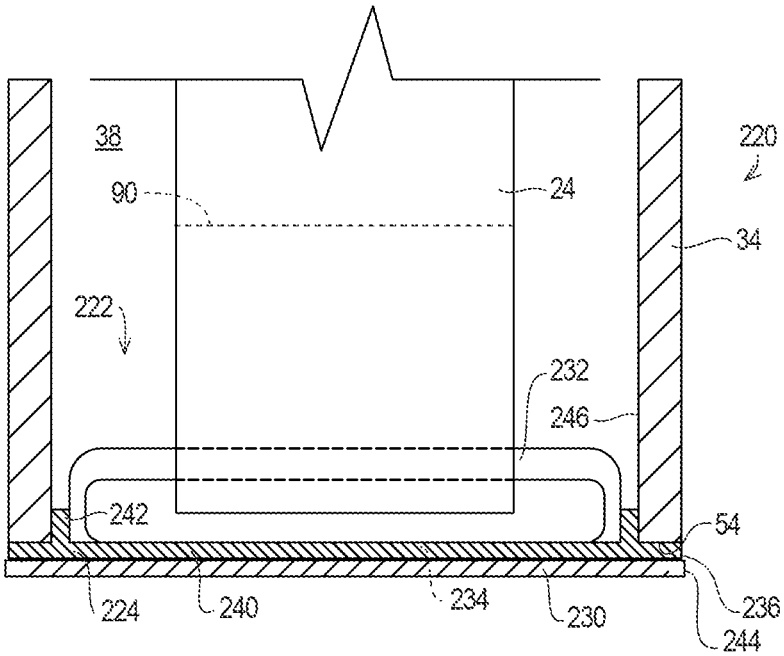
38
90
24
220
34
222
232
246
242
54
224
240
234
230
236
244

FIG. 11

# WICK DRAIN SHOE ASSEMBLIES, SYSTEMS, AND METHODS

## RELATED APPLICATIONS

This application, U.S. patent application Ser. No. 17/217,616, filed Mar. 30, 2021, claims benefit of U.S. Provisional Application Ser. No. 63/069,329 filed Aug. 24, 2020, the contents of which are incorporated herein by reference.

## TECHNICAL FIELD

The present invention relates to methods and apparatus for inserting into the earth and extracting from the earth flexible elongate members and, more particularly, to apparatus and methods for inserting wick drain material into the earth.

## BACKGROUND

For certain construction projects, elongate members such as piles, anchor members, caissons, and mandrels for inserting wick drain material must be placed into and in some cases withdrawn from the earth. It is well-known that, in many cases, such rigid members may be driven into and withdrawn from the earth without prior excavation. The present invention is particularly advantageous when employed to insert a mandrel carrying wick drain material into the earth, and that application will be described in detail herein.

Wick drain material is flexible and thus cannot be directly driven into the earth. Instead, wick drain material is normally arranged at least partly within a rigid mandrel that is driven into the earth. Once the mandrel and wick drain material have been driven into the earth to a desired depth, the mandrel alone is removed from the earth, leaving the wick drain material in place. The wick drain material that is left in place wicks moisture in its vicinity to the surface.

To allow the mandrel to carry the wick drain material into the earth, the wick drain material is secured to a wick drain shoe, and the wick drain shoe is supported by the lower free end of the mandrel such that the driving the mandrel into the earth also drives the wick drain shoe, and the free end of the wick drain material secured thereto, into the earth. When the mandrel is removed, the wick drain shoe and at least a portion of the wick drain material, including the free end thereof are left in the ground.

Under certain soil conditions, soil and/or other debris can enter the mandrel as the mandrel drives the wick drain shoe into the ground. The need exists for improved wick drain shoe assemblies for inserting wick drain material into the ground that reduce or eliminate intrusion of soil and/or other debris into the mandrel.

## SUMMARY

The present invention may be embodied as a wick drain shoe assembly adapted to be connected to a free end of a length of wick drain material and driven by a mandrel of a wick drain insertion system, the wick drain shoe assembly comprising a base portion, an extension portion secured to the base portion, and a wick drain shoe gasket. The wick drain material is connected to the wick drain shoe by securing the free end to the extension portion. The base portion is sized and dimensioned to engage the mandrel such that displacement of the mandrel in a first direction causes displacement of the wick drain shoe in the first direction. The wick drain shoe gasket is arranged between the mandrel and the base portion.

