United States Patent [19]

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[54] **OIL SKIMMING APPARATUS**

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[52] **U.S. Cl.**.....**210/242,** 210/DIG. 21
[51] **Int. Cl.**.....**E02b 15/04**
[58] **Field of Search**.....210/242, 169, 187

[56] **References Cited**

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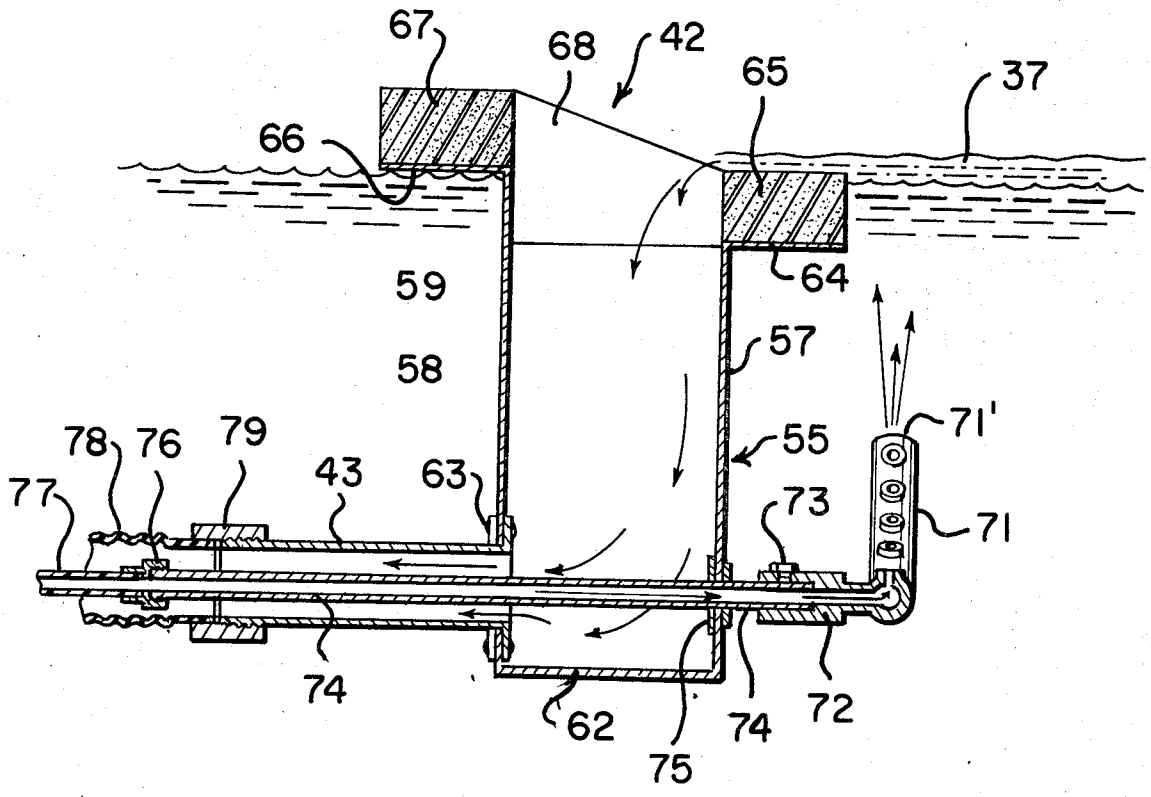
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[57] **ABSTRACT**

A skimmer body is provided with front and rear faces and with floatable members connected to the upper portions of the front and rear faces with the front floatable members being lower than the rear floatable member, the floatable members being of such capacity as to support the skimmer body with the upper surface of the front floatable member underlying the oil slick to be collected. Extending from the forward face and laterally of the skimmer body is a hot water spray heat to heat the oil slick from beneath the same just immediately to its passing over the upper surface of the front floating body. End plates confine the oil slick to the opening in the top of the skimmer body and prevent the lateral escape of the same therefrom. The oil slick is drawn into the oil skimmer body by a cable water fence gathered by boat equipment and drawn toward the skimmer body. A heater and separator and a vacuum pump that removes the oil slick from the skimmer body and a hot water pump line takes the water from the separator and delivers it to the hot water spray head on the skimmer body. The oil is delivered from the heater and separator to an oil tanker or other storage device that may be available. The oil water fence is made up of a series of floatable blocks having end plates that can be connected together by a pin and pin opening arrangement and held thereagainst by a pin locker device extending downwardly from the top surfaces of the blocks.

