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Wire bracket assembly for containment berm

Abstract

A containment berm having a flexible, substantially impermeable polymer material forming a ground section with a plurality of sidewalls extending upward from the ground section. A plurality of bracket assemblies are positioned on an external surface of the containment berm. Each of the bracket assemblies includes (i) a pair of first leg segments having first and second ends, the pair of first leg segments being joined by an end segment at their second ends; (ii) a pair of second leg segments having first and second ends, the pair of second leg segments being configured to allow relative movement between their second ends; and (iii) the pair of first leg segments and the pair of second leg segments being joined at their first ends in a substantially perpendicular configuration. One of either the pair of first or second of leg segments engages pockets on the sidewalls.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. Non-Provisional application Ser. No. 16/927,199, filed on Jul. 13, 2020, which claims the priority benefit under USC § 119 to U.S. Provisional Application No. 62/875,281, filed on Jul. 17, 2019, both of which are incorporated by reference herein in their entirety.

BACKGROUND
(1) This disclosure is directed to a flexible, portable containment apparatus for capturing liquid pollutants such as petrochemicals and the like. Environmental ground contamination is often the long term result of repeated spills of such materials during the transfer from one container to the other at a particular site, for example where vehicles are fueled and serviced. Flexible, portable structures for capturing pollutants or contaminants, often called "containment berms" are well known in the art. FIG. **1** illustrates a containment berm **100** having a ground section **102** and sidewalls **103**. Although section **102** is referred to as a "ground section," the containment berm could be positioned on any surface where potential spills need to be contained, e.g., within a building workspace or on an elevated platform.
(2) Whether the berm is rectangular, round, or otherwise, sidewalls normally enclose berm **100** to prevent the escape of liquids. In FIG. **1**, the sidewalls **103** are shown in a substantially lowered or collapsed state. The vehicle **110** will drive over the sidewalls **103** and once the vehicle is fully over ground section **102**, the sidewalls **103** may be raised. Although not specifically shown in FIG. **1**, it is also well known to position brace members against the sidewalls to maintain sidewalls **3** in a raised position to retain spilled liquids within the containment berm.
(3) Often these braces are rigid, bulky devices which are not easily installed on the containment berm. When the braces are not permanently attached to the berm material, the braces easily become misplaced and are not available when needed. When the braces are attached to the berm material, the braces are often a hindrance to compactly folding the containment berm for storage. Additionally, when the permanently attached braces become damaged, it is often necessary to replace the entire containment berm as opposed to merely the damaged brace(s). A containment berm having inexpensive braces which can be easily replaced would be a significant improvement in the art.
SUMMARY OF SELECTED EMBODIMENTS
(4) One embodiment of the invention is a containment berm having a flexible, substantially impermeable polymer material forming a ground section with a plurality of sidewalls extending upward from the ground section. A plurality of bracket assemblies are positioned on an external surface of the containment berm. Each of the bracket assemblies includes (i) a pair of first leg segments having first and second ends, the pair of first leg segments being joined by an end segment at their second ends; (ii) a pair of second leg segments having first and second ends, the pair of second leg segments being configured to allow relative movement between their second ends; and (iii) the pair of first leg segments and the pair of second leg segments being joined at their first ends in a substantially perpendicular configuration. One of either the pair of first or second leg segments engages a pocket on the ground section and the other of the pair of first or second leg segments engages a pocket on a sidewall.

Description

BRIEF DESCRIPTION OF DRAWINGS
(1) FIG. **1** illustrates a prior art containment berm.
(2) FIG. **2** is a perspective view of a containment berm with one embodiment of the bracket

