An apparatus that can be removably attached to an excavator has a bottom portion having a screen as part of the container, and the container has a variable widthwise coverage area. Liquid may drain from the screen, and debris may remain in the container to clean swampy areas.
DEBRIS REMOVAL APPARATUS

BACKGROUND OF THE INVENTION

[0001] This invention relates to an apparatus to remove solid debris from an area containing a liquid. The apparatus can attach to an excavator arm, or an excavator bucket. The width of the apparatus is variable, depending on the desired use.

[0002] U.S. Pat. No. 6,990,758 discloses a heavy-duty scraping and rake attachment for excavator buckets for clearing brush-covered earth. The attachment is easily mountable to the bucket, thus avoiding the work and expense of removing the bucket from the arm. The scraper portion provides for offset toothed scrapers, a combination of toothed scraper and blade, and blade only use and is used in conjunction with a heavy-duty rake and power-operated thumb to grasp and remove the material rooted or scraped up from the earth by the scraper. The scraper portion and rake are included in a single unit, attachable and detachable from the excavator bucket. Scrapper blade attachments are either detachably connected to the unit with bolts or permanently welded in place as desired.

[0003] U.S. Pat. No. 5,544,435 discloses a brush rake for attachment to an excavator arm equipped with a bucket and a thumb having inner and outer pairs of teeth. The brush rake has a parallel array of rake teeth attached to a rake bar, and a mounting plate having one end thereof attached to the rake bar. An opposite end of the mounting plate is adapted to overlie the body of the thumb and to be received between the outer pair of teeth of the thumb. A parallel pair of apertured ears attached to the rake bar is so disposed thereon that when the rake bar is placed adjacent and transversely with respect to the teeth of the thumb, the ears lie adjacent and on opposite sides of the inner teeth of the thumb. Mounting holes are provided in the mounting plate and matching holes are bored through the body of the thumb. The brush rake is attached to the thumb by inserting pins through the ears and through holes bored through the inner teeth of the thumb, and by inserting mounting bolts through the mounting holes and matching holes in the thumb.

[0004] U.S. Pat. No. 4,517,755 discloses a claw/rake tool attachment for use with a powered digging or material moving machine. The attachment is for clearing undergrowth and timber and consists of spaced parallel tines mounted onto a support means that is affixed to the work arm of a machine. The undergrowth and timber are held by the tines while unwanted material such as soil and the like passes through the space between the tines and is not carried with the undergrowth and timber being cleared.

[0005] As can be seen, there is a need for an apparatus that among other things, provides for use with an excavator: (1) the use of a screen to allow liquid to drain out of the apparatus, and allows the apparatus to pick up the debris, such as plant-life; (2) a structure having container portion with a bottom with upstanding edges to capture and retain the debris; (3) a structure that may accommodate cleaning ditches of varying widths by; (4) can carry and transport any debris that it picks up; (5) can determine if the container if off balance; and (5) can have non-metallic features that protect the user from electrical shock.

SUMMARY OF THE INVENTION

[0006] One aspect of the present invention is a debris cleaning apparatus (10), comprising: a container (140) having a left edge (150) and a right edge (160), and a front edge (220); a means to attach (190) the container (140) to an excavator bucket (100); a screen (80) disposed between said left edge (150) and said right edge (160) along the horizontal direction; and between the front edge (220) and a first member upper edge (70); and a means to adjust the widthwise coverage area (260) of the container.

[0007] Another aspect of the present invention is a debris cleaning apparatus (10), comprising: a container (140) having a left edge (150) and a right edge (160), and a front edge (220); a means to attach (190) the container (140) to an excavator bucket (100); a screen (80) disposed between said left edge (150) and said right edge (160) along the horizontal direction; and between the front edge (220) and a first member upper edge (70); and a compression weight sensor (370) disposed in a position to monitor a downward force near the left fourth member (50), and another compression weight sensor (370) positioned to monitor a downward force disposed near the right fourth member (50).

[0008] These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 illustrates an embodiment of the debris removal apparatus;
[0010] FIG. 2 illustrates an embodiment of the debris removal apparatus in operation, with debris in the container of the apparatus; and
[0011] FIG. 3 illustrates an embodiment of the function and structure of the retention member.

DETAILED DESCRIPTION OF THE INVENTION
The following detailed description is of the best currently contemplated modes of carrying out the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention, since the scope of the invention is best defined by the appended claims.