6 Claims, 9 Drawing Figures



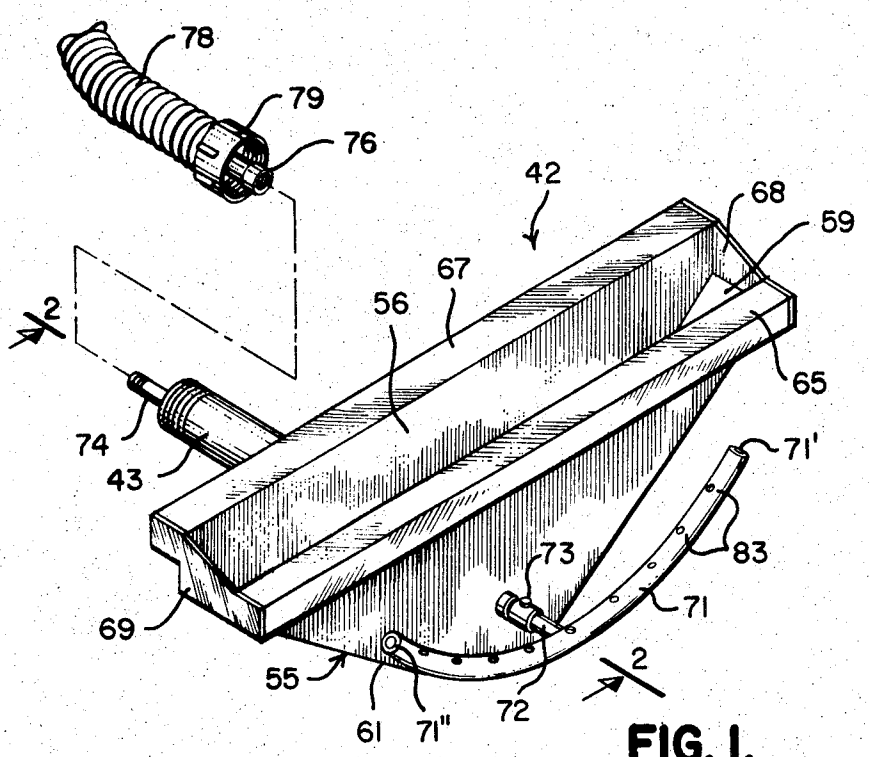


FIG. 1.

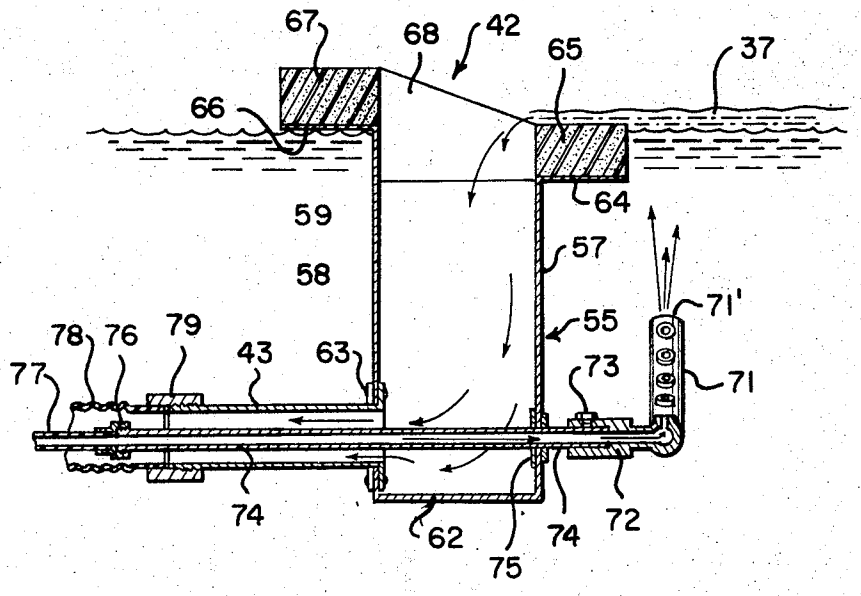


FIG. 2.

