

Specification

Title of Invention: HYDROPHILIC RATCHET DRUM OIL SKIMMER

Technical Field

[1] The present invention relates to a hydrophilic ratchet drum oil skimmer.

Background Art

[2] Various types of oil skimming equipment have been developed and used to skim spilled oil if an oil spill occurs at sea. Among them, mobile oil skimming equipment is divided into equipment that recovers spilled oil, while being towed by a ship, and equipment that recovers spilled oil, while operating on its own. In addition, the oil skimming equipment is divided into weir skimmers, adsorption skimmers, vacuum skimmers, and centrifugal force skimmers, depending on methods for skimming spilled oil.

[3] Spilled oil may have different viscosity according to the types of oil or the surrounding environments. Conventional oil skimming equipment is advantageous in skimming spilled oil with low viscosity, but it is not configured to skim spilled oil with high viscosity.

Disclosure

Technical Problem

[4] Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the related art, and it is an object of the present invention to provide an oil skimmer that is capable of making use of hydrophilic ratchet drums to skim all of low-viscosity oils, high-viscosity oils, and fine plastics.

[5] The technical problems to be achieved through the present invention are not limited as mentioned above, and other technical

problems not mentioned herein will be obviously understood by one of ordinary skill in the art through the following description.

Technical Solution

[6] To accomplish the above-mentioned objects, according to the present invention, there is provided a hydrophilic ratchet drum oil skimmer including: an oil skimming part having at least one or more drums rotatably mounted thereon, a temporary reservoir formed therein, and at least one or more scrapers for separating oil skimmed by the drums from the drums to induce the skimmed oil to the temporary reservoir; at least one or more buoyancy bodies mounted onto the oil skimming part; and a floating reservoir for receiving the skimmed oil from the temporary reservoir to store the skimmed oil therein.

Advantageous Effects of Invention

[7] The hydrophilic ratchet drum oil skimmer according to the present invention has one or more advantages as will be discussed below.

[8] Firstly, low-viscosity oils and high-viscosity oils are selectively skimmed according to selection of the rotational directions of the hydrophilic ratchet drums.

[9] Secondly, the first and second buoyancy bodies are manufactured through a single mold, thereby increasing productivity, and power systems are located inside the buoyancy bodies, thereby easily keeping the balance of the buoyancy bodies on the surface of seawater.

[10] Thirdly, the connection mechanism for connecting the floating reservoir and the oil skimming part to each other is configured to allow them to be detachable intuitively and easily from each other, so that if the floating reservoir is full of the

skimmed oil, it is replaced with new one to continuously perform oil skimming.

[11] Fourthly, heavy components such as motors, batteries, and the like are located inside the buoyancy bodies, thereby keeping the balance of the oil skimming part on the surface of seawater.

[12] The effectiveness of the invention is not limited as mentioned above, and it should be understood to those skilled in the art that the effectiveness of the invention may include another effectiveness as not mentioned above from the detailed description of the present invention.

Brief Description of Drawings

[13] FIGs. 1 and 2 are perspective views showing a hydrophilic ratchet drum oil skimmer according to an embodiment of the present invention.

[14] FIGs. 3 and 4 are exploded perspective views showing key components of an oil skimming part according to the embodiment of the present invention.

[15] FIG. 5 is a top view showing an interior of the oil skimming part according to the embodiment of the present invention.

[16] FIG. 6 is a perspective view showing a buoyancy body according to the embodiment of the present invention.

[17] FIGs. 7 and 8 are schematic views showing oil skimming operations according to rotations of drums according to the embodiment of the present invention.

[18] FIG. 9 are sectional views of various ratchet structures according to the embodiment of the present invention.

[19] FIG. 10 is a perspective view showing a first connector and a second connector according to the embodiment of the present invention.

[20] FIG. 11 is a perspective view showing other components of the hydrophilic ratchet drum oil skimmer according to the embodiment of the present invention.

