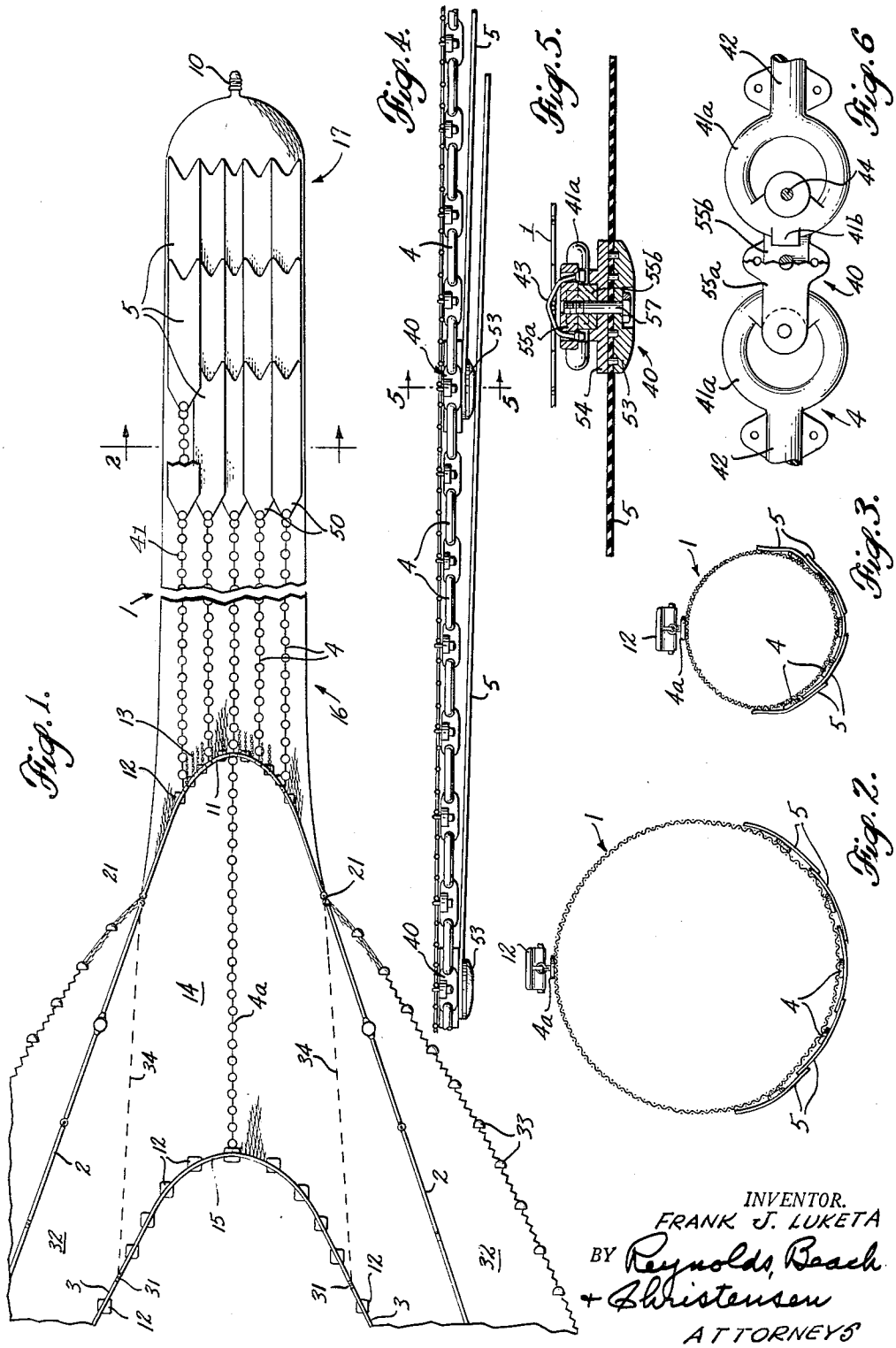
March 6, 1962 F. J. LUKETA 3,023,529

PROTECTIVE GEAR FOR TRAWL NETS

Filed Oct. 5, 1959 3 Sheets-Sheet 1



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PROTECTIVE GEAR FOR TRAWL NETS

