

[54] VESSEL MOORING DEVICES

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[58] Field of Search 114/230; 61/48

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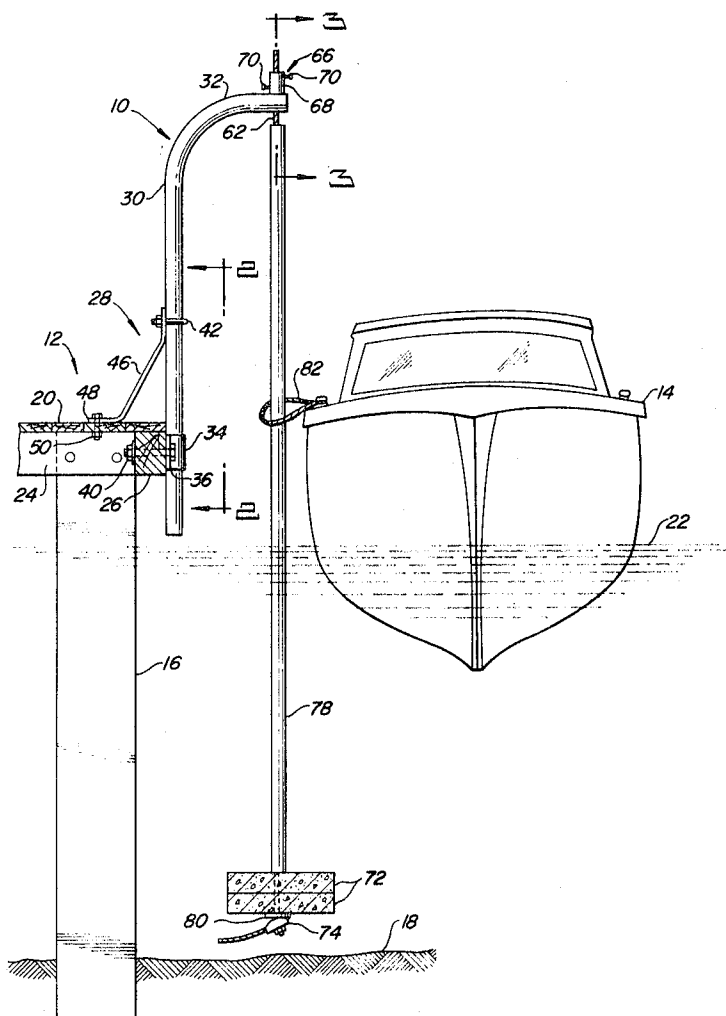
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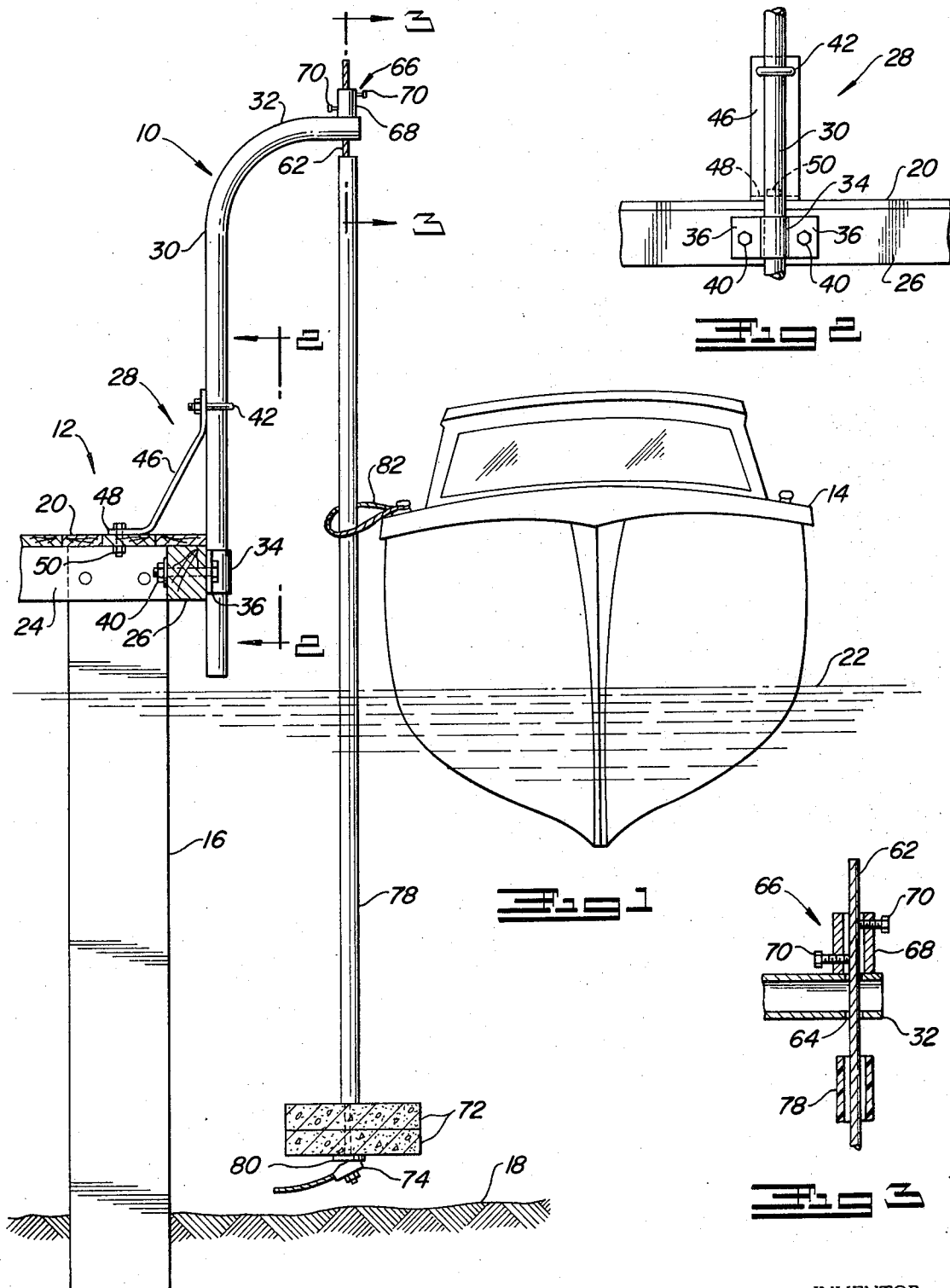
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ABSTRACT