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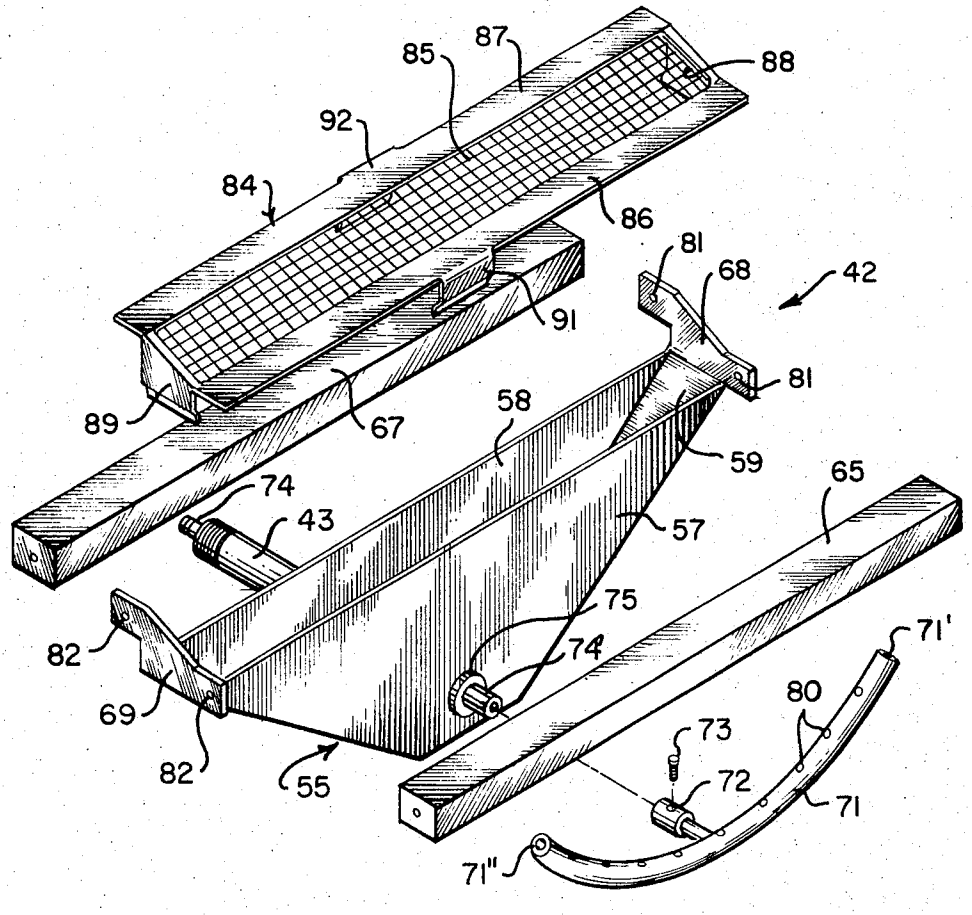


FIG. 3.

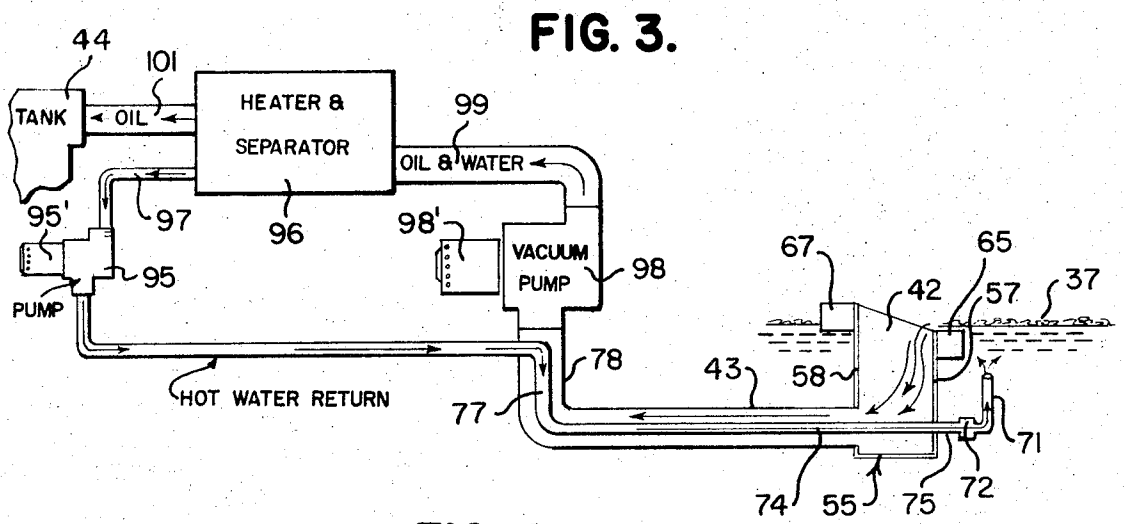


FIG. 4.

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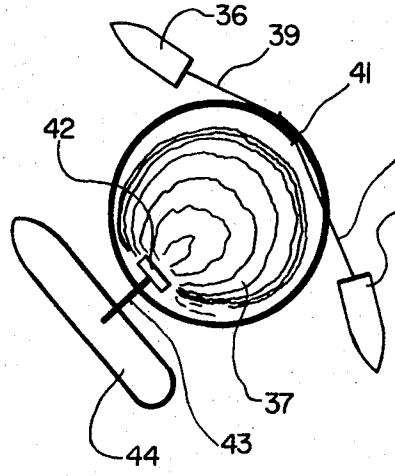


FIG.5.

