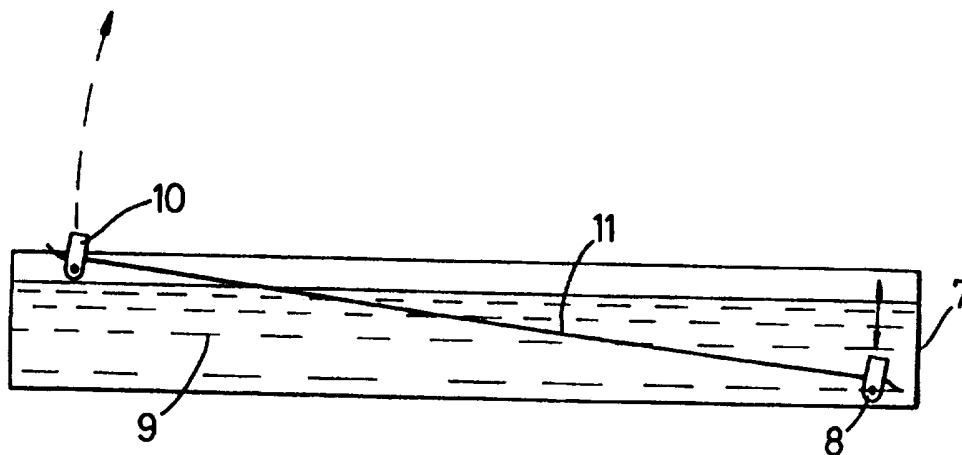




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A01K 91/16, B29C 35/04, 55/22	A1	(11) International Publication Number: WO 97/34470 (43) International Publication Date: 25 September 1997 (25.09.97)
(21) International Application Number: PCT/GB97/00720 (22) International Filing Date: 17 March 1997 (17.03.97) (30) Priority Data: 9605560.3 16 March 1996 (16.03.96) GB (71) Applicant (for all designated States except US): FLY FISHING TECHNOLOGY LIMITED [GB/GB]; Unit 18, Ffrwdgrech Industrial Estate, Brecon, Powys LD3 8LA (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): BURGESS, Paul [GB/GB]; Gludy Lake, Cradoc, Brecon, Powys LD3 9PB (GB). (74) Agents: LAINE, Simon, James et al.; Wynne-Jones, Laine & James, Morgan Arcade Chambers, 33 St. Mary Street, Cardiff CF1 2AB (GB).		(81) Designated States: AU, CA, JP, NO, NZ, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: IMPROVEMENTS RELATING TO TAPERED FISHING LINES



(57) Abstract

A fishing line (6, 13, 14) is of thermoplastic material or at least has a coating of such material. Initially it is of constant cross section. A taper is applied by heating a length to soften the plastics, and then moving that length away from the heat one end first while maintaining the length under tension. The tension stretches the line and reduces its thickness before it hardens. The first portion to escape the heat sets quickest and reduces in thickness least, while the last portion, being subject to tension the longest, is stretched and thinned the most. The heat source may be a bath (1, 7) of heated liquid (2, 9) in which the line is initially immersed.

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Improvements relating to tapered fishing lines

This invention relates to tapered fishing lines.

The 'leader' or 'cast' in fishing is normally a length of line that is at or near the terminal or hook end of the tackle. In many forms of fishing, but in particular fly fishing, a leader is required to possess a number of qualities such as strength, suppleness, weight distribution for casting, durability, abrasion resistance, particular floating/sinking characteristics and camouflage.

10 The types of leaders used in fishing today may take one of a number of forms:-

(a). Simple level nylon. However, for this to be supple enough at the hook end, it must not be too thick. But if it is uniformly thin it lacks the weight distribution to turn over properly in casting.

15 (b). Knotted tapered leaders. These have been used for well over 100 years (although only recently in nylon of course) and consist of knotting various lengths of different gauge monofilaments together so as to form a stepped taper from the main line down to the hook. Such leaders cast better than simple level monofilament leaders but have highly visible knots that often tangle. Also they have butt ends which tend to be too stiff for good turnover of the cast and hence have poor presentation.

25 (c). Knotless tapered monofilament leaders. These are extruded to form a continuous knotless taper and are normally made of nylon with added chemicals so as to improve strength and prevent water absorption. Such leaders having

a single monofilament butt either do not have sufficient weight to produce good turnover or, if they are made of sufficient diameter to give the weight, they are then too stiff to produce a good turnover and convey the energy smoothly down to the bait or fly.

