



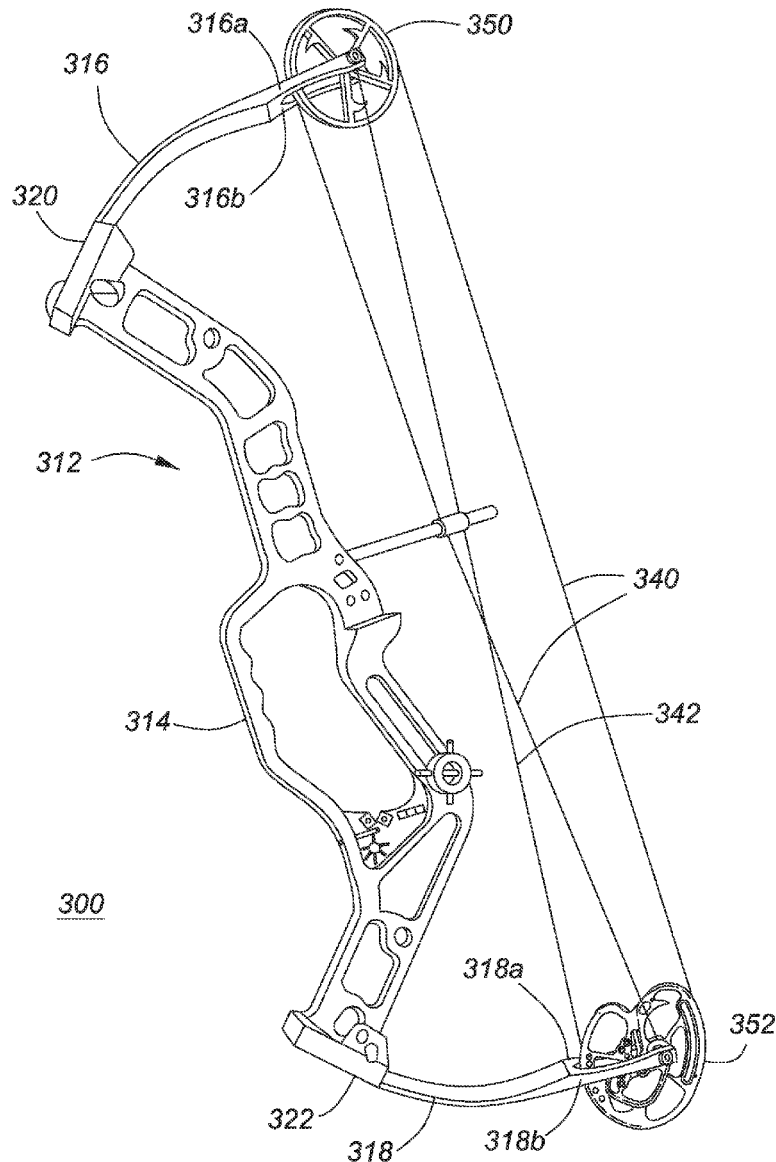
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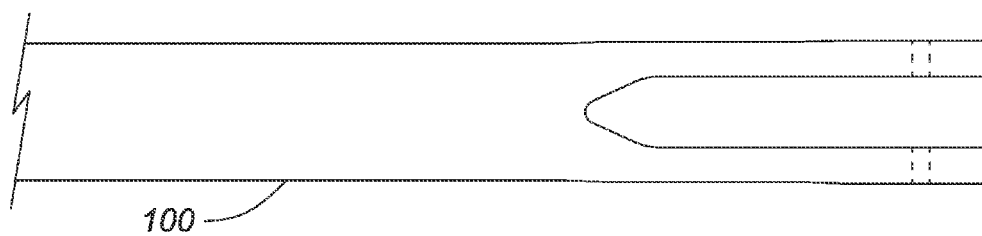
(19) **United States**(12) **Patent Application Publication**
Achkar(10) **Pub. No.: US 2017/0122694 A1**(43) **Pub. Date: May 4, 2017**(54) **ARCHERY BOW WITH TWIN FLEX LIMB**(52) **U.S. Cl.**(71) Applicant: **Nibal Achkar**, Biggar (CA)CPC **F41B 5/1403** (2013.01); **F41B 5/10**
(2013.01)(72) Inventor: **Nibal Achkar**, Biggar (CA)(21) Appl. No.: **14/928,172**