assembly of the present invention.
(3) FIGS. **3**A to **3**C illustrate three embodiments of the bracket assemblies.
(4) FIG. **4** illustrates the bracket assembly engaging one embodiment of a pocket formed on the berm sidewall.
(5) FIG. **5** illustrates another embodiment of the material layers forming a bracket pocket.
DETAILED DESCRIPTION OF SELECTED EMBODIMENTS
(6) FIG. **2** shows a section of a containment berm **1** generally formed of the ground section **2**, the sidewalls **3**, and the bracket—pocket assemblies (or sometimes “bracket assemblies”) **10** positioned between the ground section **2** and a sidewall **3** on the external surface of the containment berm **1**. In FIG. **2**, bracket assembly **10**'s connection to the ground section is on the underside **4** of the ground section which is hidden from view in FIG. **2**. Typical heights “h” for berm sidewalls **3** often range between 4″ and 24″ (although lengths outside this range are possible). As suggested in FIG. **2**, containment berms are often rectangular, but could be circular or any other shape. The size of the containment berms can vary greatly, for example as small as a width×length of 3′×3′ to greater than 50′×100′ (including any size area in between and any geometric configuration). In other embodiments, the containment berm will have a length of between 3′ and 200′, a width between 3′ and 100′, and a wall height between 4″ and 3′.
(7) FIG. **3**A shows one embodiment of a bracket assembly **10**. The bracket assembly **10** includes a pair of first leg segments **12** with each leg segment **12** having first end **13** and second end **14** and the two first leg segments **12** being joined by an end segment **15** at the second ends **14** of the first leg segments **12**. A pair of second leg segments **17** also have first ends **18** and second ends **19**, with the second leg segments **17** being connected to the first leg segments **12** at the joinder section **25** in a substantially perpendicular configuration. In certain embodiments, “substantially” perpendicular means between 65° and 115° (i.e., with “perpendicular” being 90°), while in other embodiments, it means between 75° and 105°, or between 85° and 95°. It can be seen that the second ends **19** of the second leg segments **17** are not joined together and thus are configured to allow relative movement between the second ends **19**. In the embodiments shown in FIGS. **3**A and **3**B, the second ends **19** of the second leg segments **17** have leg tips **21** bent inward toward one another. FIG. **3**C shows an embodiment where leg tips **21** are turned in an opposing direction. In other words, in the plane containing both second leg segments **17**, the tips **21** are oriented about 180° away from one another, i.e., in a generally opposing direction in the plane containing the pair of second leg segments.
(8) In many embodiments, the first and second leg segments **12** and **17** are each between 4″ and 24″ in length (e.g., 12″ in FIG. **3**A and **6**″ in FIG. **3**B). In such cases, the segment **15** is typically between 1″ and 5″ in length. While the first and second leg segments are often the same length, there may be embodiments where they are of different lengths. The leg tips normally have a length of between 0.20″ and 2.0″, with the FIGS. **3**A to **3**C embodiments having a length of 0.5″. Stated differently, tips **21** will in many embodiments have a length that is between 1.5% and 15% (or any sub-range in between) the length of second segments **17**.
(9) The bracket assembly **10** can be made of many different materials, including metals and polymers, as long as the material exhibits sufficient spring force to function as described below. A conventional spring steel rod between 2 mm and 12 mm (or any subrange in between) in diameter is one preferred material. For example, the rod could be SAE grade 1074/1075, 1095, 5160, 9255, or 301. In preferred embodiments, the rod is galvanized steel. Of course, the “rods” could employ a non-round cross-section with a cross-sectional area of, for example, between 5 mm.sup.2 and 125 mm.sup.2. In many embodiments, the bracket assembly **10** is a continuously fabricated section of wire (i.e., fabricated by drawing or rolling) bent beyond its yield point into the shape described above. However, the bracket assembly could alternatively be formed of discrete sections of material welded or otherwise connected together in the final shape of the bracket. In either case, the bracket assembly is constructed such that in its relaxed state, the spring force of the material causes

the two joinder sections **25** to spread apart a greater distance than the length of end segment **15**. In preferred embodiments when the bracket assembly is in the relaxed state, the distance between the two joinder sections **25** will be between 5% and 50% greater (or any subrange in between) than the length of end segment **15**. FIG. **3**B suggests how an angle alpha (α) is formed between leg segment **12** and end segment **15**. In many embodiments, this angle α, when the bracket assembly is in the relaxed state, will be somewhat greater than 90°, e.g., any angle between 95° and 135°. FIG. **3**C shows an α of 95°.

(10) In most embodiments, the bracket assembly **10** will support the sidewalls **3** of containment berm **1** by one pair of the leg segments (either first **12** or second **17**) engaging a pocket on the sidewall **3**. The detail section of FIG. **4** illustrates one example of how a sidewall pocket **30** may be formed on the berm. A 2″ to 6″ upper flap **6** of sidewall **3** is folded outward and downward back against the outer portion of sidewall **3** adjacent to flap **6**. Heat weld sections **7** secure the lower edge of flap **6** to the adjacent portion of sidewall **3** below the upper edge **8** of the sidewall. However, breaks or spaced apart gaps are left in weld sections **7** that will form pockets **30**. As suggested in FIG. **4**, the width of pockets **30** (i.e., gaps in section **7**) will be sufficient that the second pair of leg segments **17** can be squeezed together and inserted in pockets **30**, but the pocket width is somewhat narrower than the distance between leg segments **17** in the bracket's relaxed state. In many embodiments, this width is between about 3″ and about 6″. When leg segments **17** are allowed to return to their relaxed state, they will expand against the edges of the pockets **30**, i.e., the edges of weld sections **7**. The leg segments **12** will rest between the ground and the outer surface of the bottom section **4** of the berm.