(d). Tapered braided leaders. These are described in our Patent EP (UK) 0255237. Such leaders, by combining many filaments together, are able to produce the weight distribution required for good casting and turnover and they do avoid the problem of stiffness. Furthermore, they can be impregnated with various density polymers and so provide the angler with a wide range of floating/sinking characteristics. However, they are slow and expensive to make, and many models suck in water and give off a spray when casting. Also, they are more visible to the fish than monofilament leaders.

Many of the characteristics required in leaders are conflicting. For example, in fly fishing the leader requires the mass to be able to convey the energy from the fly line to the tippet and hence fly. But with the normal monofilament type of leaders, increasing the diameter (to achieve the required mass) increases the stiffness to the power of 4 of that diameter and the leader rapidly becomes too stiff to use.

Ideally, of course, the leader should combine all the good points suggested above whilst avoiding the undesirable characteristics.

It is the aim of this invention to provide a method of

achieving an accurate taper which is one way of providing desirable characteristics of a leader.

According to the present invention there is provided a method of tapering a fishing line whose surface layer, at least, consists of a thermoplastic material, comprising
5 subjecting the line to heat over a predetermined length and then reducing that length from one end by relative movement of the heat source and the line while maintaining a tension on the surface layer to stretch that part of the layer
10 softened by the heat and thereby taper said length.

In one preferred form, the heat source is a bath of heated liquid. The line is initially immersed over said predetermined length in the liquid, and is then gradually withdrawn while being held under tension. The portion that
15 emerges from the liquid first will solidify from a plastic state created by the heat, but not before the tension has stretched it a bit and reduced its thickness. Continuous withdrawal creates a taper which will be progressive down to the last portion remaining in the liquid. That will remain
20 heated longest, and therefore stretch and thin the most.

The line may be held upright between means that are urged apart during upwards movement from the bath to create the tension. In an alternative method, initially the line slopes down into the bath at an acute angle. The lower end
25 is immersed while the upper end is drawn up and away from the lower end.

More than one line can be stretched and tapered simultaneously, using a common heat source. In particular,

the lines may be the legs of an extended length of line material arranged in a zig-zag fashion. After the heat and tensioning treatment, the extended length is severed at the turns of the zig-zag to produce a multitude of tapered
5 leaders.

Initially the surface layer may be a tube, in which case it could be a sheath for a core of different material. This core may be present when the surface layer is stretched and tapered, and if it is substantially inextensible, the
10 sheath will creep relative to it when stretched and tapered. Alternatively, the core may be threaded through the line after the sheath is stretched and tapered. Preferably the ends of the tube are sealed around the core.

However there may be no core, in which case the tube
15 comprises the line, which after stretching and tapering is sealed at its ends.

Alternatively, the line is not hollow, but solid all through of the same material.

Usually, the line will initially be of uniform cross-section, but it could have an existing taper which is
20 modified by this method.

For a better understanding of the invention, some embodiments will now be described, by way of example, with reference to the accompanying drawing, in which:

25 Figure 1 is a diagram of a tapering apparatus for fishing lines,

Figure 2 is a diagram of a modified tapering apparatus,

Figure 3 is a diagram of another tapering apparatus,

Figure 4 is an axial section of a tapered leader, and, Figure 5 is an axial section of another tapered leader.

In Figure 1 a bath 1 contains liquid 2 which is heated to somewhere in the range 120° - 150°C, typically, for most
5 suitable polymers. A carriage 3 can move vertically in and out of the bath and is equipped with clamps 4 and 5 at top and bottom to hold a short line 6 which is to become a tapered leader. Its coating or surface layer, at least, is of thermoplastic material. The lower clamp 5 is fixed to
10 the carriage, but the upper clamp 4 is moveable with respect to the carriage to increase the distance between itself and the lower clamp 5 as the carriage 3 is raised from the lowered position shown.

Initially, most of the line 6 is immersed in the liquid
15 2 and its thermoplastic material is softened. The carriage 3 is then gradually raised, bringing the line 6 progressively clear of the liquid. At the same time, the clamp 4 is urged upwardly with respect to the carriage 3 to apply tension to the line 6. As that comes clear of the liquid,
20 it cools and hardens, but the tension will have stretched the heated portion a bit and reduced its diameter, and a taper will be produced. This will continue down to the bottom end of the line 6, which of course is immersed longest, and therefore stretched thinnest.

