A device for collecting submerged debris from a body of water

A debris collection device (10) for removing debris from the bottom surface of a body of water, the device comprising, a frame (12), a collection net (14) mounted to the frame, the frame having a straight end (20) that forms a trailing end of the frame when the frame is pulled towards an operator, wherein the straight end has a forward surface that is rearwardly inclined in the direction of travel.
A DEVICE FOR COLLECTING SUBMERGED DEBRIS FROM A BODY OF WATER

FIELD OF THE INVENTION

The present invention relates to an apparatus for collecting debris from the bottom surface of a body of water. In particular, the present invention relates to a pool rake.

BACKGROUND OF THE INVENTION

The present invention will be described with particular reference to swimming pools. However, it will be appreciated that the apparatus as described herein may have applications for collecting debris from other bodies of water and no limitation is intended thereby.

Leaf collection devices for use in swimming pools are well known. Such devices generally have a frame that supports a net. The frame is mountable to a telescopic handle that allows a user to collect leaves and other debris. There are two general types of manual debris removal devices that are commonly known in the pool arts as pool or leaf rakes and pool or leaf skimmers. A skimmer has a shallow net that it is used for skimming across the surface for collecting floating debris rather than for collecting debris that has fallen to and has collected on the bottom of the pool. The frame is generally rectangular in shape so as to optimize the skimming surface area.

The second type of device is for collecting leaves and debris that have fallen and collected on the pool floor. These are known in the art as pool rakes. Pool rakes have a deep net supported by a closed hoop type frame for collecting relatively large volumes of leaves and other debris. A pool rake is pulled towards an operator with the net uppermost so that the mouth of the net is directed downwards. The rake is moved along the floor with the bottom contacting the floor such that leaves and other debris are disturbed and lift from the surface and are drawn into and collected in the net. Sometimes the bottom edge of frame the has an extending rubber lip that is intended to lift debris from the floor. The leaf rakes may also be used to scoop debris from the surface.

Other types of deep nets collection devices are designed to be pushed across a pool floor and scoop debris into the net, which in contrast to the pool rake are
designed to be used with the mouth of the net upwardly facing. These types of devices have a forwardly inclined lip for directing suspended debris into the net. The arrangement of these forward lips generally makes them unsuitable for use in a raking motion across the bottom of the floor.

In the present specification, the term "pool rake" will be used to refer to deep net collection devices for use in cleaning the bottom of a pool by pulling towards the user in a raking motion.

Operation of a pool rake creates a certain degree of turbulence in the water. The degree of turbulence can be influenced by the amount of debris in the net. Further, when the direction of the rake is changed after a pulling rake stroke, a counter current is created. This can have the effect of allowing leaves to escape from the collecting net. Still further, as the rake is operated at an angle, as the rake is pulled along the pool floor, the currents may carry leaves forward past the mouth of the net instead of into the net.

Further, when the pool rake is being lifted out of the water so as to empty the net it will be appreciated that the net may be relatively full of leaves and debris. This can create different currents than from when the net is empty in which case water can readily flow through the net. If the pool rake is lifted too rapidly, the created current can cause leaves to come out of the net.

Accordingly there is a perceived need in the industry for a pool rake that may address this problem or provide the public with a useful or commercial choice.

**SUMMARY OF THE INVENTION**

According to a first aspect of the invention there is provided a debris collection device for removing debris from the bottom surface of a body of water, the device comprising;

- a frame;
- a collection net mounted to the frame,

the frame having a straight end that forms a trailing end when the frame is pulled towards an operator, wherein the straight end has a forward surface that is rearwardly inclined in the direction of travel.
The present inventors have surprisingly discovered that by having a straight trailing end with a forward surface rearwardly inclined with respect to the direction of travel, as the device is pulled towards an operator, a water current is created that effectively sucks leaves or debris into the net. By straight end, it is meant that the end is not curved or angled.

This may be compared to conventional pool rakes in which the trailing end is a straight planar member that is perpendicular to the direction of travel.

The forward surface of the trailing edge is obliquely disposed such that it is rearwardly inclined in the direction of travel. This means that the angle of inclination of the forward surface relative to the longitudinal axis is less than 90°. Typically, the angle of rearward inclination is between about 25° to about 80°, preferably about 30° to about 70°, preferably between about 35° to about 60° relative to the longitudinal axis of the frame. A preferred angle is about 45°. It will be appreciated that the rear surface of the trailing end may also be inclined but this is not necessarily the case.

The rearwardly inclined forward surface may include at least two forward surface portions that have different angles of inclination. Where a surface panel portion is below the longitudinal axis the angle of inclination is taken as if that surface panel portion extended above and though the longitudinal axis. In other words, the angle that is less than 90° is referred to.

