July 3, 1951 J. L. MacALLISTER 2,559,080

FISHING LEADER

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Fig. 1

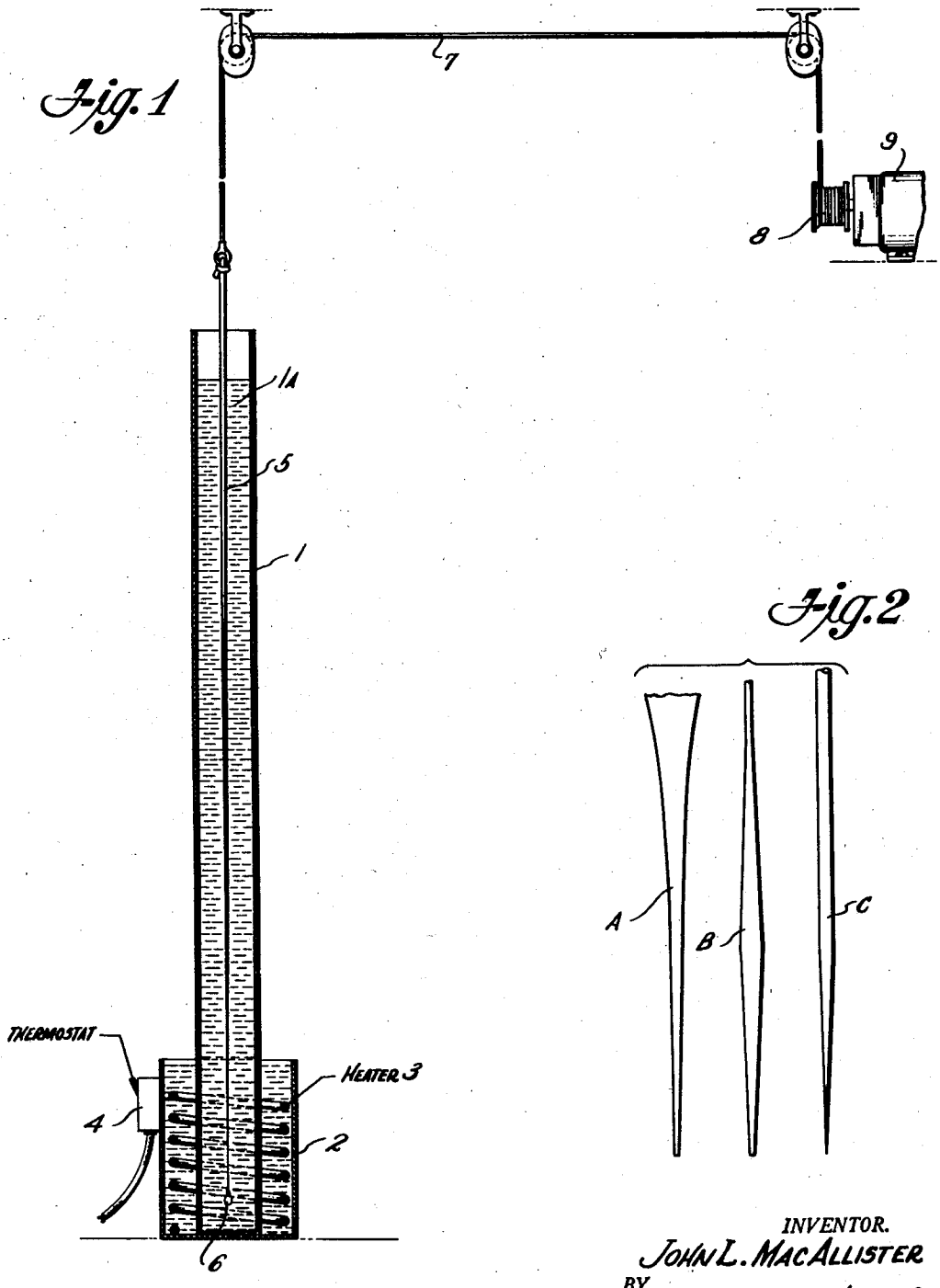

Fig. 2

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FISHING LEADER

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4 Claims. (Cl. 41—41)

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My invention relates to a means and method of producing tapered filaments, and the invention is particularly adapted for the production of tapered filaments of any length or taper ratio composed of filament forming synthetic linear polymers such as, for example, nylon.

I am aware of the fact that attempts have heretofore been made to produce tapered filaments from synthetic linear polymers such as the linear polyamides but these filaments have been made by drawing the material at varying speeds as it is extruded, with an after processing such as cold stretching to set the filament. Such methods appear to be satisfactory for short, and relatively thick, filaments such as might be used for brush bristles, for example, but have not been entirely successful for the production of very long tapered fishing leaders, for example.

Accordingly, it is an object of the present invention to provide a means and method of making tapered filaments of the linear polymers of any length and with any taper ratio, or combinations thereof, from filaments having a uniform diameter.

As the method of the present invention as utilized for producing tapered filaments does not change the molecular structure or strength of the material as originally drawn, it is another object of the present invention to provide a means and method of producing tapered filaments from linear polymers wherein the strength per unit cross sectional area is substantially the same throughout the filament extent.

In broad terms as to method my invention comprises etching linear polymer filaments having a substantially level characteristic in a corrosive acid. The surface of the filament exposed to the acid is etched or dissolved away and the length of time a given portion of the filament is exposed to the acid determines the amount of material removed, providing a constant temperature is maintained. The method additionally comprises the control of the degree of etching by regulating the temperature of the etching acid, and cleaning the filament after etching.

