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LaMora, Jr.

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(54) **ADJUSTABLE DEBRIS COLLECTION APPARATUS FOR MARITIME VESSELS AND ASSOCIATED METHODS**

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(73) Assignee: **Marine Environmental Remediation Group, LLC**

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B63B 35/32 (2006.01)
E02B 15/10 (2006.01)
E02B 15/08 (2006.01)

(52) **U.S. Cl.**
CPC ***E02B 15/10*** (2013.01); ***B63B 35/32*** (2013.01); ***E02B 15/085*** (2013.01)

(58) **Field of Classification Search**
CPC E02B 15/10; E04G 21/3261
See application file for complete search history.

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Primary Examiner — Edwin Swinehart
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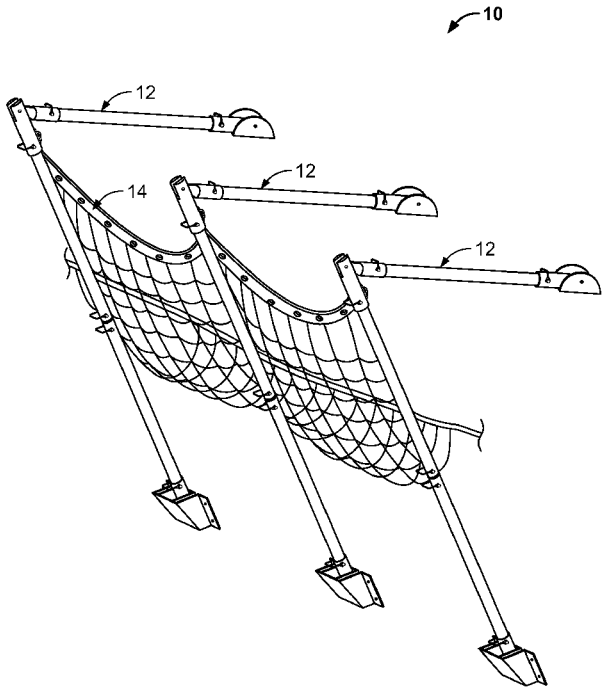
(57) **ABSTRACT**

A debris collection apparatus for a maritime vessel includes a shroud and a plurality of support structures. Each of the plurality support structures include a boot defining a cavity and configured to be secured to the vessel, a foot sized to fit within the cavity and including a frame having a rotatably mounted first universal swivel, a staff cap including a staff cap terminal having a rotatably mounted second universal swivel rotatably, a stabilizer base configured to be secured to the vessel and including a body having a rotatably mounted third universal swivel, an elevational staff section removably connected to the first universal swivel and staff cap terminal, and a horizontal staff section removably connected to the second and third universal swivels. The foot is inserted into the boot to secure the support structures in a rigid position, and the shroud is connected to both staff caps and the vessel.