Such a stepwise change of angles may facilitate the desired hydrodynamic properties of the trailing edge so as to create currents that will draw debris into and retain within the net during normal use.

The frame is typically a closed hoop defining a central aperture into the opening of the net. The frame is suitably adapted for connection with an elongate telescopic handle. Typically, the frame has a stub handle extending therefrom that receives an end of an elongate handle. Such methods of engagement are well known the art.

The frame is suitably injection moulded from a plastics material with suitable heat, UV and chemical stabilizers to protect the device from exposure to the sun and pool chemicals.
The net may be mounted to the frame in any suitable manner. There are a
number of arrangements known in the art for mounting nets to pool rakes. Preferably the net is releasably mounted to the frame so that it can be replaced when damaged.

In a preferred form of the invention, the device further includes means to improve or assist in providing a downward force to the device towards the bottom surface to be cleaned. It may be appreciated that in some cases, it may be difficult for an operator to maintain the downward force to operate the rake efficiently over a period of time. This may be particularly so, when the telescopic handle is extended to near the maximum amount possible.

The frame may be provided with additional weight at suitable places on the frame to balance the frame.

Alternatively, or in addition to, the device may include at least one fin member extending from the frame. The fin members are disposed to provide a downward hydrodynamic force when the device is traversing a surface to be cleaned. Typically there are two or more fin members mounted in parallel on each side of the frame.

According to another aspect of the invention, there is provided a device for collecting submerged debris from a body of water, the device having a frame with opposed side arms, a collection net mounted to the frame, wherein the opposed side arms have at least two fin members mounted thereon.

Typically, the fins are substantially parallel to a transverse axis of the frame. Preferably, the or each fin member has an edge that is a leading edge when the device is being pulled towards an operator that is narrower than the tailing edge.

Typically, the device has 2 to 4 preferably 3 parallel fin members on each side arm.

**BRIEF DESCRIPTION OF THE FIGURES**

Figure 1 is a schematic perspective view of a preferred device of the present invention;

Figure 2 is a schematic view of the device of Figure 1 in use;

Figure 3 is a perspective view of an alternative preferred embodiment of the present invention;
Figure 4 is a further perspective view of the device shown in figure 3.

Figure 5 shows a scraper insert that forms part of the device shown in figure 3.

Figure 6 is a perspective view of another preferred device of the present invention.

Figure 7 is a bottom plan view of the device shown in Figure 6.

Figure 8 is a right end view of the device shown in Figure 6.

Figure 9 is a side view of the device shown in Figure 6.

Figure 10 is a left side view of the device shown in figure 6.

Figure 11 is an exploded view of the device shown in figure 10.

Figure 12 is detail of a wheel housing that forms part of the device as shown in Figure 3 and Figure 13 is an exploded view of the device as shown in figure 6.

**DETAILED DESCRIPTION OF THE FIGURES**

Figure 1 shows a schematic view of a preferred collection device 10 of the present invention in the form of a pool or leaf rake. The rake 10 has a frame 12 that supports a collection net 14. The frame 12 defines the open mouth 13 of the net 14 through which debris passes in use and is retained within the net 14. The rear of the net has a handle 16 to facilitate manual emptying of the net 14. The frame may have what may be described as a net side 14a and an open side 14b.

The frame 14 has an upper edge 18 and a lower straight edge 20. The upper edge 18 has a stub handle 22 adapted to be mounted to an elongate handle, typically a telescopic handle as known in the pool cleaning arts. When the rake 10 is pulled by a user in the direction of the handle, the upper edge 12 is the leading edge and the lower edge 20 is the trailing edge.

A resilient scraping member 24 projects from the lower edge 20 at an angle pointing away from the handle. The resilient scraping member 24 may be in the form of a single flexible blade such as a squeegee or may be in the form of a plurality of parallel flexible fingers.
One advantage of a plurality of fingers over a continuous blade is that there is a gap therebetween which allows water to pass therethrough. This makes it easier for an operator to pull the rake through the water whilst still providing a scraping action. Another advantage of fingers is that they can individually accommodate obstacles on a pool bottom or side.

The scraping member 24 in use traverses a submerged surface to be cleaned so as to lift submerged debris and direct the debris into the collection net 14.

In use, an operator places the rake 10 in the water and contacts the scraping member 24 on the bottom surface of the pool and pulls the rake 10 towards them such that the scraping member traverses the bottom surface of the pool. In this orientation the net 14 is inverted such that the mouth 13 of the net is directed towards the surface to be cleaned. As the rake 10 is pulled towards the operator, the scraping member 24 lifts and directs submerged debris into the collection net 14.

Figure 2 is a schematic view of the rake 10 of Figure 1 as it is being lifted towards a water surface after it has been used to rake the bottom surface 30. The rake 10 is being pulled upwards in the direction of arrow A. The net 14 is full of debris 32. The net 14 is elongate such that the debris 32 can collect in the trailing portion of the net 14 and away from the mouth 13 so as to reduce the possibility of the debris escaping. However in prior art nets, such escape almost invariably occurs as a result of the water currents being generated as the rake 10 moves through the water.