25 Instead of tapering one line at a time, the arrangement could be doubled as indicated in broken lines. Indeed, as shown in Figure 2, by increasing the size of the bath a large number of short lines or leaders could be tapered by

entraining a single long line in zig-zag fashion as shown. The stretching and tapering would be achieved as described, and when finished the line would be severed at the turns of the zig-zag to give a multitude of tapered leaders.

5 But this does require a deep bath. It may be more convenient to use the arrangement shown in Figure 3, where there is a long shallow bath 7. At one end there is a clamp 8 which can be lowered into the liquid 9 and raised from it, while at the other end there is a clamp 10 which is constrained to follow a path indicated by the broken line
10 spiralling up and away from the clamp 8. Initially, the clamp 10 is just above the surface of the liquid 9 and a line 11 is held taut between it and the clamp 8, which is immersed. The clamp 10 is then moved upwards, following its
15 assigned path, and so the line 11 is gradually brought clear of the liquid 9 while being stretched. A taper is therefore created.

Again, the bath 7 could be widened and the clamps multiplied or the zig-zag technique adopted to accommodate
20 a number of parallel lengths of line 11.

The above describes two extremes; the first embodiment having vertical movement and the second having the line initially at a very shallow angle. It will be understood that intermediate arrangements are possible and that very
25 accurate profiling of the taper can be obtained by controlling the angle and speed of withdrawal. For example, referring back to Figure 1, it may be convenient to have a drive giving a constant speed of withdrawal, and a constant

relative vertical speed for the upper clamp 4. However, the upper clamp may be mounted on a subcarriage so that it can have horizontal movement, away from the main carriage. Thus, while the subcarriage is moved vertically, additional
5 horizontal movement during withdrawal will modify the tension and the amount of line immersed, and thus affect the taper. Likewise, variations from the spiral path of Figure 3 may be possible to give such control.

Of course, speed variability could also be introduced,
10 and generally, with several adjustable factors and computer control, a taper of the desired length and angle (which does not have to be constant throughout) can be accurately achieved.

Figure 4 illustrates one type of tapered line, having
15 a monofilament core 12 closely encased in a plastics sheath 13 which was originally cylindrical as indicated in broken lines. Preferably, the sheath will be low modulus polyurethane, which may be loaded to alter its density in known manner. The radial dimension is much exaggerated in
20 relation to the axial direction for clarity. The taper of the sheath is achieved as described above, the core 12 being left free of the clamps so that the sheath 13 can creep lengthwise relative to it.

The line may be completely of thermoplastics material,
25 without a core. It may also be tubular as illustrated in Figure 5. After tapering, the tube 14 may be threaded by a core 15, conveniently nylon monofilament, and its ends will then be sealed by welding or glue, for example. But again,

the core 15 is optional.

For convenience of illustration, leaders have been shown and described. However it is perfectly feasible to apply these techniques to one or both ends of a full line
5 whose length is of the order of 30m. It is known to be able to thread a full tubular line with a core, and this requires a passage giving some clearance. With the ends sealed, there is a substantial volume of trapped air, making the line buoyant, although the degree of buoyancy can be modified by
10 loading the polymer with dense particles or by filling the remaining space within the tube with particles or liquid.

Substantially transparent or clear lines and leaders are often considered desirable, and there are thermoplastic materials available to make transparent lines and leaders
15 according to the methods described.

Although described in terms of a line initially of constant cross-section being withdrawn gradually from a bath of heated liquid, the invention is not so limited. For example, the line may already have a simple taper, having
20 been manufactured by known methods. The process described above can be employed to modify that basic taper to a different, more complex profile.

The heated bath gives a precise interface between the plastics-softening environment and the cooling air which
25 hardens the material. But other heating agents may be employed. For example, the line may be drawn out of a hot air tube at a controlled rate, or past a microwave heater.

CLAIMS

1. A method of tapering a fishing line whose surface layer, at least, consists of thermoplastic material comprising subjecting the line to heat over a predetermined length
5 and then reducing that length from one end by relative movement of the heat source and the line while maintaining a tension on the surface layer to stretch that part of the layer softened by the heat and thereby taper said length.