(11) It can be envisioned from FIG. **4** how forces (e.g., wind) lifting the berm **1** would normally have a tendancy to pull the bracket assemblies **10** out of engagement with pockets **30**. However, it will also be seen that the tips **21** on leg segments **17** will engage the edges of pockets **30** and prevent complete withdrawal of the leg segments **17** from the pockets. Likewise, when it is desired to remove leg segments **17** from pockets **30**, the leg segments can be squeezed together to allow tips **21** to slide past the pocket edges.

(12) Although the FIG. **4** embodiment shows the leg segments **12** not retained in a pocket, alternative embodiments could also secure leg segments **12** in a pocket positioned on the underside **4** of berm ground section **2**. FIG. **5** illustrates a pocket **40** formed of two layers or panels of material bonded, sewn, or otherwise fixed to the ground section. The panels may be formed of many different materials having the required strength, but often will be constructed of the same material as the berm itself, e.g., polyvinyl chloride, polyethylene, urethane or a blend of various polymers to provide specific chemical resistance or structural characteristics. The panels' thicknesses may vary based on the mechanical characteristics desired, but will generally range between 15 and 60 mils. FIG. **5** shows the base panel **31** together with the pocket or sleeve panel **32**. The pocket panel **32** will generally be similar to base panel **31**, but will be positioned over and secured to base panel **31**. The panel may be secured together by any conventional (or future developed) technique, including gluing, chemical bonding, extrusion welding, heat sealing, or simply sewing the two panels together. However, not all of the pocket panel **32** will be fixed to base panel **31**. The two panels will be joined in the peripheral areas **33**, but not at pocket opening or mouth **34**. As suggested in FIG. **5**, the combined base panel **31** and pocket panel **32** will then be secured to the underside **4** of ground section **2**, such that pocket **40** is positioned on the ground section.

(13) FIG. **5** likewise suggests how in the illustrated embodiment, the pocket **40** will have a width “w” approximating the length of end segment **15**. The pocket **40** seen in FIG. **5** has a length L**1** into which the bracket leg segments may slide. Often this length L**1** is between 20% and 75% the length of the leg segments, but could be a larger percentage. The flexible nature of berm material and the bracket assembly allows manipulation of the leg segments and pockets necessary for the leg segments to be inserted into their respective pockets **30** and **40** (if present). Although less preferred,

the pockets **30** seen in FIG. **4** could alternatively be formed in the manner shown in FIG. **5**. Moreover, although it is preferred the pockets be on the outside surface of the berm, there could be specialized embodiments where the pockets were positioned on the inside surface of the berm. FIG. **2** illustrates the spacing distance “d” between hinge assemblies **10** along the sidewalls of containment berm **1**. In many embodiments, the distance d will be between about 12″ and about 48″, with more preferred embodiments having a distance d between about 24″ and about 36″. Nevertheless, there could be embodiments having a spacing distance d outside of these ranges.
(14) There could be many possible variations and modifications of the embodiments described above. For example, although the figures illustrate the end segment **15** forming the end of the pair of first leg segments **12**, the cross-piece formed by end segment **15** could be positioned closer along the leg segments to joinder section **25** (as opposed to at the very end of leg segments **12**). In another example, the second leg segments **17** could form an angle of greater than 90° with the plane which contains the pair of first leg segments. FIG. **3**B shows the angle β between the second leg segments **17** and the plane which contains the pair of first leg segments (the angle β is formed in the plane containing the pair of second leg segments). In many embodiments, this angle β, when the bracket assembly is in the relaxed state, will be somewhat greater than 90°, e.g., any angle between 95° and 135°. The angle β could be employed in conjunction with the angle α, or could be employed in place of the angle α (i.e., the angle β would be used alone in the bracket assembly).
(15) The term “about” will typically mean a numerical value which is approximate and whose small variation would not significantly affect the practice of the disclosed embodiments. Where a numerical limitation is used, unless indicated otherwise by the context, “about” means the numerical value can vary by +/−5%, +/−10%, or in certain embodiments +/−15%, or even possibly as much as +/−20%. Similarly, “substantially” will typically mean at least 85% to 99% of the characteristic modified by the term. For example, “substantially all” will mean at least 85%, at least 90%, or at least 95%, etc.

