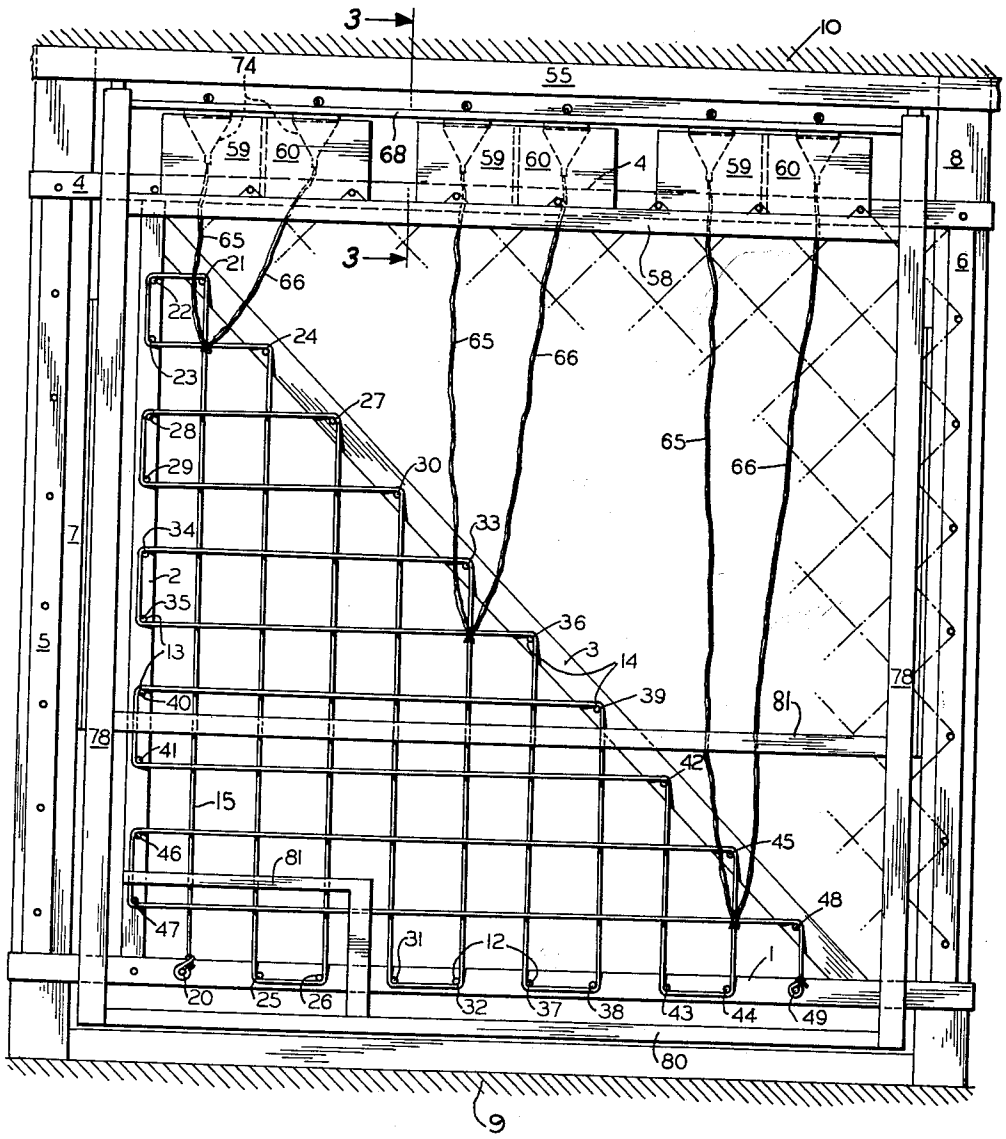
June 4, 1963 E. L. PEDLEY ETAL 3,091,834

