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CASTING LINE

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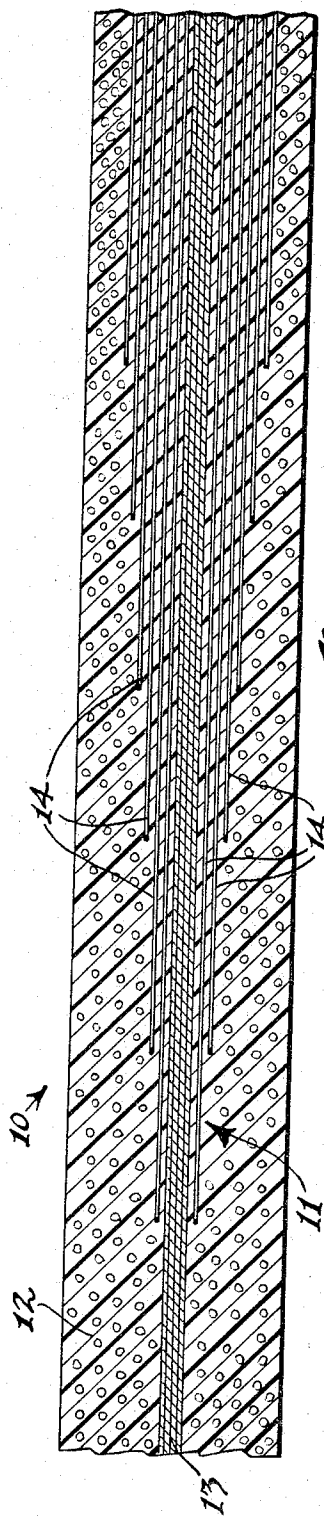


Fig. 1

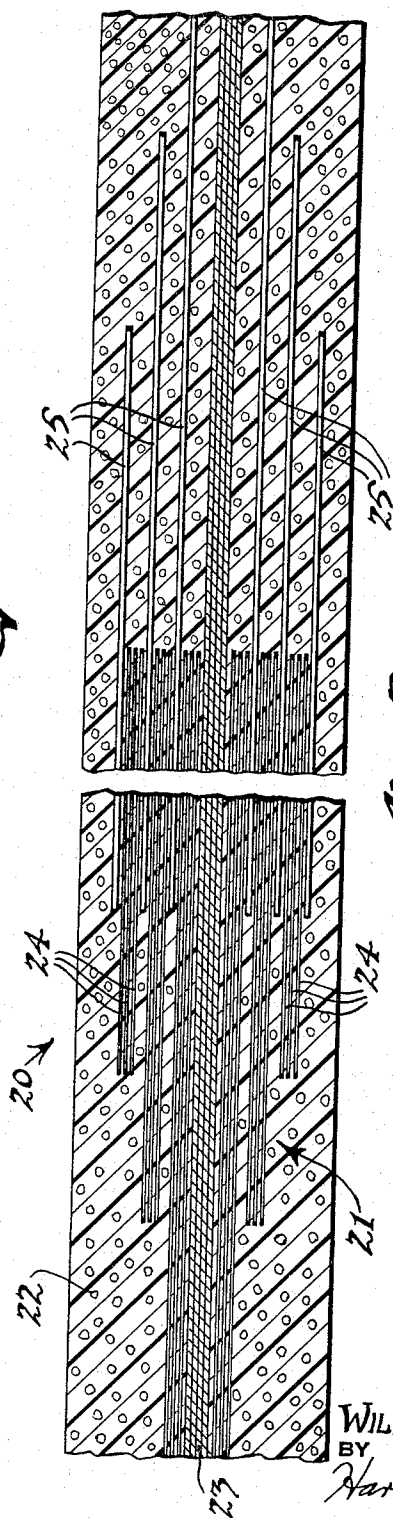


Fig. 2

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CASTING LINE

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ABSTRACT OF THE DISCLOSURE

A casting line of uniform diameter having unequal length longitudinal filaments disposed in a tapered pattern along a core line therein, to longitudinally vary the density of the casting line to improve its casting characteristics. The specific gravity of the filaments are substantially greater than one and the specific gravity of the casting line is such as to permit the casting line to float or to lie slightly submerged below the surface of the water.

This invention relates to a fishing casting line or a fly line and more particularly to a novel casting line of varying density and rigidity.