19 Claims, 17 Drawing Sheets



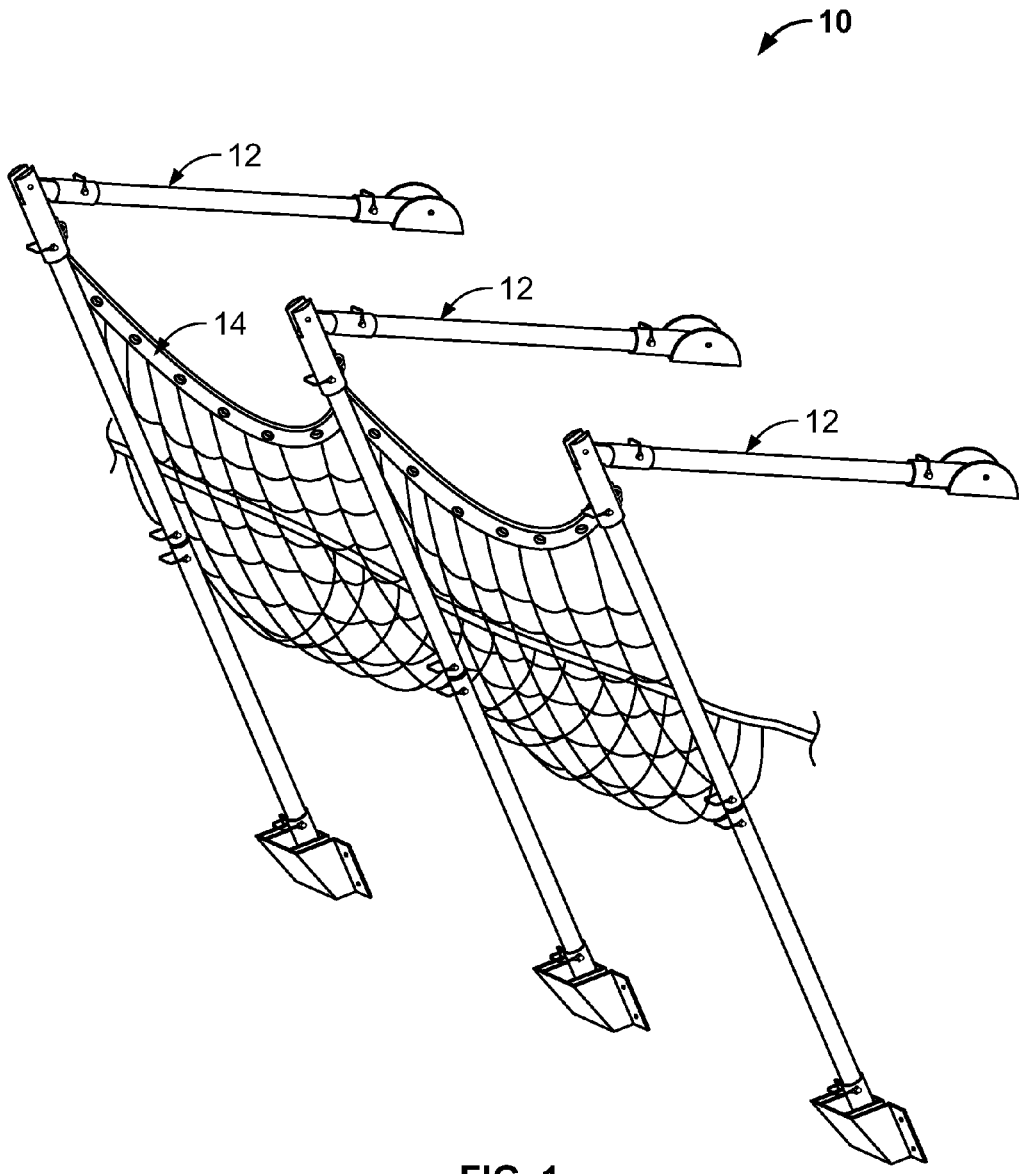


FIG. 1

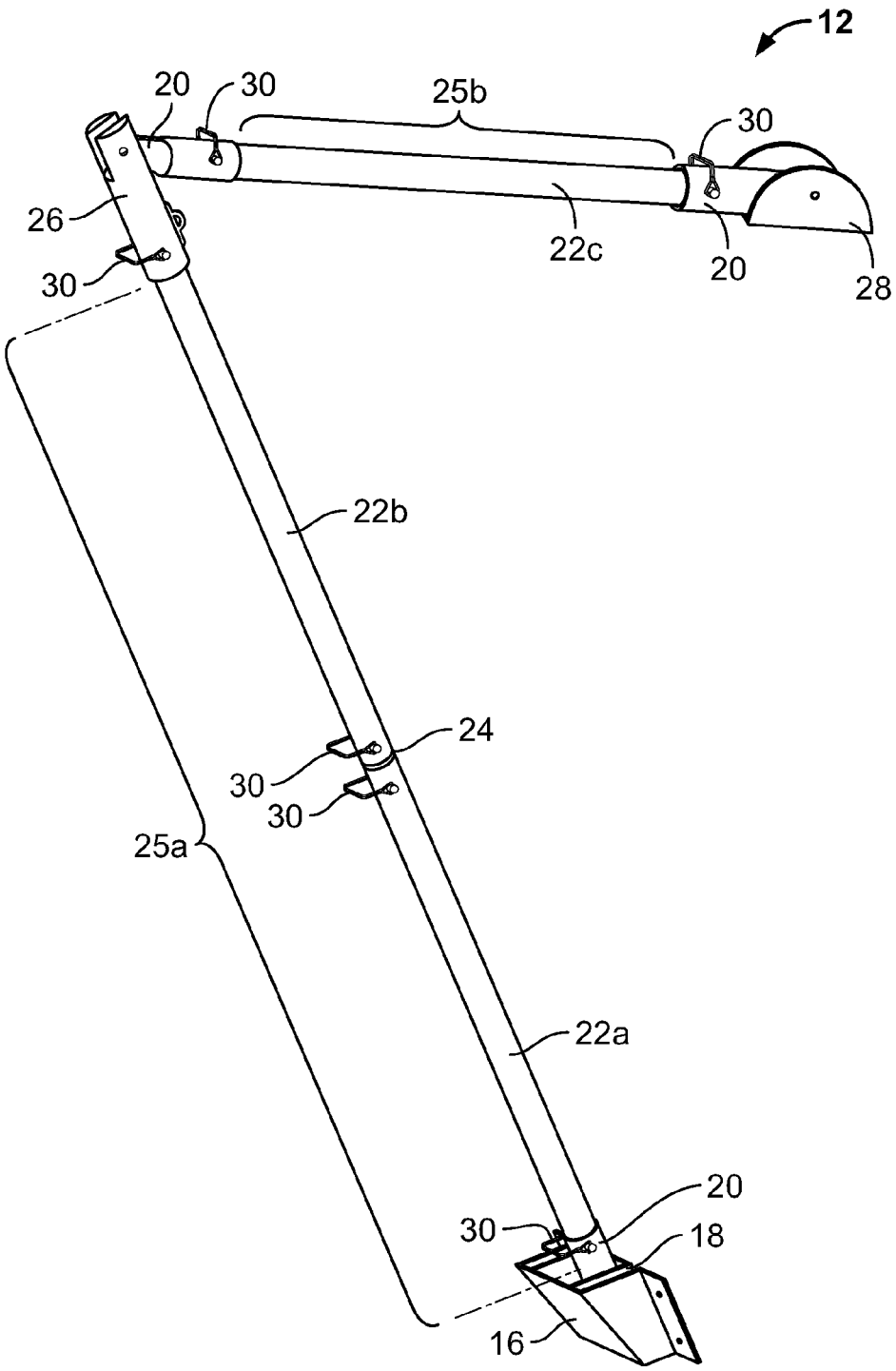


FIG. 2

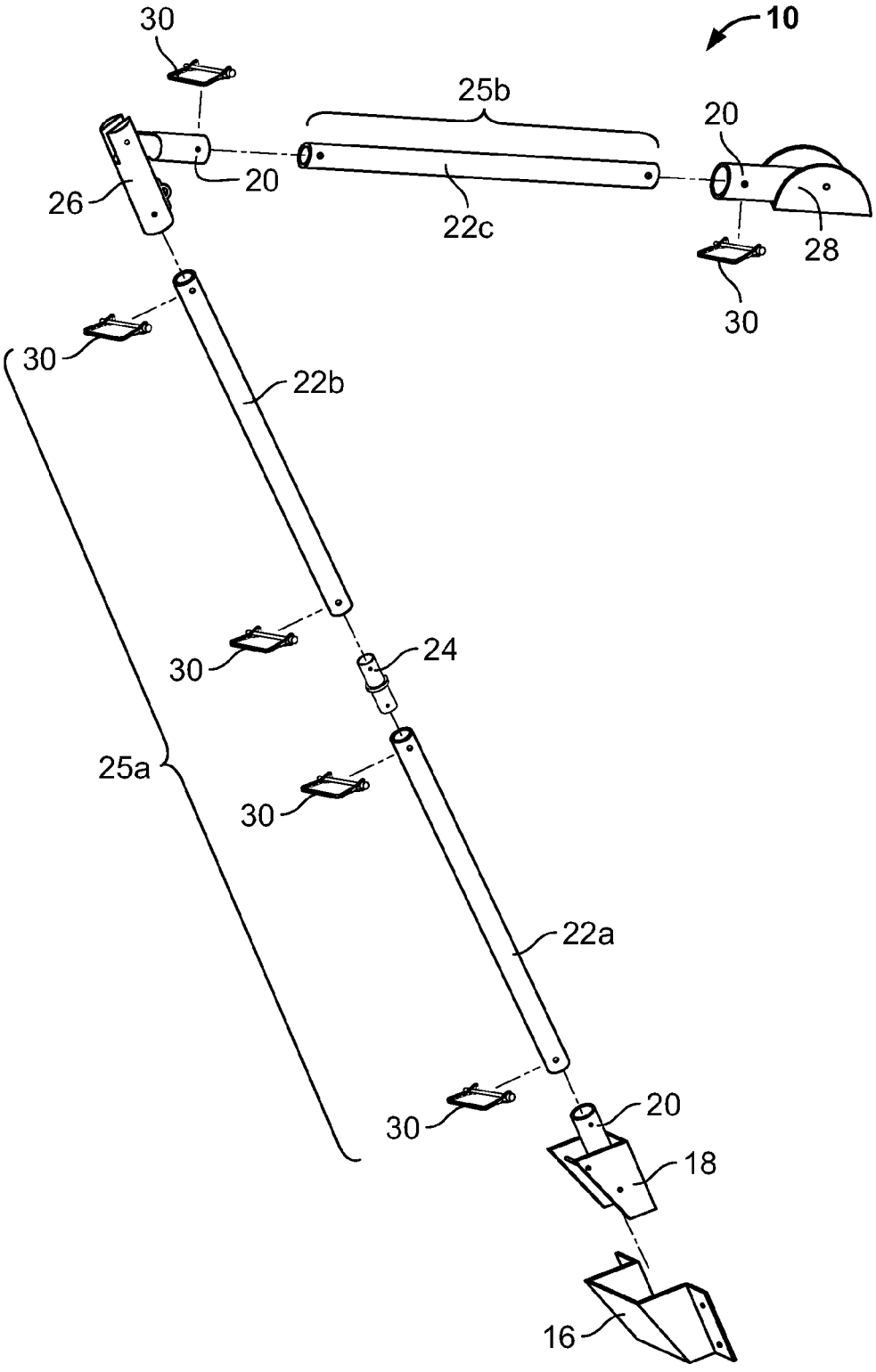


FIG. 3

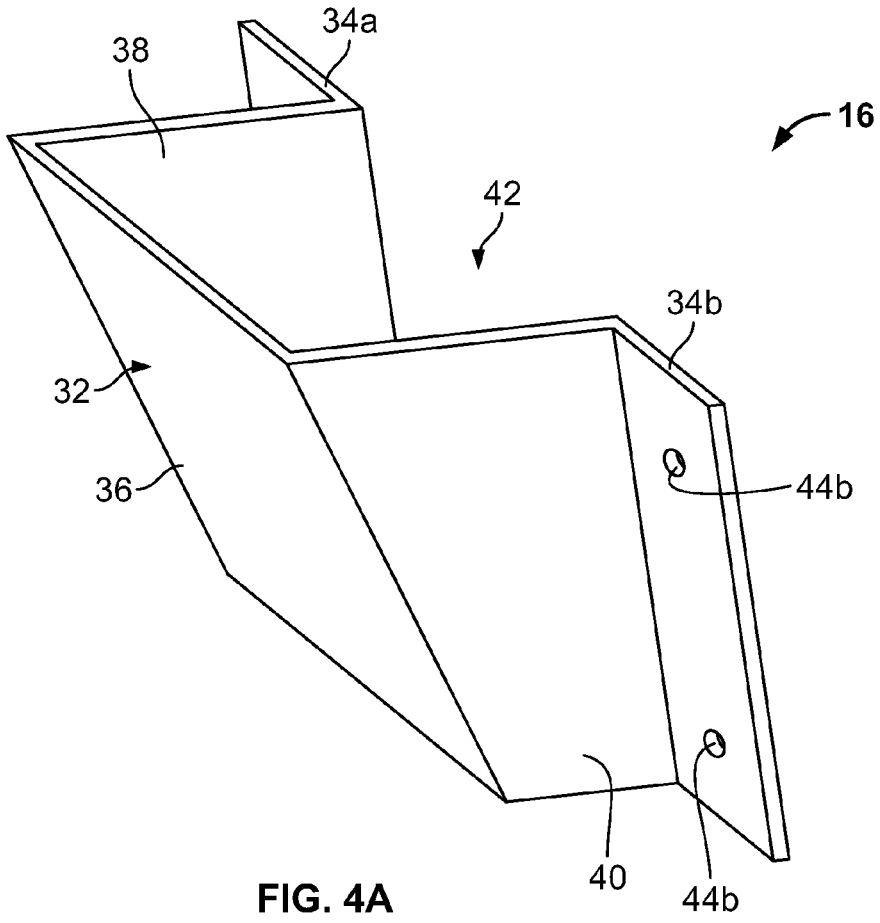


FIG. 4A

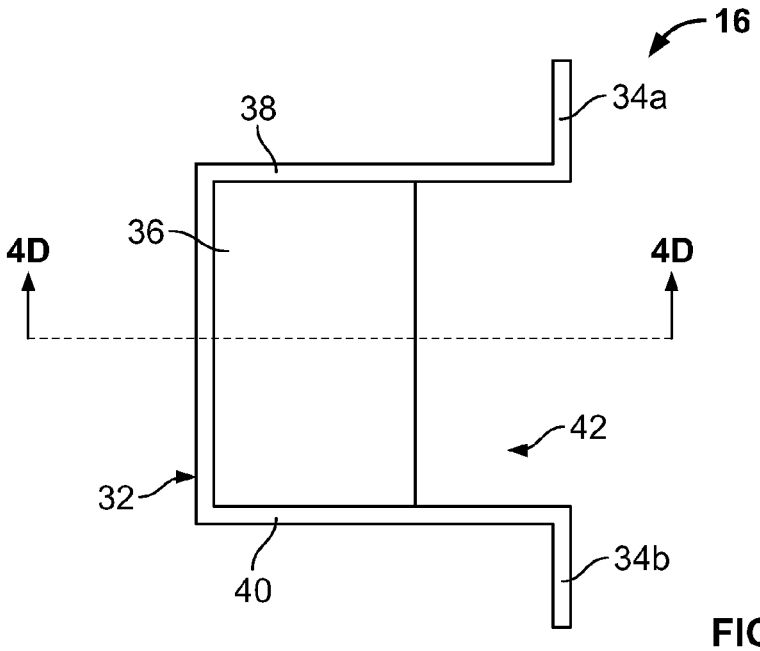


FIG. 4B

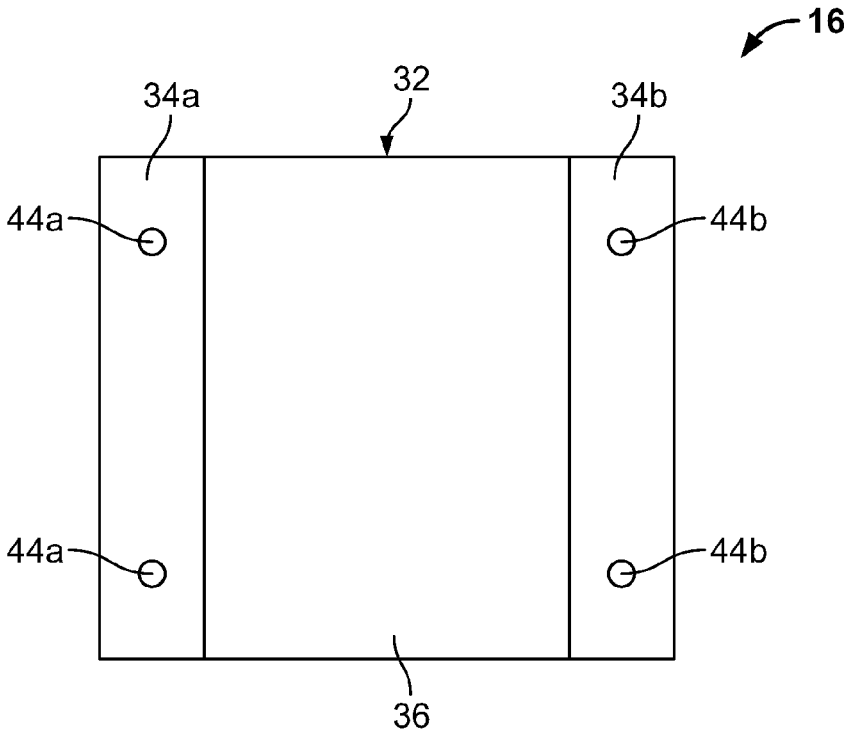


FIG. 4C

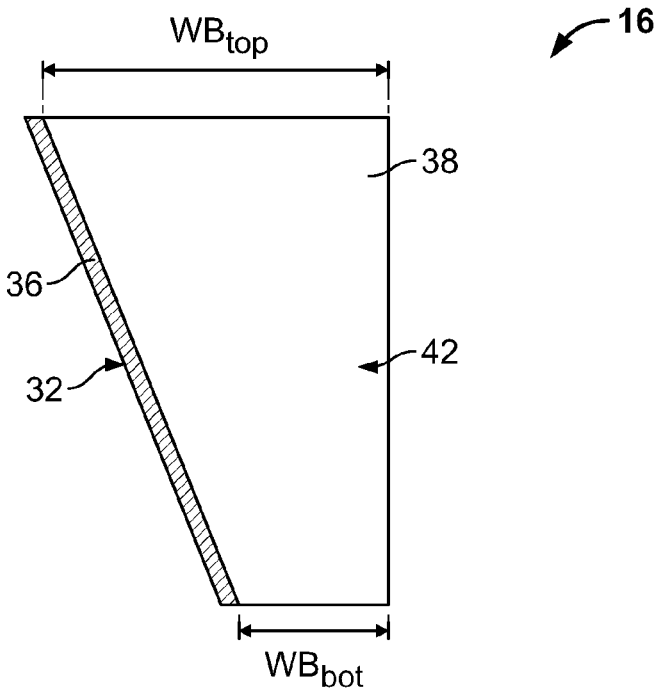


FIG. 4D

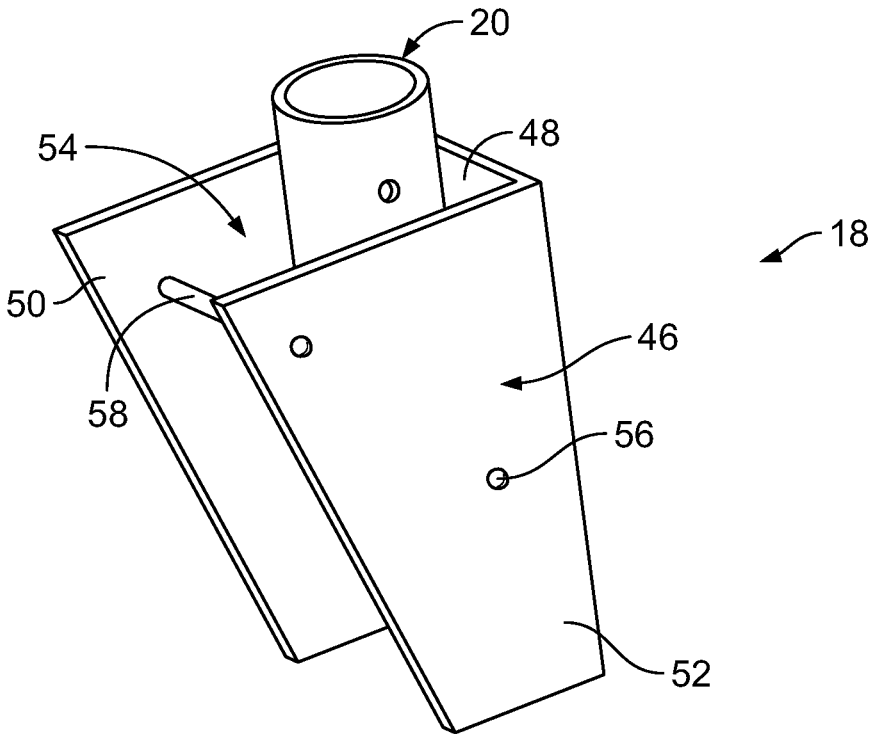


FIG. 5A

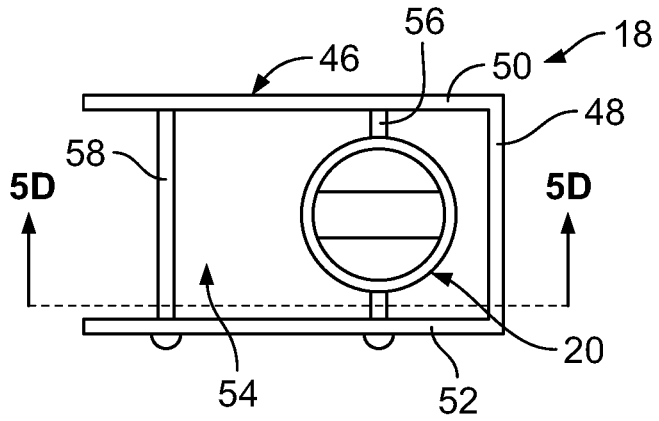


FIG. 5B

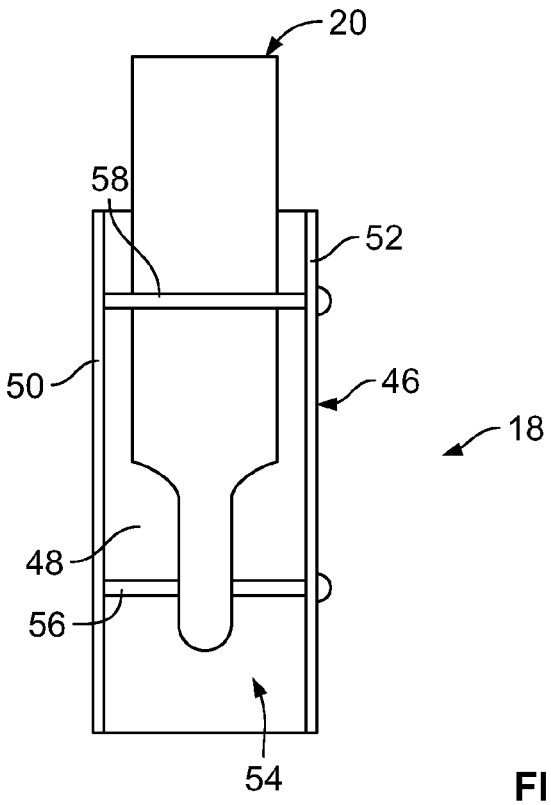


FIG. 5C

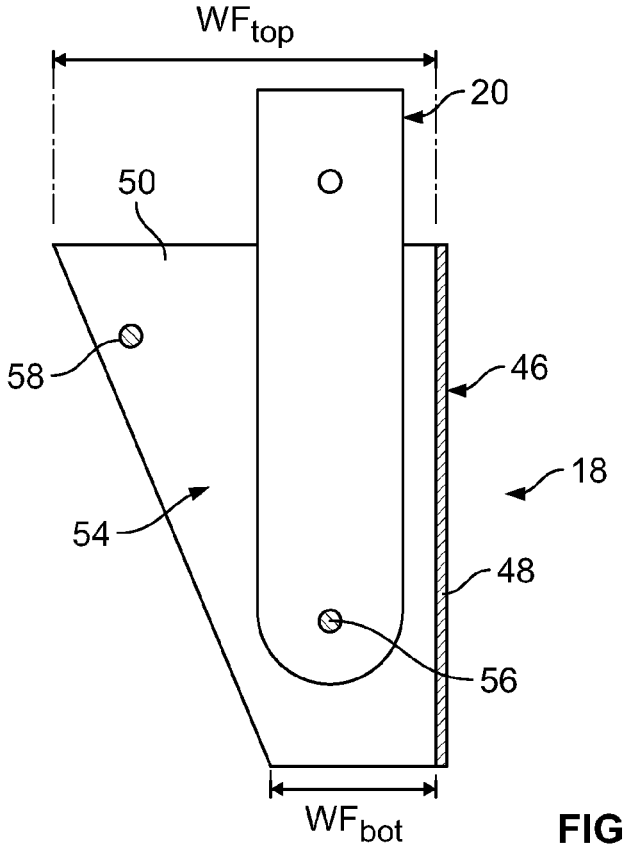


FIG. 5D

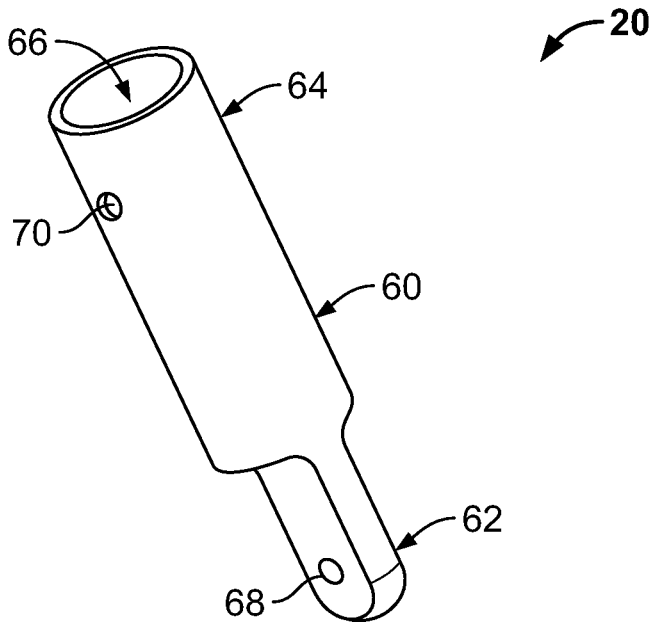


FIG. 6A

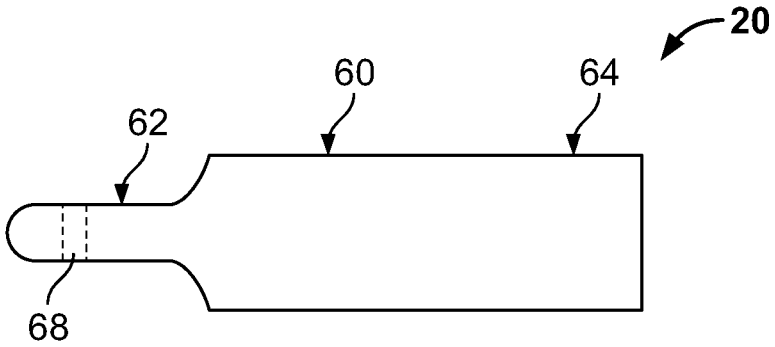


FIG. 6B

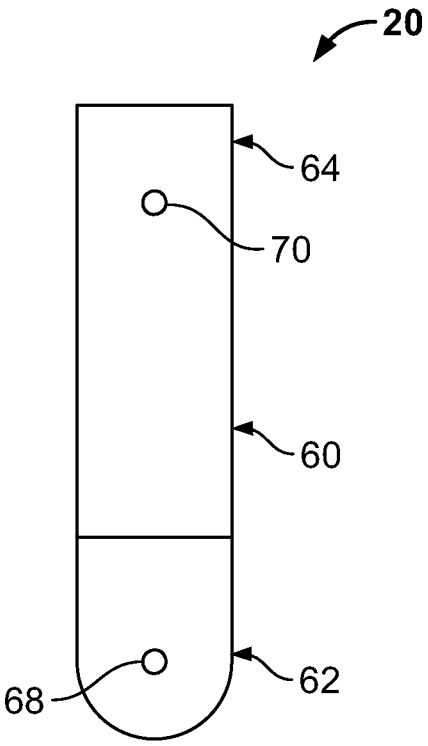


FIG. 6C

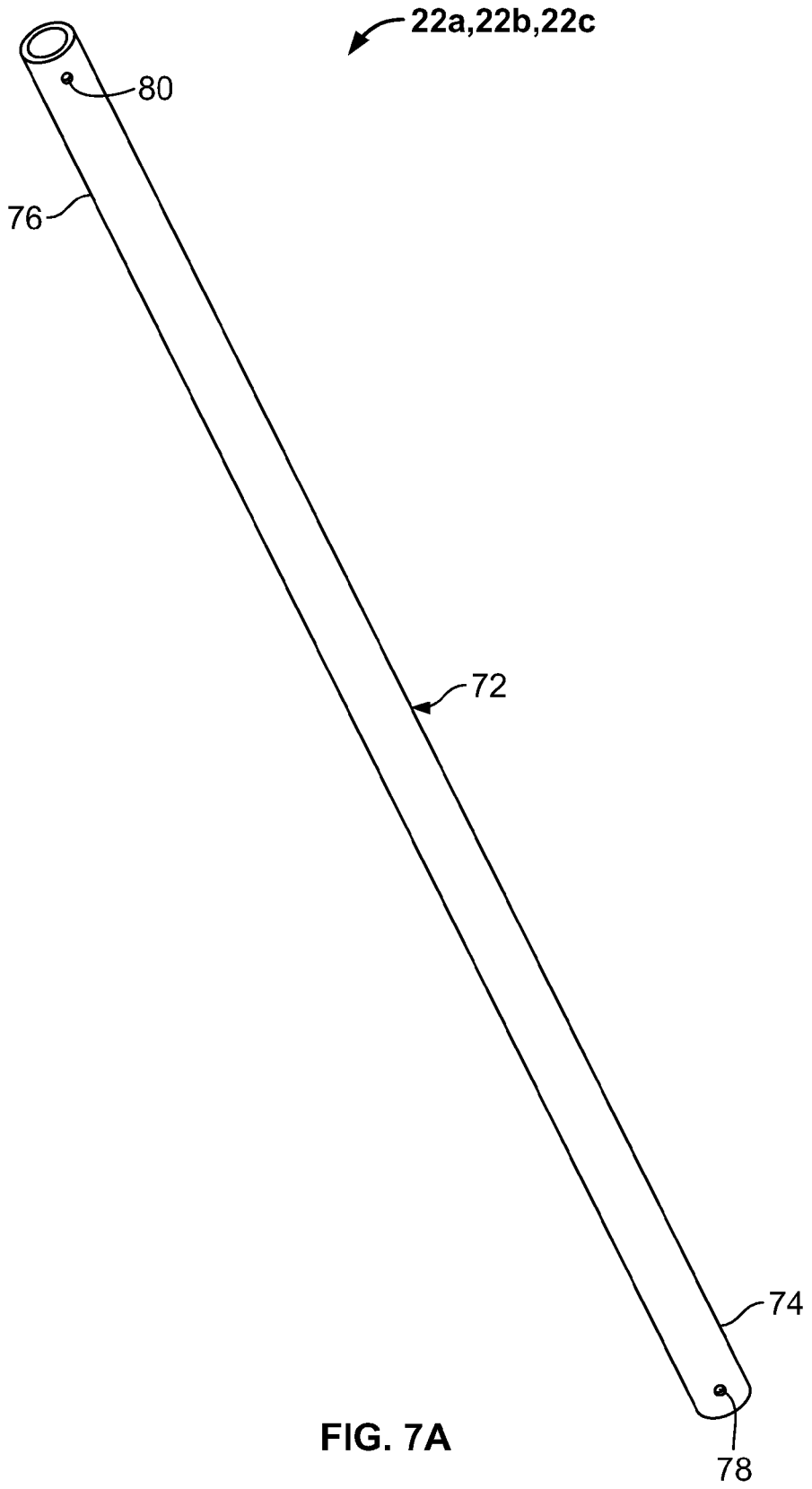


FIG. 7A

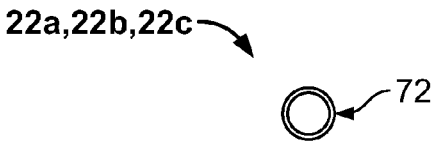


FIG. 7B

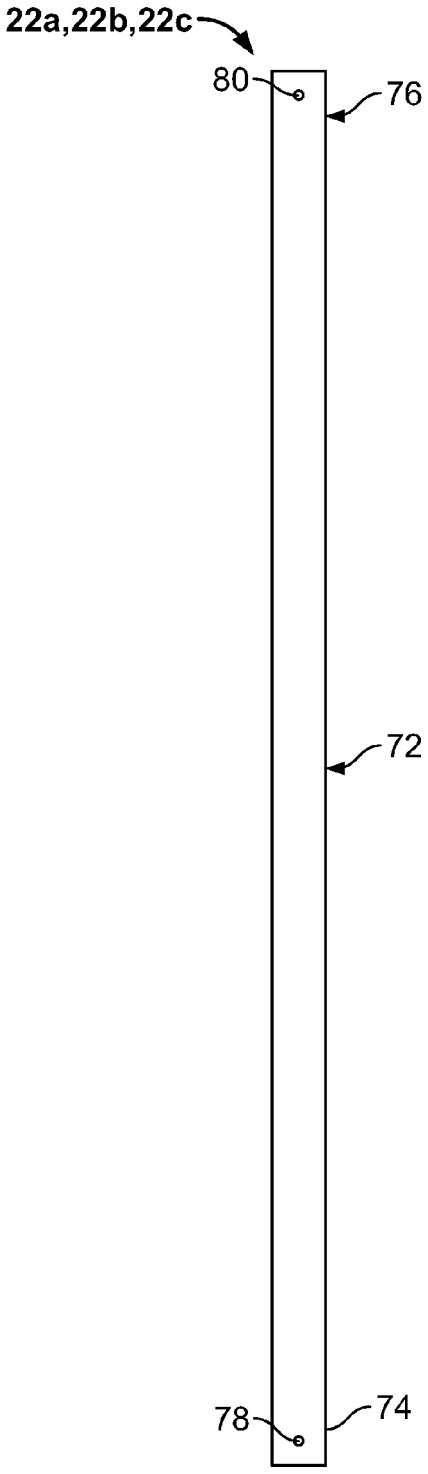


FIG. 7C

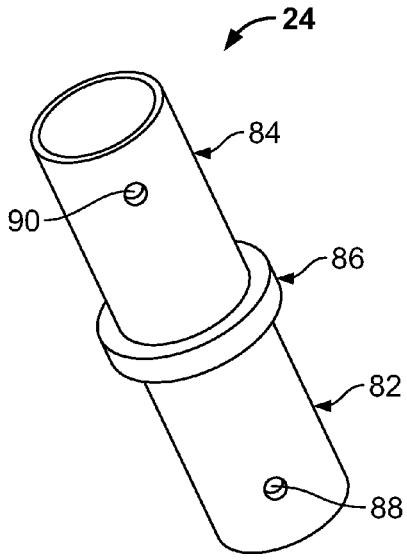


FIG. 8A

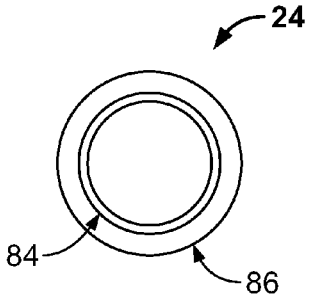


FIG. 8B

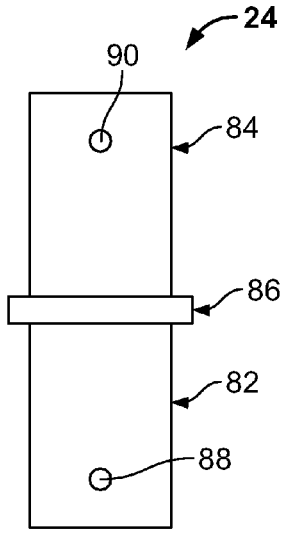


FIG. 8C

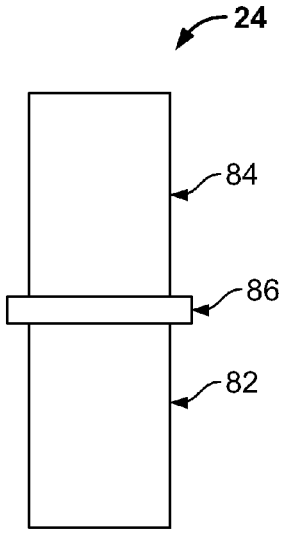


FIG. 8D

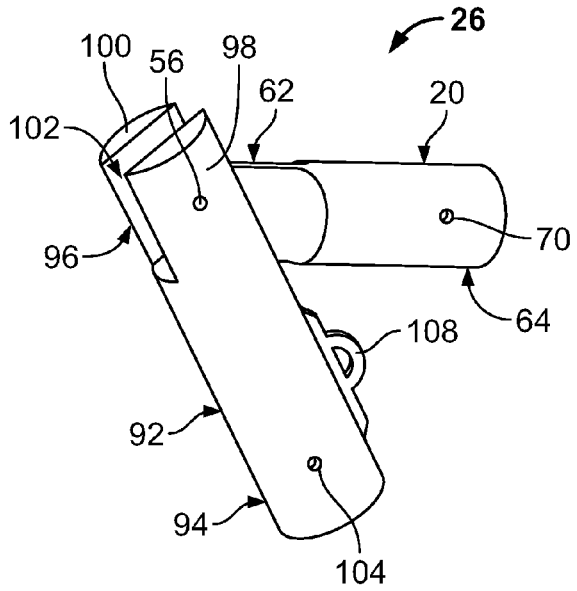


FIG. 9A

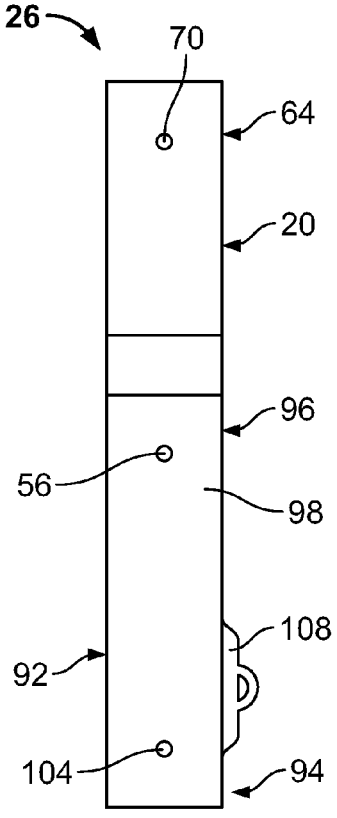


FIG. 9B

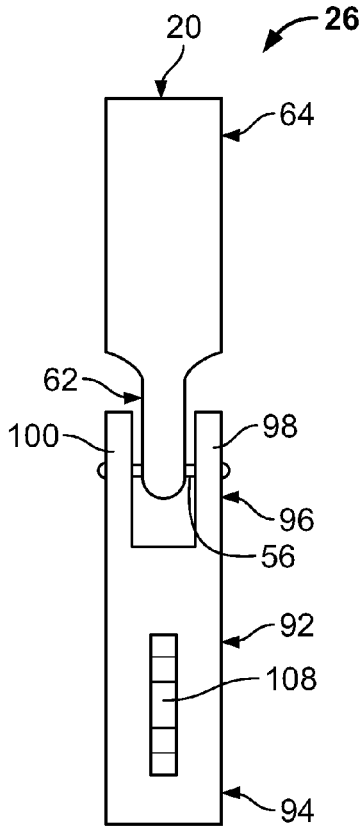


FIG. 9C

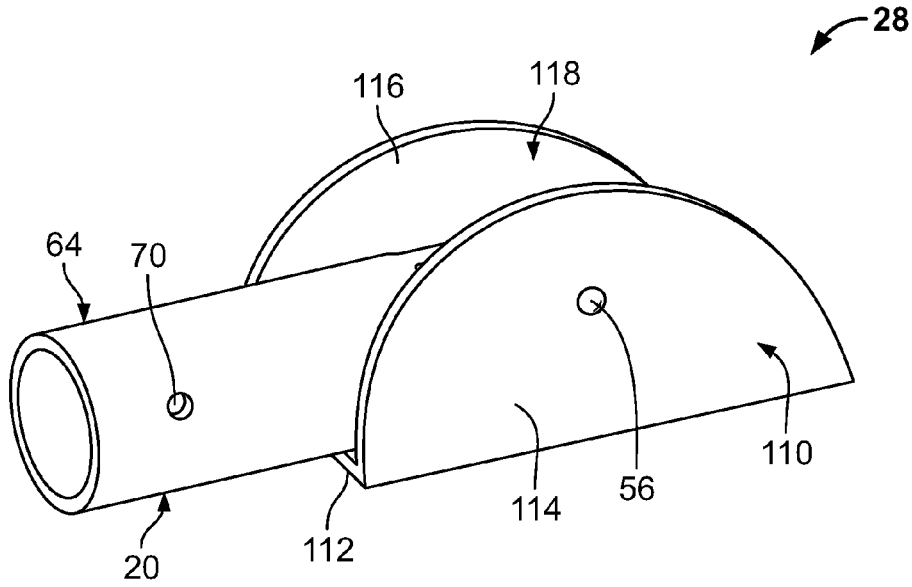


FIG. 10A

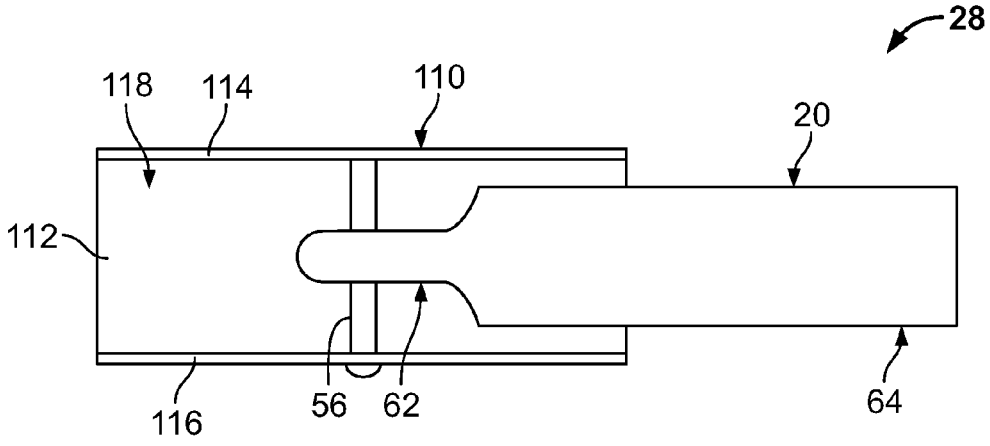


FIG. 10B

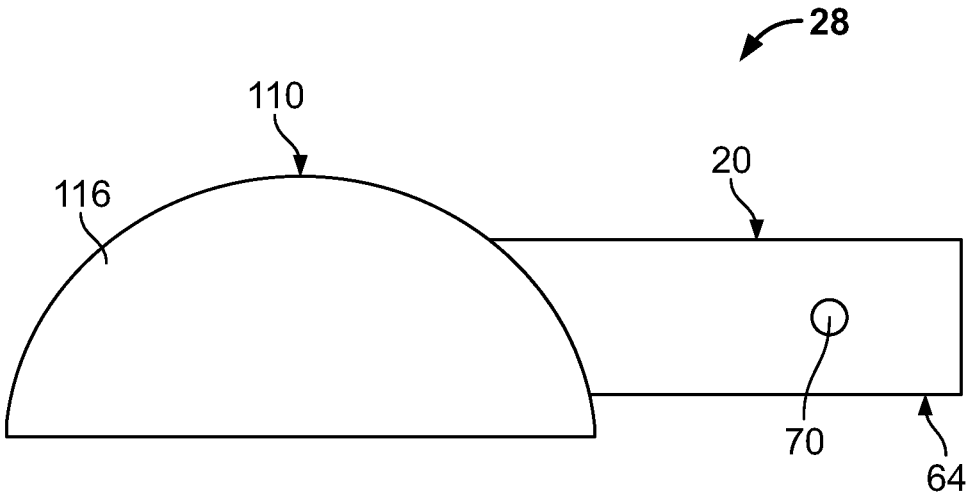


FIG. 10C

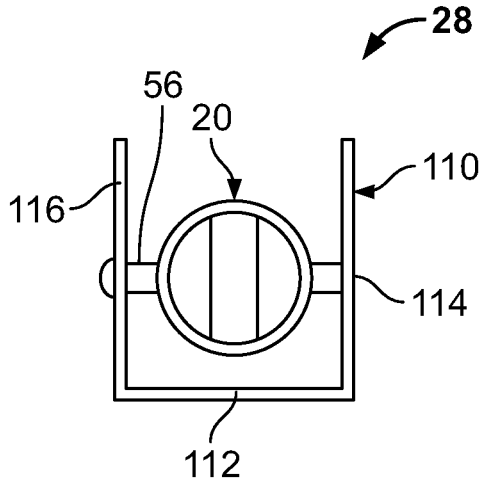


FIG. 10D

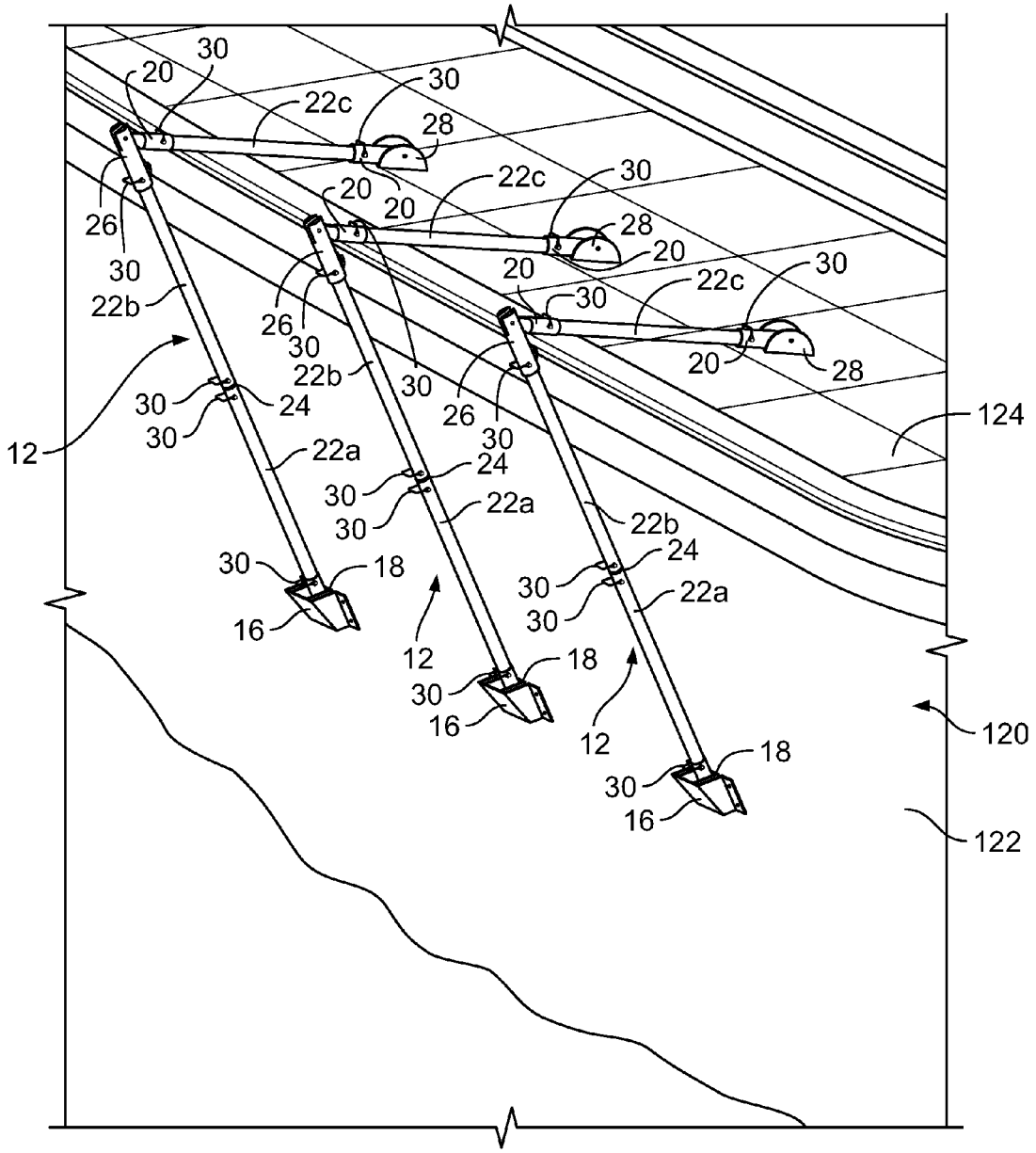

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FIG. 11

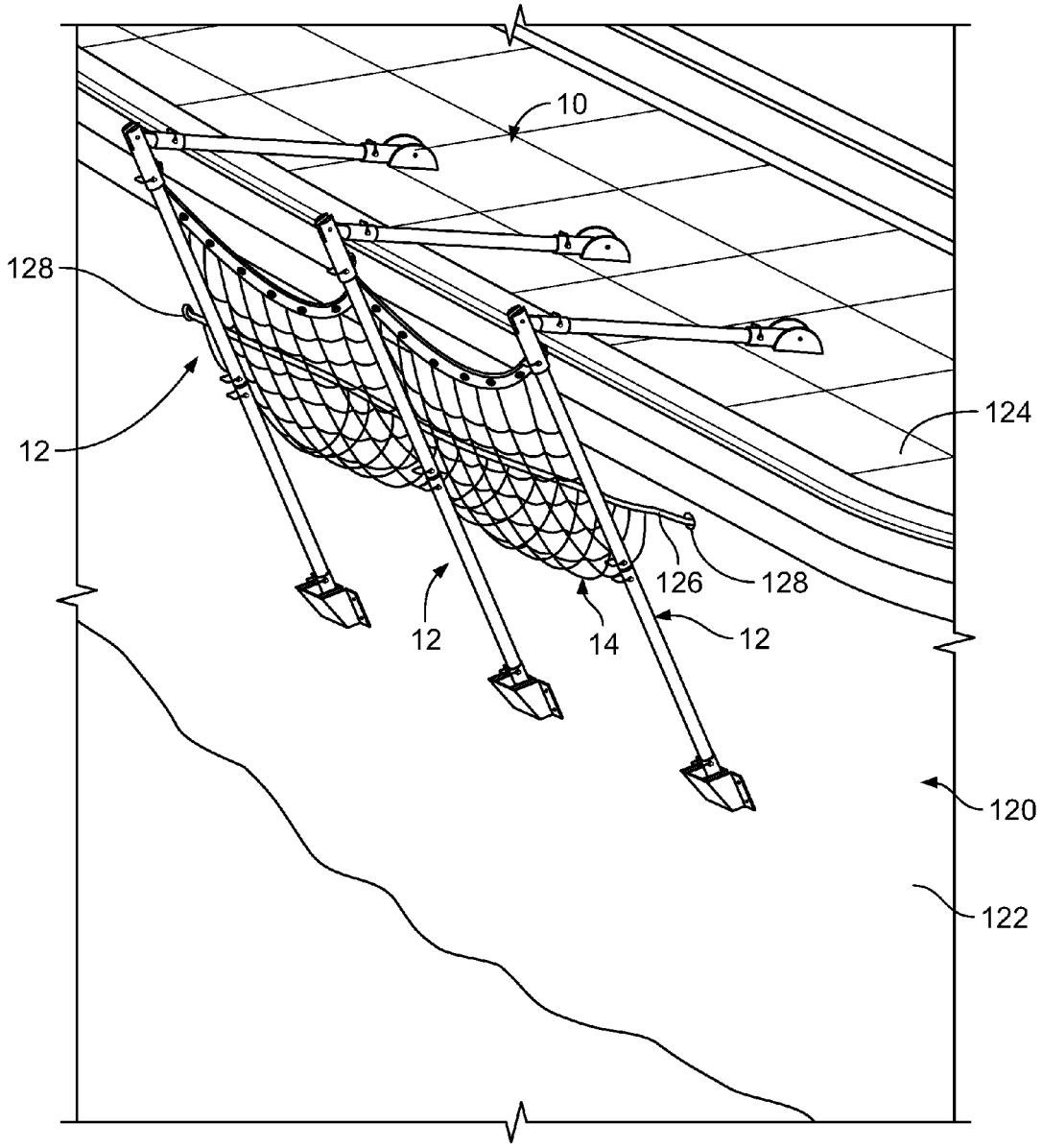

FIG. 12

ADJUSTABLE DEBRIS COLLECTION APPARATUS FOR MARITIME VESSELS AND ASSOCIATED METHODS

FIELD OF THE PRESENT DISCLOSURE