APPARATUS FOR USE IN MAKING ROPE NETS

Original Filed Nov. 2, 1959

4 Sheets-Sheet 1

FIG_1



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FIG_2

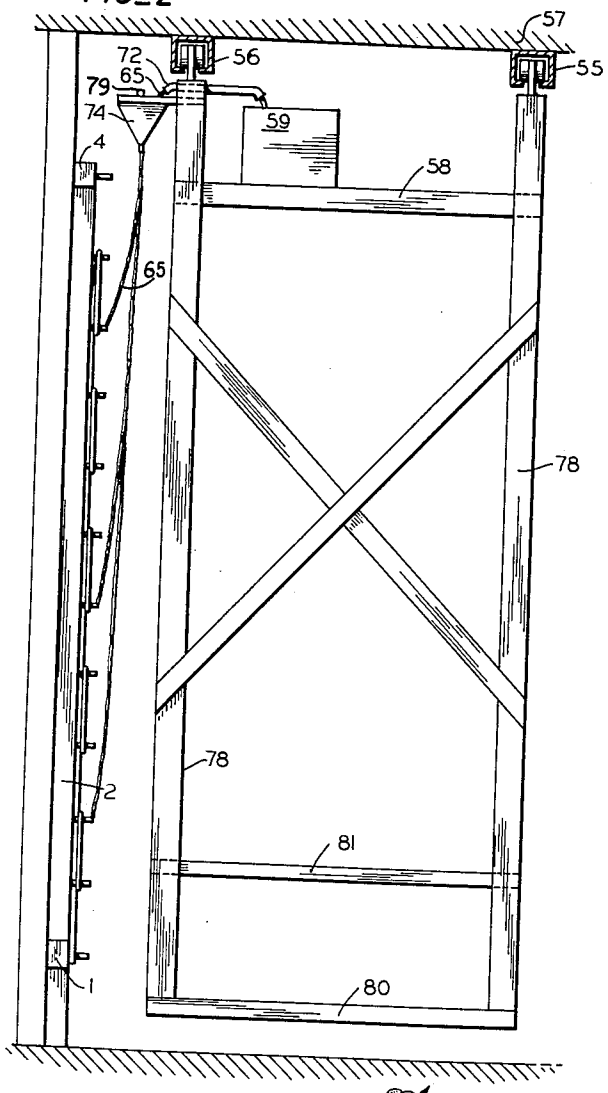


FIG_4

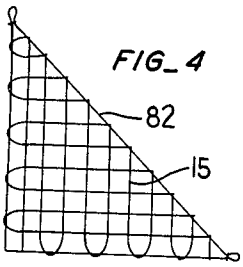


FIG_5

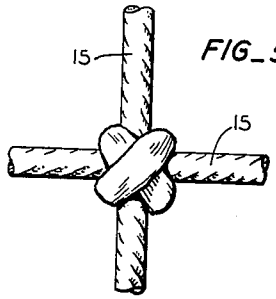


FIG_6

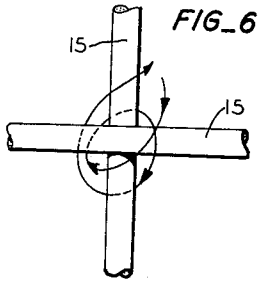
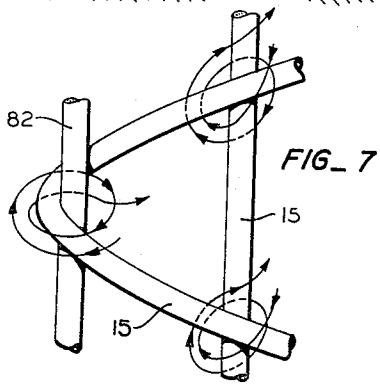