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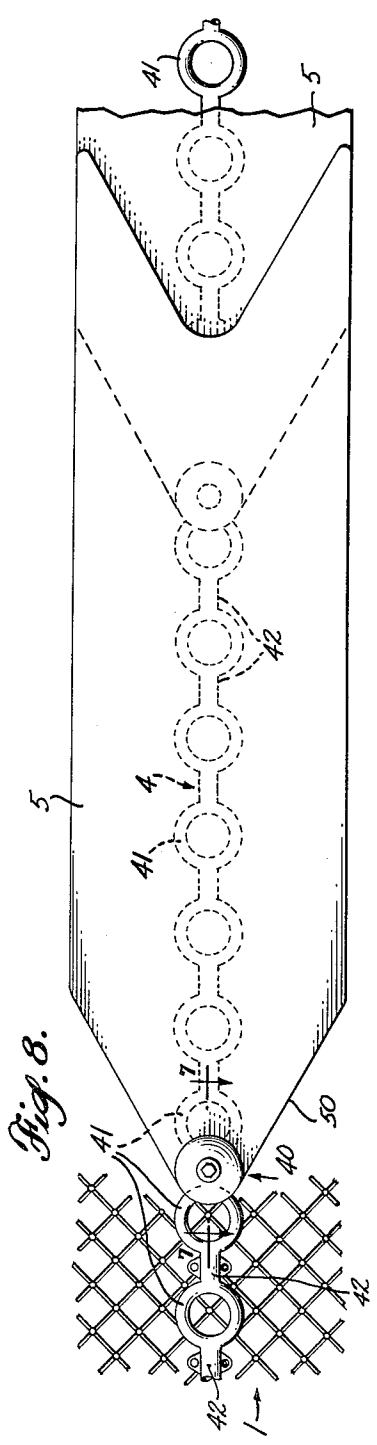


Fig. 8.

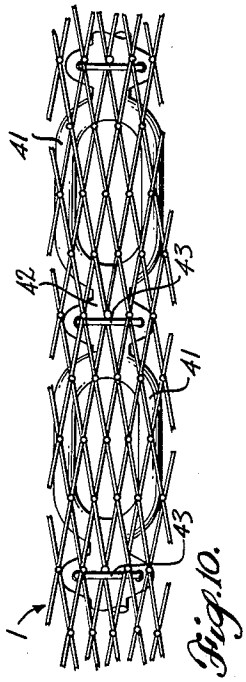


Fig. 10.

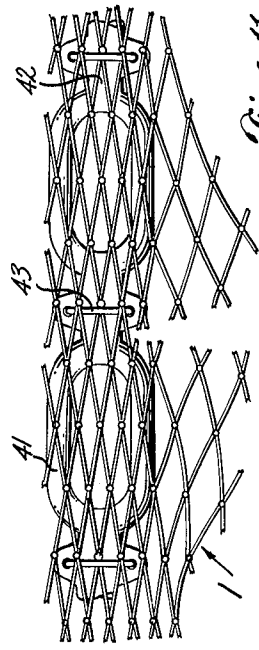


Fig. 11.

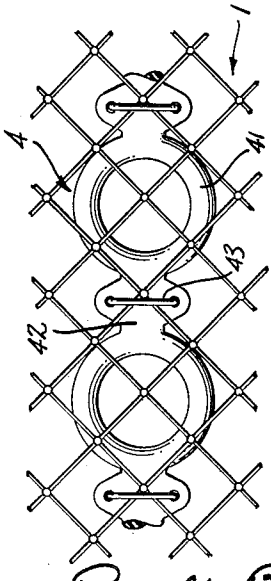


Fig. 9

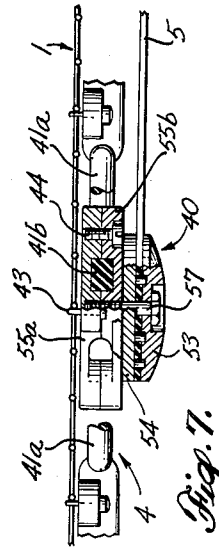


Fig. 7.

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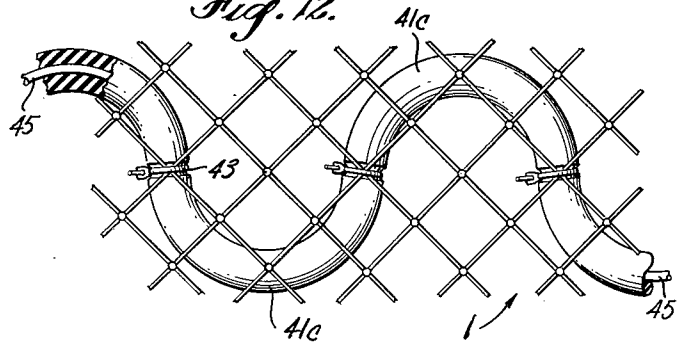
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PROTECTIVE GEAR FOR TRAWL NETS

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Fig. 12.