Best Mode for Invention

[21] Hereinafter, the present invention is disclosed with reference to the attached drawings wherein the corresponding parts in the embodiments of the present invention are indicated by corresponding reference numerals and the repeated explanation on the corresponding parts will be avoided. The terms 'modules' and 'parts', as used herein, are used only to allow the present invention to be easily described, and therefore, they do not have any distinguished meaning or roles. If it is determined that the detailed explanation on the well-known technology related to the present invention makes the scope of the present invention not clear, the explanation will be avoided for the brevity of the description. The present invention may be modified in various ways and may have several exemplary embodiments. Specific exemplary embodiments of the present invention are illustrated in the drawings and described in detail in the detailed description. However, this does not limit the invention within specific embodiments and it should be understood that the invention covers all the modifications, equivalents, and replacements within the idea and technical scope of the invention.

[22] Terms, such as the first, the second, and the like, may be used to describe various elements, but the elements should not be restricted by the terms. The terms are used to only distinguish one element from the other element.

[23] When it is said that one element is described as being "connected" or "coupled" to the other element, one element may be directly connected or coupled to the other element, but it should

be understood that another element may be present between the two elements. In contrast, when it is said that one element is described as being "directly connected" or "directly coupled" to the other element, it should be understood that another element is not present between the two elements.

[24] An expression referencing a singular value additionally refers to a corresponding expression of the plural number, unless explicitly limited otherwise by the context.

[25] In this application, terms, such as "comprise", "include", or "have", are intended to designate those characteristics, numbers, steps, operations, elements, or parts which are described in the specification, or any combination of them that exist, and it should be understood that they do not preclude the possibility of the existence or possible addition of one or more additional characteristics, numbers, steps, operations, elements, or parts, or combinations thereof.

[26] FIGs. 1 and 2 are perspective views showing a hydrophilic ratchet drum oil skimmer according to an embodiment of the present invention.

[27] FIGs. 3 and 4 are exploded perspective views showing key components of an oil skimming part according to the embodiment of the present invention.

[28] FIG. 5 is a top view showing an interior of the oil skimming part according to the embodiment of the present invention.

[29] FIG. 6 is a perspective view showing a buoyancy body according to the embodiment of the present invention.

[30] As shown, a hydrophilic ratchet drum oil skimmer 10 includes an oil skimming part 100, a buoyancy body 120, a pipe 250, and a floating reservoir 200.

[31] The oil skimming part 100 serves to remove oil spilled in the sea. The removed oil may be referred to skimmed oil.

[32] The oil skimming part 100 has at least one or more drums rotatably mounted thereon, a temporary reservoir formed therein, and at least one or more scrapers for separating the oil skimmed by the drums from the drums to induce the separated skimmed oil to the temporary reservoir.

[33] According to the embodiment of the present invention, the oil skimming part 100 has a drum 111 rotatably mounted on one side thereof, and the floating reservoir 200 is connected to the other side of the oil skimming part 100.

[34] According to another embodiment of the present invention, the oil skimming part 100 has a first drum 111 rotatably mounted on one side thereof and a second drum 112 rotatably mounted on the other side thereof so that the skimmed oil is collected to a temporary reservoir 113 formed therein. The hydrophilic ratchet drum oil skimmer 10 further includes the pipe 250 that is connected between the temporary reservoir 113 and the floating reservoir 200 connected to the buoyancy body to move the skimmed oil to the floating reservoir 200.

[35] The drums 111 and 112 have hydrophilic porous surfaces and ratchet structures.

[36] The oil skimming part 100 includes the at least one or more drums 111 and 112, the temporary reservoir 113, and at least one or more scrapers 131 and 132.

[37] The oil skimming part 100 may have only one drum 111, and otherwise, it may have the two drums 111 and 112. If the hydrophilic ratchet drum oil skimmer 10 is provided with the oil skimming part 100 having only one drum 111, it is referred to as a single hydrophilic ratchet drum oil skimmer, and otherwise, if

the hydrophilic ratchet drum oil skimmer 10 is provided with the oil skimming part 100 having the two drums 111 and 112, it is referred to as a dual hydrophilic ratchet drum oil skimmer.

[38] The at least one or more drums 111 and 112 have ratchet structures along the outer peripheral surfaces thereof.

[39] The surfaces of the drums 111 and 112 are made of hydrophilic materials. If the surfaces of the drums 111 and 112 are made of hydrophilic materials, the skimmed oil is more easily separated from the ratchet structures of the drums 111 and 112.