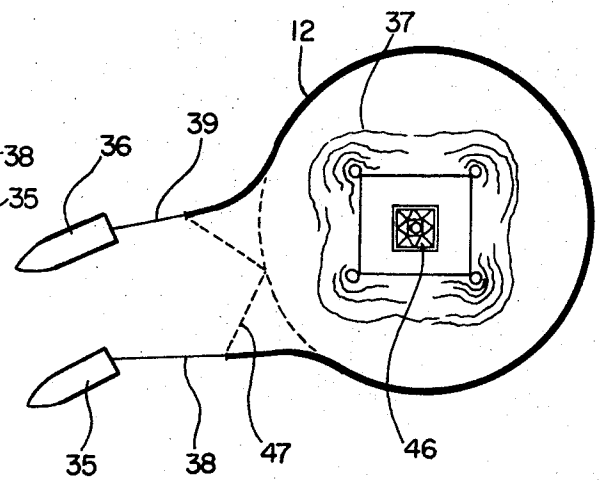


FIG.6.

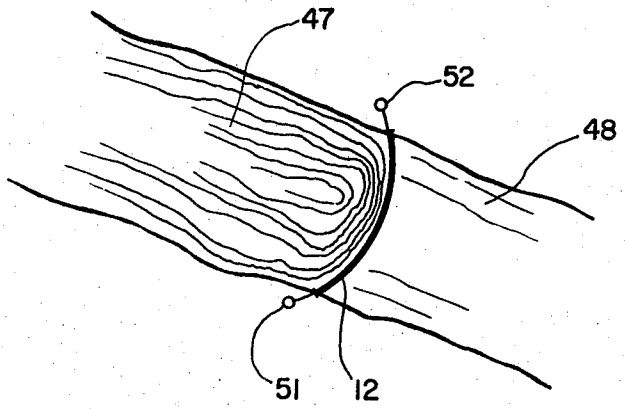


FIG.7.

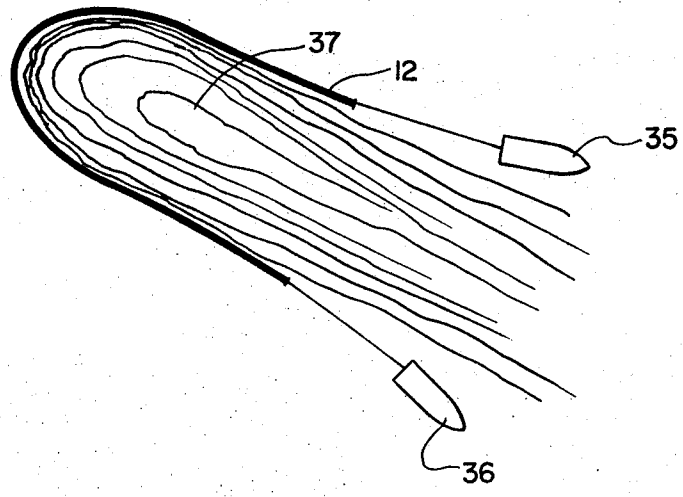


FIG.8.