Embodiments of the present disclosure generally relate to debris collection apparatuses for maritime vessels and associated methods, and, more specifically, to debris collection apparatuses that are adjustable and can be temporary installed on a maritime vessel for securing and containing debris and falling material during demolition and other activities.

BACKGROUND OF THE PRESENT DISCLOSURE

A variety of temporary structures have been utilized for years in an attempt to prevent debris and material from entering waterways and/or damaging adjacent marine structures during the demolition of maritime vessels. Exemplary temporary structures that have been utilized in the past include nets, cloth, wooden structures, and metal shields, which have all been variously employed on a case-by-case basis to prevent debris and materials from falling into adjacent water.

However, these structures are generally single use, "stick built" (e.g., they are a one time construction built to fit a specific structure that is being protected), difficult to erect and disassemble, utilize materials that cannot be safely reutilized once installed, and require an extensive amount of manpower and unrecoverable capital investment to create.

Despite the above-identified issues, there has been a lack of advancement in this field. This may be at least partially attributed to the wide variety of marine structures that are contemplated for protection. For example, buildings, bridges, ships, piers, wharfs, and quays, are all marine structures that are contemplated for protection, but each requires a different type of structural protection in order to provide acceptable results. While there are thousands of these marine structures in the world, there is little to no specialization in companies dedicated to the specific application of demolishing maritime vessels and a corresponding lack of effort to standardize protection structures to be used during the demolition of the maritime vessels, which amounts to a small but vital component of that work.

Due to the lack of uniformity between structures and a broad approach to completing a demolition project, with or without sensitivity to the underlying regulatory requirements, the known systems do not offer the flexibility and protection that is desired and/or required by both regulations and prudence on the part of the operator.

What is needed in the art is a debris collection apparatus for maritime vessels for securing and containing debris and falling material during demolition and other activities and that includes continuously stable support mechanisms, is movable and adjustable to protect different structures, can be quickly and easily erected and dismantled, and can be reused on the same vessel or other vessels. These and other needs are addressed by the adjustable debris collection apparatus of the present disclosure.

SUMMARY OF THE DISCLOSURE

Example embodiments of the present disclosure relate to debris collection apparatuses, support structures for debris collection apparatuses, methods of installing the support structures, and methods for installing the debris collection apparatus.

More particularly, in some embodiments of the present disclosure a debris collection apparatus includes a shroud for containing debris, and a plurality of support structures including at least a first support structure and a second support structure. For example, the first and the second support structures can include a boot, a foot