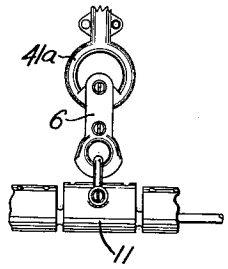


Fig. 16.

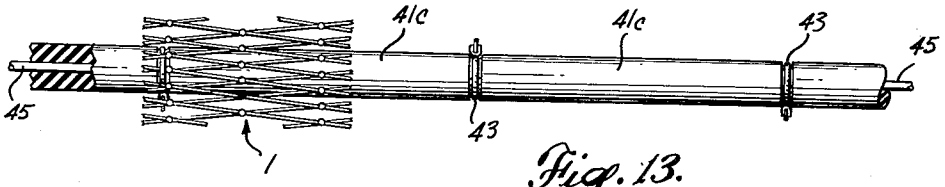


Fig. 13.

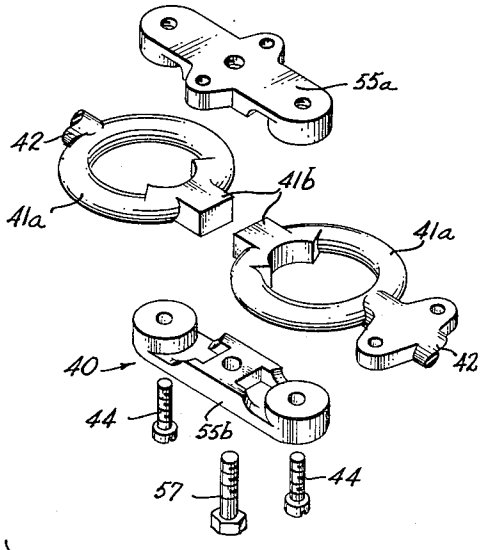


Fig. 14.

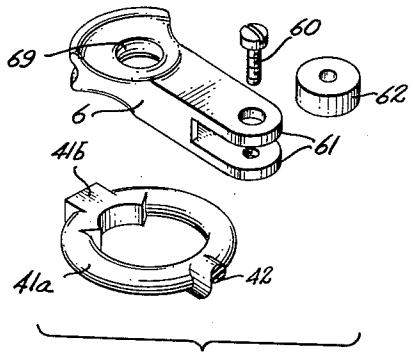


Fig. 15.

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3,023,529

PROTECTIVE GEAR FOR TRAWL NETS

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Filed Oct. 5, 1959, Ser. No. 844,556
16 Claims. (Cl. 43—9)

The entire lower body, including the cod end, of a trawl net drags along the bottom and is subject to much wear and to snagging, and it is customary to protect it by chafing gear. Such chafing gear as almost universally used heretofore consists of one or two large sheets of material such as rubber or rubber composition, each of a width and conjointly of a length to cover the area which is likely to drag the bottom. Such sheets are large, heavy and expensive. Each must be secured strongly at numerous points to the net. It is customary for this purpose to space grommets across the forward edge of the chafing gear sheets, and to secure these grommets to the netting of the body and to individual rib lines which extend lengthwise of and are lashed to the net, primarily for the purpose of limiting tearing of the body. The body, being made of mesh and being subject to the pull of the vessel and the resisting drag of fish, or sometimes of mud and rocks which enter it and weight it down, will when substantially empty elongate and close down in circumference, by reason of elongation and lateral squeezing together of the mesh squares, whereas when it is filled with fish it becomes distended substantially to its full circumference, and the mesh squares become nearly square. The points where the grommets attach to the net are, by its circumferential contraction, caused to approach one another. Since the chafing gear must not prevent distention of the body to its full circumference, the points of attachment of the grommets are located so as to permit this. When the body is contracted the points of attachment approach one another, and the chafing gear sheet intermediate the grommets, since it can not contract, bellies outwardly, that is, it loops downwardly. These loops or bellies dragging the bottom are very likely to engage snags. When they do so something must give, be it the chafing gear itself or the net body. When this happens, the chafing gear no longer protects the net, or the net itself is torn by the strain, and the fish then or subsequently trapped in the cod end are permitted to escape through the tear.