FIG_7



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FIG_3

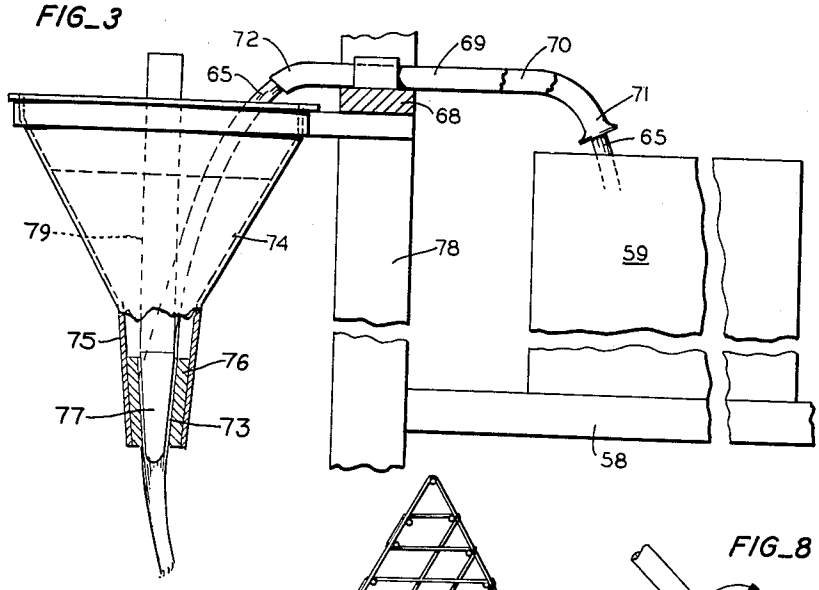


FIG_8

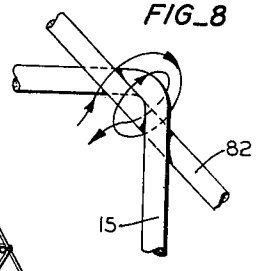


FIG_9

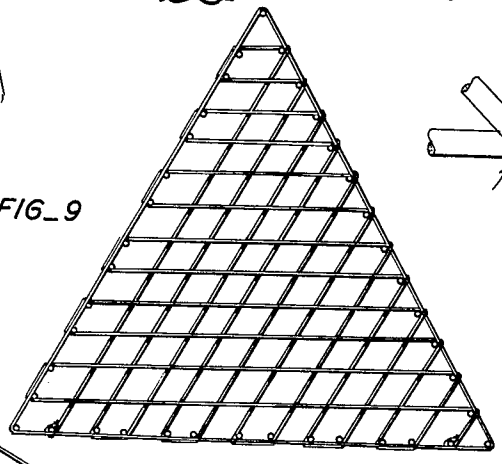
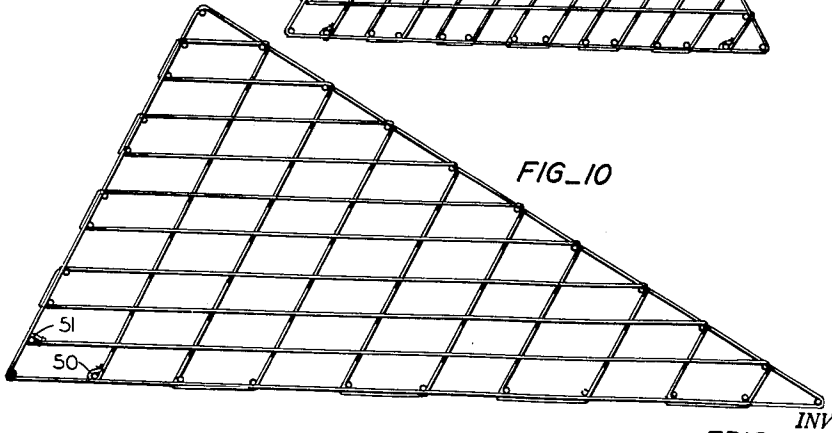


FIG_10



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FIG_11

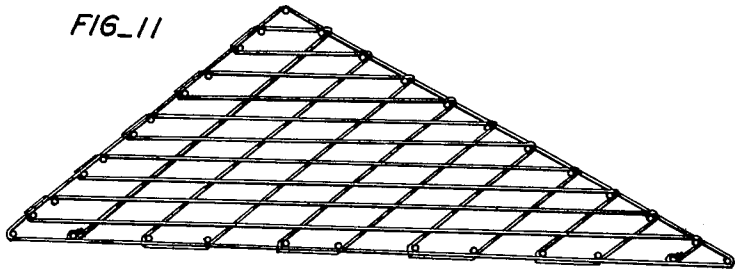


FIG_12

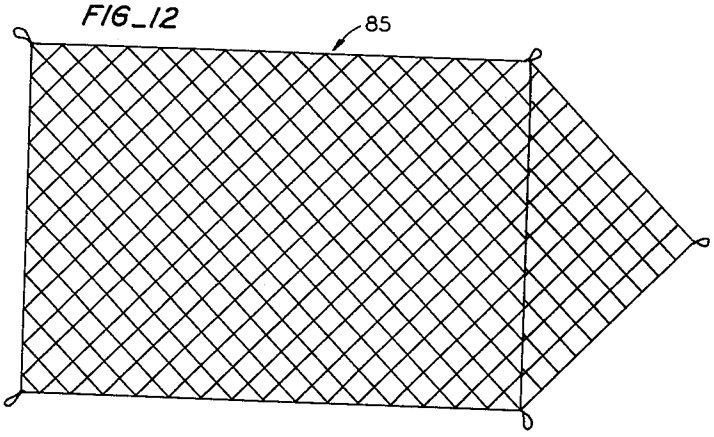
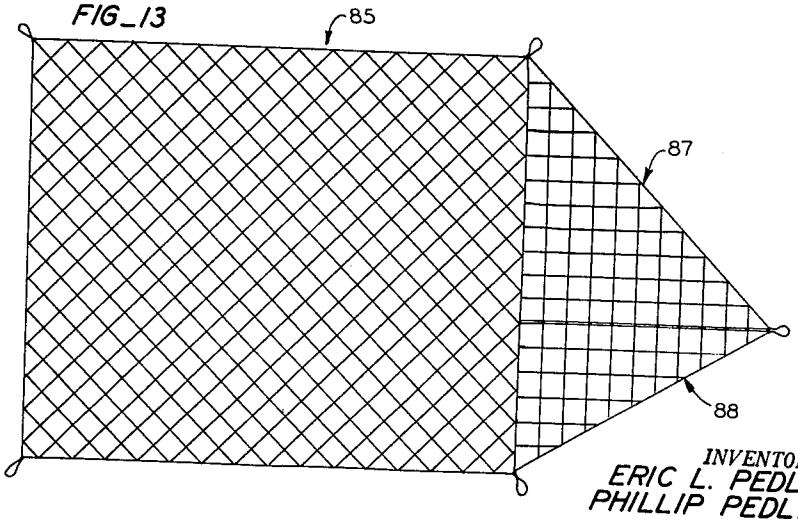


