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Connection of a support rope to a net.

THE PRESENT INVENTION relates to a method of connecting a support rope and meshes of a net and more particularly to a method of connecting a support rope and meshes of drift net, or a fixed net, for fishing.

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As is well known, a fishing net, for example, a fixed net as shown in Figure 10 of the accompanying drawings, depends from the sea surface so that it is expanded in the sea, as required. When a counter boring (twisting) moment, caused due to waves on the sea, or downwardly directed force, is intensively exerted on the fishing net, there is a risk that the net will be torn off the cords constituting the support rope and thus that the whole fishing net will fall to the bottom of the sea. Further, the connections of the fishing net to the support rope, having a large diameter, must be made at particular intervals along longitudinal axis of the support rope, to allow for fishing net expansion.

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With these problems in mind, the following requirements have been recognised as desirable by many fishing net users, in many countries over the world:-

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1. Improvements in the ease and speed of assembling and dis-assembling of a fishing net,

2. Connections between the support rope and the fishing net (where tearing-off is liable to take place) which do not involve tying one to the other

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3. Minimizing of area where net expansion operation is performed and time required to carry out net expansion.

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To facilitate understanding of the other disadvantageous feature of

the conventional net expansion method, Figure 10 illustrates a typical conventional method where an intermediate rope R' is connected to a main rope R, provided with floats in spaced relation, by connecting ropes interposed therebetween, and a fishing net is then connected to the intermediate rope R' by another connecting rope R", having an elliptic or half elliptic shape as seen from the side, with a number of binding knots formed along the upper edge of the fishing net. The connecting rope R" is called a "zig-zag rope".

However, the above-described structure of the conventional fishing net, using so-called zig-zag ropes, leads to a result that is expensive to manufacture. This is the same in the case of drift gill nets (not shown) which do not require a main rope R. Thus the conventional drift gill net is also expensive to manufacture.

Accordingly, it is an object of the present invention to provide an improved method of connecting a fishing net which can be entirely free from the drawbacks inherent in the conventional methods mentioned above.

According to the present invention there is provided a method of connecting a net to a support rope, the support rope comprising a series of main loop portions depending from the support rope, the length of a main loop portion being greater than or approximately equal to the distance between that main loop portion and an adjacent main loop portion in a given direction along the support rope, which method comprises inserting a first main loop portion through one or more meshes of the net, inserting the adjacent main loop portion, in the given direction, through the first main loop portion so that the one or more meshes of the net are positioned between the support rope and the first main loop

portion, repeating the process for each main loop portion to be used along the support rope and engaging the final main loop portion to be used to the support rope.

Thus, expansion of the fishing net is permitted by the use of this method without the necessity of tying the net to any position along the support rope. The thus-expanded fishing net can satisfactorily stand any counter boring moment which may be generated by roaring waves on the sea.

For a better understanding of the present invention and to show how the same may be put into effect reference will now be made, by way of example, to the accompanying drawings, in which:

FIGURE 1 shows a view of a cord having the circular cross-sectional configuration is stranded with the support rope with a number of main ear or loop portions having the same length depending from the support rope in the equally spaced relation;

FIGURE 2 shows a view of the cord of Figure 1 with the support rope;

FIGURE 3 shows a view of the support rope of Figure 1, illustrating how a small ear portion is formed a main ear portion;

FIGURE 4 shows a view of a main ear portion inserted through the circular hollow space of the smaller ear portion without any formation of binding knot while net meshes are hung thereon one by one;

FIGURE 5 shows the support rope of Figure 1 with the main ear portions interconnected by the small ear portions;

FIGURE 6 illustrates a net connected to a support rope by one embodiment of the method of the present invention;

FIGURE 7 shows a fragmental enlarged view of a connection between two main ear portions, in a method of the present invention;

FIGURE 8 shows a schematic view of a support rope illustrating how connection of the ear portions is achieved in accordance with the method of the present invention, including a method of attaching the final main ear portion to the support rope;

FIGURE 9 shows a schematic view illustrating how an unusable technical idea is constructed on principle; and

FIGURE 10 shows a view illustrating the connection means of a conventional fishing net.

Referring now to the drawings, Figures 1 to 3 illustrate how the support rope R constitutes a combination of a plurality of unit cords or strands and a smaller cord S having a circular cross-sectional shape (stranded cord having a high tensile strength) which are stranded together in the illustrated manner, forming a number of main ear or loop portions S, which depend from the support rope R.

When the support rope R is manufactured automatically, each of the main ear portions S, is uniformly drawn downwardly from the rope so that depending length l_1 , of each main ear S measured from the position where the main ear portion S comes out of the support rope R, is greater or substantially the same distance L_1 between individual main ear portions S.