Not only is the loss of fish serious but the job of repairing damaged chafing gear or a damaged net body is highly expensive. There is not only the cost of substitute or repair materials and of labor to be considered, but more than that the loss of valuable fishing time. In addition to their bulk and expense, the removal and substitution of a different chafing gear sheet is a matter that takes a very considerable time. If the net body itself is damaged, many hours of time are needed for its repair. The energy and time of the crew, which should be spent in fishing, is being spent instead on repairs.

The chafing gear of this invention is designed to eliminate to a large extent the causes of damage to chafing gear and net bodies, and especially any tendency of the chafing gear to belly, thereby rendering unlikely any need for repair or for loss of fishing time, while at the same time providing chafing gear of such nature and so connected to the net body that damage is minimized, and repair in the few instances where it is necessary can be readily and quickly effected, at minimum expense and loss of time. In addition, the chafing gear of this invention interposes no obstacle whatsoever to the contraction of the net body substantially to its maximum extent, that is, to its minimum circumference, while at the same time imposing no obstacle to complete distention of the same, whereby the net body is completely flexible, substantially within the limits imposed by the netting and by the stresses applied to

the net body for contraction and for distention, and is always protected by the chafing gear.

Also, the chafing gear of this invention is streamlined, so that it produces a minimum of drag.

Because of the frequency of damage heretofore to the net body, despite the protection the usual chafing gear affords, net bodies are normally further protected by riblines that extend longitudinally, at laterally spaced intervals, and are tied at frequent intervals to the netting. These riblines are intended to halt any tear before it has proceeded far, but they also introduce complications because of the flexibility and changing shape of the netting squares resulting from elongation and distention of the net body, and the unchanging length of the riblines tied thereto. The netting squares of a net body when the net body is contracted circumferentially are greatly elongated diamonds, due to the pull in the lengthwise direction, but when the net body is distended materially the same netting squares are substantially open, and square in shape. If the riblines are tied to the squares when the latter are elongated, the riblines resist squaring of the mesh; if the riblines are tied to the squares when the latter are squared, the riblines resist elongation of the mesh. If the riblines are tied to the netting while elongated, as is usually done, distention and consequent shortening of the net body will produce loops in the riblines, and these loops sometimes snag the bottom, whereas if not so looped they would not.

The present invention provides riblines whereto individual components of the chafing gear can be secured, to concentrate tension initially in the riblines more than in the netting (although the netting ultimately assumes substantially all tension), and the riblines are themselves capable of free elongation, and of subsequent elastic contraction, whereby these riblines give easily in length as the net body extends, and contract in length as the net body distends. At the same time, the riblines are elastic only to such limit as will produce strong ultimate resistance to tearing.

Points on the riblines are used, according to this invention, as the points of attachment of the chafing gear strips to the net body. It is an object of this invention to provide attaching means which are not only secure, but are easily engaged and disengaged whenever replacement of a chafing gear strip is necessary, and which will in minimum degree limit the intended flexibility of the ribline, and of the net body.

Other objects will appear more fully hereinafter.

The chafing gear is shown in the accompanying drawings applied to a net of a novel type shown in a companion application, Serial No. 834,030, filed August 17, 1959, but its use is not limited to nets of this type, for it can be applied to various types of trawl nets. No restriction is intended by the reference to a specific type of net.

In the accompanying drawings the invention is shown embodied in a form which is presently preferred by me, but again it will be understood that changes may be made in the form, character, and arrangement of the parts without departing from the spirit of the invention.

FIGURE 1 is a general bottom plan, or clam's-eye view of a net body incorporating the chafing gear of this invention, though with part of the chafing gear broken away. The net body is shown distended at least part way.

FIGURE 2 is a transverse section through the fully distended net, taken on line 2—2 of FIGURE 1, showing the relationship of the several strips of the chafing gear, and FIGURE 3 is a similar view but with the same net contracted circumferentially. Certain parts, such as caps used to secure chafing gear to riblines, are omitted.

FIGURE 4 is a longitudinal sectional view through the chafing gear, a ribline lashed to the net body, and the means for securing the chafing gear to such ribline, and

FIGURE 5 is a transverse sectional view through the same at the line 5—5 of FIGURE 4, at the location of a securing means on the ribline.

FIGURE 6 is a plan view of that part of one form of ribline to which a chafing strip is secured.

FIGURE 7 is in part a longitudinal sectional view and in part a side elevation of the securing element shown in FIGURE 6.