The specification and drawings disclose devices for mooring boats. The devices are arranged to permit vertical movement of the boats, such as caused by rise and fall of tides or rolling of the boats while maintaining the boats away from an associated dock, pier, seawall, float or the like and redistributing or absorbing energy produced by the action of water, wind and other normally expected conditions. The devices disclosed all include a mounting assembly having a support arm adapted to extend outwardly above the normal maximum water levels. A mooring member extends vertically downward from the support arm to a predetermined position which, depending upon the application, may be either below or somewhat above the normal minimum water level. The member is supported only at its upper end and is not otherwise guided or constrained. Four specific embodiments are disclosed. Two comprise weighted cables and two other comprise resilient plastic pipes or tubes.

10 Claims, 16 Drawing Figures





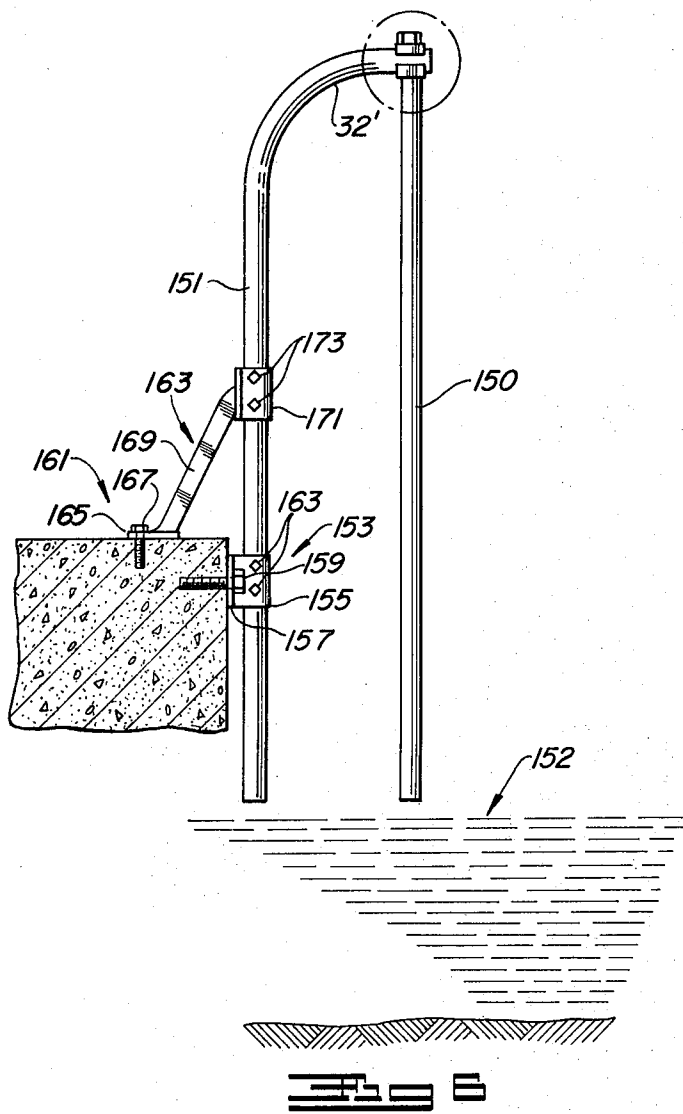
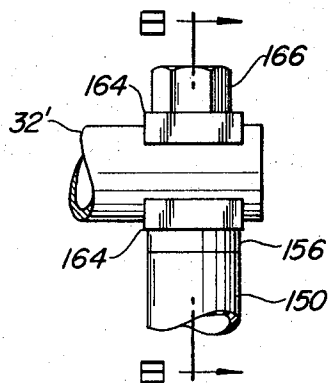
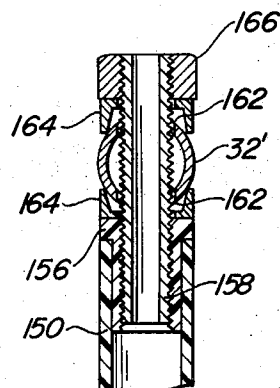
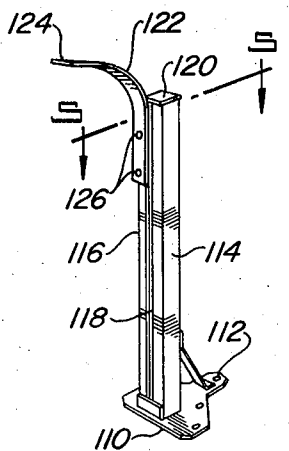
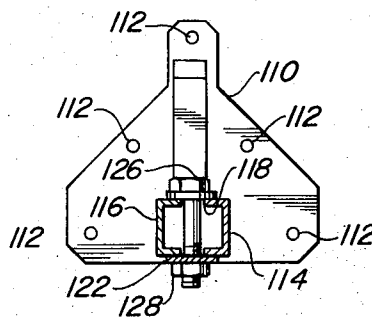
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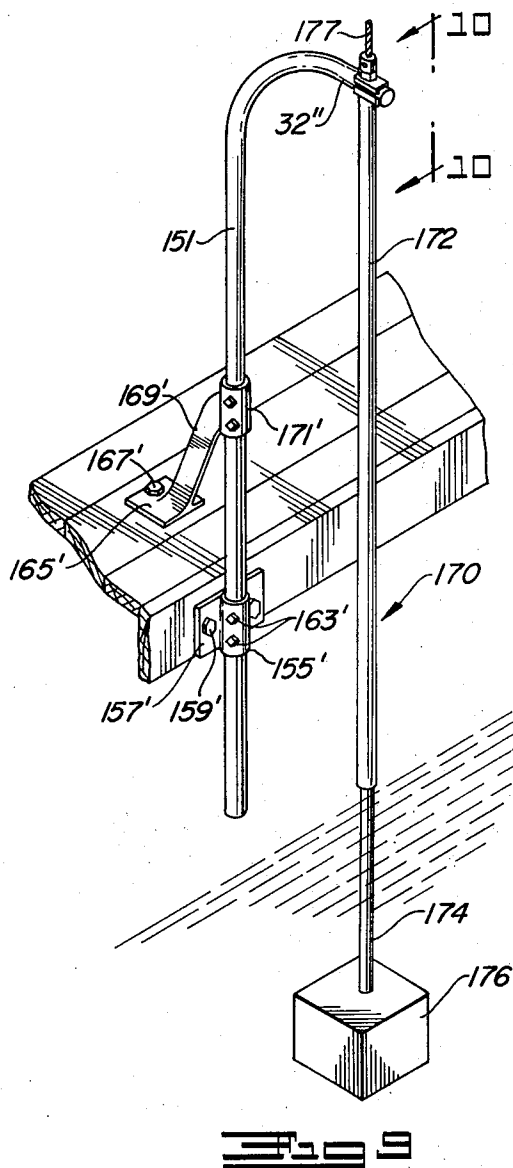
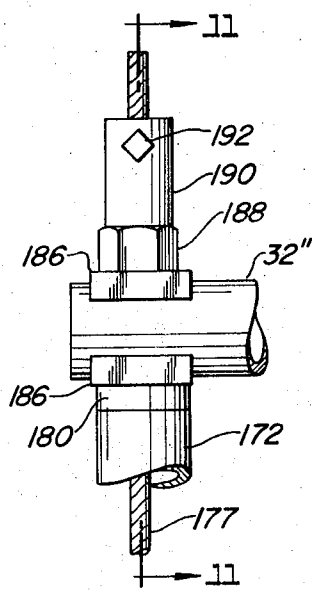
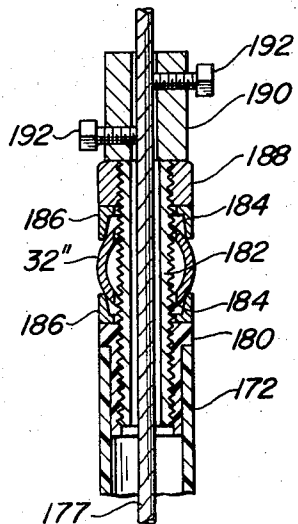
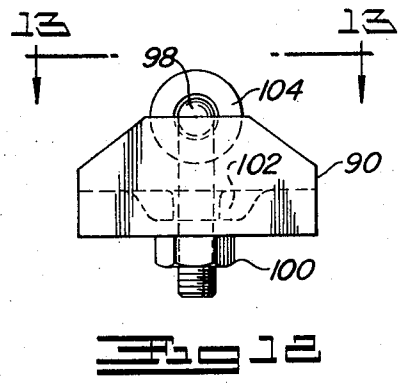
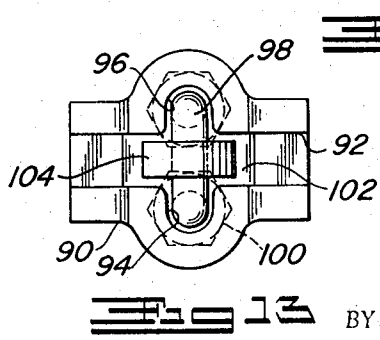
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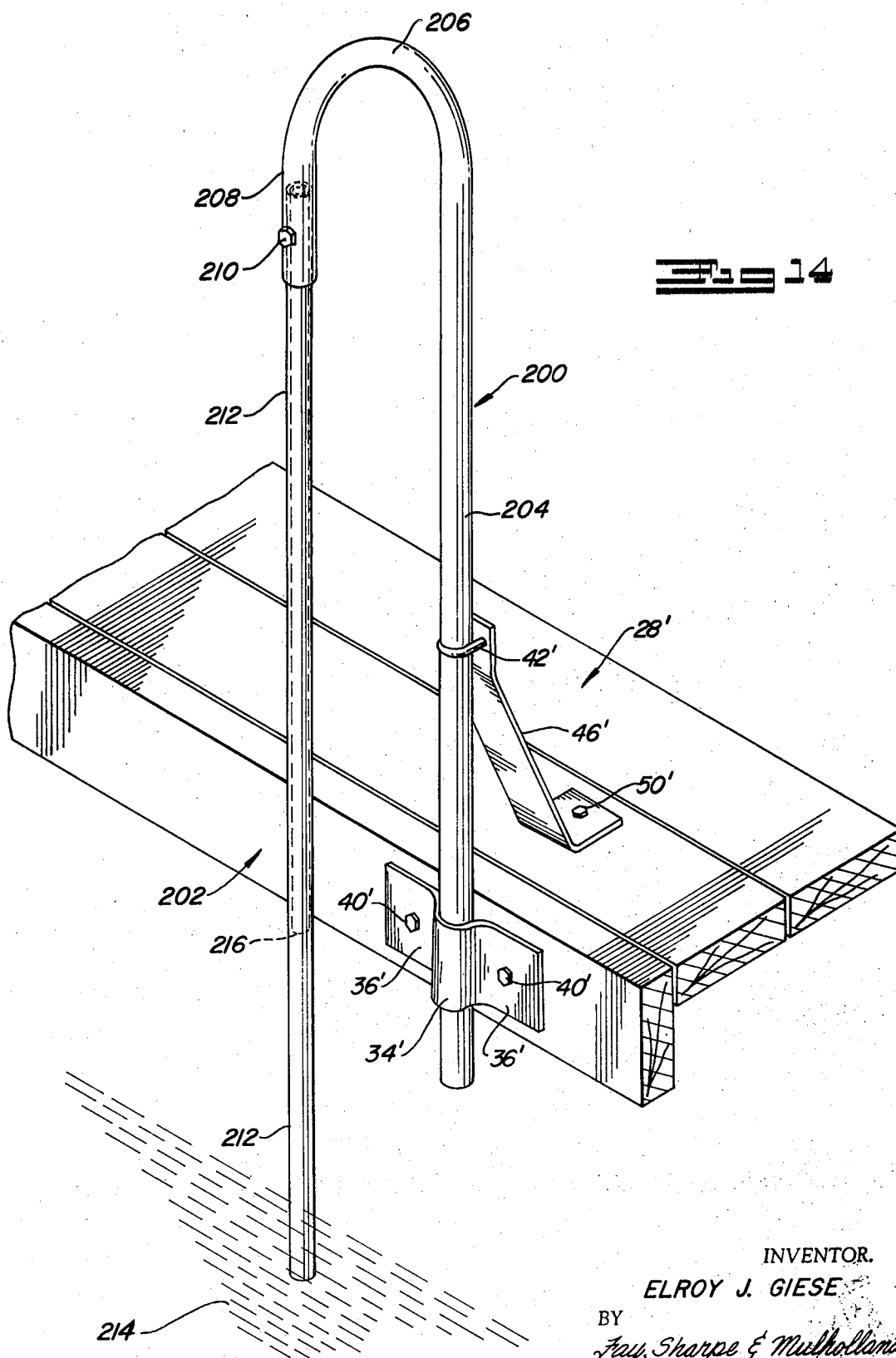