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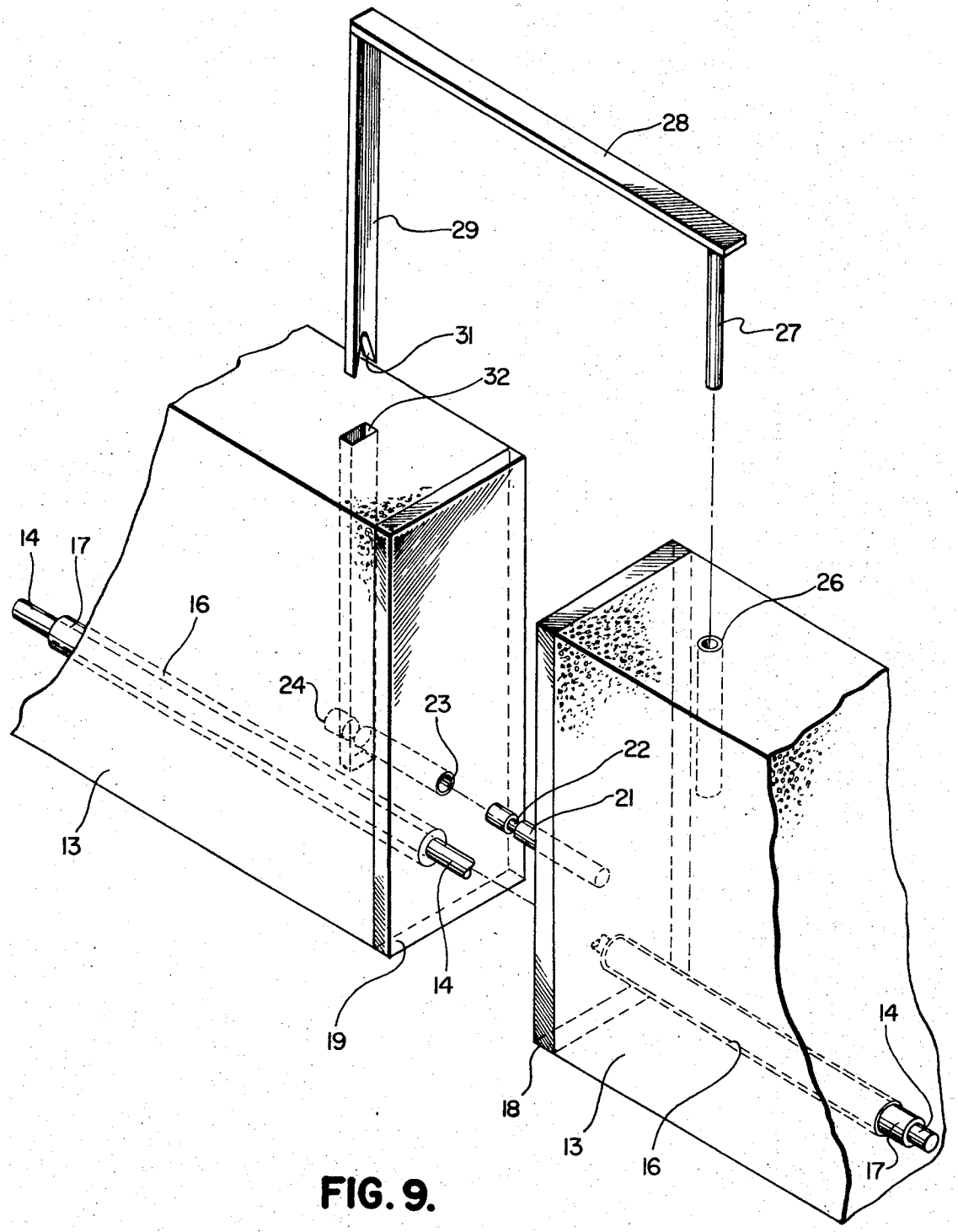


FIG. 9.

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OIL SKIMMING APPARATUS

This invention relates to oil skimming apparatus.

It is an object of the present invention to provide an oil skimming apparatus which will provide for an easy way of collecting oil slick from water surfaces, and wherein the oil slick can be recovered therefrom.

It is another object of the invention to provide an oil skimming apparatus which can be floated upon the water surface and wherein only the oil slick is extracted from the water surface to thereby eliminate the need for separating oil from water to any great extent.

It is another object of the invention to provide an oil skimming apparatus with a heated water supply taken from such water as may be taken in with the oil slick that will return the water heated and by means of a transversely extending nozzle will direct such heated water toward the under surface of the oil slick adjacent to the forward edge of the front float over which the oil slick is to pass.

It is still another object of the invention to provide an oil skimming apparatus including an oil slick gathering fence that can be shaped and adapted to direct the flow of the oil slick toward the oil skimmer body making unnecessary the need for moving the oil skimmer body over the water surface.

Other objects of the invention are to provide an oil skimming apparatus having the above objects in mind and which is of simple construction, has a minimum number of parts, inexpensive to manufacture, easy to maintain, can be manned by a minimum number of crew, light in weight, easily transported, effective and efficient in use.

For a better understanding of the invention reference may be had to the following detailed construction, taken in connection with the accompanying drawing, in which:

FIG. 1 is a collective and perspective view of an oil skimmer embodying the features of the present invention.

FIG. 2 is a longitudinal sectional view of the oil skimmer as viewed on line 2—2 of FIG. 1.

FIG. 3 is an exploded perspective view of the oil skimmer with each of the parts being shown in detail.

FIG. 4 is a diagrammatic view of the complete apparatus used in connection with the skimmer device and for delivering hot water, to the water below the oil slick and for extracting the oil slick into the skimmer for delivery to a storage tank.

FIG. 5 is a diagrammatic view illustrating one method of removing oil slick from a water surface by fencing the oil slick.

FIG. 6 is a diagrammatic view illustrating the fencing of the oil slick about an ocean drilling derrick.

FIG. 7 is a diagrammatic view of an oil slick fence extended across a river.

FIG. 8 is a diagrammatic view of a fence dragged by boats to collect oil slick into an area.

FIG. 9 is a fragmentary and collective perspective view of fragments of a floating oil resistant fence blocks adapted to be aligned with a cable and to be locked against separation thereon by separable pins and pin lockers.