Broadly, the present invention may be used for removing debris in roadside swampy ditches. The present invention may be removably mounted to an excavator bucket, or if the bucket is removed, it may be removably connected to the excavator arm. The present invention is of particular importance for use to remove plant-life, such as weeds, lilypads, and other debris, while allowing the water, small animals, and microbes to remain in the environment.

The present invention differs from the prior art by, among other things, (1) the use of a screen to allow liquid to remain, and allows the apparatus to pick up the debris, such as plant-life; (2) a structure having a bottom with upstanding edges to capture and retain the debris; (3) a structure that may accommodate cleaning ditches of varying widths; (4) can carry and transport any debris that it picks up; (5) has weight sensors that allow the operator to determine if the container is off balance; and (6) has a non-metal component separating the apparatus from the excavator, to prevent electrical damage to the excavator, or the operator.

FIG. 1 illustrates an embodiment of the present invention of the debris cleaning apparatus 10, which may have a container 140. The container 140 may have a first member 20, and it may have a second member 30 extending forwardly from said first member 20. The first member 20 may extend leftwardly to a left edge 150, and the first member 20 may extend rightwardly to a right edge 160.

A third member 40 may extend upwardly and forwardly from said second member 30, terminating at a front edge 220 at about a 45 degree angle. A fourth member 50 may extend leftwardly and upwardly from the second member 30 at about a 45 degree angle. Another fourth member 50 may extend rightwardly and upwardly from the second member 30 at about a 45 degree angle. A fifth member 60 may be pivotally mounted on the left edge 150. The fifth member 60 may pivot on an axis that is parallel to the left edge 150. Another fifth member 60 may pivot on an axis that is parallel to the right edge 160.

In one embodiment the second member 30 may define the bottom of the container 200.

FIG. 1 also illustrates a top support 130 which may run widthwise. A transverse attachment 120 (best seen in FIG. 2) may be disposed or securely attached to the top support 130. The transverse attachment 120 may be an L-shaped bracket, with the upper side disposed substantially horizontal, and then extend downwardly.

Screen supports 210 may extend lengthwise from the top support 130 to the front edge 220. Screen supports 210 may be disposed substantially parallel with one another, and dispose between the left edge 150 and the right edge 160.

As illustrated in FIG. 1, in a further embodiment, a compression weight sensor 370 may be disposed near the left fourth member 50, and another compression weight sensor 370 may be disposed near the right fourth member 50. The sensors 50 may be operatively connected to a display that the operator can see, so the operator can see if the weight reading on both of the sensors. This way if one sensor is substantially higher than the other, the operator may determine that the container 140 may be off balance and therefore unsafe to rise at heights, or to carry for substantial distances. If the operator determines that there is an unsafe weight differential, then he or she may decide to dump the debris in the container 140, and then attempt to re-load the debris.

FIG. 1 also illustrates a X-brace 350 that may support the screen 80. The screen 80 may be immediately forward from and secured to the X-brace 350.

FIG. 2 illustrates the present invention in use, with solid debris disposed within the container 140, and liquid 170 left behind in the environment. The liquid 170 is not retained within the container 140 because it may pass through container 140 because the container 140 may have a screen portion 80 with apertures 180 to retain solids and allow liquid 170 to pass through.

The transverse attachment 120 may be disposed substantially perpendicular to the top support 130. There may be two transverse attachments 120, one 120 leftwardly of the center of the apparatus, and another 120 rightwardly of the center, to allow a cable 110 to attach from one transverse attachment 120, over an excavator bucket, to another transverse attachment 120, to securely hold the debris cleaning apparatus 10 to an excavator bucket 100.

The transverse attachment 120 may have a front end 230, and a rear end 240. A cable attachment 250 may be disposed at or near a front end 230 and a rear end 240 of each transverse attachment 240, enabling a first cable 110 to extend from one transverse attachment 120 front end 230 to another transverse attachment front end 230, and enabling a second cable to extend from one transverse attachment 120 rear end 240 to the other transverse attachment rear end 240.

In one embodiment, the cable 110 may be attached at a first end to a ratchet-like cable attachment 250, and the cable may have a hook 260 at the other end. The cable may extend from over an excavator bucket 100 and the hook 260 can hook to one the downwardly extending side of the transverse attachment 120. Then the cable 110 may be tightened by the ratchet-like cable attachment 250, so that the cable 110 is in a state of tension, to tightly keep the top support 130 in contact a portion of the excavator bucket 100.

In one embodiment the screen portion 80 may be a galvanized wire mesh that may be about 2 inches by 2 inches if square. In another embodiment the screen portion may be about 1 inch by 1 inch if square. And if not square then the approximate area of 1 square inch may suffice, up to about 9 square inches. For example the screen 80 illustrated in FIG. 1 is an elongated hexagonal shape.