In practical fishing operations, using a drift gill net constructed according to the present invention, a number of support ropes R with various diameters (in the range of 3 to 50 mm) were employed. However, for the purpose of simplification, this description refers to the case where only a support rope R having a diameter of 7 mm is used.

In this case, shown in Figure 2, the support rope R constitutes a combination of eight (8) unit cords having a diameter of 3 mm stranded with one small cord, with depending length l_1 , of each main ear portion S and span L_1 between the adjacent main ear portion S being substantially the same, in the range of 25 to 30 cm.

As shown in Figure 3, the foremost end 1 of each main ear portion S is inserted at a point along the support rope R in the direction of net expansion, through the structure of the support rope R and it is then drawn downwardly therefrom to form a smaller ear portion E. The smaller ear portion E has a depending length l_2 , which is measured from the position where the smaller ear portion S comes out of the support rope R, and the smaller ear portion E is a distance L_2 , away from the adjacent main ear portion S in the net-expanding direction. The main ear portion S adjacent to the formed smaller ear portion E in the direction of net expansion is inserted through the smaller ear portion E as shown in Figure 4. To assure that the ability of the fishing net to withstand expansive force and connecting force is increased and that the disassembling operation is easily performed continuously, the smaller ear portion E is formed in such a _____

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manner that the relationship between l_2 and L_2 is $l_2 \approx L_2$, the same as the dimensional relationship between l_1 and L_1 . In the illustrated embodiment, $l_2 = L_2 = 2.6$ cm.

5 Since the support rope R specially designed for the invention provides merely a number of depending main ear portions S, which have the same length l_1 , it can be mass produced at the substantially same cost as a conventional support rope despite the kind of material used.

10 As shown in Figure 5, the foremost end I of the main ear portion S, inserted through the smaller ear portion E, is through the support rope R, in the direction of net expansion, with the aid of a suitable insert sleeve (not shown) held by an operator. Said end I then projects, in the direction of net expansion, from the support rope S on the lower surface of the support rope, at a point which is a distance approximately L_2 from the point on the support rope I from which the adjacent main ear portion S depends.

15 As will be apparent from the drawing, the part of the main ear portion S projecting from the point of the support rope R, forms a smaller ear portion E. At this time in the manufacturing operation a visual inspection or a measurement confirms whether the dimensional relation $l_2 = L_2$ has been substantially achieved or not.

20 The main ear portion S adjacent to the newly formed smaller ear portion E is fully extended through the smaller ear portion E, repeating the process shown in Figure 4. Thereafter, the connecting end meshes of a net N are hung on the main ear portions S one after another before each is pulled in the direction of net extension and inserted through the support rope R at the point where a smaller ear portion E is formed. A resulting net is shown in Figure 6.

25 The above operation is repeated, for each main ear portion S along the support rope R to form a series of supporting loops, that is to say of about 25 cm (L_1) length, approximately equal to one stretched main ear portion S, the next smaller ear portion E (as identified by point 3') is formed in the same manner as mentioned above (Figure 5). On completion of forming of the smaller ear portion E in that way, the following ear portion S

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is extended through said portion E and this operation is repeated successively.

5 According to the method of connecting the fishing net pertaining to the present invention, the variable depending points of the smaller ear portions E, are located in the vicinity of the fixed depending points 1, 2, 3, 4 5 ... of the loop-shaped main ear portion S (Figure 6) and both the smaller ear portions E and the main ear portions S overlap one another when the main ear portions S are pulled in the direction of net
10 expansion, thus improving the resistance to net expansive force and the durability of the connection between the support rope R compared with conventional nets.

As a result of a number of fishing operations using drift gill net, of
15 which the support rope had a diameter of 7 mm, and which was not loaded with weights, in the sea, it was estimated that each of the support ropes (comprising eight (8) stranded unit cords made of polypropylene) of drift gill net had a rope strength, as well as an expansive force, of 1,240 kg. When the drift gill net was immersed at an average depth of 10m in the sea, its
20 width in the expanded state was 50 m and its total weight as measured in the sea, was 11.3 kg (it should be noted that measurements were carried out in accordance with relevant JIS (Japanese Industrial Standard) measuring methods.

25 According to the method of the present invention, a series of holding connections, which may be of convex cross-section without any binding knot formed thereat, are spaced along the lower surface of the support rope R (Figure 7) by way of the steps of inserting each successive main ear portion S through the support rope R to form a smaller ear portion E adjacent the
30 next main ear portion S, inserting the next main ear portion S through the smaller ear portion E, and repeating the process as hereinbefore described, and displacing upwardly the combined structure of both main ear portion S and smaller ear portion E, and stretching the support rope R in the longitudinal direction during the net expansion operation on the sea. Owing to
35 the construction of the holding connections the strength of the support rope R can be increased remarkably.