Referring now particularly to FIG. 8, there is shown an oil slick fence 12 made up of a series of floatable oil resistant blocks 13 which are joined together by a steel cable 14 that is extended through longitudinally extending holes 16 and coated with a fiberglass coating 17. These blocks 13 are preferably made of floatable plastic material and at the end of the blocks are steel end plates 18 and 19 at their respective opposite ends thereof. The plate 18 carries a male locking pin 21 that extends perpendicularly therefrom and having a locking groove 22 at the outer end thereof. This pin 21 mates with a hole 23 extending through the plate 19 and beyond into the body of the plastic block as indicated at 24.

To lock the blocks together in end to end relationship while being assembled on cable 14, two holes are extended vertically from the upper surface of the block and downwardly. One hole is round in section, as best seen at 26 and is adapted to accommodate a swivel pin 27 carried on one end of a pin locker handle 28 and on the opposite end of the handle 28 is a depending pin locker 29 extending downwardly and parallel to the pin 27 and the lower end of which has a V-shaped locking notch 31. This pin locker 29 is of rectangular section and extends downwardly into a hole 32 of similar section that intersects with the hole 24 for receiving the pin 21 for engagement with the groove 22 to thereby hold the blocks together upon the steel cable 14. It will thus be apparent that with the pin locker 28 inserted into the top of the blocks 13 for the locking engagement of the pin 21 that the blocks 13 will be held against outward displacement from one another along the cable 14. At a time when it is desired to separate the blocks and to provide an opening in the fence 12 and therebetween, the pin locker handle 28 is pulled upwardly and the pins 27 and 29 will be disengaged from the upper surfaces of the blocks. If it is desired to maintain a separation of a greater distance of the blocks 13 from one another this can be effected by using a pin locker device with a longer handle than the handle shown at 28 or even have an adjustable handle for different lengths. If desired, instead of having the pin 21 and the pin holes 23 and 24, the blocks can be locked together by merely inserting the pins 27 and 29 into top holes 26 and 32, both of which can be round as desired. However, by providing a pin connection 21 the blocks are held more appropriately against twisting with one another and without placing undue strain or bending of the cable 14 between the blocks.

With the fence 12 assembled in the manner just described in connection with FIG. 8 and with the ends of the cable being connected to boats 35 and 36, oil slick 37 can be concentrated and dragged to a collecting location where in can be removed by the skimmer device to be described and forming a part of the means for carrying out the method of this invention.

In FIG. 5 there is shown one way of bringing together the oil slick by the boats 35 and 36 passing beyond one another and their cables 38 and 39 by which the ends of the fence 12 are connected to the boats but can be lifted over the fence 12 or under the same to permit the full closing or overlap as indicated at 41 of the fence 12 about the oil slick 37. Thereafter, as shown in FIG. 5 an oil skimmer device indicated generally at 42 and as shown more in detail in FIGS. 1 to 3 can be placed into the oil slick and drawn outwardly through a hose coupling 43 and into an oil tanker or other storage device 44. The boats 35 and 36 can continue to drag

the ends of the fence in opposite directions until the entire fence is overlapped and the oil slick is removed.

The oil slick **37** can be drawn by the boats **35** and **36** to locate the fence **12** about an oil derrick **46** leaving passageway **47** for the oiltanker to enter for the removal of the oil slick by the oil skimmer device **42**. The oil derrick equipment may also have an oil tank storage and the fence **12** can be closed therearound so as to permit the oil to be skimmed from the surface of the water about the oil derrick.

As shown in FIG. **7**, the floatable oil slick fence **12** can be extended across a river **48** so that oil slick **47** is collected upon passing downstream by the fence **12** and the equipment as shown in FIG. **5** or land based equipment can remove the oil slick above the fence **12**. The fence is anchored at the opposite shores of the river at **51** and **52**. It will thus be seen that with the anchor fence forming a part of the construction of the present invention that the skimming of oil by the oil skimmer device can be made effective.

It will be seen that the floating oil fence **12** is used to direct the oil slick toward an oil skimmer device by pulling the two ends of the floatable oil fence with boats **35** and **36** so that the oil is concentrated at the oil skimmer and so that it can be pumped directly into a nearby oil tanker or storage. By locating the fence about an oil derrick and maintaining the same about it oil spillage or leakage can be held about the oil derrick and prevented from escaping into open waters. The oil fence, as shown in FIG. **7**, can be used across the river if not for collecting purposes to prevent the oil from polluting the river when downstream therefrom.