The debris removal apparatus 10 may have a means to attach 190 to an excavator bucket 100 other than using the cable 110 and the cable attachment. For example, another means to attach 190 may be employed, such as a mounting bracket, such as that from U.S. Patent No. 6,990,758.

Although the width of the bucket may be fixed from the left edge 150 to the right edge 160, it may be able to vary by having a telescoping portions of a first member upper edge 70 and the front edge 220 (not illustrated) that can telescope outwardly, either leftwardly or rightwardly for increased widthwise coverage area 270. Alternatively, this can be per-
formed with the fifth member 60 being able to be folded out for increased widthwise coverage area 270.

[0066] In one embodiment a bar 280 may extend from the rear part of the top support 130 downwardly to the bottom of the container 140.

[0067] FIG. 3 illustrates an embodiment having a fifth member upper edge 300 that is substantially level with the first member upper edge 70. In this embodiment the fifth member upper edge 300 may have an aperture (not illustrated) to receive a locking member, such as a locking pin 330 that may be removably disposed through a retention aperture 340 in the retention member 310. A first member upper edge aperture 360 (not illustrated) may be removably received a locking pin 330, which may be removably disposed through the retention member 310.

[0068] Alternatively, the fifth member 60 may rotate about the hinge 320 my motorized or mechanical means, to allow the driver of the excavator to open or close the fifth members 60 from the driver’s cab location.

[0069] In one embodiment, the top support 130 and cable 110 is made from non-metallic composite, so that electricity cannot be conducted from the earth to the excavator, in case there is live wire in the area that is being cleaned by the apparatus 10.

[0070] Thus when there is a locking pin 330 through a retention aperture 340 and the first member upper edge aperture 360, and there is another locking pin 330 through another retention aperture 340 and the fifth member upper edge aperture 360, then the fifth member 60 will be held in position and prevented from swinging about the hinge 320.

[0071] The screen 80 may have the following properties:

Sheet Thickness for Hexagonal Opening Expanded Metal: 0.5 to 3.0 mm: Opening: 1500 mm wide; Supplied in the form of sheet or roll. Dimensions of hexagonal expanded metal are made according to customer needs. Other opening patterns like round, diamond and special shapes may be suitable. The diagonal opening may be parallel to the width of the sheet.

[0072] It should be understood, of course, that the foregoing relates to exemplary embodiments of the invention and that modifications may be made without departing from the spirit and scope of the invention as set forth in the following claims.

I claim:

1. A debris cleaning apparatus (10), comprising:
   a container (140) having a left edge (150) and a right edge (160), and a front edge (220);
   means to attach (190) the container (140) to an excavator bucket (100);
   a screen (80) disposed between said left edge (150) and said right edge (160) along the horizontal direction; and
   between the front edge (220) and a first member upper edge (70); and
   a means to adjust the widthwise coverage area (260) of the container.

2. The apparatus (10) of claim 1, wherein said means to adjust the widthwise coverage area (260) includes a fifth member (60) extending leftwardly from said left edge (150) and another fifth member (60) extending rightwardly from said right edge (160).

3. The apparatus (10) of claim 2, wherein said fifth member (60) is hingedly disposed on said left edge (150), and said other fifth member (60) is hingedly disposed on said right edge (160).

4. The apparatus (10) of claim 3, wherein said fifth member (60) has a fifth member upper edge (300) that is about the same horizontal height as said first member upper edge (70), and retention member (310) is adjustably connected to both the first member upper edge (70) and said fifth member upper edge (300), whereby said fifth member (60) can be locked in position at varied angles with respect to said first member (20).

5. The apparatus (10) of claim 1, further comprising:
   a top support (130) that is secured above said first member upper edge (70);
   an elongate transverse attachment (120) secured to and oriented substantially perpendicular with respect to said top support (130);
   a cable (110) secured at one end to said elongate transverse attachment (120), capable of extending over an excavator bucket (100) and extending to another elongate transverse attachment (120), whereby said excavator bucket (100) is disposed between each of said elongate transverse attachments (120) and said top support (130) capable of being securely disposed to an excavator bucket (100) when the cable (110) is taught.