FIGURE 8 is a bottom plan view, enlarged, of a chafing strip and part of another, the meshes of the net body, and a ribline, showing the net meshes in their relaxed or distended relationship.

FIGURE 9 is a plan view, as from within the net body looking downwardly, illustrating the net body meshes and a part of the ribline tied thereto in relaxed relationship, as in FIGURE 8 but to a larger scale.

FIGURE 10 is a view similar to FIGURE 9, but showing the meshes elongated and the ribline correspondingly deformed, but not appreciably stressed.

FIGURE 11 is a view similar to FIGURES 9 and 10, but showing the manner in which such a ribline localizes and minimizes tears in the net, when the ribline is substantially fully stressed.

FIGURES 12 and 13 are views similar to FIGURES 9 and 11, illustrating a modified form of ribline.

FIGURE 14 is an exploded isometric view of the joint between successive sections of a ribline, where a chafing gear strip is secured.

FIGURE 15 is also an exploded isometric view of the forward end connection of a ribline, where it joints the ground line at the lower bosom of the net.

FIGURE 16 is an elevation showing a detail of the connection of a ribline to the bosom line.

The net body **1** includes the intermediate section **16** and the cod end **17**, closed during use at its after end **10**. The net body is open at its forward end for entrance of fish, which are then entrapped within the cod end. The lower bosom of the net body is in this particular net defined by a ground line **11** buoyed up by floats **12** and held down by bottom-sweeping chains **13**. Sweep lines **2** are secured at **21** to the ends of the short ground line **11**, and extend forwardly to doors (not shown) that are towed from a vessel. The net body **1** also has a forwardly projecting overhang **14**, the upper bosom of which is defined by a float line **15**, also buoyed up by floats **12**. Curtain lines **3** are connected at **31** to the ends of the float line **15** and extend forwardly to the doors mentioned above. Curtains **32** are suspended from the curtain lines **3**, which themselves are buoyed up by floats **12**, and the lower edges of these curtains are held down by weights **33** that drag the bottom. The curtains **32** are laced along seams **34** to the side edges of the overhang **14**. As has been indicated, this specific type of net, shown in detail in my copending application Serial No. 834,030, filed August 17, 1959, while particularly desirable and particularly adapted to the use of the chafing gear which is about to be described, is only one of various forms of trawl nets to which the chafing gear of this invention may be applied.

The net body **1** (by which is meant the intermediate **16** and cod end **17**) is made of heavy twine, with its meshes always oriented in a way to elongate under stress in the fore and aft direction, and consequently to draw the knots laterally close together, wherefore the net body contracts circumferentially. When the net body is filled, however, the outward pressure of the contained fish will expand the same circumferentially to a diameter several times its contracted diameter, with its circumference correspondingly increased and its length decreased. FIGURES 3 and 10 are intended to suggest the contracted condition and FIGURES 2, 8, and 9 the distended condition.

As a means to support and to drag the chafing gear, and for halting tears in the mesh, and also to provide anchorages for the narrow chafing strips employed, riblines **4** extend longitudinally of the bottom-engaging portion of the net body **1**, these being spaced apart transversely by a spacing the significance of which will appear shortly. Two alternative forms of ribline are shown, and will be described. These riblines preferably are secured at their forward ends to the ground line **11**, as shown in FIGURE 1, whereby the mesh is relieved of the direct stress applied to the chafing strips, and by an anchoring device shown in detail in FIGURE 15. The means to join individual ribline sections together, and to secure a chafing gear strip to such a ribline, is best shown in FIGURES 5, 6, 7, and 14. Each ribline is tied or laced at frequent intervals throughout their length to the netting of the net body, as FIGURES 5 and 7 through 13 show. This insures conformity of contractional and expansional movement of the riblines and the chafing strips anchored thereto, and the mesh squares. Their construction in certain respects constitutes part of a companion application, Serial No. 845,799, filed October 12, 1959 on Trawl Lines, but in the particulars wherein they reinforce the net body, and support the chafing strips, they constitute part of this invention. By their lashing at frequent intervals to the net body they thus become in effect a part of the net body, and they will separate laterally as the net body distends and approach as the net body contracts. However, each ribline must itself elongate with elongation of the meshes, and shorten as the meshes shorten. The ribline of the types shown herein is believed to be novel per se and in its relationship to the net body, as will appear more fully hereinafter. The chafing strip securing means which is part of each ribline is indicated in general by the numeral **40**, there being a plurality of these securing means on each ribline, spaced at longitudinal intervals. They will be described more specifically hereinafter.