2. A method as claimed in Claim 1, wherein the heat
10 source is a bath of heated liquid, the line initially being immersed over said predetermined length in the liquid, and then being gradually withdrawn while being held under tension.

3. A method as claimed in Claim 2, wherein the line
15 is held upright between means that are urged apart during upwards movement from the bath to create the tension.

4. A method as claimed in Claim 2, wherein initially
the line slopes down into the bath at an acute angle, and wherein the lower end is immersed while the upper end is
20 drawn up and away from the lower end.

5. A method as claimed in any preceding Claim, wherein more than one line is stretched and tapered simultaneously, using a common heat source.

6. A method as claimed in Claim 5, wherein the lines
25 are the legs of an extended length of line material arranged in a zig-zag fashion.

7. A method as claimed in Claim 6, wherein, after the heat and tensioning treatment, the extended length is

severed at the turns of the zig zag to produce a multitude of tapered leaders.

8. A method as claimed in any preceding Claim, wherein the surface layer is a tube.

5 9. A method as claimed in Claim 8, wherein the surface layer is a sheath for a core of different material.

10. A method as claimed in Claim 9, wherein the core is present when the surface layer is stretched and tapered.

10 11. A method as claimed in Claim 10, wherein the core is substantially inextensible and the sheath creeps relative to it when stretched and tapered.

12. A method as claimed in Claim 9, wherein the core is threaded through the line after the sheath is stretched and tapered.

15 13. A method as claimed in any one of Claims 9 to 12, wherein the ends of the tube are sealed around the core.

14. A method as claimed in Claim 8, wherein the tube comprises the line, which after stretching and tapering is sealed at its ends.

20 15. A method as claimed in any one of Claims 1 to 7 wherein the line is solid all through of the same material.

16. A method as claimed in any preceding claim, wherein the line is initially of uniform cross-section.

25 17. A method as claimed in any one of Claims 1 to 15, wherein the line has a taper which is modified by this method.