Claims

1. A portable containment berm system comprising: a) a containment berm comprising a sidewall having a plurality of pockets; b) a plurality of brackets each adapted to engage one of the plurality of pockets, wherein each of the plurality of bracket assemblies is formed from a continuously fabricated length of material and comprises: i) a pair of first leg segments having first and second ends; ii) an end segment connecting the second ends of the pair of first leg segments; iii) a pair of second leg segments substantially perpendicular to the pair of first leg segments, wherein a first end of the pair of second leg segments is connected to the first ends of the pair of first leg segments, and wherein the second ends of the pair of second leg segments are not joined in order to allow relative movement between the second ends of the second leg segments.
2. The portable containment berm system of claim 1, wherein the material is a steel wire between 3 mm and 12 mm which is bent beyond its yield strength to define the pair of first leg segments, the pair of second leg segments, and the end segment.
3. The bracket assembly of claim 1, wherein the second ends of the pair of second leg segments have leg tips bent in an opposing direction in a plane containing the pair of second leg segments.
4. The bracket assembly of claim 1, wherein an angle α is formed between the first leg segments and the end segment, wherein the angle α is between 91° and about 135°.
5. A method of deploying a portable containment berm system, the method comprising the steps of: a) positioning on a surface a berm including a flexible, substantially impermeable polymer material forming a ground section with a plurality of sidewalls extending upward from the ground section; b) positioning in pockets formed on the berm sidewalls a plurality of bracket assemblies, each of the bracket assemblies including: i) a pair of first leg segments having first and second ends, the pair of first leg segments being joined at their second end by an end segment between 1″ and 5″ in

length; ii) a pair of second leg segments having first and second ends, the pair of second leg segments not being joined in order to allow relative movement between their second ends; iii) the pair of first leg segments and the pair of second leg segments being joined at their first ends in a substantially perpendicular configuration; iv) the first pair and pair of second leg segments each being between 4″ and 24″ in length; the leg segments being formed from a continuous length of material with a diameter between 3 mm and 12 mm; and c) wherein the pair of second leg segments are compressed together to facilitate insertion into the pockets and then compression of the second leg segments is release allowing the leg segments to expand against an interior surface of the pockets.
6. The method of claim 5, wherein the second ends of the pair of second leg segments have leg tips bent away from one another.
7. The method of claim 5, wherein the containment berm has a length of between 3′ and 200′, a width between 3′ and 100′, and a wall height between 4″ and 3′.
8. The method of claim 5, wherein an angle α is formed between the first leg segments and the end segment, wherein the angle α is between 91° and about 135°.
9. The method of claim 5, wherein the pockets on the sidewalls are configured by (i) a material forming the sidewall including an upper flap section, (ii) the flap section being folded downward against a portion of the sidewall, (iii) the flap section being attach to the sidewall at a point below an upper edge of the sidewall, and (iv) spaced gaps being left in the attachment of the flap section in order to form pocket openings.
10. A containment berm comprising: a) a flexible material forming a ground section with a plurality of sidewalls extending upward from the ground section; b) a plurality of bracket assemblies positioned on a surface of the containment berm, each of the bracket assemblies formed from a continuously fabricated length of material and including i) a pair of first leg segments having first and second ends, the pair of first leg segments being joined by an cross segment; ii) a pair of second leg segments having first and second ends, the pair of second leg segments being configured to allow relative movement between their second ends; iii) the pair of first leg segments and the pair of second leg segments being joined at their first ends with an angle between the first and second leg segments of between 60° and 120°; and c) wherein one of either the pair of the first or second leg segments engages a pocket on one of the plurality of sidewalls.
11. The containment berm of claim 10, wherein the leg segments are have a cross sectional area of between 7 mm.sup.2 and 115 mm.sup.2.
12. The containment berm of claim 10, wherein the bracket assemblies are positioned on an external surface of the containment berm.
13. The containment berm of claim 10, wherein the cross segment is at the second end of the first leg segments.
14. The containment berm of claim 10, wherein the angle between the first and second leg segments is between 75° and 115°.