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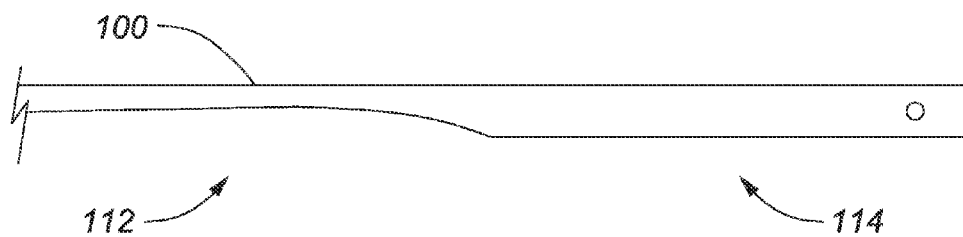
ABSTRACT(22) Filed: **Oct. 30, 2015****Publication Classification**(51) **Int. Cl.****F41B 5/14** (2006.01)
F41B 5/10 (2006.01)

An archery bow twin flex limb having a unitary or one-piece portion and a forked portion. The unitary and forked portions consist of two flexing sections separated by a transition section. The twin flex limb may be used for compound bow or compound crossbow having a single cam or dual cams.

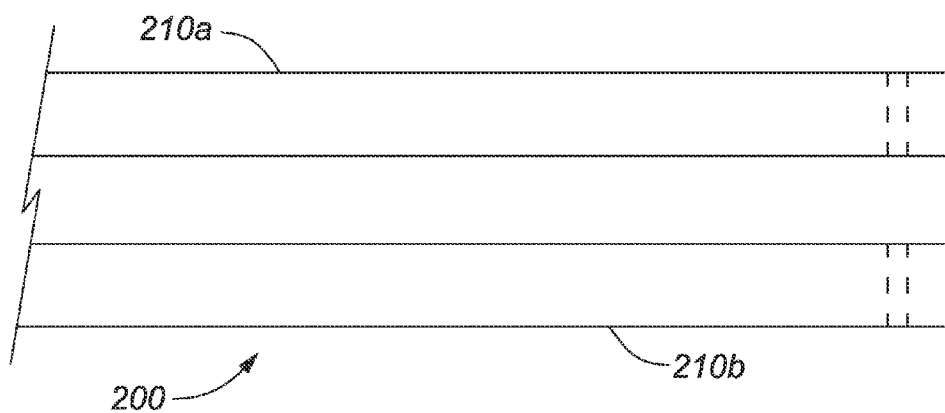




PRIOR ART
FIG. 1A

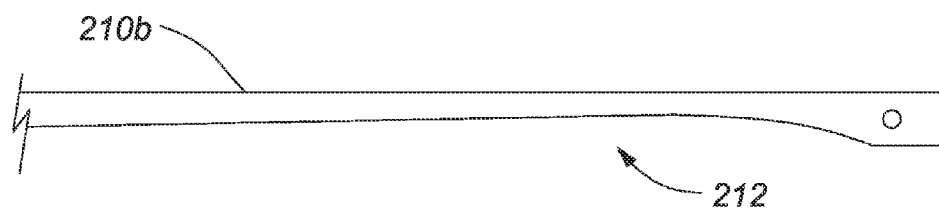


PRIOR ART
FIG. 1B



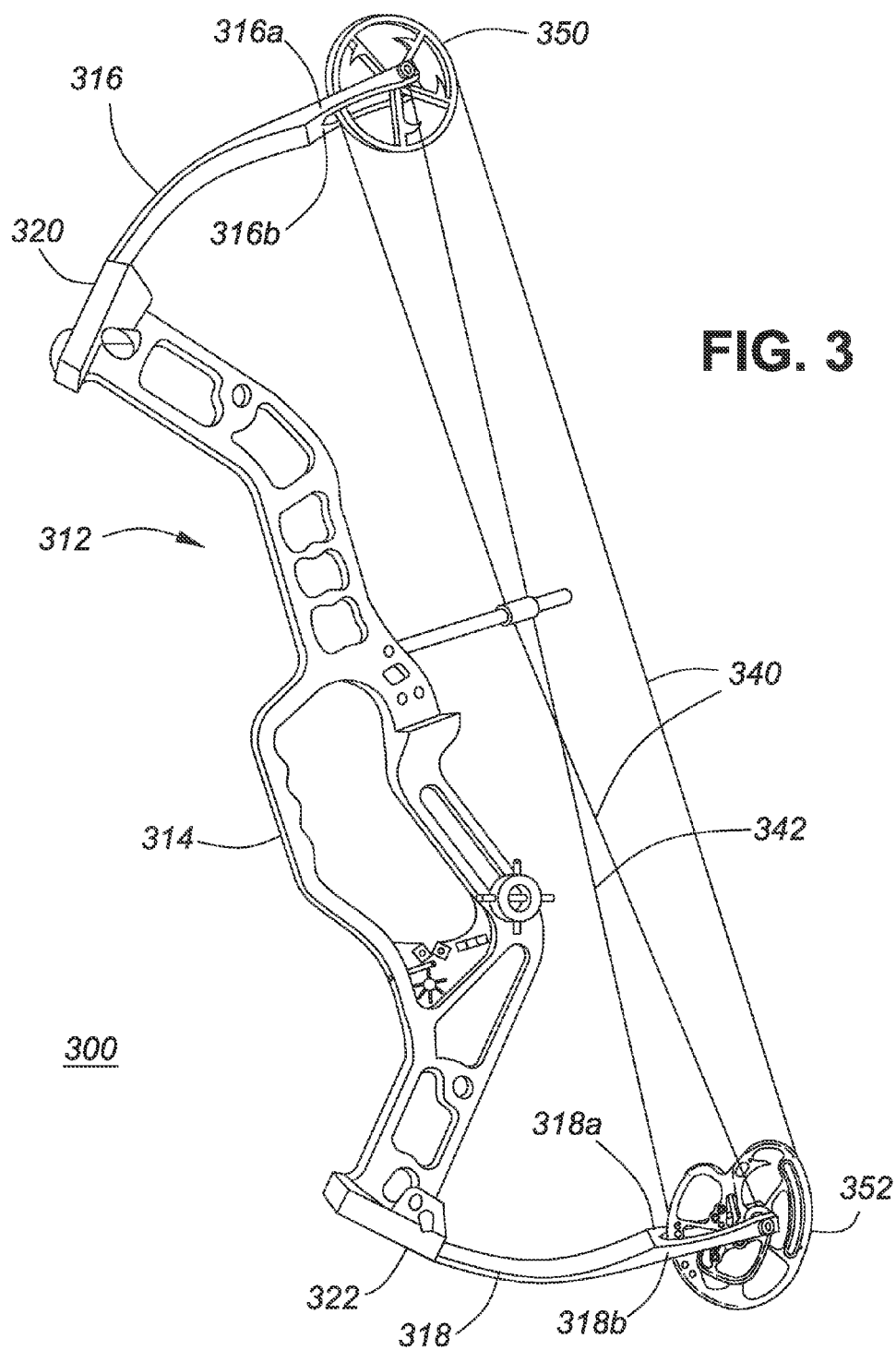
PRIOR ART

FIG. 2A



PRIOR ART

FIG. 2B



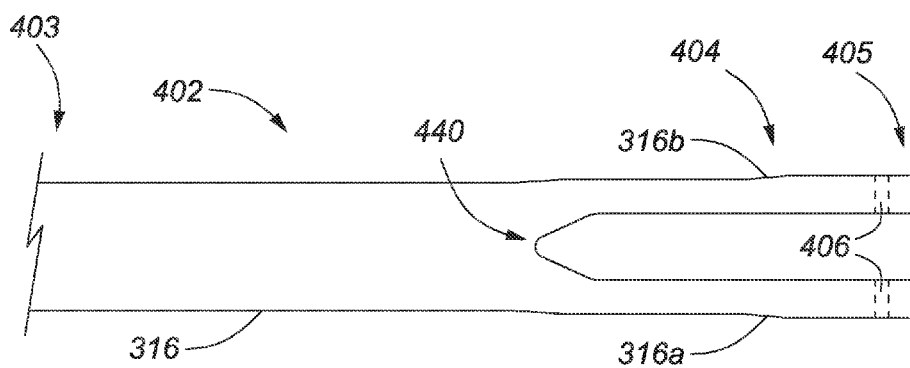


FIG. 4A

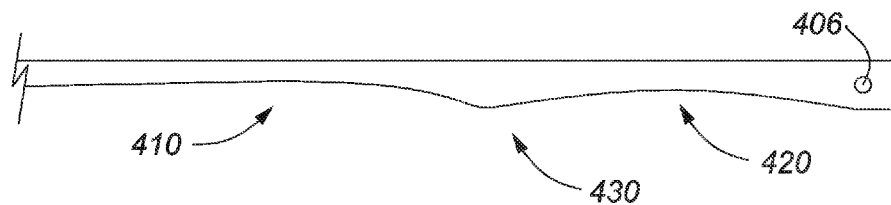


FIG. 4B

FIG. 5

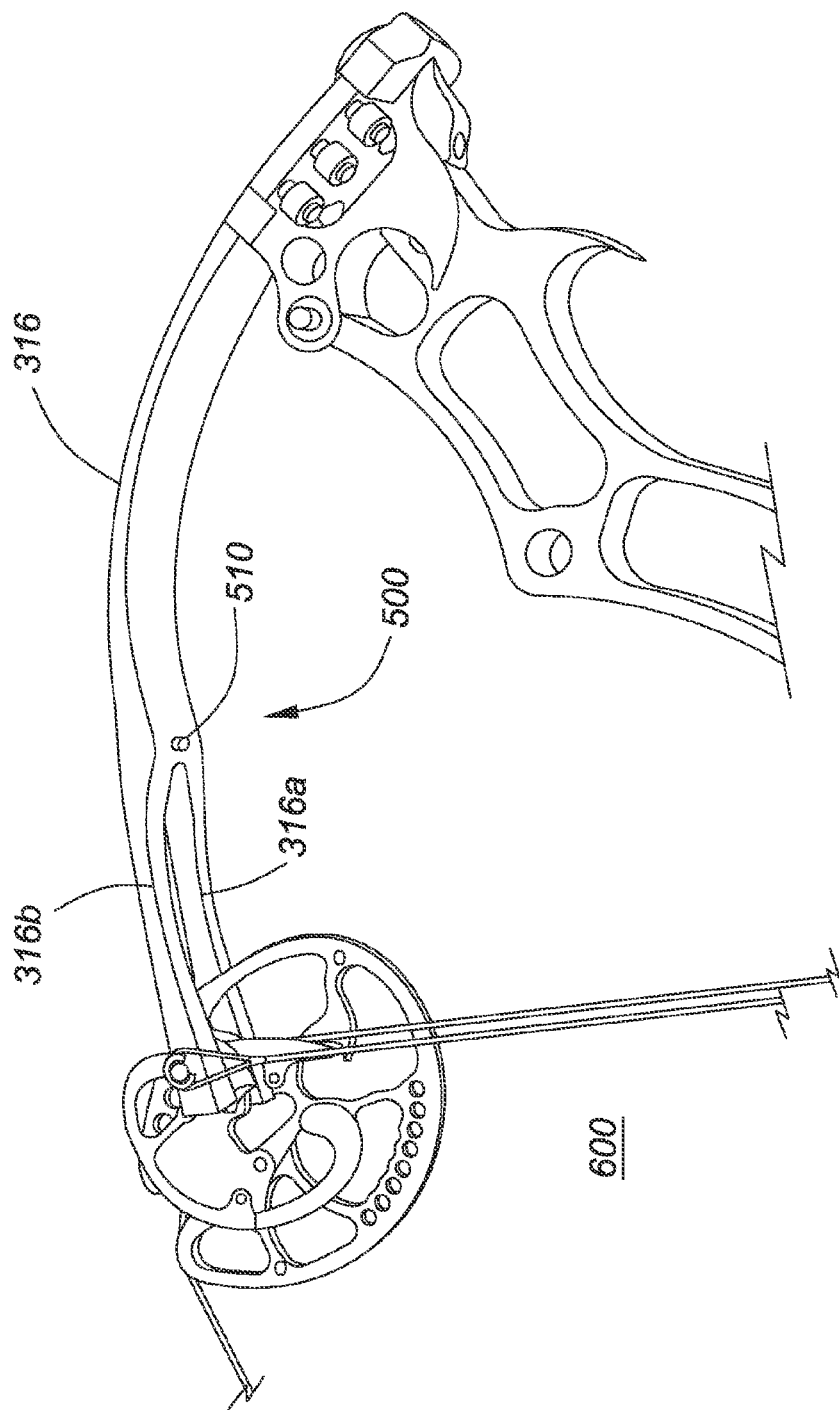


FIG. 6

ARCHERY BOW WITH TWIN FLEX LIMB

FIELD OF THE INVENTION

[0001] The invention relates to archery bows, and specifically to archery bow limbs.

BACKGROUND