[40] The surfaces of the drums 111 and 112 are made of porous materials for absorbing water thereinto. If the surfaces of the drums 111 and 112 are made of porous materials, the surfaces of the ratchet structures of the drums 111 and 112 are kept wet.

[41] The surfaces of the drums 111 and 112 are made of porous materials that form micropores thereon. The size range of the micropores is between 10 and 100 μm .

[42] If the surfaces of the ratchet structures of the drums 111 and 112 are wet, the skimmed oil through the ratchet structures is prevented from being directly attached to the surfaces of the ratchet structures by means of water, thereby allowing the skimmed oil to be more easily separated from the ratchet structures.

[43] The surfaces of the drums 111 and 112 have nanostructures for hydrophilic improvement.

[44] The nanostructures are one or more materials selected from the group consisting of nanohairs, nanofibers, nanopillars, nanorods, and nanowires.

[45] Each nanostructure has a height greater than or equal to 1 μm or a width less than or equal to 2 μm , and a distance between the neighboring nanostructures is less than or equal to 2 μm .

[46] If the nanostructures are formed on the surfaces of the drums 111 and 112, the ratchet structures are improved in hydrophilicity and thus form water films on the surfaces thereof. In this case, the contact surfaces between the ratchet structures and the skimmed oil are minimized to allow the skimmed oil to be more easily separated from the ratchet structures.

[47] The temporary reservoir 113 serves to store the oil skimmed through the at least one or more drums 111 and 112 and the at least one or more scrapers 131 and 132.

[48] The temporary reservoir 113 has a hole h formed thereon. The temporary reservoir 113 communicates with a first connector 190 as will be discussed later.

[49] According to an embodiment of the present invention, the oil skimming part 100 further includes the first connector 190, and a screw is located in the hole h and the first connector 190. The screw is located protrudingly from the hole h in such a way as to be exposed to the interior of the temporary reservoir 113. The screw rotates by means of the power generated from a motor, and if the screw rotates, the skimmed oil moves from the temporary reservoir 113 to the floating reservoir 200.

[50] According to an embodiment of the present invention, the oil skimmer 10 further includes the pipe 250, and a screw is located in the hole h and the pipe 250. The screw is located protrudingly from the hole h in such a way as to be exposed to the interior of the temporary reservoir 113. The screw rotates by means of the power generated from a motor, and if the screw rotates, the skimmed oil moves from the temporary reservoir 113 to the floating reservoir 200.

[51] The oil skimming part 100 has one scraper 131 or two scrapers 131 and 132.

[52] The at least one or more scrapers 131 and 132 match with the at least one or more drums 111 and 112. In detail, the first scraper 131 matches with the first drum 111, and the second scraper 132 matches with the second drum 112.

[53] The oil skimmed through the at least one or more drums 111 and 112 is induced to the temporary reservoir 113.

[54] The scrapers 131 and 132 are configured to allow one end thereof to be brought into contact with the surfaces of the drums 111 and 112 or to be spaced apart therefrom by minute distances.

[55] The scrapers 131 and 132 serve to separate the oil skimmed through the drums 111 and 112 by the rotations of the drums 111 and 112 from the drums 111 and 112.

[56] The scrapers 131 and 132 are located to have given inclinations when viewed on sides thereof. For example, portions of the scrapers 131 and 132 directed toward the drums 111 and 112 are placed at higher positions than portions directed toward the temporary reservoir 113. Otherwise, portions of the scrapers 131 and 132 directed toward the drums 111 and 112 may be placed at lower positions than portions directed toward the temporary reservoir 113.

[57] The scrapers 131 and 132 have the shapes of plates.

[58] The scrapers 131 and 132 have guide walls on both sides thereof.

[59] Further, the scrapers 131 and 132 are mounted on a body 113a as will be discussed later through at least one or more elastic members (e.g., springs). As a result, the scrapers 131 and 132 can adjust the contact strength with the drums 111 and 112 in every direction.

[60] In this case, the body 113a is a sub-component of the oil skimming part 100 that forms the temporary reservoir 113 on the

bottom thereof and has the drums 111 and 112, the scrapers 131 and 132, and the buoyancy body 120 mounted on top thereof, thereby serving as a framework of the oil skimming part 100.