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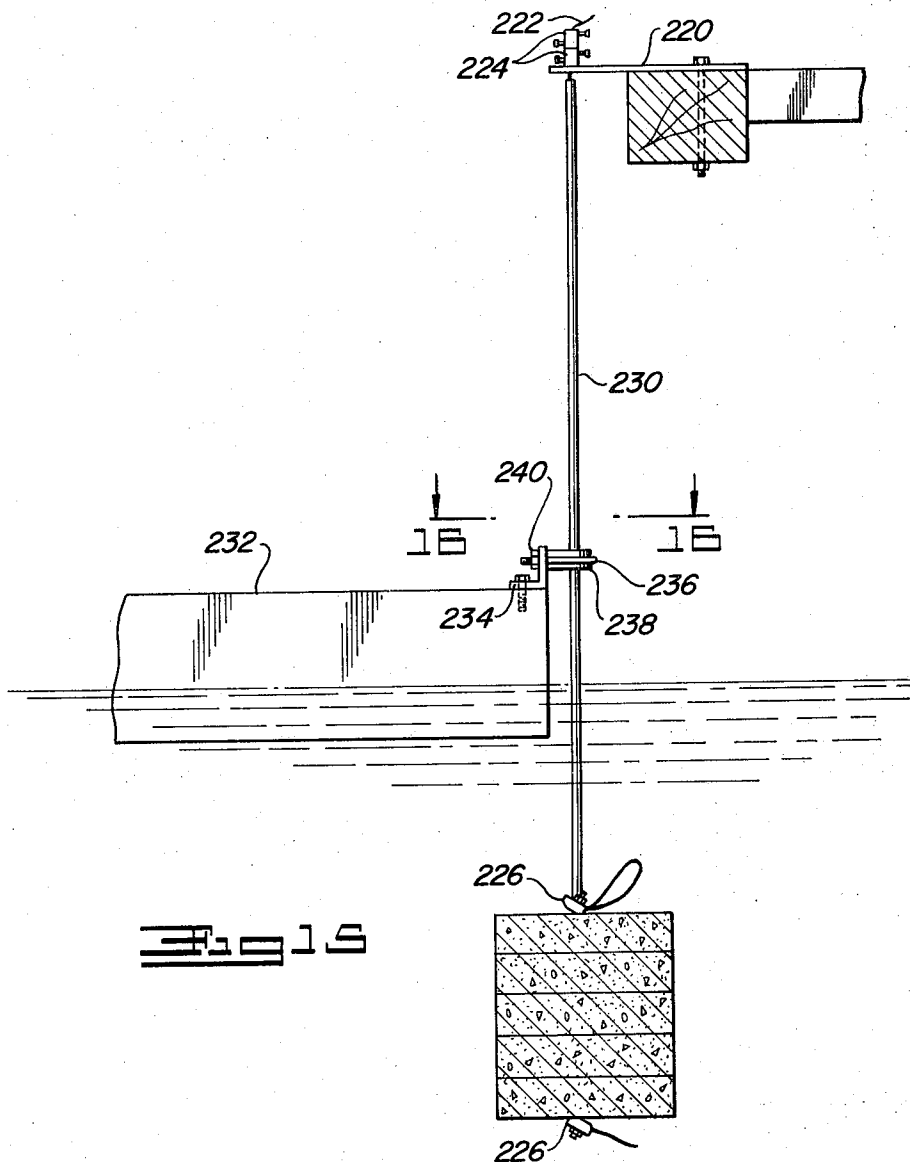


Fig 15

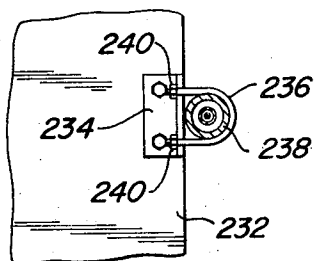


Fig 16

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VESSEL MOORING DEVICES

The subject invention is directed toward the art of boat mooring devices and, more particularly, to improved mooring devices which absorb or redistribute applied energy.