The present invention may also be embodied as a method of inserting wick drain material into the earth comprising the following steps. A wick drain shoe assembly comprising a base portion, an extension portion secured to the base portion, and a wick drain shoe gasket is formed. A free end of the wick drain material is connected to the extension portion of the wick drain shoe assembly. A mandrel is arranged such that the wick drain shoe gasket is between the mandrel and the base portion. The mandrel is displaced to drive the base portion, extension portion, and wick drain material into the earth.

The present invention may also be embodied as a wick drain insertion system configured to drive a free end of a length of wick drain material to a desired depth at a desired location, the wick drain insertion system comprising a support system, a drive system, a mandrel, a suspension system, and a wick drain shoe assembly. The wick drain shoe assembly comprises a base portion, an extension portion secured to the base portion, and a wick drain shoe gasket. The wick drain material is connected to the wick drain shoe by securing the free end to the extension portion. The base portion is sized and dimensioned to engage the mandrel such that displacement of the mandrel in a first direction causes displacement of the wick drain shoe in the first direction. The wick drain shoe gasket is arranged between the mandrel and the base portion.



## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a somewhat schematic side elevation view of an example wick drain insertion system including a first example wick drain shoe of the present invention;

FIG. **2** is a perspective view of a first example wick drain shoe gasket of the present invention;

FIG. **3** is a top plan view of the first example wick drain shoe gasket;

FIG. **4** is a front elevation view of the first example wick drain shoe gasket;

FIG. **5** is a perspective view of a first example wick drain shoe assembly comprising the first example wick drain shoe gasket;

FIG. **6** is a front elevation view of the first example wick drain shoe assembly;

FIG. **7** is an exploded view depicting the formation of the first example wick drain shoe assembly and a first step in a process of connecting wick drain material to the first example wick drain shoe assembly;

FIG. **8** is a front elevation section view taken along lines **8-8** in FIG. **1** illustrating the wick drain material connected to the first example wick drain shoe assembly and the engagement of a mandrel with the first example wick drain shoe assembly;

FIG. **9** is a side elevation section view taken along lines **9-9** in FIG. **8**;

FIG. **10** is a front elevation section view similar to FIG. **8** illustrating wick drain material connected to a second example wick drain shoe assembly and the engagement of a mandrel with the second example wick drain shoe assembly; and

FIG. **11** is a front elevation section view similar to FIG. **8** illustrating wick drain material connected to a third

example wick drain shoe assembly and the engagement of a mandrel with the third example wick drain shoe assembly;

## DETAILED DESCRIPTION

The present invention may be embodied in a number of different forms, and several examples of the present invention will be described in detail below.

## I. FIRST EXAMPLE WICK DRAIN SHOE ASSEMBLY AND FIRST EXAMPLE WICK DRAIN SHOE GASKET

Referring initially to FIG. **1** of the drawing, depicted therein is a first example wick drain shoe assembly **20** used with a wick drain insertion system **22** to insert wick drain material **24** into the ground **26** at a desired location **28**.

The example wick drain insertion system **22** is or may be conventional and comprises a support system **30**, a drive system **32**, a mandrel **34**, and a suspension system **36**. The example mandrel defines a mandrel cavity **38**. The example support system **30** comprises a support base **40** and a support mast **42**. In the example wick drain system **22**, at least a portion of the wick drain material **24** is supported on a reel **44** mounted on the support base **40**. Support systems, drive systems, mandrels, and suspension systems other than those described may be used in addition or instead.

The wick drain material **24** extends from the reel **44**, into the mandrel cavity **38** through a mandrel upper end opening **46**, and through the mandrel cavity **38** to the first example wick drain shoe **20** at a mandrel lower end opening **48**. The example drive system **32** is supported by the example support base **40** such that the drive system **32** is arranged above the desired location **28**. The example drive system **32** is configured to drive the mandrel **34** into the ground **26** at the desired location **28**. The example suspension system **36** may be configured to support the drive system **32** relative to the support system **30**.

FIGS. **5** and **6** illustrate that the example wick drain shoe assembly **20** comprises a wick drain shoe **50** and a wick drain shoe gasket **52**. As shown in FIG. **8**, the wick drain shoe gasket **52** is arranged between a mandrel lower edge **54** defining the mandrel lower end opening **48** and a drive surface **56** defined by the wick drain shoe **50**. As the mandrel **34** drives the first example wick drain shoe assembly **20** into the ground, the wick drain shoe gasket **52** is held between the mandrel lower edge **54** and the drive surface **56** such that the wick drain shoe gasket **52** inhibits passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48**.