[61] The buoyancy body 120 serves to provide buoyancy to the oil skimming part 100. The buoyancy body 120 is mounted on the oil skimming part 100. For example, the buoyancy body 120 is mounted on the oil skimming part 100 by means of brackets.

[62] The buoyancy body 120 includes a first buoyancy body 121 and a second buoyancy body 122.

[63] The first buoyancy body 121 is mounted on one side surface of the oil skimming part 100, and the second buoyancy body 122 on the other side surface of the oil skimming part 100. For example, the first buoyancy body 121 is mounted on the front end surface of the oil skimming part 100, and the second buoyancy body 122 on the rear end surface of the oil skimming part 100.

[64] The first buoyancy body 121 and the second buoyancy body 122 are made with the same mold as each other.

[65] In this case, the second buoyancy body 122 has the same shape as the first buoyancy body 121, but it rotates by 180° around an up and down axis thereof, unlike the first buoyancy body 121, and is thus mounted on the other side surface of the oil skimming part 100.

[66] The buoyancy body 120 forms an internal space in which power system components of the oil skimming part 100 are located.

[67] The oil skimmer 10 further includes a motor 151, a battery 152, and a power transmitter 153.

[68] The motor 151 includes a first motor and a second motor.

[69] The first motor generates rotational power for the first drum 111.

[70] The second motor generates rotational power for the second drum 112.

[71] The battery 152 includes a first battery and a second battery.

[72] The first battery supplies power to the first motor.

[73] The second battery supplies power to the second motor.

[74] The power transmitter 153 includes a first power transmitter and a second power transmitter.

[75] The first power transmitter transmits the rotational power generated from the first motor to the first drum 111.

[76] The second power transmitter transmits the rotational power generated from the second motor to the second drum 112.

[77] The first motor, the first battery, and the first power transmitter are located in a first space S formed in the interior of the first buoyancy body 121.

[78] The second motor, the second battery, and the second power transmitter are located in a second space formed in the interior of the second buoyancy body 122.

[79] The first buoyancy body 121 has a plurality of protrusions 121a protruding from the inner surfaces thereof toward the first space S.

[80] The first buoyancy body 121 includes a lower portion having the first space S in which an opening is formed on top thereof and an upper portion coupled to the lower portion to cover the opening.

[81] The protrusions 121a are formed on a position corresponding to the coupled position between the lower portion and the upper portion of the first buoyancy body 121.

[82] Further, the first motor 151 and the first battery 152 are located among the plurality of protrusions 121 protruding from

the inner surfaces of the first buoyancy body 121 toward the first space S and thus fixed in positions. As the first motor 151 and the first battery 152 are restrained by means of the plurality of protrusions 121a, they can stably provide the rotational power to the first drum 111 even in the case where the oil skimming part 100 moves.

[83] The lower portion of the first buoyancy body 121 has a rubber member 180 mounted on top thereof in such a way as to protrude upward from the edges of the first space S, and the upper portion of the first buoyancy body 121 is coupled to the lower portion thereof, while receiving the rubber member 180 thereinto.

[84] The oil skimmer 10 further includes a plate 160. The plate 160 is located between the lower portion and the upper portion of the first buoyancy body 121 when they are coupled to each other, thereby improving water tightness. The plate 160 is made of a rubber material.

[85] Further, the second buoyancy body 122 has the same shape as the first buoyancy body 121, while the direction mounted on the body 113a is being different from that of the first buoyancy body 121. Therefore, an explanation of the second buoyancy body 122 can be replaced with that of the first buoyancy body 121.

[86] Further, the first battery and the second battery are replaceable with new ones to prepare the continuous work of the oil skimmer 10. The first battery of the first buoyancy body 121 and the second battery of the second buoyancy body 122 are replaced with new ones after the upper portions of the first buoyancy body 121 and the second buoyancy body 122 have been removed from their lower portions.

[87] The pipe 250 is connected between the temporary reservoir 113 and the floating reservoir 200 to move the skimmed oil to the floating reservoir 200.

[88] At least a portion of the pipe 250 is located under the buoyancy body 120. If the floating reservoir 200 is connected to the second buoyancy body 122, for example, the pipe 250 is connected to the floating reservoir 200 under the second buoyancy body 122, and at least a portion of the pipe 250 is located under the second buoyancy body 122.