For the achievement of maximum casting control and distance, fishermen have for many years desired a line of varying weight so that the portion of the line moving forward through the air during casting would be heavier than the other portions of the line. With the heavier portion of the line moving through the air, the fisherman can cast his line a greater distance and more accurately.

Originally weight variation in casting lines was obtained by complicated variations in weaving or braiding patterns in the casting line. More recently, casting lines have been produced which have an advantage over simple braided lines in that they are inherently bouyant and do not require constant dressing with surface tensioning material to enable them to float. These more advanced forms of casting lines consist of flexible hollow tubes which may be formed with varying diameters in order to achieve some weight variation. However, the density variation in such hollow tubes is severely limited, and moreover, once such a line is sufficiently damaged to permit the penetration of water, the hollow core could become quickly saturated to destroy the floating characteristics of the line.

More recently, casting lines have been produced in which each line consists of a finely braided nylon core, coated with a jacketing material containing tiny air cells of varying thickness in order to vary the density and control the weight of the line. These air cells can be sealed for permanent floating characteristics, or the cells can be interconnected in such a manner that they would absorb water to sink the line if desired. Although a further claimed advantage of the cellular jacketing is that the amount and size of air spaces could be accurately controlled for weight variation, such control is lacking in precision and is most difficult to achieve with current cellular plastic technology.

Thus, all previous methods for varying the density in casting lines are achieved by varying the diameter of the lines, which has several disadvantages, some of which are quite obvious. First of all, increasing the diameter of a casting line increases its rigidity, and while this is desirable under certain circumstances, there are definite points in the design of each casting line where rigidity changes are restricted if the line is to function in the desired manner. For this reason, varying the weight of the casting line by varying its diameter can be employed only within certain design limits. One such design limit is the accommodation of a casting line having an increasing diameter to fit a casting reel. It is well known that a cast-

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ing line must meet certain aerodynamic conditions. When a line is cast through the air for substantial distances at a speed estimated as high as 55 miles per hour, the line develops considerable wind resistance directly proportional to the flat plate area it presents. Thus, increasing the diameter of those moving portions of the casting line where increased weight is desired will simultaneously increase the resistance to the passage of the moving portion of the line through the air, consequently decreasing the casting distance and the fisherman's facility of line control.

Under certain conditions it is recognized that casting lines may have specific gravities greater than 1 so that they may submerge and present lures below the surface of the water. However, the greatest number of casting lines in use are designed to present the lure at the surface of the water, so that the line must either have a specific gravity less than 1, or a combination of the specific gravity and surface tension characteristics which will enable the line to float.

It is therefore an object of this invention to overcome the disadvantages enumerated by providing a novel casting line in which not only the weight but also the rigidity may be varied and accurately controlled in any portion of the line.

Another object of this invention is to provide a novel casting line in which the weight may be varied and accurately controlled in any portion of the line without varying its diameter.

A further object of this invention is to provide a novel casting line in which the rigidity and elasticity of the line may be varied and accurately controlled in any portion of the line without varying its diameter.

Another object of this invention is to provide a novel casting line in which the weight of different portions of a line of uniform cross-section may be varied by varying the density of materials in the line.

Another object of this invention is to provide a casting line of uniform cross-section in which the density of the line may be varied by a core member of novel construction, the density of which may be varied and accurately controlled in any portion of the line.

Another object of this invention is to provide a casting line having a core member of novel construction including an elongated flexible core line of substantially uniform cross-section to which are attached a plurality of filaments of substantially smaller cross-sectional area than said core line and having a greater density than said core line and a jacket completely surrounding the core member of substantially less density than the core member.

A further object of this invention is to provide a casting line having a core member including a plurality of filaments of varying lengths having a specific gravity substantially greater than 1, the cross-sectional area of the filaments varying along the core member in order to vary the rigidity and the elasticity of the casting line.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings, wherein:

FIG. 1 is an enlarged longitudinal section of a portion of a casting line made in accordance with this invention for varying its density; and

FIG. 2 is a view similar to FIG. 1 showing the construction of a casting line made in accordance with another embodiment of this invention for varying its rigidity and elasticity as well as its density.