Given the foregoing understanding of the basic construction and operation of the present invention, the details of construction and use of the first example wick drain shoe assembly **20** will now be described in further detail.

As perhaps best shown in FIG. **7**, the first example wick drain shoe **50** comprises a base portion **60** and an extension portion **62**, and FIGS. **2**, **3**, and **7** illustrate that the first example wick drain shoe gasket **52** defines a gasket opening **64** and a gasket perimeter edge **66**. The example base portion **60** is a plate defining a base lower surface **70**, the drive surface **56**, and a base perimeter edge **72**. The example extension portion **62** is a plate defining first and second shoe openings **80** and **82**. The extension portion **62** further defines an anchor portion **84** and a bearing portion **86**. The example extension portion **62** is connected to the base portion **60** by welding or the like such that displacement of the base portion **60** is transmitted to the extension portion **62** during normal use of the wick drain shoe assembly **20**.

FIGS. **7-9** illustrate that the wick drain shoe assembly **20** is formed by displacing the wick drain shoe gasket **52** such that the extension portion **62** extends through the gasket opening **64** and the wick drain shoe gasket **52** lies on the drive surface **56** of the base portion **60**. Further, the example gasket perimeter edge **66** is substantially aligned with the base perimeter edge **72** as shown by FIGS. **8** and **9**.

FIGS. **8** and **9** illustrate that the extension portion **62** of the first example wick drain shoe assembly **20** extends into the mandrel cavity **38** through the mandrel lower opening **48**. FIGS. **8** and **9** also illustrate that the base portion **60** of the first example wick drain shoe assembly **20** and the mandrel **34** are configured such that, with the first example wick drain shoe assembly **20** in a drive configuration relative to the mandrel **34**, downward forces on the mandrel **34** are transmitted to the first example wick drain shoe assembly **20** and a free end **90** of the wick drain material **24** connected thereto. These downward forces further place the wick drain material **24** in tension, thereby securing the free end **54** of the wick drain material **24** relative to the first example wick drain shoe assembly **20** as describe above.

More specifically, FIG. **9** perhaps best illustrates that the free end **90** of the wick drain material **24** is passed through the first shoe opening **80** and then through the second shoe opening **82** such that the wick drain material **24** loops around the anchor portion **84** and such that at least a first portion **92** of the wick drain material **24** is between the bearing portion **58** and a second portion **94** of the wick drain material **24**. Tension on the wick drain material **24** effectively clamps the first portion **92** of the wick drain material **24** between second portion **92** of the wick drain material and the bearing portion **86**. At that point, friction inhibits movement of the free end **90** relative to the first example wick drain shoe assembly **20** and thus the free end **90** is carried with the first example wick drain shoe assembly **20** when the example wick drain shoe assembly **20** is displaced by the mandrel **34**.

The base lower surface **70** is configured to engage the soil at the desired location **28** to allow the first example wick drain shoe assembly **20** to be driven into the ground **26** using the mandrel **34**. Accordingly, the shape of the base perimeter edge **74** and of the mandrel **34** will be configured to match each other and to suit soil conditions at the desired location **28**.

Any material capable of forming a seal appropriate to inhibit passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48** and maintaining that seal while the wick drawing shoe assembly **20** is driven to the desired depth may be used to form the wick drain gasket **52**. For example, the example wick drain gasket **52** may be made of a compressible material that allows the wick drain gasket **52** to deform or compress slightly when the mandrel lower edge **54** is held or forced into contact with the wick drain gasket **52**.

## II. SECOND EXAMPLE WICK DRAIN SHOE ASSEMBLY AND SECOND EXAMPLE WICK DRAIN SHOE GASKET

Referring now to FIG. **10** of the drawing, depicted therein is a second example wick drain shoe assembly **120** constructed in accordance with, and embodying, the principles of the present invention. The second example wick drain shoe assembly **120** is used with a wick drain insertion system such as the wick drain insertion system **22** described

above to insert wick drain material **24** into the ground as described above with respect to the first example wick drain shoe assembly **20**.