The chafing gear of this invention is not a single sheet, nor is it, preferably, even a plurality of longitudinally spaced sheets each of sufficient width to span the bottom-engaging portion of the net body. Rather, the chafing gear in its preferred form, shown herein, comprises a plurality of individual chafing strips **5** distributed along certain of or each of the several riblines, each strip being of such length and width that several of them, as they overlap at their side edges, are required to span the bottom-engaging portion of the net body when the body is fully distended. While a strip might be of a length to extend the full length of the net body, it is preferable that each strip be of relatively short length. At all times the after end of each such short strip overlaps the forward end of the next strip aft on the same ribline to an extent that despite elongation they will always overlap at their ends. This is best shown in FIGURES 1 and 8. Each such strip may be sheet of rubber, neoprene, or similar tough abrasion-resistant material. Each is secured by its forward end only to one of the securing means **40**, and preferably each chafing strip **5** is faired at its forward end, as shown at **50**, to lessen drag. The longitudinal edges of each strip are underlapped or overlapped in relation to adjoining strips. Collectively at all times the chafing strips **5** cover the bottom-engaging area of the net body. The riblines must be sufficiently closely spaced laterally that the strips cannot spread so far apart under normal circumferential distention that they ever fail to lap at their side edges.

The form of ribline best suited for use with the chafing gear described is itself extensible up to a given limit, and elastically contractible, in the longitudinal direction. Therefore, while certain of the advantages of the chafing gear may be attained when riblines of more or less conventional type are used, I prefer to use riblines of the special and novel type I shall now describe, in order to realize to the full the advantages of the chafing gear.

In the form shown in FIGURES 1 through 11 each such ribline **4** is made primarily of elastic material, such as rubber or neoprene, but since a continous straight line of such material of uniform cross-section would resist stretching at a constantly increasing rate, and so would unduly restrict the intended initial elongation of the

meshes to which it is tied at frequent intervals, I prefer to incorporate flat loops or rings **41**, of rubber or the like, with short integral connecting necks **42**, also of rubber. The ties to the meshes are located at these necks **42**, or at elements hereinafter described which replace certain necks, and are shown spaced at intervals of two points or meshes; see FIGURE 9. Any convenient tie may be employed; the one shown best in FIGURE 5 comprises a rubber rattail **43** headed at one end and projecting through a hole at one side of the neck **42** or equivalent element, thence around the mesh just ahead of a knot, and then through a hole at the opposite side of the neck, where release of tension in it automatically forms a second head.

It would be inconvenient and uneconomical to make a ribline of the total length required, and that length will vary in different installations, hence each ribline is made in sections, which are secured end to end to make up the required length. Also, securing means for the chafing strips **5** are needed at intervals, so it is convenient to end each section at such a securing means, and to provide means there to connect together the ends of adjoining sections. Such a securing means is shown in FIGURES 5, 6, 7, and 14. The end loop **41***a* of each of two end-adjoining sections of ribline is molded with lugs **41***b* which interrupt its circular form. Two half-clamps **55***a* and **55***b* are socketed to receive the lugs **41***b* and to enclose a portion of each loop **41***a*. They are held clamped by clamping screws **44**. The half-clamp **55***a* is arranged like a neck **42**, to receive a rattail tie **43**. The half-clamp **55***b* is straddled by a block **54** that cooperates with a cap **53** to clamp between them the forward tip of a chafing strip **5**. Cap **53**, block **54**, and the half-clamp **55***b* are all connected by a screw **57**, which threads into one or both of the half-clamps. By such a construction any chafing strip is readily removable and replaceable, and any section of a ribline is similarly removable and replaceable.

An alternative form of ribline is shown in FIGURES 12 and 13. Here instead of full loops the ribline incorporates half-loops **41***c*, in sinusoidal form. The ribline may include a flexible reinforcing cable **45**, which will not greatly interfere with straightening of the ribline as in FIGURE 13, yet will strongly resist further elongation, or tearing past the ribline.

The forward end of the ribline of the type first described may be secured to the ground line **11** by means of the connector shown in FIGURE 15. The terminal loop **41***a* is of the same shape as all other such terminal loops; compare FIGURE 14. It is received between jaws **61** of a clevis **6** that has an aperture **69** for engagement with an element carried by the ground line (not herein shown). A filler bushing **62** fits within loop **41***a* and between jaws **61**, and the whole is secured by a screw **60** that passes through the jaws and threads into one thereof, and that passes through the bushing **62** and the loop **41***a*.