[0002] An archery bow typically consists of a rigid center riser having a handle grip and a pair of flexible limbs extending from the opposing end portions of the riser. The limbs may be produced as a one piece or solid limb which has a forked end to support the cam or wheel of the bow. The solid limb is simple, has a slim design, and is easy to attach to the riser. The solid limb is less affected by tensional twisting during use due to its solid construction. A solid limb bow may be heavier, however, and may have a shorter life span due to stress on the limb. Most solid limbs tend to flex from the limb attachment point at the riser towards the forked end containing the cam or wheel. The forked end may be reinforced or stiffened in order to be rigid enough to contain the cam or wheel.

[0003] Other bow limbs have a two piece or split limb design. For each of the upper and lower limb, two limbs or pieces are mounted to the riser and extend to support the cam or wheel of the bow. A split limb bow typically is quieter than the solid limb bow and weighs less. The split limb bow also typically has a longer flexing or working section than a solid limb bow and thus has a higher level of stored energy and efficiency. A split limb bow is typically wider, however, and requires each piece of the limb to be attached to the riser. A split limb also may be affected by tensional forces due to the lean of the cam as the bow is being drawn to full weight. To compensate, one piece of the two piece limb may have a different size or thickness.

SUMMARY

[0004] According to an embodiment of the present disclosure, there is provided a limb for a compound archery bow. The limb includes an elongate member with a proximal end configured to engage a riser of the archery bow and a distal end configured to support a rotatable assembly. The elongate member has a first flexing section adjacent the proximal end, and a second flexing section adjacent the distal end. The second flexing section has first and second arms configured to support the rotatable assembly. The first flexing section and the second flexing section are configured to flex as the bow is drawn. The elongate member includes a transition section disposed between the first flexing section and a second flexing section. The transition section is primarily non-flexing. In some embodiments, the transition section does not flex as a bowstring of the bow is drawn.

[0005] In one embodiment there is provided an archery bow. The archery bow includes a riser; an upper limb and a lower limb. Each of the upper limb and lower limb includes an elongate member with a proximal end configured to engage the riser of the archery bow and a distal end configured to support a rotatable assembly. The elongate member has a first flexing section adjacent the proximal end, and a second flexing section adjacent the distal end, with the second flexing section having first and second arms configured to support the rotatable assembly. The first flexing section and the second flexing section are configured to flex as the bow is drawn. The elongate member includes a

transition section disposed between the first flexing section and a second flexing section. The bow includes a bow string routed between the upper limb and the lower limb; and at least one power cable routed between the upper limb and the lower limb. The transition section is primarily non-flexing, and in some embodiments, the transition section does not flex as a bowstring is drawn.