The invention is especially suited for mooring small craft and will be described with particular reference thereto; however, it will be appreciated the invention is capable of broader application and can be used for boats of a variety of sizes.

In general, a primary object of the invention is the provision of a simple boat mooring device that is adapted to absorb or redistribute, without injuring the boat, forces acting to move the boat. Broadly, the invention contemplates a mooring device including a mounting bracket assembly adapted to be mounted to a dock, pier, float, seawall or the like and having a vertically adjustable support arm portion which extends outwardly over the water surface at an elevation substantially above the normal maximum water level. Suspended from the outer end of the arm portion is a mooring or bumper member which, depending upon the application, extends vertically downward to a level substantially below the normal minimum water level or somewhat above the same. The member is supported only at its upper end and is not otherwise affixed to the dock or the like.

Four different embodiments of the mooring member are disclosed. One comprises a relatively flexible metal cable provided with a weight at its lower end. The size of the weight varies depending upon the size of the boat being moored, the amount of wave and wind action expected, and so on; however, for typical installations for small craft, two of the mooring devices with 160 to 480 pounds of weight on each is usually adequate. The action of the weighted cable is such that even under substantial, repetitively applied forces, its lateral deflection is extremely small. In fact, for comparatively large boats, the cables need to be no more than 12 to 18 inches from the dock.

A second embodiment of the mooring member comprises a somewhat resilient tube of rigid polyvinylchloride, stiff polyethylene or the like, which is connected to the support arm. The tube is, of course, relatively flexible and resilient throughout its length. The nature of the tube allows it to transfer energy produced by water, wind and similar conditions without permitting deflection of an amount sufficient to allow the boat to engage the associated dock or the like. The member and its mounting arrangement functions to redistribute energy of the boat normally transmitted to a more solid object (as opposed to a yielding object).

The third embodiment of the mooring member combines features of the first two and contemplates a member including a tube rigidly connected to the support arm and a weighted cable extending downwardly through the tube. This arrangement combines the action of the first two embodiments to provide an extremely effective mooring device which produces a damping action, as well as, redistributing applied forces.

A fourth embodiment of the invention contemplates a mooring device which comprises a mounting member in the form of a pipe having a first vertically extending portion adapted to be connected to the float, dock, seawall or the like. The upper end portion of the pipe is

curved outwardly and downwardly to provide a second, relatively short downwardly extending portion outwardly spaced from the first. A section of plastic pipe is received in the end of the second portion to extend downwardly toward the normal water level.

A further object of the invention is the provision of a mooring device which eliminates the need for fenders and similar cushioning devices between the moored vessel and the dock.

A further object of the invention is the provision of a device of the type described which quickly and easily absorbs or redistributes forces acting on the moored vessel, such as those produced by wind, waves and the like.

Another object is the provision of a mooring device that is suited for use on substantially any type of pier, dock, seawall or float and which will protect the moored vessel from normal forces acting thereon.

Still another object is the provision of a mooring device of the type discussed which allows vertical movement of the vessel as well as roll and pitch.

A further object is the provision of a mooring device wherein the moored craft is retained in a manner such that it can accommodate itself to movements produced by various environmental conditions and the like, but is held tightly enough to prevent damage to the vessel.

A further object of the invention is the provision of a mooring device which is simple to build and install.

Yet another object of the invention is the provision of a mooring device which can be used for boats of a variety of sizes.

Yet another object is a mooring device which is simple to remove for transfer to another location.

Another object is the provision of a mooring device which provides a safety grip for embarking and disembarking from the moored craft.

These and other objects and advantages will become apparent from the following description when read in conjunction with the accompanying drawings wherein;

FIG. 1 is an elevational view showing a mooring device formed in accordance with a preferred embodiment of the invention;

FIG. 2 is a view taken on line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a pictorial view of a modified form of mounting bracket for the mooring device;

FIG. 5 is a cross-sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is an elevational view of a modified form of mooring device formed in accordance with the invention;

FIG. 7 is an enlarged detailed view of the circled portion of FIG. 6;

FIG. 8 is a cross-sectional view taken on line 8—8 of FIG. 7;

FIG. 9 is a pictorial view of a third mooring device embodying the invention;

FIG. 10 is an enlarged view taken on line 10—10 of FIG. 9;

FIG. 11 is a cross-sectional view taken on line 11—11 of FIG. 10;

FIG. 12 is a detailed view of a preferred cable clamp utilized in the mooring devices;

FIG. 13 is a view taken on line 13—13 of FIG. 12;

FIG. 14 is a modified form of mounting bracket and mooring member;

FIG. 15 is an elevational view of a modified form of the invention; and,

FIG. 16 is a cross-sectional view taken on line 16—16 of FIG. 15.

Referring to particular in FIG. 1, a mooring device 10 is shown affixed to a dock 12 for mooring a vessel such as boat 14. Although the mooring device 10 is shown affixed to a stationary dock, it is to be understood that the device could be mounted on a floating dock, a seawall or the like. It should also be understood that only one of the devices shown; there are normally two or more positioned for attachment to the boat at appropriate points longitudinally thereof.

In the embodiment shown, the dock includes vertical pilings 16 which extend upwardly from the bottom 18 to support a wooden deck 20 a suitable distance above the normal maximum water level 22. The dock includes the necessary cross-beams 24 and longitudinal stringers 26.