It can be seen from Figure 2 that the forward surface 22a of the bottom edge of the frame 12 is rearwardly inclined in the direction of travel marked by arrow A. The angle of inclination a is about 40° to 50° to the longitudinal axis B of the frame. This is to be compared with prior art pool rakes in which the bottom edge of the frame has no rearward inclination when pulled vertically or horizontally and is at right angles to the longitudinal axis of the frame.

The present inventors have surprisingly discovered that when the bottom edge of the frame is inclined in this manner a water flow is generated in the direction of arrow C that effectively sucks debris such as leaves into the collection net. This flow or current also acts to keep debris in the net. This can avoid problems with prior art nets in which leaves can either escape from the net or there is incomplete collection.
of debris and particularly debris that is scraped from the surface and is floating in the water and subject to currents generated by movement of the rake though the water.

In figure 2, the direction of travel is shown in a substantially vertical direction. It will be appreciated that in a typical raking movement on the bottom of the pool, the orientation of the longitudinal axis will not be strictly horizontal.

Figure 3 shows a perspective view of a further preferred device 10 of the invention. The same reference numerals will be used to refer to the same features as discussed above in relation to Figures 1 and 2. For convenience, the net is not shown.

The resilient scraping fingers 24 may be seen more clearly in this Figure. The frame 12 is a different shape having an uppermost section to which the handle 22 is mounted and opposed downwardly directed shoulder portions 36 that lead to parallel side arms 38. Each side arm 38 has three parallel fins 40. Each fin 40 has a curved outer surface radiating out from a narrow leading edge (in the direction of the raking movement as described above) towards a wider trailing edge.

It will be appreciated that the rake 10 is operated at an angle such that the fins 40 are downwardly directed at angles of between about 30° to about 60°. This has the effect of providing a downward pressure of water so as to assist in the raking action. It will be appreciated that the frame and net have a degree of buoyancy that must be counteracted by an operator in use to insure there is a sufficient scraping and cleaning action. The fins can operate to counter act the effect of the buoyancy. To further assist in such operation, the lower edge of the frame may be weighted. The weights are designed such that the device is comfortably weighted for an operator.

The upper part of the frame 36 has an over moulded rubber shoulder portion which is profiled with parallel grooves. Again this feature serves to facilitate movement though the water.

The lower edge 20 is inclined at an angle of 45° to the longitudinal axis of the frame, being that axis that extends along the handle 22. The lower edge 20 also has a series of parallel fins 42 spaced along the length thereof. These fins may assist in
creating the hydrodynamic flow of the inclined bottom edge to direct debris into the net.

Figure 4 shows the rake of Figure 3 from the bottom in which the angle of the bottom edge can be more clearly seen. Figure 4 shows the side arm 38 having truncated tear drop slots 39 that receive the base of fins 40.

Figure 5 shows the scraping member 24 fitted with projections 42 to allow it to be press fitted into the lower edge 20 of the frame. This allows for easy manufacture as well as for damaged or worn scrapers to be replaced.

Figure 6 shows a perspective view of another preferred rake 100 of the invention. The rake is similar to that in Figure 1 and similar reference numerals will be used to describe the same features. The rake 100 does not have the fins 42 along the forward surface of the lower edge 20 of the frame. The scraping member 24 is formed form a series of spaced parallel flexible projections or fingers 24a.

Figures 7, 8, 9, and 10 respectively show bottom side and end views of the pool rake 100 as shown in Figure 6.

Figure 9 that shows the side view shows that the forward surface 20a of the lower or trailing edge has a first panel portion 200 rearwardly inclined at a first angle ato the longitudinal axis of the frame 100 and a second trailing panel 202 that forms the trailing edge of the trailing end at a second angle \(\beta\) to the longitudinal axis of the frame. Angle \(a\) is about 30° to 40° and angle \(\beta\) is about 60 to about 70°. Without wishing to be bound by theory, it is considered that such an arrangement facilitates generation of a desired hydrodynamic flow.

Figures 7, 9, 10 and 11 that the underside or net side of the lower edge 20 is mounted has an opposed pair of rollers 56. The purpose of the rollers is to facilitate the reverse raking movement. Generally, when raking, either a pool bottom or on the ground, a rake is drawn towards a user, the rake is then lifted and pushed away to a different part of the surface to collect further debris. However, with pool rakes, these are often attached to relatively long extension handles to allow a user standing at the edge of the pool to reach the middle of the pool. This can make raking difficult and unwieldy to those not used to such activities or older persons. The wheels provide a low friction surface that allow the rake frame to be pushed backwards to a "restart" position without having to lift the rake.
The rollers may also allow use of the rake to collect debris in the reverse orientation or in other words a pool scoop. Pool scoops scoop debris from the bottom surface of a pool floor by pushing the scoop away from an operator. The open mouth of the net in this cases faces upwards and when the scoop is pushed along a surface to be cleaned the leading edge of the scoop scrapes along the bottom surface of the pool, thereby sliding under the debris and lifting it upwardly from the surface where it may enter the open mouth of the net as it is being pushed forward.