Referring now to the drawings in more detail, FIG. 1 discloses a section of a casting line including a body 10 of substantially uniform diameter or cross-sectional area including a core member 11 and a jacket 12. The core member 11 includes an elongated central core line 13 of

substantially uniform diameter or cross-sectional area having a pre-determined specific gravity. A preferred form of core line 13 is a braided plastic line of nylon, or any other synthetic or natural material. A typical value for the specific gravity of the core line 13 is 1.1.

The core member 11 also includes a plurality of elongated filaments 14 which may be secured by any convenient means, such as an adhesive to the central core line 13. Although FIG. 1 illustrates the filaments 14 as spaced apart and occupying a considerable area of the body 10, actually, this is for illustrative purposes only, since the filaments 14 would ordinarily be tightly bunched together and against the core line 13. Moreover, the total cross-sectional area of the filaments 14 would be substantially less than the cross-sectional area of the core line 13. It will be noted in FIG. 1 that the filaments 14 are of varying lengths so that their ends form a tapering pattern to gradually vary the density of the body 10 longitudinally. A filament material which has been used with much success is fiber glass, which has a high specific gravity in the order of 2.5, and which also exhibits high tensile strength and flexibility in fibers used for this purpose.

The entire core member 11, including the core line 13 and filaments 14 are surrounded by a coating or jacket 12 of substantially uniform thickness and a substantially greater cross-sectional area than the combined cross-sectional area of the core member 11. A preferred form of jacket material is a cellular plastic of any number of different kinds, such as vinyl foam plastic, which may be extruded around the core member 11 in an intimate fashion. The specific gravity of the cellular plastic jacket 12 may vary widely, but a specific gravity of 0.2 was found to be an effective flotation medium and readily extrudable into the desired product.

FIG. 2 discloses a similar type of casting line as FIG. 1, but illustrates the structure and location of the elements of the core member in order to precisely control and vary the elasticity and rigidity along different portions of the length of the line. The body 20 has a central core member 21 and a surrounding jacket 22 similar to the arrangement of FIG. 1. The core member 21 comprises an elongated core line 23 of uniform cross-sectional area, which may be of nylon and identical to the core line 13 in FIG. 1.

The casting line of FIG. 2 differs from the casting line of FIG. 1 in the location of the filaments 24 and 25. The fine filaments 24 of reduced cross-sectional area and desired length are located in the longitudinal portions of the body 20 where greater flexibility is required. The coarse filaments 25 of greater cross-sectional area than the fine filaments 24 are located in the longitudinal portions of the body 20 where more rigidity and elasticity is desired. In order for the total cross-sectional area of the fine filaments 24 to equal the total cross-sectional area of the coarse filaments 25, there must be a corresponding greater number of fine filaments 24 in order to balance the density of the coarse and fine filaments, particularly where the fine filaments 24 overlap the coarse filaments 25, as illustrated in the middle portion of FIG. 2. FIG. 2 also illustrates not only the manner of controlling the flexibility and rigidity of the line, but also discloses filaments 24 and 25 of varying lengths to form a tapered pattern in order to proportionately vary the density longitudinally in the body 20.

In the volume production of lines made in accordance with this invention, the core members 11 and 21 are preferably prepared in advance of the jacket extrusion by precisely cutting the exact number and length of the fiber glass filaments 14, 24 and 25, accurately locating these filaments in the desired areas of the line, and securing them to the central core lines 13 or 23 in the corresponding locations. These filaments 14, 24 and 25 may be secured to the core lines 13 or 23 by an adhesive, and it has been found that it is necessary only to adhere the forward lead-end of the filament to the central core lines

13 and 23. It is also necessary that the adhesive employed to secure the glass fibers to the central core line must have a melting point slightly higher than the extrusion temperature of the cellular jacket. Filaments 14, 24 and 25 may also be incorporated into the central core lines 13 or 23 by introducing the filaments into the braiding operation of the central core line 13 or 23 at the various points where incremental weight increases are desired, and in lengths which will provide subsequent incremental weight decreases as the braiding operation progresses. After core member 11 or 21 has been fabricated, then the jacket 12 or 22 may be formed about the respective core member by any type of coating process, but preferably extrusion.