The mooring device 10 is affixed to the dock and includes an assembly 28 which adjustably supports a rigid generally vertically extending pipe member 30. The pipe member 30 has its upper end portion 32 bent to define a support arm extending outwardly of the dock. Preferably, the arm portion extends from about 8 inches to about 18 inches outwardly of the dock. It will be noted that pipe member 30 can be used as a safety grip when embarking or disembarking from the moored vessel.

As best shown in FIG. 2, the bracket assembly 28 includes a first generally U-shaped member having a curved portion 34 and a pair of laterally extending flange or mounting portions 36. The portion 34 is sized so as to closely receive pipe 30 while permitting vertical adjustment of the pipe. In the embodiment shown, the mounting flanges 36 are connected to the longitudinal stringer 26 by a pair of bolts 40. Preferably, the depth of curved portion 34 is slightly less than the diameter of pipe 30 so that tightening of bolts 40 causes the pipe 30 to be clamped against the stringer 26.

The bracket assembly 28 also includes angle support member 46 which has a vertically extending upper end to which is connected a U-bolt that clampingly engages pipe 30. In the embodiment shown, the lower end of support member 46 is bent as shown at 48 and connected to deck 20 by a bolt 50. As is apparent, by loosening bolts 40 and U-bolt 42, the pipe 30 can be shifted vertically to position the outwardly extending end portion 32 a desired distance above the water level.

Supported from the outer end of the laterally extending support arm portion 32 of pipe 30 is a mooring and energy absorbing member. In the embodiment under consideration, the mooring member comprises cable member 62 which passes through an opening 64 formed in the outer end portion of member 32 (see FIG. 3). The cable 62, like the other elements of the assembly, is preferably formed from corrosion resistant material. For example, in the embodiment shown, the cable is formed from aluminum clad steel.

The cable is connected to and suspended from support arm portion 32 by a keeper member 66 which includes a rigid metal sleeve 68 having a center opening to receive the cable. A pair of set screws 70 pass

through threaded openings in sleeve 68 to affix cable 62 within the sleeve.

Carried at the lower end of cable 62 is a relatively heavy weight in the form of one or more blocks 72 of concrete or the like. The blocks have a center opening through which the lower end of the cable freely passes. A cable clamp 74 engages the cable at a position beneath the blocks to hold the blocks on the cable.

It will be noted that the cable 62 is not connected to the dock at its lower end. It is merely suspended in the water and maintained under a tension by the weight of the blocks 72. It has been found that lateral engagement of the cable by the boat under forces normally experienced, such as the wakes of passing boats, normal wind action, waves and the like, produces only a very slight lateral movement of the cable. Under normal conditions, a cable spacing from about 8 inches to about 18 inches from the edge of the dock is sufficient to prevent engagement of the blocks with the dock or the pilings.

It has been observed that the total weight suspended at the end of the cable does not have to be inordinately large. For example, for most craft up to about 30 feet in length, two cables each carrying weight of from about 160 pounds to about 480 pounds are usually adequate to prevent the craft from being moved into engagement with the dock under normal conditions. The ability of the weighted cable to absorb energy makes it a particularly effective mooring arrangement. Further, the action of the weights in the water produces a damping action on the cables.

In the embodiment shown in FIG. 1, the cable 62 has a loose plastic sleeve member 78 positioned to protect the boat from direct engagement with the cable. It will be noted that the sleeve 78 which, for example, is formed from polyethylene or the like, is freely rotatable about the cable 62 and extends from the blocks 72 to a position above the location where the cable could be engaged by a boat. A washer 80 is positioned between the blocks 72 and the clamp 74. The loose fitting relationship between the sleeve 78 and the cable 62 allows the sleeve to rotate about the cable to equalize wear around the periphery of the sleeve. In the embodiment shown, the boat 14 is connected to the cable 62 by a loop 82 which loosely encircles the sleeve 78. This allows free vertical movement of the boat while controlling lateral, axial and rolling movement.

The cable clamp 74 could take many forms, however, the preferred form is shown in FIGS. 12 and 13. An important aspect of the clamp is that it is designed to bend the lower end of the cable laterally so that it will not engage the bottom 18 of the waterway. In particular, the clamp includes a generally U-shaped cast body portion 90 which has a cable receiving groove or recess 92. The groove 92 has laterally extending recessed portions 94, 96 which receive a U-bolt member 98. The U-bolt member is positioned with its legs on opposite sides of the groove 92. Nuts 100 are threadedly received on the lower ends of the legs. As best shown in FIG. 12, the groove 92 has a depressed portion 102 which is directly under the U-bolt 98. Carried on the U-bolt is a roller shaped member 104 called a keeper. As can be appreciated, with the cable extending through the recess 92 and under the roller 104, tightening of the nuts 100 will cause the roller 104 to

force the cable into the recess 102. The bending or deflection of the cable causes it to extend laterally as shown in FIG. 1. An important aspect of the clamp is its ability to bend the cable at an angle. The bent portion has a broom-like action that sweeps the area under the blocks. This helps prevent sand and silt build-up in shallow water areas which could adversely affect the functioning of the apparatus.

FIGS. 4 and 5 show a modified form of adjustable support bracket which can be used in the FIG. 1 embodiment or in any of the other embodiments to subsequently be described. In particular, the FIG. 4 mounting bracket is arranged for any type of dock, pier or the like and includes a mounting base plate 110 which is formed from relatively heavy metal plate and provided with a plurality of bolt openings 112. Connected to the top surface of the plate 110 are a pair of channel members 114 and 116. As best shown in FIG. 5, the channels 114 and 116 are positioned with their flanges facing one another and in vertical alignment. The flanges are spaced so as to provide a pair of vertical grooves 118 which extend substantially the entire length of the channels. The particular manner in which the channels are joined to the base plate 110 is not of importance; however, in the illustration they are welded about their lower edges to the upper surface of the plate 110. Extending across the upper end of the channels is a cover plate 120 which is also welded to the channels.