FIG_13



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United States Patent Office 3,091,834 Patented June 4, 1963

3,091,834

APPARATUS FOR USE IN MAKING ROPE NETS

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Original application Nov. 2, 1959, Ser. No. 850,246. Divided and this application Sept. 20, 1961, Ser. No. 142,471

7 Claims. (Cl. 28—1)

This invention relates to rope nets and has for one of its objects the provision of improved means for making rope nets more efficiently than heretofore, and this application is a division of application Serial No. 850,246 filed November 2, 1959.

Another object of the invention is the provision of an apparatus for making rope nets having greater uniformity than heretofore insofar as the characteristics of the connections between ropes of the net at their crossing or engaging points.

A still further object of the invention is the provision of an improved apparatus for making rope nets of different outlines.

Heretofore, as disclosed in our United States Letters Patent No. 2,817,263, issued December 24, 1957, the desirability of lashing together lengths of rope that were in crossing engaging relation with fiberglass strands impregnated or coated with a hardening plastic was disclosed.

In the prior method a disadvantage was the limited pot life of the plastic, which must necessarily be in liquid form when applied in order to impregnate, or to bond together the filaments of the lashing strands. The cold plastics, such as a polyester or an epoxy, require hardening agents or catalysts to effect the reaction that will develop the heat essential for the hardening or curing step.

In the method disclosed in said patent, the plastic and hardening agent or agents are mixed together in a body through which the lashing strand is drawn, and the reaction commences in said body, hence delays in the lashing of the rope frequently result in the body hardening before it is used, and in any event, the body of plastic changes its characteristics during the period in which it is used, and therefore is not uniform.

By the present method, the strand used for lashing the rope is made up of two smaller strands of filaments, each preferably having half of the total number of filaments for each lashing strand. These separate strands are drawn through two separate bodies of inactivated liquid plastics each containing the catalysts essential for effecting the reaction necessary for hardening or setting the plastics, when said plastics and catalysts are brought together. Or one plastic may be an epoxy, for example, and the other the hardening agent. Until the saturated strands are brought together no reaction will occur, but when brought together, the necessary reaction for setting or hardening the plastic occurs. Thus the separate plastics will remain fluid indefinitely, until brought together.

By bringing the separate saturated or coated strands together during or immediately prior to the lashing step, the possibility of the plastic setting up in the containers is eliminated, and furthermore the reaction of the plastic at each lashed portion is uniform.

One of the objects of the present invention is the provision of apparatus for insuring thorough coating of the filaments of glass in the lashing strands with plastic, and in metering the plastic so applied to the filaments to the desired amount.

A still further object of the invention is the provision of means for metering the plastic as it is applied to the glass filaments of the strands thereof, and yet enable release of strands that may have become connected or

tangled so as not to materially impede the operation of lashing the ropes of the net together. An additional object of the invention is the provision of apparatus for laying a net and for applying plastic to glass filaments in strands thereof immediately prior to lashing together the lengths of rope forming said net at their crossing points.

Other objects and advantages will be obvious from the description and drawings.

In the drawings, FIG. 1 is a side elevational view of a triangular net and the apparatus employed in making the net.

FIG. 2 is an end view of the apparatus of FIG. 1.

FIG. 3 is an enlarged fragmentary sectional view taken through the upper portion of the apparatus of FIG. 1 along line 3—3 thereof.

FIG. 4 is a reduced plan view of a triangular net including the edge ropes.

FIG. 5 is an enlarged fragmentary view of a pair of the ropes of the net at their crossing point after the lengths are lashed together and coated with plastic.

FIG. 6 diagrammatically illustrates the movement of the glass strands in lashing the ropes together.

FIG. 7 diagrammatically illustrates the movement of the glass strands of the net of FIG. 4 in lashing the edge rope to the mesh forming rope.

FIG. 8 diagrammatically illustrates the movement of the glass strands lashing the edge rope to the mesh rope of the net along the hypotenuse line of the triangular outline of the net.

FIG. 9 is a diagrammatic view of a triangular net having the outline of an equilateral triangle which is adapted to be made on a frame having projections along lines defining an equilateral triangle.