[89] The oil skimmer 10 further includes the screw. The screw is located inside the pipe 250 and rotates to move the skimmed oil from the temporary reservoir 113 to the floating reservoir 200.

[90] The floating reservoir 200 receives the skimmed oil from the temporary reservoir 113 and thus stores the skimmed oil therein.

[91] The floating reservoir 200 is replaceable with new one by means of coupling and separation between the first connector 190 and a second connector 290 as will be discussed later according to the amount of skimmed oil stored therein.

[92] FIGs. 7 and 8 are schematic views showing oil skimming operations according to the rotations of the drums according to the embodiment of the present invention.

[93] As shown, the oil skimmer 10 skims spilled oil according to first and second modes.

[94] The first mode is a mode in which low-viscosity oils that form thin oil films are skimmed. The second mode is a mode in which oils solidified due to high viscosity or fine plastics are skimmed.

[95] Referring to FIG. 7, the rotational direction of the drum 111 is determined, depending upon the first mode and the second mode that are divided according to types of spilled oil.

[96] In the first mode 710, the drum 111 rotates from the outside of the oil skimming part 100 toward the inside of the oil skimming part 100. In the first mode 710, low-viscosity oils are skimmed.

[97] If the first mode is chosen, the drum 111 skims at least one of bunker-A oil, diesel oil, kerosene, lubricating oil, and floating chemical substances, while rotating from the outside of the oil skimming part 100 toward the inside of the oil skimming part 100.

[98] In the first mode 710, the drum 111 rotates at a lower speed than that in the second mode.

[99] If the drum 111 rotates at a higher speed in the first mode 710, starvation may occur. Water flows due to the fast rotation of the drum 111, which forms a water hole around the drum 111, and therefore, oil is not skimmed well because of the water hole.

[100] To prevent the starvation from occurring, the drum 111 is required to rotate at a low speed in the first mode 710, and the Rotations Per Minute (RPM) of the drum 111 in the first mode 710 is lower than the RPM of the drum 111 in the second mode 720.

[101] In the second mode 720, the drum 111 rotates from the inside of the oil skimming part 100 toward the outside of the oil skimming part 100. In the second mode 720, high-viscosity oils are skimmed.

[102] If the second mode 720 is chosen, the drum 111 skims at least one of bunker-C oil, low sulfur fuel oil (LSFO), and fine plastics, while rotating from the inside of the oil skimming part 100 toward the outside of the oil skimming part 100.

[103] In the second mode 720, the drum 111 rotates at a higher speed than that in the first mode 710.

[104] In the second mode 720, the drum 111 to which oil is attached is raised above the surface of water by a given height, by means of the surface material and structure thereof, the rotational speed thereof, the type of oil, the viscosity of oil, the difference in density between oil and water, and the surface tension of oil.

[105] To allow the spilled oil to be raised from the surface of water according to the rotation of the drum 111, the drum 111 is required to rotate at a high speed, and therefore, the RPM of the drum 111 in the second mode 720 is higher than that of the drum 111 in the first mode 710.

[106] In the state where the oil is raised, the oil is separated from the drum 111 by means of the scraper 131 and falls down to the temporary reservoir 113.

[107] To allow the oil to be more efficiently skimmed in the second mode 720, the oil skimming part 100 further includes a stand 135 (See a reference numeral 730). The stand 135 is spaced apart from the drum 111. The stand 135 induces the oil separated from the drum 111 by means of the scraper 131 to the temporary reservoir 113 by means of gravity.

[108] The stand 135 is located under the scraper 131.

[109] The stand 135 has a given inclination when viewed on side thereof to allow a portion directed toward the temporary reservoir 113 to be placed at a lower position than a portion directed toward the drum 111.

[110] The stand 135 has a bent portion. The stand 135 extends to the temporary reservoir 113, while having the given inclination,

and is then bent to extend in a direction vertical with respect to the temporary reservoir 113.

[111] The stand 135 has the shape of a plate, while having guide walls on both sides thereof.

[112] Referring to FIG. 8, the rotational directions of the first drum 111 and the second drum 112 are determined, depending upon the first mode and the second mode divided according to types of spilled oil.

[113] In the first mode 710, the first drum 111 and the second drum 112 rotate from the outside of the oil skimming part 100 toward the inside of the oil skimming part 100. In the first mode 710, low-viscosity oils are skimmed.