[0006] In the following description, similar features have been given similar reference numerals. Directional references employed in the specification or claims, such as upper, lower, top, bottom, left, right, clockwise, counter-clockwise, first half, second half, and the like are employed for ease of description and are not intended to limit the scope of the invention in any respect. It will be readily apparent that an archery apparatus according to the present disclosure may be oriented in any direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following detailed description when read in connection with the accompanying drawings describes embodiments of the invention. The various features of the drawings are not necessarily to scale.

[0008] FIGS. 1A and 1B are top and side views of a portion of a solid limb known in the prior art;

[0009] FIGS. 2A and 2B are top and side views of a portion of a split limb known in the prior art;

[0010] FIG. 3 is a perspective view of a bow with twin flex limbs according to one embodiment of the present disclosure;

[0011] FIGS. 4A and 4B are top and side views of a portion of a twin flex limb according to one embodiment of the present disclosure;

[0012] FIG. 5 is a side view of an upper portion of a bow according to one embodiment of the present disclosure; and

[0013] FIG. 6 is a back perspective view of an upper portion of a bow according to one embodiment of the present disclosure.

[0014] While the invention will be described in conjunction with the illustrated embodiments, it will be understood that it is not intended to limit the invention to such embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the scope of the invention as defined by this specification as a whole, including the appended claims.

DETAILED DESCRIPTION

[0015] An archery bow typically consists of a rigid center riser having a handle grip and a pair of flexible limbs extending from the opposing end portions of the riser. The limbs may be produced as a one piece or solid limb with a forked end to support the cam or wheel of the bow. FIGS. 1A and 1B illustrate top and side views of a portion of a traditional solid or one piece limb **100** which is known in the prior art. The limb **100** tends to flex from the limb attachment point at the riser (not shown) towards the forked end which contains the cam or wheel (not shown). The one piece limb **100** has a flexible or flexing section **112** in the unitary portion of the limb **100** and a rigid or non-flexing section **114** in the forked portion of the limb **100**, as indicated in FIG. 1B. The flexing section **112** works or flexes to store potential energy as the bow is drawn. The rigid section **114** has larger

dimensions than the flexing section 112 in order to be reinforced or stiffened and rigid enough to contain the cam or wheel.

[0016] FIGS. 2A and 2B illustrate top and side views of a portion of a traditional split or two piece limb 200. The limb 200 consists of two individual limbs 210a and 210b. A proximal end of each limb attaches to the riser (not shown). Distal ends of the limb 210a, 210b are configured to contain the cam or wheel (not shown). The split limb typically has a longer flexing section 212 when compared to the flexing section 112 of the solid limb 100. The flexing section 212 is indicated in the side view of FIG. 2B for one of the limbs 210a; the second limb 210b has a similar flexing section. The flexing section 212 generally has smaller dimensions than the proximal or distal ends of the limb 210a which are configured to engage the riser or to support a cam or wheel.

[0017] FIG. 3 illustrates a single cam archery bow 300 according to one embodiment of the present disclosure. The bow 300 has a rigid riser 312 with a carrying handle 314. Upper and lower twin flex limbs 316, 318 extend from opposing ends of the riser 312 from respective riser attachments 320 and 322. The twin flex limbs 318, 318 may be substantially parallel to each other or disposed at a diverging angle, depending on the desired features of the bow. Each limb 316, 318 is an elongate member which terminates in a spaced forked portion with arms 316a, 316b and arms 318a, 318b respectively. The limbs 316, 318 and arms 316a, 316b and 318a, 318b are configured at their distal ends or tips to support a rotatable assembly which engages a bowstring 340 and a power cable 342. The rotatable assembly may be a wheel 350 as shown in FIG. 3. The wheel 350 is mounted to the upper limb 316 at the top of the bow 300 and may be journaled on an axle for free rotation in either direction. The axle spans the arms 316a, 316b. The rotatable assembly may be a cam, such as the cam 352 which is mounted to lower limb 318. The cam 352 is mounted on an axle which spans the arms 318a, 318b. The bow string 340 and power cable 342 are strung between the wheel 350 and cam 352 in a known manner. The apparatus shown in FIG. 3 illustrates a single ear archery bow 300 but it will be understood by those skilled in the art that the twin flex limbs 316, 318 described herein may be used in any other type of compound bow, including but not limited to, a dual cam bow, a cam and a half bow, a binary cam bow or a compound cross bow.