Referring now to FIGS. **1** to **3**, the skimmer device indicated generally at **42** employing an important part of apparatus in carrying out the present process of effecting the actual recovery of the oil from the water surface will be described. The oil skimmer **42** comprises generally a hopper or funnel shaped body **55**, closed at its bottom end and open at its top, as indicated at **56**, to provide a large laterally extended space into which oil slick **37**, FIG. **2** can be collected. This open top body **55** has a front face **57** and a rear face **58**, spaced from one another and the bottom has downwardly converging opposing portions **59** and **61** closing upon a short laterally extending bottom plate **62** and into which the oil slick **37** is dropped and concentrated so that it can be drawn from the skimmer device **42** through hose coupling **43** that has a tightly sealed connection **63** in the rear face of the skimmer body **55**.

The forward face **57** is bent forwardly at a low level to provide a supporting flange **64** for a long transversely extending block **65** of floatable material of light weight and of oil resistant plastic. The rear face **58** has a rearwardly extending flange **66** that supports a similar long block of floatable plastic material **67** at the rear of the skimmer and adapted to lie at a higher elevation than the forward block **65**. The weight of the device and the cubicle volume of the blocks **65** and **67** are calculated to lower the skimmer body **55** to such an extent that oil slick **37** will always run over the top of the block **65** and be kept from floating rearwardly beyond the rear wall **58** by the wall **67**. The side ends of the opening **56** are closed by forwardly and downwardly inclined end plates **68** and **69** carried upon the upper ends of the oppositely inclined bottom portions **59** and **61** as best seen in FIG. **3**. The floatable blocks **65** are secured between the end plates **68** and **69** while resting upon the respective flanges **64** and **66** to which they may be adhered and will keep the oil slick from laterally shifting from the opening **56** and at the same time serve to cut through the opposite sides of the oil slick as it is being forced along the water surface toward the oil skimmer. In order to assure the continual flow of the oil slick of heavy oil as distinguished from light oil, a hot water spray head **71** of arcuate shape is extended from the front wall **57** to underlie the forward edge of the insulating block **65** to direct hot water toward the underside of the oil slick **37** as best illustrated in FIG. **2**. There are several openings on the concaved face of the arcuate spray head **71** so that a concentration of the hot water is effected toward the center of the oil slick area overflowing the block **65**.

This spray head **71** has a rearwardly extending fitting **72** that is secured by a set screw **73** to a hot water supply pipe **74** that extends through closure plate means **75** surrounding the opening in the front wall **57** for the pipe **74**. This pipe **74** is aligned with the center of the oil collecting pipe **43** extending from the rear face **58** so that it can be coupled by a fitting **76** to a flexible hot water hose **77**. This hot water hose **77** lies within a flexible hose **78** that is coupled by a fitting **79** to the oil outlet **43** from the skimmer body **55**.

The ends of the spray head **71** are preferably open at **71'** and **71''** through which hot water can be spilled to further effect concentration and the breaking away of a lateral extent of the oil slick **37** to be taken into the skimmer body **55**. Oil holes **83** are laterally spaced along the inner side of the spray head **71** to give a full lateral extent of the hot water action upon the oil slick **37**.

In FIG. **3** there is shown a construction which is slightly different from the construction described of the skimmer body with regard to FIGS. **1** and **2** and this being that instead of having the forwardly and rearwardly extending flanges **64** and **66** of the forward and rearward faces **57** and **58** of the skimmer body **55**, the floatable blocks **65** and **66** are sufficient rigidity as to be supported in and of themselves between the end faces **68** and **69** by screws entering screw holes **81** and **82** thereof and in the provision of a strainer the device **84** having a mesh **85** connected between forward and rearward portions **86** and **87** that will rest respectively upon the long transversely extending float members **65** and **67**. Depending end clips **88**, **89** and intermediate clips **91** and **92** depend from this strainer **84** with oppositely inclined walls **59** and **61** well inwardly of the end plates **68** and **69** and with the forward and rearward walls **57** and **58** of the skimmer body. Otherwise the skimmer body is generally of the construction already described and similar numerals are accordingly applied thereto in FIG. **3**.

In FIG. **4** there is shown the complete apparatus with which the hot water and oil hoses **77** and **78** extending from the oil skimmer **55** are connected to operate the oil skimmer. The hot water hose **77** is connected to a water pump **95** which takes hot water from a heater and separator **96** by a pipe **97** and delivers the hot water to the inner hose **77** and pipe **74** and to the spray head **71** to direct the hot water against the underside of

the oil slick **37** to render it more effective and so that it will more readily pass over the float **67** and into the skimmer body **55**. The large hose **78** is connected to a vacuum pump **98** that is connected by a pipe **99** to the heater and separator so that the oil slick once collected in the skimmer body **55** is delivered to the separator **96** wherein the water in the oil slick is heated so that hot water is taken from the heater and separator by the water pump **95** and the separated oil is delivered from the heater and separator **96** through a pipe **101** to the storage tanker **44**. The respective pumps **95** and **98** have their respective drive motors **95'** and **98'**.