In the preferred method of extruding a coating of cellular material about the central core, a poly blend foamed vinyl compound which has already been plasticized is introduced into a conventional cross head extruder apparatus along with a suitable amount of foaming agent. This material is extruded into a uniform covering of the prepared central core 11 or 21, but during the extrusion, no foaming or reduction in specific gravity takes place. Foaming can be achieved by extruding into a pressure chamber. However, a more practical method of foaming is simply to pass the extrusion product through an oven or heat chamber which will elevate the temperature to 360° F., at which temperature the foaming agent releases gas into the soft plastic mass to produce the desired cellular structure. An example of the materials employed in preparing the vinyl foam cellular jacket could be as follows:

	Parts
Geon 8720 (B. F. Goodrich Chem. Co.)	100
Zinc oxide	3
Sulphur	1.5
Altax (Vanderbilt Co.)	1
Cumate (Vanderbilt Co.)	0.25
Celogen (Naugatuc Chem. Co.)	2

The above formulation is intimately mixed for 20 minutes in a two roll mill at 210° F. It is then removed from the mill and cubed or granulated for feeding into the extruder, where it is extruded over the composite center cores 11 or 21. After the foaming action has taken place, the product can be surface finished for additional gloss or desirable color by using any desired coating method with a wide variety of coating resins, depending upon the surface characteristics desired.

The cellular plastic used in the jackets 12 and 22 may be formed to have the cells open to permit the penetration of water and thereby submerge the casting line so that a lure may be presented below the surface of the water. The cells may also be sealed in a known manner in order to preserve the floating characteristics of the jacket so that the casting line may present a lure upon the surface of the water.

As previously mentioned, there is no novelty in the use of the cellular plastic material or jackets in casting lines, nor is there any novelty in the use of nylon cores in casting lines. However, the novelty in this invention lies in the use of weighted media, and particularly filaments of high density, such as fiber glass of the necessary density, length, and cross-sectional area and concentration in the combined core members 11 and 21 to effect the necessary variation and location in density as well as rigidity and elasticity of the different portions of a casting line.

Any conventional method of extruding cellular plastic material about the core member to form a jacket may be employed, such as the process and method described in "Modern Plastics Encyclopedia 1964." Example of different cellular plastic materials employed in these processing methods are vinyl, nylon, silicone rubbers and other plastics.

The process of extruding a plastic coating around a core of any material, whether braided or not is also known in the art. Examples of such processes are the coating of

plastic materials about synthetic and natural yarns, coating of plastic materials about metal cores. Moreover, it is also common industrial practice to extrude a cellular plastic coating about stranded or braided cores for the purpose of achieving flotation, such as the extrusion of a cellular plastic coating about braided electrical conductors.

Glass in its conventional form is a rigid, highly elastic material. It becomes flexible when drawn into a filament. Flexibility of fiber glass is directly related to the diameter of the glass filaments produced. Glass fibers are in commercial production having diameters varying from less than two microns to more than twenty microns. Invariably the large diameter fibers are more rigid or stiffer than fibers of a smaller diameter. Obviously, the specific gravity of fiberglass made from the same composition does not differ. Therefore, a casting line made in accordance with this invention, in which glass fibers are employed as the filaments 14, 24 and 25 to obtain the desired weight control in a given portion of the casting line, may be made more yielding or flexible by employing a greater number of glass fibers of substantially smaller diameter. If, however, rigidity or elastic recovery is required or desired in the same casting line, then a smaller number of glass fibers of comparatively greater diameter should be employed. The flexibility or the rigidity or elastic recovery of a casting line is important in achieving the proper degree of tip action or play in the physical act of casting.

In order to better appreciate the advantages of a casting line made in accordance with this invention, as compared with conventional casting lines, and particularly those now currently designed for weight control, a more specific example of the construction of the line will now be described.