FIGS. 10, 11 are diagrammatic views of triangular nets having the outlines of scalene triangles in which none of the angles are right angles, the outline of the net of FIG. 10 having all acute angles while that of FIG. 11 has one obtuse angle.

FIGS. 12 and 13 are diagrammatic views of nets of different irregular outlines, and which nets are combinations of rectangular and triangular nets adapted to be made on the frames and by the apparatus of FIG. 1.

Referring to FIGS. 1, 2, a net frame on which the triangular nets are adapted to be formed may have a lower horizontally extending frame member **1**, a vertical frame member **2** extending upwardly from one end of member **1** and an inclined frame member **3** that connects the ends of members **1, 2** that are remote from their adjoining ends. These members **1, 2, 3** are disposed in a vertical plane and form a right angle triangle for use in forming a triangular net having an outline similar to that formed by the frame members.

In the event a rectangular net is to be formed, such as is shown in the aforesaid patent, the lower frame member **1** and an upper frame member **4** parallel therewith may be employed, together with spaced parallel vertical end members **5, 6** extending between said members **1, 4** thereby forming a rectangular net frame. It is obvious that the member **2** could extend between members **1, 4,** if desired, in place of the end frame member **5**. Any suitable wall or posts **7, 8** may extend between floor **9** and a ceiling beam **10** to support the net frames.

In the triangular net frame that is illustrated in FIGS. 1, 2, and as has already been described, equally spaced lateral projections **12**, such as pegs, bolts, nails or the equivalent, extend laterally from one side of member **1** in a row that extends longitudinally of said member, and similar projections **13** having the same spacing as projections **12** project laterally from the side of member **2** and are in a row extending longitudinally of member **2**. The projections **12, 13** that are at the adjoining ends of

members 1, 2 are preferably spaced approximately the same distance from the intersection of lines coincidental with the rows of projections on said members.

Projections 14 are equally spaced along frame member 3 and project laterally therefrom at the points of intersection between lines extending horizontally from projections 13 and vertically from projections 12.

It is seen from the foregoing that lines coincidental with the three rows of projections that are on frame members 1, 2, 3 define the outline of a right angle triangle having two sides of equal length, and which sides are at right angles to each other, while the line extending through projections 14 constitutes the hypotenuse of the triangle.

It is to be understood that the present invention is not restricted to any particular shape of triangular net, since it is apparent from FIGS. 9–11 that the net may have different outlines, such as that of an equilateral, isoceles or scalene triangle.

In forming any of the triagle nets, a single rope is used for forming the body of the net having the mesh openings.

While the net of FIG. 1 is vertical, being formed on a vertical frame, the near lengths of rope between bends along the outer outline of the net will be considered as overlying the lengths crossed thereby.

In forming the net of FIG. 1 the starting point will be designated 20, which is the projection 12 on frame member 1 nearest to the lower end of vertical frame member 2. The points 21, 22, 23, 24 will constitute projections 14, 13 on the members 3, 2 to which the rope is successively extended and around which it is bent.

The rope, which may be designated 15 extends parallel with member 2 from point 20 on member 1 to point 21 on frame member 3, then parallel with member 1 to point 22 on member 2, then over and parallel with member 2 to point 23 on member 2, and then parallel with member 1 to point 24 on member 3. From point 24 rope 15 extends parallel with member 2 to point 25 on member 1 and then over and parallel with member 1 to point 26 on member 1.

From point 26 the cycle described from point 20 to 26 is repeated until the end of the rope terminates at point 49 at the end of member 1 that is opposite to point 20.

A characteristic of the net will be that the lengths of rope 15 that extend across the frame between members 1 and 3 are parallel with member 2, and the other half of the lengths that extend between members 2, 3 are parallel with member 1.

Another characteristic of the net is that all of the horizontal runs that are parallel with member 1 extend over the vertical runs that are parallel with the member 2.

It is obvious, of course, that the start of the net may be at point 49 instead of point 20, but in this case all of the vetrical runs of rope would extend over the horizontal runs. Or the net could start at point 47, which is the lowermost projection on member 2, or it could start at point 22 which is at the upper end of member 2, but in any instance the start is at one of the ends of one of the frame members and all of the parallel lengths that extend in one direction would be either over or under all of the parallel lengths that extend in the other direction. This characteristic is different from that of a single rope rectangular net.

Also, characteristic of a triangular net, of this invention, is the fact that one-half of the runs are parallel with one edge of the net while the other half are parallel with an adjacent edge. This differs from the rectangular net made from a single rope. Also, the number of projections on the net frame are the same for each edge of the net, in a triagular net, although those along each of the frame members may be spaced differently from those on an adjacent member.