Adjustably connected in the slot 118 is an arm 122 which is formed generally as shown and provides an outwardly extending support portion 124. The bracket arm 122 is adjustably connected to the grooves 118 by a pair of studs 126 which extend through openings in the bracket arm 122 and through the grooves 118. Nuts 128 are connected to the threaded outer ends of the studs 126. As can be appreciated, by tightening the nuts 128 the bracket arm is firmly clamped to the flanges of the channels 114 and 116 to lock it in a desired position. Merely by releasing the nuts, the bracket can be readjusted as desired.

FIGS. 6 through 8 show a modified form of mooring device which is particularly suited for smaller size vessels. The FIG. 6 through 8 embodiment could use the same mounting bracket assembly described with reference to the FIG. 1 embodiment; however, the mounting bracket assembly shown comprises a vertically extending pipe member 151 formed as the previously discussed pipe 30. Pipe 151 is adjustably supported at its lower end in a bracket 153 which comprises a short sleeve 155 which slidably receives pipe 151. Sleeve 155 is welded to a mounting bracket 157 which is connected by bolts or lag screws 159 to a vertical face of the pier or dock 161. Set screws 163 extend through sleeve 155 to releasably engage pipe 151. A second bracket portion 163 includes a base 165 which is joined to a horizontal surface of the pier or dock 161 by lag screws 167. A bracket arm portion 169 extends upwardly from the base 165 to a second sleeve 171 through which pipe 151 extends. A pair of set screws 173 pass through sleeve 171 and clampingly engage pipe 151.

In the FIG. 6 through 8 embodiment, the mooring member comprises a resilient tube member 150. The tube 150 is a relatively heavy walled piece of polyvi-

nylchloride tubing or the like which is mounted to extend vertically downward through the outer end portion of the bracket section 32'. Specifically, the tube is a section of 1 1/4 inch, Schedule 40 polyvinylchloride pipe. As shown, the member 150 is rigidly connected to portion 32' and extends to slightly above the normal water level 152, although it can extend below the water level if desired. The tube 150 is resilient throughout its length and provides a smooth surface against which the boat may engage. With the resilient nature of the tube 150, substantial and repetitive lateral forces can be exerted against the tube with only a small resultant deflection. The tube provides an extremely satisfactory mooring member or bumper.

The tube can be connected to the bracket in many ways; however, FIGS. 7 and 8 show the preferred connecting arrangement. As shown, the tube 150 is provided with an internally threaded polyvinylchloride insert 156 which is adhesively bonded within the upper end of the tube. A hollow threaded stud or sleeve member 158 is threaded within the insert 156 and it extends upwardly through openings 162 formed through the outer end of the bracket portion 32'. A pair of short channel sections 164 are positioned on opposite sides of the support arm portion 32' with their flanges engaged with the outer surface of the bracket. A nut 166 is threaded to the upper end of member 162 to allow the assembly to be rigidly clamped to the bracket.

FIGS. 9 through 11 show a third embodiment which combines features of the devices shown in FIGS. 1 and 6. The device of FIGS. 9 through 11 is shown as being provided with a mounting bracket formed in the same manner as the mounting bracket described with reference to FIGS. 6 through 8 embodiment. Accordingly, like reference numerals have been utilized to identify the same elements but differ therefrom by the addition of a prime (') suffix. The description of the FIG. 6 through 8 bracket is to be taken as equally applicable unless otherwise noted.

In particular, the embodiment of FIGS. 9 through 11 utilizes a combined weighted cable and resilient tubular mooring assembly 170. As shown, a first resilient tubular member 172 which comprises a section of polyvinylchloride pipe or the like is rigidly connected at its upper end to the support arm portion of the mounting bracket. A second section of polyvinylchloride pipe 174 is telescopically received in the lower end of section 172. Preferably, section 174 is slip fitted in section 172 so that it can be telescoped inwardly or outwardly relative thereto.

A cable 177 is supported from the outer end of the bracket arm portion and extends downwardly through the members 172 and 174 to a position below the normal minimum water level. A heavy weight in the form of a block 176 of concrete or the like is connected at the lower end of cable 177 by a clamp (not shown), such as the clamp shown in FIGS. 12 and 13.

The connection of the tube 172 and cable 177 66'' to the bracket on portion 32'' is best shown in FIGS. 10 and 11. As shown in FIG. 11, the tube 172, is provided with an internally threaded adapter plug 180 which is adhesively bonded in the upper end. A threaded stud 182 is received in the plug 180 and extends upwardly through openings 184 formed in the outer end of the bracket portion. Channel members 186 are positioned

on opposite sides of the pipe and arranged with flange portions in engagement with the outer surface of the pipe. A nut member 188 is engaged with the upper end of the threaded stud 182 and clamps the assembly to the bracket portion. The cable extends upwardly through the stud 182 and is anchored at its upper end by a keeper member 190 provided with a pair of set screws 192 which extend inwardly to affix the cable 177 in the keeper. As can be appreciated, by releasing the set screws, it is possible to adjust the cable to any desired length so that the lower end of the mooring member 170 is the proper distance below the water line; however, adjustment is preferably accomplished by releasing and moving the clamp on the lower end of the cable. Additionally, the telescoping nature of the tubular members 172 and 174 allows a wide degree of adjustment of the mooring member 170.

The combination of the tubular member 172 with the weighted cable allows substantial lateral force to be absorbed with very little shifting of the assembly. Additionally, the plastic tube provides a natural cushion for engagement by the vessel.