[114] If the first mode 710 is chosen, the first drum 111 and the second drum 112 skims at least one of bunker-A oil, diesel oil, kerosene, lubricating oil, floating chemical substances, while rotating from the outside of the oil skimming part 100 toward the inside of the oil skimming part 100.

[115] In the first mode 710, the first drum 111 and the second drum 112 rotate at lower speeds than those in the second mode 720.

[116] If the first drum 111 and the second drum 112 rotate at high speeds in the first mode 710, starvation may occur. Water flows due to the fast rotations of the first drum 111 and the second drum 112, which forms water holes around the first drum 111 and the second drum 112, and therefore, oil is not skimmed well because of the water holes.

[117] To prevent the starvation from occurring, the first drum 111 and the second drum 112 are required to rotate at low speeds in the first mode 710, and the Rotations Per Minute (RPM) of the first drum 111 and the second drum 112 in the first mode 710 is

lower than the RPM of the first drum 111 and the second drum 112 in the second mode 720.

[118] In the second mode 720, the first drum 111 and the second drum 112 rotate from the inside of the oil skimming part 100 toward the outside of the oil skimming part 100. In the second mode 720, high-viscosity oils are skimmed.

[119] If the second mode 720 is chosen, the first drum 111 and the second drum 112 skim at least one of bunker-C oil, low sulfur fuel oil (LSFO), and fine plastics, while rotating from the inside of the oil skimming part 100 toward the outside of the oil skimming part 100.

[120] In the second mode 720, the first drum 111 and the second drum 112 rotate at higher speeds than those in the first mode 710.

[121] In the second mode 720, the first drum 111 and the second drum 112 to which oil is attached is raised above the surface of water by a given height, by means of the surface material and structure thereof, the rotational speed thereof, the type of oil, the viscosity of oil, the difference in density between oil and water, and the surface tension of oil.

[122] To allow the oil to be raised from the surface of water according to the rotations of the first drum 111 and the second drum 112, the first drum 111 and the second drum 112 are required to rotate at high speeds, and therefore, the RPM of the first drum 111 and the second drum 112 in the second mode 720 is higher than the RPM of the first drum 111 and the second drum 112 in the first mode 710.

[123] In the state where the oil is raised, the oil is separated from the first drum 111 and the second drum 112 by means of the first scraper 131 and the second scraper 132 and fall down to the temporary reservoir 113.

[124] To allow the oil to be more efficiently skimmed in the second mode 720, the oil skimming part 100 further includes a first stand 135 and a second stand 136 (See a reference numeral 730). The first stand 135 and the second stand 136 are spaced apart from the first drum 111 and the second drum 112, respectively. The first stand 135 and the second stand 136 induce the oil separated from the first drum 111 and the second drum 112 by means of the scraper 131 to the temporary reservoir 113 by means of gravity.

[125] The first stand 135 and the second stand 136 are located under the first scraper 131 and the second scraper 132, respectively.

[126] The first stand 135 and the second stand 136 have given inclinations when viewed on sides thereof to allow portions directed toward the temporary reservoir 113 to be placed at lower positions than portions directed toward the first drum 111 and the second drum 112.

[127] The first stand 135 and the second stand 136 have bent portions. The first stand 135 and the second stand 136 extend to the temporary reservoir 113, while having the given inclinations, and are then bent to extend in directions vertical with respect to the temporary reservoir 113.

[128] The first stand 135 and the second stand 136 have the shapes of plates, while having guide walls on both sides thereof.

[129] FIG. 9 are sectional views showing various examples of the ratchet structures according to the embodiment of the present invention.

[130] As shown, the ratchet structures 702a, 702b, or 702c are applied to the first drum 111 and the second drum 112.

[131] The ratchet structures 702a and 702b have sectional shapes of triangles, as shown.

[132] As shown, if the sectional shapes of the ratchet structures 702b are right-angled triangles or obtuse-angled triangles, surfaces 704b coming into contact with the oil increase in area, thereby allowing the solidified oil (low sulfur fuel oil) to be skimmed through end portions 703b and allowing high sulfur fuel oil to be skimmed through the surfaces 704b.