The relationship between the meshes and the ribline which FIGURES 8 and 9 show is that which they assume during tying of the ribline to the net, and when the net body is fully distended or relaxed. The meshes are square in shape, the ribline is tied at every other knot in its length, and the rings **41** are fully relaxed. When the net body is elongated and circumferentially contracted, the meshes are elongated, as in FIGURE 10, to appear as elongated diamonds. The ribline being tied at regular intervals to the net, it too must elongate substantially as freely as the meshes, or else it will unduly restrict the flexibility of the net, and impose undesirable stresses on the same. The rings or flat loops **41** in themselves have such slight resistance to deformation in shape in the longitudinal direction, as distinguished from resilient deformation, that they yield freely and elongate with elongation of the meshes, and do not restrict the latter. When the elongating force is removed, they resiliently

resume their original shape. However, their limit of deformation in shape has been substantially reached in FIGURE 10, and any further tendency to elongate causes the loops **41** to resist strongly, though somewhat elastically. Thus if the net body were to snag on the bottom (which is unlikely, because it is protected by the chafing gear) and a tear start, the resistance of a stretched ribline, as in FIGURE 11, will halt the extension of the tear and minimize the damage. Much the same effect is produced by the sinuous form of ribline, shown in FIGURE 12 in relaxed condition, and in FIGURE 13 fully stretched out. In this form of ribline the rattails **43** encircle the ribline at circumferential grooves provided at correct intervals and locations, and their ends are suitably joined to tie the meshes to the ribline. Securing elements for the chafing gear strips are not shown in conjunction with this form of the ribline, but they may be similar to those already described.

As has been stated, when the net body is fully distended as in FIGURE 2, the chafing strips **5** are still of a width that their edges overlap. Although the strips are secured only at their forward ends, the drag of the bottom and the water reaction holds them rather closely against the net body as the net is drawn forwardly through the water. It is when the net is first set that the meshes tend to contract to a circumference something like that shown in FIGURE 3, in comparison to FIGURE 2. This causes close lateral approach of the riblines **4**, and consequently the securing elements **40** are brought closely together in the lateral direction. Nevertheless, the overlapping relationship of the edges of the strips **5** permits this contraction to occur and the strips will fit together and move relatively sidewise without interference. The water, in effect, serves as a lubricant to facilitate such sliding. They still protect the net body, and when the net becomes filled, they tend to move apart but still overlap and protect the entire bottom-engaging area of the net body. The tail end of a strip ahead protects the securing means and streamlined forward end of the next strip aft.

There is never any downwardly looping forward edge of a chafing gear sheet, as in former chafing gears, to snag on bottom obstructions. As a result the likelihood of damage to the chafing gear and to the net body is much reduced. If damage should occur, it is not necessary to remove the entire chafing gear and replace it, but only such strip or strips as may be damaged, or any damaged ribline section. Furthermore, since the stress which may be caused by the snagging of any given chafing strip is applied to a ribline which is laced throughout its length to the net body, this does not concentrate stress at any one point on the net. The ribline being strong is unlikely to be broken and, until it is broken, extensive damage to the net can hardly occur.

As shown herein at **4***a*, in FIGURES 1, 2 and 3, the particular net illustrated has a ribline extending along its uppermost part, for a purpose such as the securement of floats. The floats may attach to a modified form of the securing means **40**.

I claim as my invention:

1. In combination wih the net body of a trawl net, a plurailty of chafing strips, each of a given width, extending in use longitudinally beneath the net body, the given width of each strip being less than the width of the bottom-engaging portion of the netting of the net body, and each strip being disposed in edge-overlapping relation with adjoining strips to collectively cover the entire width of the bottom-engaging portion, and a plurality of means carried by the net body and securing the forward end only of the respective strips, whereby the latter trail aft each from its securing means, the securing means for the individual strips being spaced apart transversely, with the net body fully distended, by a distance less than the given width of the strips.

2. The combination of claim 1, including at least one

additional series of strips disposed in similar edge-overlapping relation, and a like number of securing means carried by the net body, spaced longitudinally from the first-mentioned securing means, and securing the forward ends only of the strips of the additional series, the strips being of a length, relative to the longitudinal spacing between securing means, to overlap each forward end of a strip, other than the leading strips, with the after end of the strip next ahead of it, regardless of elongation or distention of the net body.