having a first universal swivel, a staff cap having a second universal swivel, a stabilizer base having a third universal swivel, an elevational staff section, and a horizontal staff section. Continuing with this exemplary embodiment, the boot can define a cavity and is configured to be removably secured to a vessel for receiving the foot which is generally sized to fit within the cavity of the boot. The foot additionally includes the first universal swivel and a frame that the first universal swivel is rotationally mounted to. The foot can be connected to the staff cap by the elevational staff section, which connects to the first universal swivel of the foot, and a staff cap terminal of the staff cap. In this regard, the staff cap can include the second universal swivel and the staff cap terminal that the second universal swivel is mounted to. The stabilizer base is configured to be removably secured to the vessel and connected to the staff cap by the horizontal staff section, which connects to the second universal swivel of the staff cap and the third universal swivel of the stabilizer base. In this regard, the stabilizer base can include the third universal swivel and a body having the third universal swivel rotatably mounted thereto. The foot can be inserted into the boot to set the first and second support structures in a rigid position, and the shroud can be connected to the staff cap of the first support structure, the staff cap of the second support structure, and the vessel to collect debris. In some embodiments, the shroud can be one of a mesh net and a welding blanket, while in other aspects the shroud can include a tensioner cable that can be connected to the vessel and tightened to secure the shroud to the vessel.