[133] As shown, if the sectional shapes of the ratchet structures 702c are curves with given curvatures, end portions 703c become sharply pointed, thereby allowing the skimming efficiency of solidified oil to be improved. In this case, each end portion 703c is formed by joining a first curved surface 704c1 and a second curved surface 704c2.

[134] FIG. 10 is a perspective view showing the first connector and the second connector according to the embodiment of the present invention.

[135] As shown, a first end of the pipe 250 communicates with the hole h, and a second end of the pipe 250 communicates with the first connector 190. The first connector 190 may be a sub-component of the pipe 250.

[136] If the first connector 190 is coupled to the second connector 290, a pipe 191 of the first connector 190 and the pipe 250 communicate with the second pipe 291 so that they communicate with the floating reservoir 200.

[137] The first connector 190 has a coupling groove 193 formed on at least a portion thereof around the circumference of a hole 192 formed therein.

[138] The coupling groove 193 consists of a semicircular lower groove 193a surroundingly formed along the bottom of the hole 192

and a pair of guide grooves 193b extending upward in parallel with each other from both sides of the lower groove 193a. Referring to FIG. 10, the lower groove 193a of the coupling groove 193 is formed under a reference line RL, whereas the guide grooves 193b are above the reference line RL.

[139] The floating reservoir 200 includes the second connector 290. The second connector 290 has the second pipe 291 extending forward from the floating reservoir 200. The second pipe 291 communicates with the floating reservoir 200. If the second connector 290 is coupled to the first connector 190, the second pipe 291 communicates with the first pipe 191 so that it communicates with the temporary reservoir 131.

[140] The second connector 290 has an insertion member 293 fittedly inserted into the coupling groove 190. A portion of the insertion member 293 has the shape of a semicircle surrounding the bottom of a hole formed on the end of the second pipe 291, so that it is fittedly inserted into the lower groove 193a.

[141] If the insertion member 293 moves along the guide grooves 193b and is thus inserted into the lower groove 193a, the second pipe 291 can communicate with the first pipe 191.

[142] Further, the second connector 290 includes a handle 292. If the handle 292 is pulled upward by a worker in a state where the oil skimmer 10 floats on the surface of seawater, the second connector 290 is separated from the first connector 190. After that, if the handle 292 of a new floating reservoir 200 is held to allow the insertion member 291 to be inserted into the coupling groove 193, the old floating reservoir 200 is replaced with the new floating reservoir 200.

[143] The floating reservoir 200 is replaceable with new one by means of the coupling and separation between the first connector

190 and the second connector 290 according to the amount of skimmed oil stored therein.

[144] FIG. 11 is a perspective view showing other components of the hydrophilic ratchet drum oil skimmer according to the embodiment of the present invention.

[145] As shown, the oil skimmer 10 further includes triangular buoyancy bodies 910, propellers 920, hydrofoils 930, and connection belts 940.

[146] The triangular buoyancy bodies 910 are coupled to the propellers 920 in the form of modules. The triangular buoyancy bodies 910 reduce resistances against wind or seawater when the oil skimmer 10 moves forward, while providing buoyancy for the oil skimmer 10. The triangular buoyancy bodies 910 serve to induce the spilled oil to the drum 111.

[147] The propellers 920 provide thrust for moving the oil skimmer 10. Further, the propellers 920 perform steering.

[148] The hydrofoils 930 are mounted on the underside of the oil skimming part 100. The hydrofoils 930 serve as stands when the oil skimmer 10 is located on the land or ship. The hydrofoils 930 serve to allow the oil skimmer 10 to stably operate, without being influenced by waves and ocean currents, while the oil skimmer 10 is running.

[149] The connection belts 940 serve to stably connect the floating reservoir 200 to the oil skimming part 100. The connection belts 940 are connected to loops 181 mounted on the body of the oil skimming part 100 (See FIG. 10). As the connection belts 940 are connected to the loops 181, the first connector 190 and the second connector 290 that are coupled to each other are prevented from being separated unintentionally from each other.

[150] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any specific arrangement of software, which is calculated to achieve the same purpose, may be substituted for the specific embodiment shown. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

CLAIMS

【Claim 1】

A hydrophilic ratchet drum oil skimmer comprising:

an oil skimming part having at least one or more drums rotatably mounted thereon, a temporary reservoir formed therein, and at least one or more scrapers for separating oil skimmed by the drums from the drums to induce the skimmed oil to the temporary reservoir;

at least one or more buoyancy bodies mounted onto the oil skimming part; and

a floating reservoir for receiving the skimmed oil from the temporary reservoir to store the skimmed oil therein.