FIG. 14 shows an embodiment which is somewhat similar to the FIGS. 6 through 8 embodiment. In particular, the FIG. 14 embodiment is shown utilizing a supporting bracket arrangement identical to that described with reference to FIG. 1 and 2. Accordingly, like reference numerals have been used to identify the same parts but differentiated from the FIG. 1 embodiment through the use of prime (') suffixes. A description of a FIG. 1 element is to be taken as equally applicable to the corresponding numbered element of the FIG. 14 embodiment except as otherwise noted.

The features of importance in the FIG. 14 embodiment are the arrangement of the vertically extending support post 200 and its relationship to the downwardly extending mooring assembly 202. As shown, the support post 200 has a long vertical section 204 which passes through the U-bolt 42' and the U-shaped bracket 34' and is rigidly supported thereby. The upper end portion of the pipe 200 is curved as shown at 206 and has a short downwardly extending portion 208. The mooring assembly 202 is received within the open lower end of portion 208 and is connected therein by a bolt 210 which passes through the lower end of portion 208 and the upper end of the mooring assembly 202.

The mooring assembly 202 comprises a first elongated section of plastic pipe 212 which extends downwardly to a position approximately at the normal water level 214. The plastic pipe 202 is relatively resilient throughout its length and functions as described with reference to plastic pipe 150 of the FIG. 6 embodiment. Preferably however, a second section of pipe 216 is telescoped in the upper end of pipe 202 and extends downwardly throughout the portion of major flexure. The FIG. 14 embodiment thus provides a vertically extending mooring member of varying resilience which functions to redistribute substantial amounts of repetitively applied energy. Additionally, the nature of the vertical support pipe 200 and its curved upper end allows it to have sufficient resilience to function as a force distributing member. FIGS. 15 and 16 show an arrangement of the invention which is particularly suited for use on raised docks or piers to which a floating dock is connected for movement vertically with

changing tides. As best shown in FIG. 15, a support arm member 220 extends laterally from the pier or fixed dock. The support arm is, in the embodiment shown, simply a metal plate bolted to the pier and extending laterally therefrom at a level above the normal minimum water level. A relatively heavy flexible metal cable 222 is supported from the outer end of the support arm 220 and is releasably connected thereto by a pair of keeper members 224 which are identical to member 190 of the embodiments of FIGS. 9 through 11. At the lower end of the cable 222 a plurality of heavy weights or cement blocks are supported and connected by cable clamps 226 on opposite sides thereof. The clamps 226 are of the type shown in FIGS. 12 and 13. At the upper clamp 226 a loop of cable is provided so that the blocks can be raised or lowered.

Extending substantially throughout the length of the cable above the weights is a plastic tube 230 which is freely rotatable relative to the cable 222. The floating dock or other vessel 232 is connected with the cable so that it is prevented from moving laterally but permitted to ride vertically up and down the cable with changing tides. In the embodiment shown, the connecting means comprises an angle bracket member 234 which is bolted or otherwise positively connected to the dock 232 and provided with a U-bolt 236 which encircles the cable 222. A resilient wear sleeve or bushing 238 is positioned within the U-bolt and firmly clamped therein by tightening of the nuts 240. It is to be appreciated that other types of connecting means could be used for attaching the dock to the vertical cable.

The invention has been described in great detail sufficient to enable one of ordinary skill in the art to make and use the same. Obviously, modifications and alterations of the preferred embodiment will occur upon a reading and understanding of the specification and it is my intention to include all such modifications and alterations as part of my invention insofar as they come within the scope of the appended claims.

What is claimed is:

1. A mooring device for vessels comprising:

- a bracket assembly including a laterally extending support arm portion, mounting bracket means including adjustment for adjustably supporting said support arm from a dock or the like with said support arm extending outwardly thereof above the normal maximum water level;
- a flexible cable adjustably suspended from the support arm portion and extending vertically downwardly to a point beneath the normal minimum water level but having clearance from the bottom; said cable being supported only above the water level with the portion below the water level suspended in the water without further support from the dock,
- a weight connected to the lower end portion of said cable; and,
- a tube member formed of resilient plastic material positioned about said cable.

2. The device as defined in claim 1 wherein said tube member has its upper end portion rigidly connected to said support arm.

3. The device as defined in claim 1 wherein said tube member extends between the support arm and the weight and is freely rotatable about said cable.

4. The device as defined in claim 1 wherein said bracket assembly includes a vertically extending member which extends upwardly above said dock or the like and from which said support arm extends.

5. The device as defined in claim 1 wherein said bracket assembly includes mounting plate members adapted to engage a top and side surface of said dock or the like; and wherein said support arm is carried by a vertical member adjustably connected to said mounting plate members.

6. The device as defined in claim 1 including means for allowing adjustment of the position of said weight on said cable.

7. A mooring device comprising a support bracket assembly including a support arm member and mounting means for connecting said support arm to a dock or the like so said support arm extends laterally of said dock or the like at an elevation above the normal maximum water level;

a mooring member depending from the outer end portion of said support arm and extending vertically downward, said mooring member comprising an elongated, relatively resilient first plastic tubu-

lar member connected at its upper end to said support arm and otherwise unengaged or supported by said bracket assembly said support arm including a tube member having a first vertically extending portion terminating at its upper end in a U-shaped return bend portion, said mooring member being received in said return bend portion and extending downwardly therefrom generally parallel to said first portion of said support arm.

8. The mooring device as defined in claim 7 including a second plastic tubular member telescopically received in said first plastic tubular member and extending downwardly.

9. The mooring device as defined in claim 7 wherein said bracket assembly includes means for permitting adjustment of the elevation of said support arm.

10. The mooring device as defined in claim 7 wherein said support arm member is adjustably carried by said support bracket assembly includes a generally upwardly extending bracket which is releasably connected to the first vertically extending portion of said support arm.

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