In some aspects of the present disclosure, the plurality of support structures can include a third support structure having a staff cap, and the shroud can be further connected to the staff cap of the third support structure.

In other aspects of the present disclosure, the elevational staff section can include at least two staffs connected by at least one staff union, and the horizontal staff section can include at least two staffs connected by at least one staff union.

In still other aspects of the present disclosure, the foot can include a stop pin that restricts rotation of the first universal swivel, the staff cap terminal can restrict rotation of the second universal swivel, and/or the body of the stabilizer base can restrict rotation of the third universal swivel.

In additional aspects of the present disclosure, the boot can be secured to a side of the vessel and the stabilizer base can be secured to a deck of the vessel.

In some aspects of the present disclose, the elevational staff section of the debris collection apparatus can be removably connected to the first universal swivel and the staff cap terminal by removable pins, and the horizontal staff section can be removably connected to the second universal swivel and the third universal swivel by removable pins. In this exemplary configuration, the first and second support structures can be deconstructed by removing the foot from the boot, removing the removable pins, and disconnecting the first universal swivel of the foot, the elevational staff section,

the second universal swivel of the staff cap, the horizontal staff section, and the third universal swivel of the stabilizer base.

In accordance with embodiments of the present disclosure, a portable support structure kit for a debris collection apparatus used to collect debris during demolition of a maritime vessel is provided. The portable support structure kit can include a boot, a foot having a first universal swivel, a staff cap having a second universal swivel, a stabilizer base having a third universal swivel, an elevational staff section, and a horizontal staff section. Continuing with this exemplary embodiment, the boot can define a cavity and is removably securable to a vessel for receiving the foot which is generally sized to fit within the cavity of the boot. The foot additionally includes the first universal swivel and a frame that the first universal swivel is rotatably mountable to. The foot is connectable to the staff cap by the elevational staff section, which is connectable to the first universal swivel of the foot, and a staff cap terminal of the staff cap. In this regard, the staff cap can include the second universal swivel and the staff cap terminal that the second universal swivel is mountable to. The stabilizer base is removably securable to the vessel and connectable to the staff cap by the horizontal staff section, which is connectable to the second universal swivel of the staff cap and the third universal swivel of the stabilizer base. In this regard, the stabilizer base can include the third universal swivel and a body having the third universal swivel rotatably mountable thereto. The foot is insertable into the boot to set the first and second support structures in a rigid position, and the shroud is connectable to the staff cap of the first support structure, the staff cap of the second support structure, and the vessel to collect debris.

In accordance with embodiments of the present disclosure, a method of installing a support structure on a vessel is provided. In this exemplary method, a boot that defines a cavity is first secured to the vessel. An elevational staff section is then removably connected to a foot by removably engaging the elevational staff section with a first universal swivel of the foot. The foot includes a frame having the first universal swivel mounted thereto, and is generally sized to fit within the cavity of the boot. The elevational staff section is then removably connected to a staff cap by removably engaging the elevational staff section with a staff cap terminal. The staff cap can further include a second universal swivel rotatably mounted to the staff cap terminal. A horizontal staff section is then removably connected to the staff cap by removably engaging the horizontal staff section with the second universal swivel of the staff cap. Next, a stabilizer base is removably secured to the vessel. The stabilizer base can include a body and a third universal swivel rotatably mounted to the body. The horizontal staff section can then be removably connected to the third universal swivel of the stabilizer base. Finally, the foot can be inserted into the boot to rigidly secure the support structure.

Additional features, functions and benefits of the disclosed debris collection apparatuses, support structures for debris collection apparatuses, methods of installing the support structures, and methods for installing the debris collection apparatuses will be apparent from the detailed description which follows, particularly when read in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present disclosure, reference is made to the following detailed description of an exemplary embodiment considered in conjunction with the accompanying drawings, in which:

FIG. **1** is a perspective view of the debris collection apparatus of the present disclosure;

FIG. **2** is a perspective view of a support structure of the debris collection apparatus of FIG. **1**;

FIG. **3** is an exploded perspective view of the support structure of FIG. **2**;

FIG. **4**A is a perspective view of a boot of the support structure of FIGS. **2** and **3**;

FIG. **4**B is a top view of the boot of FIG. **4**A;

FIG. **4**C is a rear view of the boot of FIG. **4**A;

FIG. **4**D is a sectional view of the boot of FIG. **4**A taken along line **4**D-**4**D of FIG. **4**B;

FIG. **5**A is a perspective view of a foot including a universal swivel of the support structure of FIGS. **2** and **3**;

FIG. **5**B is a top view of the foot including universal swivel of FIG. **5**A;

FIG. **5**C is a rear view of the foot including universal swivel of FIG. **5**A;

FIG. **5**D is a sectional view of the foot including universal swivel of FIG. **5**A taken along line **5**D-**5**D of FIG. **5**B;

FIG. **6**A is a perspective of the universal swivel of the support structure of FIGS. **2** and **3**;

FIG. **6**B is a rear view of the universal swivel of FIG. **6**A;

FIG. **6**C is a side view of the universal swivel of FIG. **6**A;

FIG. **7**A is a perspective view of a staff of the support structure of FIGS. **2** and **3**;

FIG. **7**B is a top view of the staff of FIG. **7**A;

FIG. **7**C is a side view of the staff of FIG. **7**A;

FIG. **8**A is a perspective view of a staff union of the support structure of FIGS. **2** and **3**;

FIG. **8**B is a top view of the staff union of FIG. **8**A;

FIG. **8**C is a rear view of the staff union of FIG. **8**A;

FIG. **8**D is a side view of the staff union of FIG. **8**A;

FIG. **9**A is a perspective view of a staff cap including a universal swivel of the support structure of FIGS. **2** and **3**;

FIG. **9**B is a rear view of the cap including universal swivel of FIG. **9**A;

FIG. **9**C is a side view of the cap including universal swivel of FIG. **9**A;

FIG. **10**A is a perspective view of a stabilizer base including a universal swivel of the support structure of FIGS. **2** and **3**;

FIG. **10**B is a top view of the stabilizer base including universal swivel of FIG. **10**A;

FIG. **10**C is a side view of the stabilizer base including universal swivel of FIG. **10**A;

FIG. **10**D is a rear view of the stabilizer base including universal swivel of FIG. **10**A;

FIG. **11** is a perspective view showing three support structures installed on a vessel to be demolished; and

FIG. **12** is a perspective view showing the debris collection apparatus installed on a vessel to be demolished.

DETAILED DESCRIPTION OF THE PRESENT DISCLOSURE

Embodiments of the present disclosure generally relate to debris collection apparatuses for maritime vessels and associated methods, and, more specifically, to debris collection apparatuses that are adjustable and can be temporarily installed on a maritime vessel for securing and containing debris and falling material during demolition and other activities.

FIG. **1** is a perspective view of a debris collection apparatus **10** for installation on a maritime vessel, e.g., a ship

or boat, to be demolished. The debris collection apparatus **10** includes a plurality of semi-rigid support structures **12** and a shroud **14** connected to each of the support structures **12**. The support structures **12** are configured to be removably installed on a maritime vessel, while the shroud **14** is removably connected to the support structures **12** and configured to catch any debris or material that may fall from the maritime vessel, thus preventing such debris and/or material from falling into any adjacent waterways or onto any adjacent marine structures, e.g., docks, piers, wharfs, etc., and damaging them. The functionality and components of the debris collection apparatus **10** is described in greater detail below.

FIGS. **2** and **3** show a single support structure **12** of the debris collection apparatus **10** in greater detail. FIG. **2** is a perspective view of the support structure **12** shown in FIG. **1**, while FIG. **3** is an exploded perspective view of the support structure **12** shown in FIG. **2**. The support structure **12** includes a boot **16**, a foot **18** including a universal swivel **20**, a plurality of rigid staffs **22***a*, **22***b*, **22***c*, a staff union **24**, a staff cap **26** including a universal swivel **20**, a stabilizer base **28** including a universal swivel **20**, and a plurality of pins **30** interconnecting the various components.

The boot **16** is generally a support structure that is configured to be connected with the side of a maritime vessel (e.g., a boat or a ship) and is configured to receive the foot **18**, which is inserted into the boot **16** to provide for vertical installation of the support structure **12**. A universal swivel **20** is rotational engaged with the foot **18** to permit limited rotation, and is connected with a first staff **22***a*. The first staff **22***a* is connected with the staff union **24**, which is in turn connected with the second staff **22***b*. Accordingly, the staff union **24** interconnects the first staff **22***a* and the second staff **22***b*. It should be understood that more than two staffs **22***a*, **22***b* and more than one staff union **24** can implemented if desired. For example, third, fourth, or fifth staffs can be connected in series with the first and second staffs **22***a*, **22***b* by additional staff unions **24** to create a longer vertical section. This process can be repeated and staffs can be added until the desired length is reached where the final staff is capped with a staff cap **26**. In the illustrated example of FIGS. **1-3**, the staff cap **26** is connected to the second staff **22***b*. A universal swivel **20** is rotational engaged with the staff cap **26** and connected with the third staff **22***c*, which is in turn connected with another universal swivel **20** that is rotational engaged with the stabilizer base **28**. The stabilizer base **28** can be removably mounted to a vessel deck and provides for removable attachment of the support structure **12** to the deck. It should be understood that each of the above-described components are removably attached to one another such that the support structure **12** can be easily deconstructed and moved, e.g., to another location on the same boat or to a different maritime vessel, or so that the support structure **12** can be easily expanded, e.g., additional staffs can be added.

Additionally, as shown in FIGS. **2** and **3**, the first staff **22***a*, staff union **24**, and second staff **22***b* generally form an elevational staff section **25***a*, while the third staff **22**C generally forms a horizontal staff section **25***b*. It should be understood that the elevational staff section **25***a* and the horizontal staff section **25***b* can respectively include a single staff, or a plurality of staffs connected by one or more staff unions. For example, while the elevational staff section **25***a* is shown with two staffs and one staff union, it can alternatively comprise a single staff and no staff union, or can have three staffs and two staff unions, etc. Similarly, while the horizontal staff section **25***b* is shown with a single staff and no staff union, it can alternatively comprise two staffs and one staff union, etc. This functionality permits the elevational and horizontal staff sections **25***a*, **25***b* to be increased or decreased in length based on the vessel that the debris collection apparatus **10** is installed on.

Turning now to the details of each individual component, FIGS. **4**A-**4**D show the boot **16** in greater detail. The boot **16** generally includes an angled body **32** connected with first and second flanges **34***a*, **34***b*. The angled body **32** includes a back **36**, a first side **38**, and a second side **40** (opposite the first side **38**), which define a cavity **42**. The first and second sides **38**, **40** generally taper inward, e.g., reduce in width, from a top width, WB_{top}, to a bottom width, WB_{bot}. The tapered geometry of the first and second sides **38**, **40** causes the cavity **42** to also be tapered (see, e.g., FIG. **4**D, which is a sectional view of FIG. **4**B taken along line **4**D-**4**D). The angled body **32** is connected with the first and second flanges **34***a*, **34***b*, which each have a pair of holes **44***a*, **44***b* extending therethrough (see, e.g., FIG. **4**C). The holes **44***a*, **44***b* can be ¼" diameter and facilitate attachment of the boot **16** to the side of a vessel with appropriately sized fasteners, e.g., bolts. The body **32** of the boot **16** is generally formed with a shape and size that substantially matches the shape and size of the foot **18** to permit insertion of the foot **18** into the cavity **42** and secured in place by the body **32** and the side of the vessel that the boot **16** is attached to. The boot **16** can be constructed of mild steel that is cold rolled and hot forged. The boot **16** can also be created from a single sheet of metal, which could be of ⅛" thickness, and formed by cold bending at four corners. It should be understood that any other suitable material could be utilized and any other suitable metal forming techniques can be implemented to create the boot **16**.