The second example wick drain shoe assembly **120** comprises a wick drain shoe **122**, a wick drain shoe gasket **124**, and an adhesive layer **126**. The example wick drain shoe **122** is similar to the example wick drain shoe **50** described above and comprises a base portion **130** and an extension portion **132**. Like the example wick drain shoe gasket **52** described above, the example wick drain shoe gasket **124** defines a gasket opening **134** and a gasket perimeter edge **136**. The example adhesive layer **126** is arranged to secure the wick drain shoe gasket **124** in place relative to the wick drain shoe **122**. As shown in FIG. **10**, the gasket perimeter edge **136** is adjacent to a base perimeter edge **140** of the base portion **130**.

The example wick drain shoe **122** is or may be secured to the wick drain material **24** in generally the same manner as described above with reference to the first example wick drain shoe assembly **20**. Also as described above with reference to the first example wick drain shoe **20**, the wick drain mandrel **34** is arranged relative to the example wick drain shoe **122** such that downward displacement of the wick drain mandrel **34** downwardly displaces the base portion **130**, the extension portion **132**, and the free end **90** of the wick drain material **34**.

Accordingly, as shown in FIG. **10**, the wick drain mandrel **34** engages the wick drain shoe gasket **124** when driving the wick drain shoe assembly **120** into the ground. As the mandrel **34** drives the second example wick drain shoe assembly **120** into the ground, the second example wick drain shoe gasket **122** is held between the mandrel lower edge **54** and the base portion **130** such that the wick drain shoe gasket **122** inhibits passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48**.

Any material capable of forming a seal appropriate to inhibit passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48** and maintaining that seal while the wick drawing shoe assembly **120** is driven to the desired depth may be used to form the wick drain gasket **124**. For example, the example wick drain gasket **124** may be made of a compressible material that allows the wick drain gasket **124** to deform or compress slightly when the mandrel lower edge **54** is held or forced into contact with the wick drain gasket **124**.

## III. THIRD EXAMPLE WICK DRAIN SHOE ASSEMBLY AND THIRD EXAMPLE WICK DRAIN SHOE GASKET

Referring now to FIG. **11** of the drawing, depicted therein is a third example wick drain shoe assembly **220** constructed in accordance with, and embodying, the principles of the present invention. The third example wick drain shoe assembly **220** is used with a wick drain insertion system such as the wick drain insertion system **22** described above to insert wick drain material **24** into the ground as described above with respect to the first example wick drain shoe assembly **20**.

The third example wick drain shoe assembly **220** comprises a wick drain shoe **222** and a wick drain shoe gasket **224**. The example wick drain shoe **222** is similar to the example wick drain shoe **50** described above and comprises a base portion **230** and an extension portion **232**. Like the example wick drain shoe gasket **52** described above, the example wick drain shoe gasket **224** defines a gasket opening **234** and a gasket perimeter edge **236**.

The second example wick drain shoe gasket **224** further defines a main portion **240** and a projection portion **242**. The main portion **240** is substantially planar, while the projection portion **242** is sized and dimensioned to be snugly received within the mandrel cavity **38**. The main portion **240** of the third example wick drain shoe gasket **224** is arranged relative to base portion **230** such that the projection portion **242** extends from the main portion **240** away from the base portion **230**. As shown in FIG. **11**, the gasket perimeter edge **236** is adjacent to a base perimeter edge **244** of the base portion **230**.

The example wick drain shoe **222** is or may be conventionally secured to the wick drain material **24**. And as described above with reference to the first example wick drain shoe **20** and second example wick drain shoe **120**, the wick drain mandrel **34** is arranged relative to the third example wick drain shoe **222** such that downward displacement of the wick drain mandrel **34** downwardly displaces the base portion **230**, the extension portion **232**, and the free end **90** of the wick drain material **34**.

FIG. **11** also shows that the wick drain mandrel **34** engages the wick drain shoe gasket **224** when driving the wick drain shoe assembly **220** into the ground. In particular, as the mandrel **34** drives the third example wick drain shoe assembly **220** into the ground, the third example wick drain shoe gasket **222** is held between the mandrel lower edge **54** and the base portion **230** such that the wick drain shoe gasket **222** inhibits passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48**. The projection portion **242** of the third example wick drain shoe gasket **224** extends up along an inner surface **246** of the mandrel and into mandrel cavity **38** through the mandrel lower end opening **48** to create greater surface area between the wick drain mandrel **34** and the wick drain shoe gasket **224**. The increased overlap between the surface of the wick drain shoe gasket **224** and the inner surface **246** of the mandrel enhances an ability of the wick drain shoe gasket **222** to inhibit passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48**.