Other objects and advantages of my invention will be apparent from the ensuing description of the drawings in which:

Figure 1 is a diagrammatic side view partly in section of one form of apparatus suitable for producing long tapered filaments suitable for fishing leaders, for example.

Figure 2 is outline drawings of several types of taper reproducible by the means and method of the present invention.

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Referring to Figure 1, a tube 1, such as an iron pipe, is sealed at the bottom thereof and is filled with an acid 1A corrosive to the linear polymers, such as, for example, phenol of about 88% strength, to a distance equal to the taper desired. An 88% strength phenol means 88% phenol to 12% water. The acid is preferably maintained at a substantially constant temperature as by an oil bath 2 heated by an electrical heater 3 under the control of a thermostat 4. The acid in vertical tank 1 is readily heated by connection and may be heat insulated if desired. It should, however, be pointed out that the fumes from the phenol are highly corrosive and dangerous to breathe. For that reason the exposed phenol surface should be as small as practical and convenient means should be provided from a safety standpoint to remove the fumes from the enclosure in which the tank is being used.

With the tank acid heated to at least over 100° F. to provide a practical etching time, from one to twenty filaments 5 as, for example, of level .017" nylon nine feet long are weighted as by iron weight 6 at the bottom thereof are suspended over the tank from a cord 7 leading to a drum 8 controlled by a reversible variable speed motor 9. For clarity of illustration only one filament is shown.

To produce a continuous taper on the filament, the filament is immersed progressively by action of motor 9. With a feed into the acid of approximately one and one half feet per minute, a taper of the .017" stock to a tip diameter of .007 has been produced on nine foot lengths at an acid temperature of approximately 110° F. After the leader becomes fully immersed it is quickly removed.

Upon removal, the tapered filament will be found to be covered with a jelly-like residue which is removed to expose the final surface of the tapered filament. As this residue hardens on exposure to water, forming a hard scum, water containing cleansers is to be avoided. Alcohol or a weak alcohol-phenol solution may be used, but I prefer to exclude both air and water by immediately immersing the filament in mineral oil. This may be done by use of a tank similar to tube 1. The residue is then readily wiped off the filament, revealing a surface closely approximating the original filament except that it is dulled due to the etching. This low reflection characteristic is highly advantageous for fishing leaders as will be pointed out later.

It will be noted that there is no significant stress applied to the filament during the etching

process and in consequence there is no change in strength of the leader relative to unit cross sectional areas in any part of the leader. At the present time I have not determined whether or not the removed material is dissolved in the acid or is so changed as to be readily removed after treatment. In any event, tapers are reproducible as to time and temperature of the etch.

In this respect, any desired taper, or combination of tapers, can be produced from filaments having level characteristics by varying time and/or temperature of etching as shown in several examples in Figure 2. Here taper A is produced by varying the immersion rate. Taper B is produced by varying the immersion rate and then looping the filament to immerse both ends. Taper C represents a heavy bristle with one end only tapered.

As pointed out, I am unable to state what the reaction between the phenol and the filament may be. Experiment has shown, however, that part of the material is released from the filament into the etching fluid and part of the material in a changed form remains on the filament in a condition to be wiped off to expose the unchanged polyamide surface at the full depth of etching, if not subject to atmospheric contact for too long a time. The material separated from the main body of the polyamide either into the etching fluid or into the adhering residue has been found to be highly inflammable, and suitable precautions should be taken to prevent ignition of this material.

As the etched surface of the tapered filaments has a dull finish, they provide ideal characteristics for under water use in fishing. As the surface layers of the etched material have not been weakened by the etching process, as would happen if the surface finish were to be dulled by scratching with an abrasive, I do not desire to be limited solely to a tapered filament having an acid etched surface. The etching can be performed to leave a level filament with the desired dull finish by rapid immersion and withdrawal of the filament from the etching solution, by immersion parallel to the surface of the etching solution, or by progressing a continuous filament through the etching solution to give the filament surface a uniform etch throughout the filament length.

While I have shown the etched filaments as being produced by a batch process, it will be obvious to those skilled in the art that equally satisfactory results can be obtained by progressing a continuous length of filament through the etching solution. With recurrent changing rate cycles to obtain the desired taper in various sections of the longer filament, these sections after cleansing can then be cut apart to provide separate filaments of the desired length and taper.

Furthermore, while I have described my invention as being applied to relatively long tapered filaments of relatively small diameter, I do not desire to be limited thereto as heavier stock can be etched to provide tapered bristles for paint brushes or the like for example following the invention described and claimed herein.

While I have also described the method of my invention as being applied primarily to filamentary bodies, it is similarly adaptable for use to change a dimension or surface condition of bodies of other shapes. Bevels, for example, can readily be made on edges of thin sheets of the linear polyamides or internal areas of thin sheets or other bodies can be etched uniformly or differentially to change a desired dimension or to provide a dull surface.

I claim:

1. The method of tapering a level linear polyamide filament comprising immersing said filament in an etching acid and varying the amount of etch by varying the immersion time along the length of said filament to taper said filament.

2. Method in accordance with claim 1, including the step of heating said etching acid to approximately 110° F. to increase the speed of the etching action on said filament.

3. The method of tapering a linear polyamide filament which comprises immersing said filament in an etching acid for times varying along the length of said filament to produce the desired taper and wiping off an etching residue to expose the tapered surface.

4. The method of tapering a linear polyamide filament which comprises immersing said filament in an etching acid for times varying along the length of said filament to product the desired taper, withdrawing said filament, coating said withdrawn filament with a mineral oil, and wiping off said oil and etching residue adhering to said filament.

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