FIGS. **5**A-**5**D show the foot **18** in greater detail. The foot **18** generally includes an angled frame **46** and a universal swivel **20**. The angled frame **46** includes a back **48**, a first side **50**, and a second side **52** (opposite the first side **50**), which define a cavity **54**. The first and second sides **50**, **52** generally taper inward, e.g., reduce in width, from a top width, WF_{top}, to a bottom width, WF_{bot}, in a similar fashion to the body **32** of the boot **16**. The tapered geometry of the first and second sides **50**, **52** causes the cavity **54** to also be tapered (see, e.g., FIG. **5**D, which is a sectional view of FIG. **5**B taken along line **5**D-**5**D). Accordingly, the frame **46** of the foot **18** is generally formed with a shape and size that substantially matches the shape and size of the boot **16** so that the foot **18** can be inserted into the cavity **42** of the boot **16** and can engage the boot **16** in a mating relationship. More specifically, the bottom width, WF_{bot} of the foot **18** is less than the top width WB_{top} of the boot **16** so that the foot **18** can be inserted into the boot **16**. When inserted into the boot **16**, the foot **18** is positioned within the cavity **42** with the back **48** of the frame **46** adjacent the side of the vessel that the boot **16** is attached to. The foot **18** can be constructed of mild steel that is cold rolled and hot forged. The foot **18** can also be created from a single sheet of metal, which could be of ⅛" thickness, and formed by cold bending at two corners to form the cavity **54**. It should be understood that any other suitable material could be utilized and any other suitable metal forming techniques can be implemented to create the foot **18**. The universal swivel **20** is inserted into and positioned within the cavity **54** of the foot **18**, and connected to the foot **18** with a swivel pin **56**. Particularly, the swivel pin **56** extends from the first side **50** to the second side **52** and through a portion of the universal swivel **20** (discussed in greater detail below) so that the universal swivel **20** can rotate about the swivel pin **56**. The foot **18** additionally

includes a stop pin **58** that extends from the first side **50** to the second side **52**. The stop pin **56** is generally positioned at the wider end of the first and second sides **50**, **52**, e.g., the end having the top width WB_{top}, and at a position so that the swivel pin **56** is between the stop pin **58** and the back **48** of the foot **18**. Accordingly, the stop pin **58** is configured so as to prevent or limit rotation of the universal swivel **20** beyond a certain point. The stop pin **58** can also include an outer coating or sheath that can prevent the universal swivel from being damaged. The swivel pin **56** and the stop pin **58** can be class "eight" pins, or any other suitable pin.

FIGS. **6**A-**6**C show the universal swivel **20** in greater detail. The universal swivel **20** generally includes a body **60** having a connecting rod **62** connected to a head **64**. The head **64** is generally circular in shape and is hollow defining an internal chamber **66**, whereas the connecting rod **62** is generally solid and of a reduced width compared to the head **64**. This configuration allows for components to be inserted into the internal chamber **66** of the head **64**, while the connecting rod **62** can be inserted into smaller openings or cavities. Furthermore, the connecting rod **62** includes a pre-drilled hole **68** extending therethrough, while the head **64** includes a similar pre-drilled hole **70** extending through the entirety thereof. The hole **68** of the connecting rod **62** permits insertion of, for example, the swivel pin **56**, discussed above in connection with FIGS. **5**A-**5**D. Accordingly, the hole **68** permits the universal swivel **20** to be rotationally mounted to various components, e.g., the foot **18**. The hole **70** of the head **64** permits insertion of, for example, the pin **30**, which could be a Curt Safety Pin™, or any other similar commercially available pin. In a situation where a component, e.g., the first staff **22***a*, is positioned in the internal chamber **66** of the head **64**, the two components can be connected by the pin **30** extending through the hole **68** and through similarly sized pre-drilled holes extending through the first staff **22***a*, discussed in detail below.

FIGS. **7**A-**7**C show the first, second, and third staffs **22***a*, **22***b*, **22***c* in greater detail. It should be understood that the first, second, and third staffs **22***a*, **22***b*, **22***c* are identical in construction and the description made herein with respect to the first staff **22***a* holds true for the second and third staffs **22***b*, **22***c* as well. Furthermore, while only three staffs are referenced, it should be understood that the present disclosure includes as many staffs as necessary to create an appropriately sized support structure **12** for the task that it is being implemented for. The first staff **22***a* includes a body **72** that is generally tubular in shape has a first end **74** and a second end **76**. The first and second ends **74**, **76** each respectively include a hole **78**, **80** extending through each opposing side of the first staff **22***a*. The holes **78**, **80** can be ¼" in diameter. The first staff **22***a* is sized to be inserted into the head **64** of the universal swivel **20**. Additionally, the holes **78**, **80** are sized and positioned to match the hole **70** of the universal swivel **20** so that a pin **30** can be inserted through the hole **78** (or the hole **80**, depending on orientation), and the hole **70** when the first staff **22***a* is inserted into the head **64** of the universal swivel **20** and the hole **78** (or the hole **80**, depending on orientation) is aligned with the hole **70**, thus removably connecting the first staff **22***a* with the universal swivel **20**. Accordingly, when connected with the universal swivel **20**, the first staff **22***a* can rotate with the universal swivel **20** about the swivel pin **56**. The first staff **22***a* can also be connected with the staff union **24**, discussed in greater detail below. The staffs **22***a*, **22***b*, **22***c* can be constructed of mild steel, cold rolled, hot forged, and formed by constant circular extrusion. In some embodiments, the staffs **22***a*, **22***b*, **22***c* can have an outside diameter of 1 15/16" and an inside diameter of 1¾", with ends severed perpendicular to the longitudinal axis of the staff.

FIGS. **8**A-**8**D show the staff union **24** in greater detail. The staff union **24** is a generally tubular component that includes a first end **82**, a second end **84**, and an annular staff stop **86** positioned intermediate the first and second ends **82**, **84** and having a greater diameter than the first and second ends **82**, **84**. The first and second ends **82**, **84** also each include a hole **88**, **90**, respectively. The hole **88** extends entirely through the first end **82**, e.g., through each opposing side, while the hole **90** extends entirely through the second end **84**, e.g., through each opposing side. The holes **88**, **90** can be ¼" in diameter. The first and second ends **82**, **84** are sized in shape and diameter to be inserted into the first end **74** or the second end **76** of any one of the staffs **22***a*, **22***b*, **22***c*, while the annular staff stop **86** is generally sized to be larger than the inner diameter of the staffs **22***a*, **22***b*, **22***c*. For example, in a first aspect the first and second ends **82**, **84** can have a 1 11/16" outside diameter and the annular staff stop **86** can have 2" diameter. When, for example, the first end **82** of the staff union **24** is inserted into the second end **76** of the first staff **22***a*, the annular staff stop **86** prevents the staff union **24** from sliding entirely into the first staff **22***a* by engaging an end face of the first staff **22***a*. The staff union **24** can then be connected with the first staff **22***a* by aligning the hole **88** of the staff union **24** with the hole **80** of the first staff **22***a* and inserting a pin **30** through the aligned holes **80**, **88**, thus releasably connecting the staff union **24** with the first staff **22***a*. The staff union **24** can then be connected to the second staff **22***b* by inserting the second end **84** into the second staff **22***b*, aligning the hole **88** of the staff union **24** with the hole **78** of the second staff **22***b* and inserting a pin **30** through the aligned holes **78**, **88**. As referenced above, any number of staffs **22***a*, **22***b*, **22***c* can be connected to one another by any number of staff unions **24** in order to form a support structure **12** of the desired size. The staff union **24** can be constructed of solid mild steel stock, cold rolled and hot forged.

As discussed above and shown in FIGS. **2** and **3**, the first staff **22***a*, staff union **24**, and second staff **22***b* generally form an elevational staff section **25***a*, while the third staff **22***c* generally forms a horizontal staff section **25***b*. The elevational staff section **25***a* and the horizontal staff section **25***b* can each respectively include a single staff, or a plurality of staffs connected by one or more staff unions, which allows the elevational and horizontal staff sections **25***a*, **25***b* to be increased or decreased in length based on the vessel that the debris collection apparatus **10** is installed on.

As illustrated in FIGS. **2** and **3**, the second staff **22***b* can be connected with the staff union **24** and with the staff cap **26**. FIGS. **9**A-**9**D show the staff cap **26** in greater detail. The staff cap **26** includes a staff cap terminal **92** and a universal swivel **20**. The staff cap terminal **92** includes a tubular end **94** and a bifurcated end **96**. The tubular end **94** is generally circular in shape and is hollow so as to permit the insertion of components such as the staffs **22***a*, **22***b*, **22***c*. The bifurcated end **96** includes a first flange **98**, a second flange **100**, and a channel **102** defined by the first and second flanges **98**, **100**. The configuration of the bifurcated end **96** allows the connecting rod **62** of a universal swivel **20** to be inserted into the channel **102** for connection with the staff cap terminal **92**. The connecting rod **62** of the universal swivel **20** can be inserted into the channel **102** and connected to the staff cap terminal **92** with a swivel pin **56**. Particularly, the swivel pin **56** extends across the first and second flanges **98**, **100** and the connecting rod **62** of the universal swivel **20** so that the universal swivel **20** can rotate about the swivel pin **56**.

Rotation of the universal swivel **20** is limited by the interruption and impact against the staff cap terminal **92**. In some embodiments, this can provide a range of motion for the universal swivel **20** of approximately 270°. Furthermore, the tubular end **94** includes a pre-drilled hole **104** extending therethrough. The hole **104** of the tubular end **94** permits insertion of, for example, the pin **30** in order to engage the staff cap terminal **92** with a staff **22***a*, **22***b*, **22***c*. For example, a second end **76** of the second staff **22***b* can be positioned inside the tubular end **94** of the staff cap terminal **92** with the hole **80** of the second staff **22***b* aligned with the hole **104** of the staff cap terminal **92**. Once aligned, a pin **30** can be inserted through the holes **80**, **104**, thus securing the second staff **22***b* to the staff cap terminal **92**. The staff cap terminal **92** can also include a connection loop **108** that can be welded to the side of the staff cap terminal **92** to allow the shroud **14** to be connected thereto. The staff cap terminal **92** can be constructed of mild steel, cold rolled and hot forged. The staff cap terminal **92** can also be formed by welding, for example, a 2¼" diameter solid bar stock with the first and second flanges **98**, **100** cut to accept the universal swivel **20** to a pipe having, for example, a 2¼" outer diameter.

The staff cap **26** can be connected with another staff, e.g., the third staff **22***c*, which can be connected to the universal swivel **20** that is rotationally mounted to the staff cap terminal **92**. That is, the first end **74** of the third staff **22***c* can be inserted into the head **64** of the universal swivel **20** so that the hole **78** of the third staff **22***c* is aligned with the hole **70** of the universal swivel **20**. Once aligned, a pin **30** can be inserted through the holes **70**, **78**, thus securing the third staff **22***c* to the universal swivel **20**. The second end **76** of the third staff **22***c* can then be connected with the stabilizer base **28**, described in greater detail below.

FIGS. **10**A-**10**D show the stabilizer base **28** in greater detail. The stabilizer base **28** includes a body **110** and a universal swivel **20**. The body **110** includes a bottom **112**, a first side **114**, and a second side **116**, which define a channel **118**. This configuration allows for the connecting rod **62** of a universal swivel **20** to be inserted into the channel **118** for connection with the body **110** of the stabilizer base **28**. The connecting rod **62** of the universal swivel **20** can be inserted into the channel **118** and connected to the stabilizer base **28** with a swivel pin **56**. Particularly, the swivel pin **56** extends from the first side **114** to the second side **116** and across the connecting rod **62** of the universal swivel **20** so that the universal swivel **20** can rotate about the swivel pin **56**. Rotation of the universal swivel **20** within the stabilizer base **28** is limited by the interruption and impact against the bottom **112** of the body **110**, and can be generally limited to 180°. The universal swivel **20** of the stabilizer base **28** is utilized to connect the third staff **22***c* to the stabilizer base **28** by insertion of the second end **76** of the third staff **22***c* into the head **64** of the universal swivel **20** so that the hole **80** of the third staff **22***c* is aligned with the hole **70** of the universal swivel **20**. Once aligned, a pin **30** can be inserted through the holes **70**, **80**, thus securing the third staff **22***c* to the universal swivel **20**. The body **110** of the stabilizer base **28** can be constructed of mild steel that is cold rolled and hot forged. The body **110** of the stabilizer base **28** can also be created from a single sheet of metal, which could be of ⅛" thickness, and formed by cold bending at two points. It should be understood that any other suitable material could be utilized and any other suitable metal forming techniques can be implemented to create the body **110** of the stabilizer base **28**.