Any material capable of forming a seal appropriate to inhibit passage of dirt and debris into the mandrel cavity **38** through the mandrel lower end opening **48** and maintaining that seal while the wick drawing shoe assembly **220** is driven to the desired depth may be used to form the wick drain gasket **224**. For example, the example wick drain gasket **224** may be made of a compressible material that allows the wick drain gasket **224** to deform or compress slightly when the mandrel lower edge **54** is held or forced into contact with the wick drain gasket **224**.

## IV. ADDITIONAL CONSIDERATIONS

Multiple styles or types of wick drain shoes can be combined with a wick drain shoe gasket, such as the wick drain shoe gaskets **20**, **120**, and **220** described above, to form a wick drain shoe assembly of the present invention. For example, co-pending U.S. Provisional Patent Application Ser. No. 63/056,437 describes a number of wick drain shoes similar to the wick drain shoes **50** and **122** that may be combined with a wick drain shoe gasket such as the example wick drain shoe gaskets **20**, **120**, and **220** described herein. In addition, any of the wick drain shoe gaskets **20**, **120**, and **220** described herein may be combined with a conventional wick drain shoe such as the example wick drain shoe **222** described herein.

Further, an adhesive layer such as the adhesive layer **126** may be used with the first example wick drain shoe assembly **20**, the third example wick drain shoe assembly **220**, or any of the other wick drain shoes depicted in co-pending U.S. Provisional Patent Application Ser. No. 63/056,437.

What is claimed is:

**1**. A wick drain shoe assembly adapted to be connected to a free end of a length of wick drain material and driven by a mandrel of a wick drain insertion system, the wick drain shoe assembly comprising:

a base portion;

an extension portion secured to the base portion; and

a wick drain shoe gasket made of compressible material; wherein

the wick drain material is connected to the wick drain shoe by securing the free end to the extension portion;

the wick drain shoe gasket is supported by the base portion;

the base portion is sized and dimensioned such that displacement of the mandrel in a first direction applies a force to the base portion through the wick drain shoe gasket to displace the wick drain shoe in the first direction;

the wick drain shoe gasket is sized, dimensioned, and arranged between the mandrel and the base portion such that, when the wick drain shoe is displaced in the first direction, passage of dirt and debris between the wick drain mandrel and the base portion is substantially inhibited; and

after removal of the mandrel, the wick drain shoe assembly and at least portion of the wick drain material remain in the earth.

**2**. A wick drain shoe assembly as recited in claim **1**, in which:

the mandrel defines a mandrel lower edge; and

the mandrel lower edge is configured to engage the wick drain shoe gasket.

**3**. A wick drain shoe assembly as recited in claim **1**, in which:

the mandrel defines a mandrel cavity and a mandrel lower end opening; and

the wick drain shoe gasket is configured to inhibit passage of dirt and debris into the mandrel cavity through the mandrel lower end opening.

**4**. A wick drain shoe assembly as recited in claim **1**, in which:

the mandrel defines a mandrel cavity, a mandrel lower end opening, and mandrel lower edge, where the mandrel lower edge extends around the mandrel lower edge opening; and

the wick drain shoe gasket is configured to inhibit passage of dirt and debris into the mandrel cavity through the mandrel lower end opening.

**5**. A wick drain shoe assembly as recited in claim **1**, in which:

the base portion defines a base perimeter edge;

the wick drain shoe gasket defines a gasket perimeter edge; and

the gasket perimeter edge is substantially aligned with the base perimeter edge during displacement of the wick drain shoe in the first direction.

**6**. A wick drain shoe assembly as recited in claim **1**, in which:

the mandrel defines a mandrel lower edge;

the base portion defines a base perimeter edge;

the wick drain shoe gasket defines a gasket perimeter edge; and

the mandrel lower edge, the gasket perimeter edge, and the base perimeter edge are substantially aligned during displacement of the wick drain shoe in the first direction.