Where an odd number of projections are on each of the frame members, the rope will end at a different point than where an even number of projections are used. For example, in FIG. 10, the rope starts at point 50 and ends at point 51. However, this is immaterial.

In laying the net and in completing it, the apparatus of FIGS. 1 and 2 may be used, and which apparatus comprises a carriage suspended from overhead tracks 55, 56 (FIGS. 1, 2) that may be secured to ceiling beams 10 or to any other suitable overhead support adjacent to the net frame. These tracks are parallel with members 1, 4 of the net frame and are preferably at a higher level than member 4 which is the upper frame member that may be employed in the making of a rectangular net.

This carriage has an upper horizontal platform or support 58 (FIG. 2) on which a plurality of spaced pairs of containers 59, 60 may be supported in a row (FIG. 1).

Each pair of containers is the same, and they may be separate or each pair may be a single receptacle having a partition therein to provide a pair of compartments.

The two containers of each pair will contain a strand of untwisted glass filaments or roving, and a pair of such strands will ultimately form the single strand employed for lashing together the rope lengths of a net at their crossing points, as well as lashing edge ropes to the net, and in lashing two or more nets together. Thus each container of each pair may carry a strand that is one-half of a final strand, and the half strands, or the strand in each container may be in a coil or on a roll, or supported or arranged in any other manner suitable for being drawn from the container without becoming fouled.

The strands from each pair of containers 59, 60 are designated 65, 66.

Adjacent to the row of containers is a horizontal bar 68 at the side of the carriage adjacent to the net. This bar carries three pairs of guide tubes 69, 70, which tubes extend transversely across the bar. One of the ends 71 of each pair of tubes extends over the containers 59, 60 of each pair thereof and these ends 71 are preferably curved downwardly and slightly flared for extending the strands 65, 66 therethrough, while the opposite ends 72 of the tubes that are adjacent to the net may also be downwardly curved. The strands 65, 66 are thus adapted to be easily drawn through the tubes 69, 70 into the ends 71 thereof and out of the ends 72 (FIG. 3).

Carrried by the bar 68 in a position below the end 72 of each tube 69, 70 is a funnel like container 74.

The spout 75 at the lower end of each funnel 74 is downwardly elongated and its sides extend convergently downwardly.

Removably positioned within each spout is a removable metering die 76, which die is preferably vertically elongated, having tapered outer sides conforming to the downward taper of the sides of the spout. This die is formed with a central, vertical, open ended passageway 73, the sides of which extend convergently in a downward direction.

Each strand 65, 66 is adapted to pass downwardly through each container and each funnel 74 and through the bore of the metering die 76 positioned within the latter. The bore of die 76 is somewhat larger than the diameter of each strand that is adapted to pass therethrough, therefore in order to effect the metering operation, the lower tapered end 77 of an upwardly removable stem 79 is positioned within said passageway 73, and the glass filaments will automatically distribute themselves uniformly around said tapered end 77 and the sides of the passageway upon drawing the strand downwardly through said passageway. Thus, lower portion 77 of the stem may be called a core element of the metering die since glass filaments pass around it.

One of the funnels of each pair thereof may contain a plastic, such as a polyester and a catalyst of one type, which, for example, may be cobalt, while the other funnel

of each pair may contain a polyester and a catalyst such as peroxide. Or one funnel may contain an epoxy and the other a hardener. In any event, no hardening of the plastic in either funnel will be effected until they are brought together, and there are numerous different formulas that are similarly operative.

Upon drawing each strand through each of the metering dies, which includes the core element **77**, the glass filaments, being substantially parallel, hard and smooth, will be drawn past the core element and each of the filaments will be coated with the plastic in the funnel **74**, but free from excess, which is why the die is called a "metering die." Should there be a snarl or bunching of filaments in a strand being drawn through the funnel, or should some foreign material in the strand or in the plastic be drawn to the metering die so that the strand cannot be drawn through the passageway around the core element, it is only necessary for the operator to momentarily lift the stem **79** in order to free the strand or foreign material to enable the strand to again pass through the die with the core element in place.

The stem is preferably of metal and is merely held in position by gravity during withdrawal of each strand, although the downward movement of the glass filaments therepast will tend to urge the stem downward. The taper of the sides of the passageway **73** and the core element are such as to preclude jamming of the filaments. However, when the operation of withdrawing the strands is stopped for an appreciable length of time, the stems may be tapped to tightly engage the filaments and to thereby insure against leakage of the plastic.

The metering dies could be used without the core, provided the diameter of the passageway were substantially equal to the diameter of the strand to be drawn therethrough, but snarls, foreign material and the like could not readily be cleared, and operations would cease.