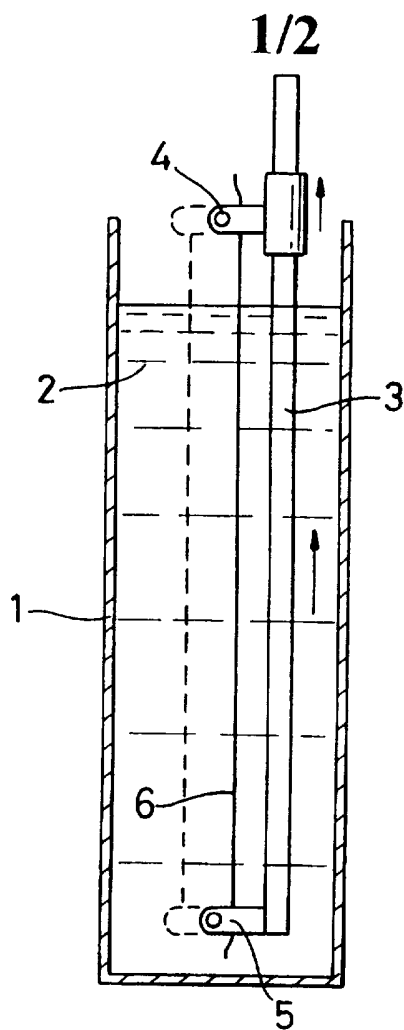


Fig. 1

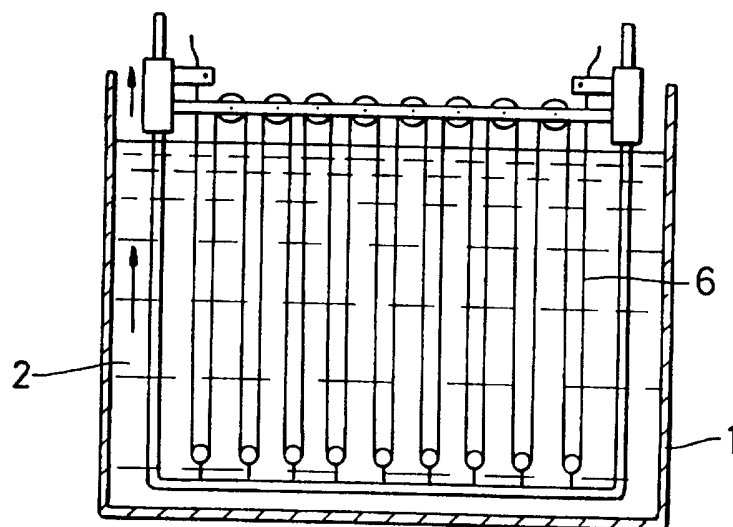


Fig. 2

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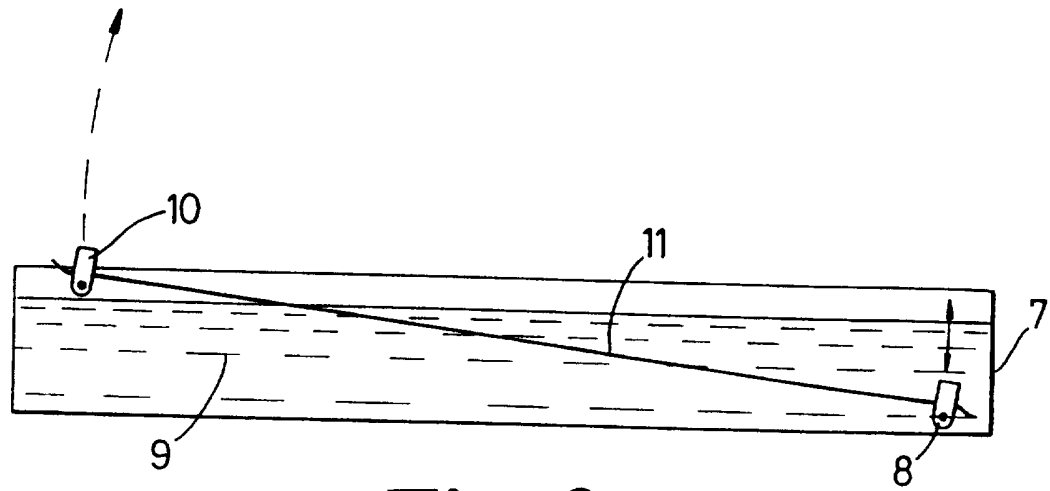


Fig. 3

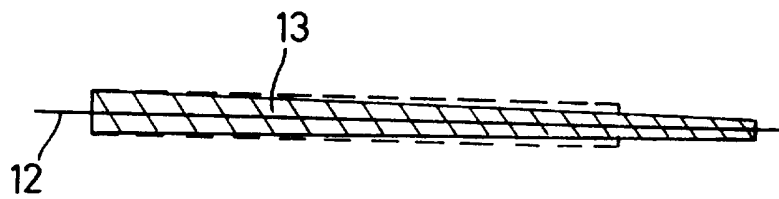


Fig. 4

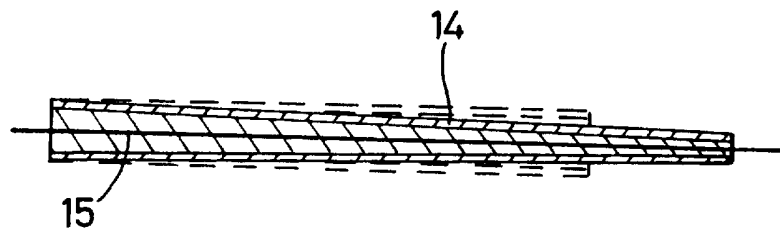


Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 97/00720

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A01K91/16 B29C35/04 B29C55/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A01K B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 92 21508 A (HR PLAST OY) 10 December 1992 see page 2, line 5 - line 14 see page 3, line 9 - page 4, line 27; figures	1
A	DE 11 61 004 B (TESTA INTERNATIONALE GESELLSCHAFT FÜR SCHÄDLINGSBEKÄMPFUNG M.B.H.) 9 January 1964 see the whole document	1
A	US 2 817 221 A (NEWTON PERHAM) 24 December 1957 see column 2, line 37 - column 3, line 20; figures	1
	- / - -	

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Date of the actual completion of the international search

4 July 1997

Date of mailing of the international search report

16.07.97

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INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/GB 97/00720

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 283 891 A (ENTACO LTD) 24 May 1995 see page 7, last paragraph - page 9, paragraph 3; figures -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 97/00720

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