**7**. A method of inserting wick drain material into the earth, comprising the steps of:

forming a wick drain shoe assembly comprising

a base portion,

an extension portion secured to the base portion, and

a wick drain shoe gasket made of compressible material;

connecting a free end of the wick drain material to the extension portion of the wick drain shoe assembly;

arranging a mandrel such that the wick drain shoe gasket is between the mandrel and the base portion;

displacing the mandrel in a first direction such that the mandrel engages the wick drain shoe gasket such that a force is applied to the base portion through the wick drain shoe gasket to drive the base portion, extension portion, and wick drain material into the earth; and

removing the mandrel such that the wick drain shoe assembly and at least portion of the wick drain material remain in the earth.

**8**. A method as recited in claim **7**, in which the mandrel defines a mandrel lower edge, the method further comprising the step of configuring the mandrel lower edge to engage the wick drain shoe gasket.

**9**. A method as recited in claim **7**, in which the mandrel defines a mandrel cavity and a mandrel lower end opening, the method further comprising the step of configuring the wick drain shoe gasket to inhibit passage of dirt and debris into the mandrel cavity through the mandrel lower end opening.

**10**. A method as recited in claim **7**, in which the mandrel defines a mandrel cavity, a mandrel lower end opening, and mandrel lower edge, where the mandrel lower edge extends around the mandrel lower edge opening, the method further comprising the step of configuring the wick drain shoe gasket to inhibit passage of dirt and debris into the mandrel cavity through the mandrel lower end opening.

**11**. A method as recited in claim **7**, in which:

the step of forming the wick drain shoe assembly comprises the steps of

defining a base perimeter edge on the base portion, and

defining a gasket perimeter edge on the wick drain shoe gasket; and

the step of arranging the mandrel comprises the step of substantially aligning the gasket perimeter edge with the base perimeter edge.

**12**. A method as recited in claim **7**, in which the mandrel defines a mandrel lower edge, where:

the step of forming the wick drain shoe assembly comprises the steps of

defining a base perimeter edge on the base portion, and

defining a gasket perimeter edge on the wick drain shoe gasket; and

the step of arranging the mandrel comprises the step of substantially aligning the gasket perimeter edge with the base perimeter edge.

**13**. A wick drain insertion system configured to drive a free end of a length of wick drain material to a desired depth at a desired location, the wick drain insertion system comprising

a support system;

a drive system;

a mandrel;

a suspension system; and

a wick drain shoe assembly comprising:

a base portion,

an extension portion secured to the base portion, and

a wick drain shoe gasket made of compressible material;

wherein

the wick drain shoe gasket is supported by the base portion;

the wick drain material is connected to the wick drain shoe by securing the free end to the extension portion;

the base portion is sized and dimensioned to such that displacement of the mandrel in a first direction applies a force to the base portion through the wick drain shoe gasket to displace the wick drain shoe in the first direction; and

the wick drain shoe gasket is sized, dimensioned, and arranged between the mandrel and the base portion such that, when the wick drain shoe is displaced in the first direction, passage of dirt and debris between the wick drain mandrel and the base portion is substantially inhibited; and

after removal of the mandrel, the wick drain shoe assembly and at least portion of the wick drain material remain in the earth.

**14**. A wick drain insertion system as recited in claim **13**, in which:

the mandrel defines a mandrel lower edge; and

the mandrel lower edge is configured to engage the wick drain shoe gasket.

**15**. A wick drain insertion system as recited in claim **13**, in which:

the mandrel defines a mandrel cavity and a mandrel lower end opening; and

the wick drain shoe gasket is configured to inhibit passage of dirt and debris into the mandrel cavity through the mandrel lower end opening.

**16**. A wick drain insertion system as recited in claim **13**, in which:

the mandrel defines a mandrel cavity, a mandrel lower end opening, and mandrel lower edge, where the mandrel lower edge extends around the mandrel lower edge opening; and

the wick drain shoe gasket is configured to inhibit passage of dirt and debris into the mandrel cavity through the mandrel lower end opening.

**17**. A wick drain insertion system as recited in claim **13**, in which:

the base portion defines a base perimeter edge;

the wick drain shoe gasket defines a gasket perimeter edge; and

the gasket perimeter edge is substantially aligned with the base perimeter edge during displacement of the wick drain shoe in the first direction.

**18**. A wick drain insertion system as recited in claim **13**, in which:

the mandrel defines a mandrel lower edge;

the base portion defines a base perimeter edge;

the wick drain shoe gasket defines a gasket perimeter edge; and

the mandrel lower edge, the gasket perimeter edge, and the base perimeter edge are substantially aligned during displacement of the wick drain shoe in the first direction.

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