3. In combination with the net body of a trawl net, a plurality of riblines spaced transversely and extending longitudinally of and each secured throughout its length to the bottom netting mesh of the net body, securing means carried by each ribline, and a like number of chafing strips each of a width exceeding the full-net spacing between riblines, but insufficient to cover more than a portion of the breadth of the net body, each secured at its forward end only to the corresponding one of the riblines and trailing thence aft, in edge-overlapping relation to the adjoining strips, and collectively of a width to cover the bottom-engaging portion of the net body.

4. The combination of claim 3, including additional securing means carried by the riblines and spaced longitudinally from the securing means first mentioned, and additional chafing strips similarly secured at their forward ends to the additional securing means, in like edge-overlapping relation, all said strips being of a length that their after ends overlap strips aft of them.

5. The combination of claim 3, wherein the riblines are elastically extensible and contractible substantially as freely as the netting whereto they are secured.

6. The combination of claim 3 wherein each ribline incorporates elastically stretchable and resiliently contractible loops spaced along its length.

7. The combination of claim 3, wherein each ribline is of sinous shape and of elastically deformable material, whereby it will stretch with elongation of the netting meshes and contract with their relaxation.

8. In combination with the net body of a trawl net, having a transverse ground line across its lower bosom, a plurality of riblines secured at their forward ends to said ground line and extending aft in transversely spaced disposition beneath, and secured at intervals to, the bottom-engaging portion of the net body, a plurality of securing means disposed at intervals in the length of each ribline, and a like number of narrow, elongated chafing strips each secured at its forward end to a different one of said securing means, only, and trailing thence aft beneath the net body to overlap the forward end of the strip next aft, each strip being of a width to overlap along its side edges the side edges of the laterally adjacent strips when the net body is fully distended, and thereby collectively to cover the entire bottom-engaging portion of the net body.

9. The combination of claim 8 the securing means including disengageable means for ready removal and replacement of individual strips.

10. In combination with the cod end of a trawl net, a plurality of riblines extending in spaced-apart relation lengthwise of the bottom-engaging portion of the cod end, and secured thereto throughout their length, a plurality of securing means incorporated at spaced intervals in the length of each ribline, and a plurality of chafing strips each having a complemental securing means, the various securing means on the riblines and chafing strips being interengaged to distribute the chafing strips over the bottom-engaging portion of the cod end, each strip being of such width and length to overlap, when so distributed, the side edges of the adjoining strips at each side when the cod end is fully distended, and the forward ends of the adjoining strip aft of each given strip.

11. In combination with a trawl net body of mesh, elongatable from and circumferentially distensible to a generally square relaxed disposition, a plurality of longitudinally directed riblines laterally spaced apart and each secured at frequent intervals to the mesh, each ribline being longitudinally extensible and elastically contractible generally in accordance with and coextensive with the limits of elongation and relaxation of the meshes to which it is secured.

12. The combination of claim 11, wherein the riblines include resiliently elongatable and elastically contractible loops intermediate successive points of securement to the mesh, for elongation and relaxation by stresses applied to the mesh.

13. The combination of claim 11, wherein the riblines are of sinuous form, and of material resiliently elongatable and elastically contractible, the riblines being secured to the mesh at the points of reversal of their curvature, for elongation and relaxation by stresses applied to the mesh.

14. The combination of claim 13, including a flexible but substantially inelastic line incorporated in the ribline.

15. In combination with a net body of mesh and a sectional ribline secured thereto at intervals in its length, and formed with loops spaced along its length, a connector for the adjoining ends of the ribline sections, comprising complemental clamp elements encircling each terminal loop, and means to retain the same in clamping engagement ttherewith, a chafing strip, a saddle straddling one of the clamp elements and engaging one face of the chafing strip, a cap engaging the opposite face thereof and cooperating with said saddle to clamp the chafing strip therebetween, and a clamping screw threaded into a clamp element to retain said cap and saddle in clamping engagement.

16. In combination with a trawl body of mesh, elongatable from and circumferentially distensible to a generally square relaxed disposition of its meshes, a plurality of longitudinally directed and extensible and contractible riblines laterally spaced apart and each secured to the mesh at intervals permitting elongation and relaxation of the mesh squares, and a flexible but inelastic cable incorporated in the ribline, and of a length to prevent elongation of the ribline and hence of the mesh beyond the limit of elongation of such mesh, in the event the mesh is torn.

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