【Claim 2】

The hydrophilic ratchet drum oil skimmer according to claim 1, wherein the drums are mounted on one side of the oil skimming part, and the floating reservoir is connected to the other side of the oil skimming part.

【Claim 3】

The hydrophilic ratchet drum oil skimmer according to claim 1, wherein the oil skimming part has the first drum rotatably mounted on one side thereof and the second drum rotatably mounted on the other side thereof.

【Claim 4】

The hydrophilic ratchet drum oil skimmer according to claim 3, further comprising a pipe connected between the temporary reservoir and the floating reservoir connected to one side buoyancy body to move the skimmed oil to the floating reservoir.

【Claim 5】

The hydrophilic ratchet drum oil skimmer according to claim 4, wherein the oil skimming part further comprises:

a first scraper for inducing the skimmed oil by the first drum to the temporary reservoir; and

a second scraper for inducing the skimmed oil by the second drum to the temporary reservoir.

【Claim 6】

The hydrophilic ratchet drum oil skimmer according to claim 1, wherein the drums have hydrophilic porous surfaces and ratchet structures.

【Claim 7】

The hydrophilic ratchet drum oil skimmer according to claim 6, wherein the rotational directions of the drums are determined, depending upon a first mode and a second mode divided according to types of spilled oil.

【Claim 8】

The hydrophilic ratchet drum oil skimmer according to claim 7, wherein if the first mode is chosen, the drums skim at least one of bunker-A oil, diesel oil, kerosene, lubricating oil, and floating chemical substances, while rotating from the outside of the oil skimming part toward the inside of the oil skimming part.

【Claim 9】

The hydrophilic ratchet drum oil skimmer according to claim 7, wherein if the second mode is chosen, the drums skim at least one of bunker-C oil, low sulfur fuel oil (LSFO), and fine plastics, while rotating from the inside of the oil skimming part toward the outside of the oil skimming part.

【Claim 10】

The hydrophilic ratchet drum oil skimmer according to claim 9, wherein the oil skimming part further comprises a stand for inducing the oil separated from each drum by means of the corresponding scraper to the temporary reservoir if the second mode is chosen.

【Claim 11】

The hydrophilic ratchet drum oil skimmer according to claim 1, wherein the oil skimming part comprises a first connector having a coupling groove formed on at least a portion thereof along the circumference of a hole formed therein, and the floating reservoir comprises a second connector having an insertion member fittedly inserted into the coupling groove.

【Claim 12】

The hydrophilic ratchet drum oil skimmer according to claim 11, wherein the coupling groove comprises:

a semicircular lower groove surroundingly formed along the bottom of the hole; and

a pair of guide grooves extending upward in parallel with each other from both sides of the lower groove.

【Claim 13】

The hydrophilic ratchet drum oil skimmer according to claim 1, wherein the buoyancy bodies comprise:

a first buoyancy body mounted on one side surface of the oil skimming part; and

a second buoyancy body having the same shape as the first buoyancy body, while rotating by 180° around an up and down axis

thereof, unlike the first buoyancy body, in such a way as to be mounted on the other side surface of the oil skimming part.

【Claim 14】

The hydrophilic ratchet drum oil skimmer according to claim 13, further comprising:

- a first motor for generating rotational power for the first drum;

- a first battery for supplying power to the first motor;

- a first power transmitter for transmitting the rotational power generated from the first motor to the first drum;

- a second motor for generating rotational power for the second drum;

- a second battery for supplying power to the second motor;

and

- a second power transmitter for transmitting the rotational power generated from the second motor to the second drum,

wherein the first motor, the first battery, and the first power transmitter are located in a first space formed in the interior of the first buoyancy body, and the second motor, the second battery, and the second power transmitter are located in a second space formed in the interior of the second buoyancy body.

【Claim 15】

The hydrophilic ratchet drum oil skimmer according to claim 13, wherein the first buoyancy body has a plurality of protrusions protruding from the inner surfaces thereof toward the first space.