FIGS. **11** and **12** generally show an example debris collection apparatus in use. Particularly, FIG. **11** is a perspective view showing three support structures **12** installed on a maritime vessel **120** to be demolished, while FIG. **12** is a perspective view showing the debris collection apparatus **10**, including three support structures **12** and a shroud **14** connected to the support structures **12**, installed on the maritime vessel **120** to be demolished. In use, the operator obtains a mechanism (e.g., a boat or man lift) to allow access to the maritime vessel **120**, and particularly a side **122** of the marine vessel **120**, or to a marine structure (not shown) to be protected. The boot **16** is then placed against the side **122** of the marine vessel **120** in a configuration so that the wider portion of the boot **16** is facing a deck **124** of the marine vessel **120** and held in place by a metal-to-metal adhesive. The operator or installer then drills through the pairs of holes **44***a*, **44***b* (see FIGS. **4**A-**4**D) of the boot **16** with a bit that is generally 1/16" smaller than the holes **44***a*, **44***b*. The installer then utilizes a fastener, e.g., self-tapping metal screws, rivets, etc., to permanently attach the boot **16** to the side **122** of the marine vessel **120**. The installer then places additional boots **16** along the side **122** of the marine vessel **120** generally installed at approximately 8' intervals around the circumference of the marine vessel **120**. Once a sufficient number of boots **16** have been mounted, the installer can install the remaining sections of the support structures **12** from the deck **124** of the marine vessel **120**.

Next, the installer connects the first staff **22***a* to the foot **18** as described in detail above. That is, the first staff **22***a* is inserted into the universal swivel **20** of the foot **18**, and connected thereto by a pin **30** extending through the hole **78** of the first staff **22***a* and the hole **70** of the universal swivel **20**. The installer can then connect as many staffs **22***a*, **22***b*, **22***c* as necessary utilizing staff unions **24**, as described in detail above, in order to form the elevational staff section **25***a* and extend the support structure **12** to the elevation necessary to offer protection of the operations being considered.

Once a sufficient elevation has been achieved, the installer then connects the staff cap **26** to the terminal staff **22***a*, **22***b*, **22***c* (for example, the second staff **22***b*, as shown in FIGS. **2**, **3**, **11**, and **12**), in the fashion described in detail above. That is, the second staff **22***b* is inserted into the staff cap terminal **92** of the staff cap **26**, and connected thereto by a pin **30** extending through the hole **104** of the staff cap terminal **92** and the hole **80** of the second staff **22***b*. Next, the installer connects another staff section, e.g., third staff **22***c*, to the universal swivel **20** of the staff cap **26**, as described in detail above, in order to form the horizontal staff section **25***b* that ultimately mounts to the marine vessel deck **124**. Specifically, the first end **74** of the third staff **22***c* is inserted into the universal swivel **20** of the staff cap **26**, and connected thereto by a pin **30** extending through the hole **78** of the third staff **22***c* and the hole **70** of the universal swivel **20**. The second end **76** of the third staff **22***c* is then inserted into the universal swivel **20** of the stabilizer base **28**, and connected thereto by a pin **30** extending through the hole **80** of the third staff **22***c* and the hole **70** of the universal swivel **20**. In this configuration, the third staff is connected with the stabilizer base **28**, and the stabilizer base **28** is linked to the foot **18** by way of the first, second, and third staffs **22***a*, **22***b*, **22***c*, and the staff cap **26**.

The stabilizer base **28** is installed on any horizontal surface of the marine vessel **120**, e.g., the deck **124** or exposed metal plate of levels or decks that have been exposed during the demolition process. The stabilizer base **28** can be adhered to the deck **124** or exposed metal plate by metal-to-metal adhesive and/or by appropriately sized fasteners (e.g., self-tapping metal screws, rivets, etc.) extending through pilot holes extending through the bottom **112** of the

stabilizer base **28**. The stabilizer base **28** can be removed from the deck **124** by wedge extraction when the support structure **12** is needed to be moved or disassembled.

The foot **18** of the support structure **12** (e.g., after assembly of the support structure **12**) can be inserted into the boot **16**, thus securing the support structure **12** to the marine vessel **120** in a mounted and rigid position ready to have the shroud **14** attached. Once all of the support structures **12** are completely mounted to the marine vessel **120** the shroud **14** can be connected to each of the support structures **12** by clipping a portion of the shroud **14** to the connection loop **108** of each staff cap **26** for each of the support structures **12**. A shroud tensioner cable **126** can then be thread through a bottom portion of the shroud **14**, or, for example, attached to the shroud **14** with carabiners or slip loops engaging grommets thereof, and inserted into two appropriately sized holes **128** formed in (e.g., drilled or cut through) the side **122** of the marine vessel **120** or in an area of sufficiently lower elevation to form a cup into which debris and contaminants are collected. That is, during demolition of the maritime vessel **120**, any debris or contaminants that happen to fall overboard will be caught by the debris collection apparatus **10**, and trapped in the shroud **14**, so that they do not fall into the adjacent waterway or onto an adjacent marine structure, e.g., dock, pier, warf, etc. It should be understood by one of ordinary skill in the art that the shroud **14** can be a mesh net, welding blanket, or any other known shroud device.

Once demolition is complete, or at any intermediate time if desired, the debris collection apparatus **10** can be disassembled and removed. Specifically, the shroud **14** can be detached from the support structures **12**, and each of the support structures **12** can be disassembled whereby the foot **18** can be removed from the boot **16**, and each of the foot **18**, universal swivels **20**, staffs **22***a*, **22***b*, **22***c*, staff unions **24**, staff cap **26**, and stabilizer base **28** can be detached from one another by removing the pins **30** that connect each adjacent component. Once the support structures **12** are disassembled, the boot **16** and the stabilizer base **28** can be removed from the maritime vessel **120** by removing the implemented fasteners and through wedge extraction. The debris collection apparatus **10** can then be reused at another demolition site.

Accordingly, the present disclosure provides a new debris and contaminant support structure that can be utilized on any type of ship during a demolition process, or on any other fixed or floating maritime structure, regardless of confirmation, design, or construction materials. Furthermore, the present disclosure can be utilized in conjunction with a variety of other commercially available components, e.g., shroud systems, to protect inadvertent marine contamination.

Additionally, and in accordance with the above description, the present disclosure provides an environmental control system including structural supports for protective shrouds to protect the waterways from inadvertent contamination by debris and scree (torch residue from cutting operations) that may result from cutting and demolition operations upon ships moored to piers. Thus, the present disclosure satisfies concerns for human health, solid emissions, and safety by providing the ability to prevent scree, exfoliating lead-based paint, slag (molten metal debris), and heavy objects (upwards of 600 pounds) from inadvertently falling into the waterways in areas where the debris collection apparatus **10** of the present disclosure is installed.

It will be understood that the embodiments of the present disclosure described herein are merely exemplary and that a person skilled in the art may make many variations and modifications without departing from the spirit and the scope of the invention. All such variations and modifications, including those discussed above, are intended to be included within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A debris collection apparatus for a maritime vessel, comprising:

a shroud for containing debris; and

a plurality of support structures, at least including a first and a second support structure, wherein each of the plurality of supports structures comprises:

a boot defining a cavity, the boot being configured to be removably secured to the maritime vessel;

a foot including a frame and a first universal swivel rotatably mounted to the frame, the foot being sized to fit within the cavity of the boot;

a staff cap including a staff cap terminal and a second universal swivel rotatably mounted to the staff cap terminal;

a stabilizer base including a body and a third universal swivel rotatably mounted to the body, the stabilizer base being configured to be removably secured to the maritime vessel;

an elevational staff section removably connected to the first universal swivel and the staff cap terminal; and

a horizontal staff section removably connected to the second universal swivel and the third universal swivel;

wherein the foot is inserted into the boot to secure the first and second support structures in a rigid position, and the shroud is connected to the staff cap of the first support structure, the staff cap of the second support structure, and the vessel to collect debris.

2. The debris collection apparatus of claim **1**, wherein the plurality of support structures includes a third support structure having a staff cap, the shroud being further connected to the staff cap of the third support structure.

3. The debris collection apparatus of claim **1**, wherein the elevational staff section includes at least two staffs connected by at least one staff union.

4. The debris collection apparatus of claim **1**, wherein the horizontal staff section includes at least two staffs connected by at least one staff union.

5. The debris collection apparatus of claim **1**, wherein the foot includes a stop pin that restricts rotation of the first universal swivel.

6. The debris collection apparatus of claim **1**, wherein the staff cap terminal restricts rotation of the second universal swivel.

7. The debris collection apparatus of claim **1**, wherein the shroud is one of a mesh net and a welding blanket.

8. The debris collection apparatus of claim **1**, wherein the boot is secured to a side of the maritime vessel and the stabilizer base is secured to a deck of the maritime vessel.

9. The debris collection apparatus of claim **1**, wherein the elevational staff section is removably connected to the first universal swivel and the staff cap terminal by removable pins, and the horizontal staff section is removably connected to the second universal swivel and the third universal swivel by removable pins.

10. The debris collection apparatus of claim **9**, wherein the first and second support structures can be deconstructed by removing the foot from the boot, removing the removable pins, and disconnecting the first universal swivel of the foot, the elevational staff section, the second universal swivel of

the staff cap, the horizontal staff section, and the third universal swivel of the stabilizer base.

11. The debris collection apparatus of claim **1**, wherein the shroud includes a tensioner cable that can be connected to the maritime vessel and tightened to secure the shroud to the maritime vessel.

12. A portable support structure kit for a debris collection apparatus used to collect debris during demolition of a maritime vessel, comprising:

a boot defining a cavity, the boot being removably securable to the maritime vessel;

a foot including a frame and a first universal swivel rotatably mountable to the frame, the foot being sized to fit within the cavity of the boot;

a staff cap including a staff cap terminal and a second universal swivel rotatably mountable to the staff cap terminal;

a stabilizer base including a body and a third universal swivel rotatably mountable to the body, the stabilizer base being removably securable to the maritime vessel;

an elevational staff section removably connectable to the first universal swivel and the staff cap terminal; and

a horizontal staff section removably connectable to the second universal swivel and the third universal swivel;

wherein the foot is insertable into the boot to secure the first and second support structures in a rigid position.

13. The portable support structure kit of claim **12**, wherein the elevational staff section includes at least two staffs connectable by at least one staff union.

14. The portable support structure kit of claim **12**, wherein the horizontal staff section includes at least two staffs connectable by at least one staff union.

15. The portable support structure kit of claim **12**, wherein the foot includes a stop pin that restricts rotation of the first universal swivel.

16. The portable support structure kit of claim **12**, wherein the staff cap terminal restricts rotation of the second universal swivel.

17. The portable support structure kit of claim **12**, wherein the elevational staff section is removably connectable to the first universal swivel and the staff cap terminal by removable pins, and the horizontal staff section is removably connectable to the second universal swivel and the third universal swivel by removable pins.

18. The portable support structure kit of claim **17**, wherein the first and second support structures are deconstructable by removing the foot from the boot, removing the removable pins, and disconnecting the first universal swivel of the foot, the elevational staff section, the second universal swivel of the staff cap, the horizontal staff section, and the third universal swivel of the stabilizer base.

19. A method of installing a support structure on a maritime vessel, comprising:

securing a boot to the maritime vessel, the boot defining a cavity;

removably connecting an elevational staff section to a foot by removably engaging the elevational staff section with a first universal swivel of the foot, the foot being sized to fit within the cavity of the boot and further including a frame having the first universal swivel mounted thereto;

removably connecting the elevational staff section to a staff cap by removably engaging the elevational staff section with a staff cap terminal of the staff cap, the staff cap further including a second universal swivel rotatably mounted to the staff cap terminal;

removably connecting a horizontal staff section to the staff cap by removably engaging the horizontal staff section with the second universal swivel of the staff cap;

removably securing a stabilizer base to the maritime vessel, the stabilizer base including a body and a third universal swivel rotatably mounted to the body;

removably connecting the horizontal staff section to the third universal swivel of the stabilizer base; and

inserting the foot into the boot.

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