With the present metering die, different sized dies may be readily inserted in each funnel according to different sized strands, such different sizes being either due to different numbers of filaments in a strand, or different sized filaments or both, but each metering die will accommodate a larger range of sizes than where the diameter of the passageway through the die were the sole controlling factor, and where there was no core element.

The carriage suspended from tracks **55**, **56** and that carries the containers **59**, **60** includes depending opposed end member **78** (FIGS. 1, 2) and a lower platform **80** extending between and carried by said end members at their lower ends.

The platform **80** will carry several operators. One standing on the platform can reach the upper portion of the net on the net frame, although a support **81** may be provided on one end of the platform to facilitate reaching the uppermost portion of the net, while other operators can also work on the net in a standing or seated position on platform **80**.

In a normal operation there is one operator for each pair of containers **59**, **60** and each operator draws a pair of strands **65**, **66** together adjacent to each of the crossing points of the rope lengths forming the net. After so bringing the strands together, the crossing ropes are lashed together as seen in FIGS. 5, 6 and the lashing is then cut at the tie to form a solid lashing at each crossing point as seen in FIG. 5.

The plastic is activated for setting and hardening as soon as the strands are brought together and during the lashing operation, and a predetermined time thereafter it becomes hard. Some of the plastic will enter the interstices of the rope, hence the tie is bonded to the rope and the filaments of the strands become bonded to each other so that each lashed portion becomes practically an integral unit. Since the glass filaments of each strand are not stretchable and are not twisted on each other, and since the plastic has a uniform hardening time after each lashing is completed, there is no weakness or variation in strength at the different lashed points.

The lashing of a rectangular net or other net of different outline will be accomplished in the same manner as above described.

An edge rope **82** may be extended or threaded through the loops formed at the bends of the net rope **15** as seen in FIG. 7, and which edge rope may be of a larger diameter than that of rope **15**. This edge rope may also be lashed to the net rope **15** so that the completed net will be capable of being handled as a unit as seen in FIG. 4 and lashed to a rectangular net rope **85** generally as indicated in FIGS. 12, 13.

In FIGS. 12, 13 different triangular nets are shown at one of the ends of a rectangular net. FIG. 12 shows one triangular net such as may be formed on the frame of FIG. 1 whereas FIG. 13 shows two triangular nets **87**, **88** lashed to one end of a rectangular net and lashed to each other. The nets **87**, **88** are of different triangular outline as may occur in special instances where the area to be protected may have an outline that is not symmetrical.

As has already been explained, the nets of FIGS. 9, 10, 11 may be formed by the same method as has been described for the net of FIG. 1. The frame members of the net frame are positioned on the wall in an arrangement to correspond with the outlines of the nets of FIGS. 9–11 and which members carry the requisite number of projections as seen in FIGS. 9–11. Obviously the smaller the mesh openings are to be the closer the spacing between the pegs, nails, bolts or whatever projections are on the frame for making the bends.

While the mesh openings in FIG. 10 are elongated, this is not objectionable in some instances, although the arrangement can be carried to an objectionable extreme, in which case, the triangular net may be made up of a number of nets that more nearly approach a net in which the mesh openings are square.

The particular shape of the die **76** in each spout **75** in combination with the core element, substantially eliminates excess plastic on the strand drawn through the nozzle, as well as air bubbles that may be in the plastic. During the period when the strands are not being drawn through the dies **76**, the filaments of the strands cooperate with the cores in each die for preventing leakage of plastic, although as explained before the stem **79** may be slightly tapped downwardly, if desired, where the strands are not used for long intervals of time.

It may be mentioned that the mere contact between one of the sides of a pair of coated strands **65**, **66** is adequate for commencing the reaction resulting in hardening of the plastic.

While the employment of glass fibers or filaments in strands thereof for securing the rope lengths together at their crossing points is preferred, it is not intended that the invention be necessarily restricted thereto. Also, it is the intention that the claims appended hereto cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

We claim:

1. Apparatus for making a rope net comprising; spaced frame members disposed in a vertical plane including projections thereon projecting from a lateral side thereof between which lengths of rope for said net are adapted to extend and over which said rope is adapted to be bent with certain of said lengths extending angularly across others thereof in substantially engaging relation at their crossing points, a carriage at one side of said frame members, means mounting said carriage for movement in a plane parallel with the plane in which said frame members are disposed, means on said carriage for separately supporting a pair of strands of fiberglass for withdrawal therefrom, means on said carriage for supporting a pair

of separate containers of fluid plastic, each container of said pair including guide means for guiding one of said strands through the body of fluid plastic adapted to be held therein and out of each container, means on said carriage adapted to support an operator thereon in a position for manually drawing said strands from said guide means and for lashing the lengths of rope adapted to be held on said frame members at their said crossing points.