It will thus be seen that as the slick is drawn by the floating fence **12** toward the skimmer device **55** that the oil slick can flow over the float **65** into the skimmer body and thus be taken through the apparatus as shown in FIG. **4** for delivery to a storage tank **44** wherein it will have been collected from the water surface and upon being reconditioned made available for actual use without the oil having been lost to the sea or having polluted the water thereof and spoiled the shores and sea bird life.

It should be apparent that there has now been provided apparatus and a process for carrying out the removal of oil slick from water surfaces, the water fence construction **12** has been clearly described and as well the oil skimmer device **55** and the general apparatus for the operation of the oil skimmer.

It should be understood that the float members **65** and **67** can be changed to add more or less buoyancy to the skimmer depending upon the weight of the suction hose and the hot water return line. Where the oil is to be taken from the shore or where there is a support for the oil skimmer the float devices for the oil skimmer will not be needed. The oil skimmer can be rested on the edges of a pit slope just under the oil surface. Also with light weight oils, the hot water line can be disconnected. The screen **84** is used to keep debris such as dead birds and wood from the opening of the skimmer body and from going through or into the suction hose apparatus. Oil pollution of the waters can be effected with this apparatus and by this method so that they will be kept free of oil pollution.

What is claimed is:

1. An oil skimming apparatus for removing oil from the surface of a body of water comprising a laterally elongated body having a large top opening, a closed bottom and depending front and rear faces, laterally elongated front and rear float members, the front float member having its top surface lying below the rear float member, said float members supporting the weight of the skimmer body to locate the top face of the front float member beneath the surface of said body of water so that the oil slick can be drawn and floated thereover into the skimmer body and outlet means connected to the bottom of the skimmer body to remove the collected oil slick, and a hot water pipe line extending through the oil skimmer body and having a laterally extending spray head disposed just forwardly of the forward edge of the front float member and beneath the surface of said body of water to heat the oil slick just immediately through its passage over the top face of front float member and into the skimmer body.

2. An oil skimming apparatus as defined in claim **1**, and said skimmer body having a forwardly extending flange on the front portion of the skimmer body and said rear face having a rearwardly extending flange, said front face flange being lower than the rear face flange and said floatable members being respectively supported by the respective flanges and end plates overlying the ends of the floatable members and serving to prevent the lateral escape of the oil slick upon passing over the front float member into the oil skimmer body.

3. An oil skimming apparatus as defined in claim **1**, and end plates secured to the opposite ends of the skimmer body and extending upwardly from the opening thereof and said floatable members extending between the end plates and secured at their ends thereto, and a strainer having a central mesh, said strainer having depending spring projections engageable with the opposite end plates and with the front and rear face portions to releaseably secure the strainer to the open end of the skimmer body and said floatable members having their upper faces underlying the strainer front and rear edges to sustain the floatable members against upward displacement.

4. An oil skimming apparatus as defined in claim **1**, and a heater, separator and vacuum pump means secured to the outlet means of the oil skimmer body for removing the oil slick from the skimmer body to heat the same and separate it from any water which may have been removed, and a pump for returning heated water from the heater and separator to the laterally extending hot water spray head on the skimmer body.

5. An oil skimming apparatus as defined in claim **4**, and a floatable water fence in combination therewith and adapted to be utilized in cooperation with said apparatus comprising floatable blocks, a cable extending through the blocks and means for uniting the blocks upon the cable to each other to provide a continuous barrier to confine the oil slick and directing the same toward the oil skimmer body and means for drawing the water fence toward the oil skimmer body.

6. An oil skimming apparatus as defined in claim **5**, and said floatable fence blocks having vertical end plate members and said means for uniting the blocks together comprises a longitudinal pin extending horizontally from the surface of a first end plate, said pin having a locking groove adjacent the end of said pin opposite said first end plate, a cooperating opening for said pin in a second cooperating and adjacent end plate, said opening extending through said second end plate into the fence block connected thereto, a locking member for said fence blocks comprising a first vertically arranged rod and a second vertically arranged rod connected by a horizontally arranged handle connecting the upper ends of said rods, a notched end on the lower end of said first rod, holes vertically arranged in the upper surface of said fence blocks constructed and arranged whereby said first rod lockingly engages the pin groove when said pin is located interiorly of a fence block and said second rod pivotally connects another fence block to an adjacent block, communicating holes horizontally arranged in each fence block and a continuous cable extending through said holes whereby said blocks are lockingly and pivotably united along the length of said cable.

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