This leads to the advantageous features that the diameter of a support rope can be reduced, at least by an extent of $1/5$ to $1/4$, compared with that of a conventional rope, and, moreover, that the manhours required to connect the support rope to a fishing net N may be considerably reduced.

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When disassembling of the fishing net is required to repair it or replace it with another net, the disassembling operation is initiated from the rearmost smaller ear portion E (Figure 8) and it is completed by disconnecting each main ear portion 4 from the corresponding smaller ear portion E, by reversing the operations by which the net was constructed, so that the whole fishing net N is disassembled from the support rope R.

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Obviously, the connecting and disconnecting operations may be performed in the same manner as described above with respect to the bottom edge of a fishing net N.

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The embodiment described above has been used in practical fishing operations in the fishing area of the Japan Sea and Pacific Ocean and utilization of floats and weights (not shown) was determined in accordance with conventional fishing practices depending on the position where they were placed in the sea (in the range of 2 to 1,000 m in depth).

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In the case where the fishing operation was performed with the use of fixed net, the fishing net expanded to a width of 20 m at a position of 12 m in depth, as measured down from the sea surface. In this practical fishing operation, the main rope R used therefor had a diameter of 15 mm and it was found that the same fishing effect was obtainable as when a conventional main rope (Figure 10) having a diameter of 20 mm was used.

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This means that the diameter of the main rope for use with fishing nets can be reduced to $3/4$ of that of the conventional one.

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Further, in every embodiment mentioned above, it was confirmed that time required for connecting and disconnecting fishing nets the same width was reduced to $1/20$ compared with conventional ones, taking the differences caused by the place where the operation was performed, into account.

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When the method of the present invention is employed to bind a net 10 to a support rope R the formation of the holding connections, without any binding knot formed thereat, and the pattern the stretched main ear portions S, in parallel with the support rope R (Figure 8) to form support loops, can be visually recognised at all time. Thus, the support rope R has a characteristic appearance. In connection with the advantageous effects of the present invention, it should be noted that any technical concept (as shown in Figure 9) that adjacent loop-shaped depending loops may be connected to one another in an alternate manner without any consideration taken of the possibility of falling-down will belong to one of lower concepts which will be not acceptable from the viewpoint of industrial utilization within the scope of the patent law.



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CLAIMS

1. A method of connecting a net to a support rope, the support rope comprising a series of main loop portions depending from the support rope, the length of a main loop portion being greater than or approximately equal to the distance between that main loop portion and an adjacent main loop portion in a given direction along the support rope, which method comprises inserting a first main loop portion through one or more meshes of the net, inserting the adjacent main loop portion, in the given direction, through the first main loop portion so that the one or more meshes of the net are positioned between the support rope and the first main loop portion, repeating the process for each main loop portion to be used along the support rope and engaging the final main loop portion to be used to the support rope.
2. A method according to Claim 1, wherein the main loop portions are all of approximately equal length.
3. A method according to Claim 1 or 2, which further comprises the step of inserting each first main loop portion, after insertion through one or more meshes of the net, through the support rope, to form a smaller loop portion extending from the support rope, the length of the smaller loop portion being approximately equal to the distance of the smaller loop portion from the adjacent main loop portion in the given direction, and inserting the adjacent main loop portion through the smaller loop portion so formed.
4. A method according to any one of the preceding claims, wherein the final loop portion is secured to the support rope by extending the final main loop portion through the support rope.



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5. A method according to any one of the preceding claims, wherein the main loop portions are formed from a strand of the support rope.
 6. A method according to any one of the preceding claims, wherein the net is a fishing net.
 7. A method of disconnecting a net from a support rope, the net being connected to the support rope by the method of any one of Claims 1 to 6, said method of disconnection comprising the method of connection of the net to the support rope, executed in reverse.
 8. A net and support rope connected together by a method in accordance with any one of Claims 1 to 6.
 9. A net comprising a mesh portion and a support rope, the support rope comprising depending main loop portions, each loop portion being inserted through the mesh and being prevented from depending from the rope by the adjacent main loop portion in the direction of insertion being inserted through the end of the main loop portion, to attach the mesh portion to the support rope, the final main loop portion being attached to the support rope.
 10. A method of connecting a net to a support rope, substantially as described hereinbefore with reference to Figures 1 to 8 of the accompanying drawings.
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