2. Apparatus for use in the operation of lashing together the crossed rope lengths of a net at the crossing points of said lengths comprising; a carriage, a generally vertically disposed net frame on which such net is adapted to be laid and supported, means supporting said carriage alongside said net frame, supporting means for supporting a strand of filaments of lashing material on said carriage, a receptacle for plastic coating material supported on said carriage at a level above the upper level of said net frame, guide means between said supporting means and said receptacle for guiding a strand from said supporting means into and through said receptacle and the plastic adapted to be held within the latter, said receptacle including a metering die in its lower end having a passageway therethrough through which said strand is adapted to be drawn from below said passageway subsequently to passage of said strand through the plastic within said receptacle whereby an operator below said receptacle may lash said strand directly around said rope lengths upon withdrawal of said strand from said receptacle, means mounting said carriage for horizontal movement alongside said net frame, and means on said carriage below said receptacle for supporting an operator on said carriage.

3. In apparatus for use in the operation of lashing together the crossed rope lengths of a net at the crossing points of said lengths, comprising; a receptacle for holding a fluid plastic adapted to coat the filaments of a strand of lashing material to be lashed around said rope lengths at said crossing points, said receptacle including an open ended vertically elongated passageway through which said plastic is adapted to flow by gravity when a body of such plastic is held within said receptacle and through which passageway said filaments are adapted to be drawn downwardly from a point below said passageway, a core element loosely supported in said passageway by gravity between the sides of which and the sides of said passageway said filaments are adapted to be positioned when drawn downwardly through said passageway, said core element including a portion therein accessible from outside said receptacle for manual manipulation for tightening the same in said passageway or for withdrawal from the latter as desired, the sides of said passageway being convergent in a downward direction and the outer sides of said core element being similarly convergent.

4. Apparatus for coating the filaments of separate strands of lashing material adapted to be brought together for lashing rope lengths comprising: a pair of separate compartments respectively holding inactivated bodies of fluid plastic that separately include agents adapted to activate the material of said bodies only when the material of said bodies is brought together, supporting means for supporting separate strands of said lashing material for withdrawal of said strands therefrom; guide means between said compartments and said supporting means for guiding one of said strands into the body of plastic material in each of said compartments, each compartment of said pair thereof including a passageway opening outwardly thereof through which such strand of said lashing material from the plastic material in each compartment is adapted to be drawn; the outwardly opening ends of said passageways being downwardly directed for downward withdrawal of said strands therefrom, and receptacle supporting means supporting said compartments in an elevated position to enable an operator to bring said strands together at a point below said compartments for lashing such rope lengths at said point.

5. In apparatus as defined in claim 4, an open ended die element removably supplied in each compartment in which each of said passageways is formed; a core element removably positioned within each passageway between the sides of which core element and passageway the filaments of each strand are adapted to be drawn; said passageway in each compartment being below the plastic body in the latter for feeding plastic to each passageway by gravity, and said core element in each passageway being held in the latter under the influence of gravity at all times and being accessible from outside each compartment for manual removal from each passageway to permit snarled filaments to be freely withdrawn through each passageway when each core element is so removed.

6. Apparatus for use in the operation of lashing together the crossed rope lengths of a net at the crossing points of said lengths comprising: a substantially vertically disposed net frame on which such net is adapted to be laid and supported; a receptacle for holding a body of plastic coating material, and supporting means for supporting a strand of filaments of lashing material; means for supporting said receptacle and said supporting means including a carriage, and means supporting said carriage for movement horizontally in a plane that is substantially parallel with the plane in which said net frame is positioned; said receptacle being formed with a passageway that is in communication with the body of plastic material adapted to be held in said receptacle and through which a strand from said supporting means is adapted to be drawn downwardly from below said receptacle to said crossing points whereby plastic of said body will coat said strand when said strand is so drawn through said passageway.

7. Apparatus for coating the filaments of separate strands of lashing material adapted to be brought together for lashing together a plurality of elements comprising: a pair of separate compartments respectively holding inactivated bodies of fluid plastic that separately include agents adapted to activate the material of said bodies only when the material of said bodies is brought together, supporting means for supporting separate strands of said lashing material for withdrawal of said strands therefrom; guide means between said compartments and said supporting means for guiding one of said strands into the body of plastic material in each of said compartments from a point above the level of each body, each compartment of said pair thereof including a passageway opening outwardly thereof at a point below the level of said body through which such strand of said lashing material from the plastic material in each compartment is adapted to be drawn, whereby one of such strands of said lashing material is drawn downwardly into each of said compartments, and through the plastic material, exiting therefrom below the level of said body; and receptacle supporting means supporting said compartments in an elevated position to enable an operator to bring said strands together at a point below said compartments for lashing said elements together.

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