The wheels allow the rake to be pushed along the bottom surface of a pool in a shovelling or scooping function. Generally the scraping member 24 is removed so as not to obstruct flow of debris into the net.

The inclined surface of the bottom edge 20 now becomes the leading surface of the scoop rather than the tailing surface of the rake. The present inventors have surprisingly discovered that the inclined edge facilitates both scooping and raking actions to suck debris into the net.

Figure 12 is a detail of the wheel housing. It will be appreciated that an alternative to a wheel may be a projection that reduces friction across the surface as a result of its physical conformation and/or material, for example a Teflon or other coating.

Figure 13 shows an exploded view of the frame 12. The frame 12 has a lower base section 52 and an insert 50 that realisably secures a net to the frame. The insert 50 is secured in place by screws. This allows a net to be replaced if it becomes damaged.

It will be appreciated that the pool rake of the present invention may offer advantages over the numerous pool rakes that are currently available. The rake has hydrodynamic properties that assist in debris collection and retention.

It will be appreciated that various changes and modifications may be made to the invention as described and claimed herein without departing from the spirit and scope thereof.
CLAIMS

1. A debris collection device for removing debris from the bottom surface of a body of water, the device comprising;
   a frame;
   a collection net mounted to the frame,
   the frame having a straight end that forms a trailing end of the frame when the frame is pulled towards an operator, wherein the straight end has a forward surface that is rearwardly inclined in the direction of travel.

2. The device of claim 1, which further comprises a scraping member mounted to the trailing end of the frame.

3. The device of claim 2, wherein the scraping member comprises a plurality of flexible fingers.

4. The device of claim 2 or claim 3, wherein the scraping member is removeably mountable to the trailing end of the frame.

5. The device of any one of claims 1 to 4, wherein the forward surface is rearwardly inclined at an angle of between about 25° to about 80° to the longitudinal axis of the frame.

6. The device of any one of claims 1 to 4, wherein the angle is between about 30° to about 70°.

7. The device of any one of claims 1 to 4 wherein the rearwardly inclined forward surface comprises at least two forward surface portions that have different angles of inclination.

8. The device of any one of claims 1 to 7, wherein the frame is adapted to be mounted to an elongate handle at an end opposite the straight end.

9. The device of any one of claims 1 to 8, wherein the frame has opposed side arms, each side arm having at least one fin member mounted thereon.

10. The device of claim 9, wherein each fin member is substantially parallel to a transverse axis of the frame.
11. The device of claim 10, wherein the or each fin member has a fin leading edge and a fin trailing edge when the device is being pulled towards an operator that is narrower than the tailing edge.

12. The device of any one of claims 9 to 11, wherein the device has 2 to 4 preferably 3 parallel fin members on each side arm.

13. The device of any one of claims 1 to 12, wherein the inclined surface further includes a plurality of parallel fin members aligned substantially normal to the forward inclined surface.

14. The device of any one of claims 1 to 13, wherein the trailing end has at least one friction lowering member mounted thereon.

15. The device of claim 14, wherein the friction lowering member comprises two opposed wheels.
Fig. 7
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

E04H 4/16 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

EPODOC - ECLA, E04H4/16A

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

WPI & EPDOC - IPC & ECLA, E04H4/16/low, A01K61/00C, E02F5/28/low and keywords (rake, net, scoop, mesh, screen, incline, taper, angle, bevel, handle, pole, fin, trailing, rearward, vane, foil, wing) and like terms;

WPI & EPDOC - keywords (pool, bath, pond, clean, scoop, rake, debris, net, mesh, screen, incline, taper, angle, bevel, handle, pole, frame, edge, surface, end, trailing, rearward) and like terms;

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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See patent family annex

* Special categories of cited documents:
  * "A" document defining the general state of the art which is not considered to be of particular relevance
  * "E" earlier application or patent but published on or after the international filing date
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  * "O" document referring to an oral disclosure, use, exhibition or other means
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Date of the actual completion of the international search

11 January 2013

Date of mailing of the international search report

11 January 2013

Name and mailing address of the ISA/A

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<td>US 4013563 A (PETRIK) 22 March 1977 Figs. 1 - 3</td>
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<td>A</td>
<td>US 4994178 A (BROOKS) 19 February 1991 Fig. 1</td>
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