A conventional casting line designated as a DT-4-F line in the standardized nomenclature system has a minimum diameter of .030 inch, a maximum diameter of .042 inch, a maximum weight of 4.2 grains per linear foot, and a minimum weight of 2.67 grains per linear foot. Twenty-six strands of fiber glass commercially designated as 140's will weigh 4.2 grains per linear foot. These strands each consist of 204 filaments, each of which has a diameter of .0004 inch. The twenty-six strands, including voids and interstices will occupy an area of .00085 sq. in. This area is equal to a circle having a diameter of .0033 in. The weight of these twenty-six strands alone is equal to the desired maximum weight of the above conventional casting line, and if incorporated in a portion of a casting line made in accordance with this invention, will insure at least the maximum desired weight in this portion. Moreover, these same twenty-six strands will occupy only 12 percent of the cross-sectional area available in the specified minimum line diameter of .030 in. If the core line 13 or 23 is made from braided nylon, it will not only have an effective specific gravity of 1.1, but will occupy only .00141 sq. in. or 20 percent of the .0070686 sq. in. area of the casting line having a minimum diameter of .030 in. The cellular jacket 12 or 22 in the line has a specific gravity of .2 and will occupy 68 percent of the cross-sectional area available in the same line having the minimum diameter of .030 in. Thus, with 12 percent of the cross-sectional area of the casting line being occupied by the fiber glass filaments having a specific gravity of 2.5, 20 percent of the cross-sectional area being occupied by the nylon core line having a specific gravity of 1.1, and the remaining 68 percent of the cross-sectional area being occupied by cellular jacket having a specific gravity of .2, the specific gravity of the composite body 10 or 20 at the heaviest desired portion of the line is .656. Obviously, the specific gravity of .656 in the maximum weighted portion of a casting line made in accordance with this invention is more than sufficient to render the line buoyant.

Furthermore, in obtaining the maximum weight of the line by controlling the specific gravity or density of the materials, the diameter of the line is not increased. As a

matter of fact, the diameter of the casting line made in accordance with this invention is uniform throughout its length at the minimum diameter. Thus, since the diameter remains minimally uniform, its wind resistance remains constant throughout its length, at the lowest possible value.

Moreover, the rigidity of the casting line can be varied in accordance with this invention without increasing the diameter.

Thus, it is possible to produce maximum weight in a minimum cross-sectional area and to vary the weight without changing the diameter. By maintaining a uniform diameter throughout the length of the casting line, (known as a "level line"), the total volume of the line may be reduced, as compared with a line whose weight is varied by increasing its diameter.

A casting line made in accordance with the invention can easily be accommodated on a casting reel designed for the conventional level line, whereas, a line which gradually increases in diameter could very easily create difficulties in the operation as well as the storage capacities of the reel.

It will be obvious that the principles of this invention can be applied to a composite casting line in which the variation in density may be achieved by the incorporation of other material besides fiber glass, having specific gravities greater than the cellular jacket or core line, in order that the maximum weight may be incorporated into a minimum cross-sectional area. Glass fiber filaments have been selected because of their ready availability in a wide range of filament diameters, their comparatively high specific gravity and because of their inertness and suitability for water and weather resistance.

It can also be understood that if an extra heavily weighted portion of line is desired, the filamentary weight control of this invention can be combined with an increased diameter of the line. However, because of the filamentary control, the diameter of the line would not have to be increased as much as in a conventional line with the same weight demands.

It will therefore be apparent to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A casting line comprising:

(a) an elongated flexible body of uniform cross-sectional area,

(b) said body comprising an elongated core member within said body,

(c) said core member comprising a plurality of elongated flexible filaments of unequal lengths and of a uniform material having a specific gravity substantially greater than 1,

(d) said filaments extending longitudinally and laterally adjacent each other in a longitudinally tapered pattern at predetermined locations within said body to longitudinally vary the density of said body.

2. The invention according to claim 1 in which each filament has a uniform cross-sectional area.

3. The invention according to claim 1 in which the cross-sectional area of each filament varies to vary the rigidity of said body.

4. The invention according to claim 1 in which each filament comprises glass.

5. The invention according to claim 1 in which said core member further comprises an elongated flexible core line of substantially uniform cross-sectional area in the center of said body, each filament having a cross-sectional area substantially less than the cross-sectional area of said core line and having a specific gravity greater than said core line.

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6. The invention according to claim 5 in which said filaments are secured to said core line.

7. The invention according to claim 5 in which said filaments comprise a plurality of fine filaments of a predetermined cross-sectional area employed to provide more flexibility in a portion of said body for a predetermined density, and a smaller number of coarse filaments of the same total cross-sectional area as said fine filaments and employed in another portion of the body to provide a more rigid body portion having the same predetermined density.

8. The invention according to claim 1 in which said body further comprises an elongated tubular jacket of cellular plastic material surrounding said core member.

9. The invention according to claim 8 in which the specific gravity of said core member is greater than 1, the specific gravity of said cellular plastic jacket is substantially less than 1, and the resultant specific gravity of said body is less than 1.

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10. The invention according to claim 8 in which the major portion of any cross-sectional area of said body is occupied by said cellular plastic jacket.

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