6. The apparatus (10) of claim 1, further comprising:
   a top support (130) that is secured above said first member upper edge (70) via a plurality of screen supports (210) oriented substantially vertical;
   an elongate transverse attachment (120) secured to and oriented substantially perpendicular with respect to said top support (130) leftwardly of the center of the apparatus (10);
   another elongate transverse attachment (120) secured to and oriented substantially perpendicular with respect to said top support (130) rightwardly of the center of the apparatus (10);
   each elongate transverse attachment (120) having a front end (230) and a rear end (240);
   a first cable (110) secured at one end to said elongate transverse attachment front end (230) and capable of extending over an excavator bucket (100) and extending to another elongate transverse attachment front end (230);
   a second cable (110) secured at one end to said elongate transverse attachment rear end (240) and capable of extending over an excavator bucket (100) and extending to another elongate transverse attachment rear end (240);
   whereby said excavator bucket (100) is disposed between each of said elongate transverse attachments (120) and said top support (130) capable of being securely disposed to an excavator bucket (100) when the cable (110) is taught.

7. The apparatus (10) of claim 1, wherein said top support (130) is made of rigid non-conductive material, and said cables (110) are also made of non-conductive material.

8. The apparatus (10) of claim 7, further comprising:
   a compression weight sensor (370) disposed in a position to monitor a downward force near the left fourth member (50), and another compression weight sensor (370) positioned to monitor a downward force disposed near the right fourth member (50).
9. The apparatus (10) of claim 8, wherein one of said weight sensors (370) is disposed on said second member (30) leftwardly of the center of the apparatus, and another weight sensor (370) is disposed on said second member (30) rightwardly of the center of the apparatus.

10. A debris cleaning apparatus (10), comprising:
   a container (140) having a left edge (150) and a right edge (160), and a front edge (220);
   a means to attach (190) the container (140) to an excavator bucket (100);
   a screen (80) disposed between said left edge (150) and said right edge (160) along the horizontal direction; and between the front edge (220) and a first member upper edge (70); and
   a compression weight sensor (370) disposed in a position to monitor a downward force near the left fourth member (50), and another compression weight sensor (370) positioned to monitor a downward force disposed near the right fourth member (50).

11. The apparatus (10) of claim 10, wherein said means to adjust the widthwise coverage area (260) includes a fifth member (60) extending leftwardly from said left edge (150) and another fifth member (60) extending rightwardly from said right edge (160).

12. The apparatus (10) of claim 11, wherein said fifth member (60) is hingedly disposed on said left edge (150), and said other fifth member (60) is hingedly disposed on said right edge (160).

13. The apparatus (10) of claim 12, wherein said fifth member (60) has a fifth member upper edge (300) that is about the same horizontal height as said first member upper edge (70), and retention member (310) is adjustable connected to both the first member upper edge (70) and said fifth member upper edge (300), whereby said fifth member (60) can be locked in position at varied angles with respect to said first member (20).

14. The apparatus (10) of claim 10, further comprising:
   a top support (130) that is secured above said first member upper edge (70);
   an elongate transverse attachment (120) secured to and oriented substantially perpendicular with respect to said top support (130); and
   a cable (110) secured at one end to said elongate transverse attachment (120), capable of extending over an excavator bucket (100) and extending to another elongate transverse attachment (120), whereby said excavator bucket (100) is disposed between each of said elongate transverse attachments (120) and said top support (130) capable of being securely disposed to an excavator bucket (100) when the cable (110) is taught.

15. The apparatus (10) of claim 10, further comprising:
   a top support (130) that is secured above said first member upper edge (70) via a plurality of bars (280) oriented substantially vertical;
   an elongate transverse attachment (120) secured to and oriented substantially perpendicular with respect to said top support (130) leftwardly of the center of the apparatus (10);
   another elongate transverse attachment (120) secured to and oriented substantially perpendicular with respect to said top support (130) rightwardly of the center of the apparatus (10);
   each elongate transverse attachment (120) having a front end (230) and a rear end (240);
   a first cable (110) secured at one end to said elongate transverse attachment front end (230) and capable of extending over an excavator bucket (100) and extending to another elongate transverse attachment front end (230);
   a second cable (110) secured at one end to said elongate transverse attachment rear end (240) and capable of extending over an excavator bucket (100) and extending to another elongate transverse attachment rear end (240), whereby said excavator bucket (100) is disposed between each of said elongate transverse attachments (120) and said top support (130) capable of being securely disposed to an excavator bucket (100) when the cable (110) is taught.

16. The apparatus (10) of claim 15, wherein said top support (130) is made of rigid non-conductive material, and said cables (110) are also made of non-conductive material.

17. The apparatus (10) of claim 10, wherein one of said weight sensors (370) is disposed on said second member (30) leftwardly of the center of the apparatus, and another weight sensor (370) is disposed on said second member (30) rightwardly of the center of the apparatus.