[0018] FIGS. 4A and 4B illustrate a portion of the upper twin flex limb 316 in further detail. FIGS. 4A and 4B and the detailed description herein refer to the upper twin flex limb 316 but it will be appreciated that the lower twin flex limb 318 includes similar or complementary features. The portion of the limb 316 which attaches to the riser 312 and riser attachment 320 is omitted in FIGS. 4A and 4B but the limb 316 connects with the riser 312 in a manner similar to the attachment of a solid or one piece limb. The limb 316 consists of a one piece or unitary portion 402 adjacent to the riser attachment at the proximal end 403 and a forked portion 404 which includes the arms 316a, 316b at a distal end 405. The forked portion 404 is configured to support a rotatable assembly such as the wheel 350 or cam 352 (not shown in FIGS. 4A and 4B). In one embodiment, an opening 406 is defined in the distal end 405 of each of the arms 316a, 316b for supporting an axle and the rotatable assembly.

[0019] The limb 316 also consists of a first working or flexing section 410 located in the unitary portion 402 and a second working or flexing section 420 located in the forked

portion 404. The first and second flexing sections 410, 420 are separated by a transition section 430 which is located partly in the unitary portion 402 and partly in the forked portion 404. While the first and second flexing sections 410, 420 are configured to flex and store energy, the transition section 430 is non-flexing or primarily non-flexing or rigid in order to resist flexing or bending when the bow is drawn. As described herein, a flexing section or area refers to a portion of the limb which is able to flex and store energy. The stored energy is transferred to the arrow or projectile (not shown) when the bowstring 340 is released.

[0020] During use as the bowstring 340 is drawn, each of the limbs 316, 318 is drawn inwards or towards each other and both first and second flexing sections 410, 420 of each limb 316, 318 flex or bend to store potential energy in the bow 300. The flex of the limb 316 during use is further illustrated in the side view of FIG. 5. In contrast to a traditional solid limb bow, the arms 316a, 316b of the limb 316 in the second flexing section 420 will also flex as draw is applied. In some embodiments, the flex required by the unitary portion 402 of the limb 316, 318 is reduced since the forked portion 404 also flexes.

[0021] With the combination of the first flexing section 410 and second flexing section 420, each of the limbs 316, 318 has a longer flexing or working area relative to the working or flexing area of a traditional one piece or two piece limb. This twin flex arrangement of limbs 316, 318 may offer improved efficiency of the bow 300 over a traditional bow with one piece or solid limbs. The separation of the flexing sections 410, 420 by the transition section 430 divides the total stress on the limb 316 into two components. Thus, with the transition section 430, concentrated stresses may be reduced and the life of the limbs 316, 318 also may increase as a result.

[0022] FIG. 4A illustrates a top view of the limb 316 and shows that the limb 316 defines a base 440 in the transition section 430 from which the arms 316a, 316b and the forked portion 404 extend. The base 440 may be a rounded v-shaped or a generally u-shaped portion. Similar to a one piece bow, the arms 316a and 316b may flare slightly outward from unitary portion 402 of the limb 316. In one embodiment, the unitary portion of the limb 316 and the first flexing section 410 may be approximately 0.9 to 2.5 inches wide and the width of the limb 316 at the distal end 405, between the outer edges of the arms 316a, 316b, may be approximately 1.25 to 2.5 inches wide. In one embodiment, the first flexing section is approximately 1.25 inches wide and the width of the limb 316 at the distal end 405, between the outer edges of the arms 316a, 316b, is approximately 1.5 inches wide. Thus, the width of the arms 316a, 316b at the distal end 405 of the twin flex limb 316 is generally less than the width of the spaced-apart limbs of a two piece bow which may be up to 3 inches wide. The width of the transition section 430 also may vary and range in width from approximately 0.9 to 2.5 inches. In one embodiment, the width of the transition section 430 is 1.25 inches.

[0023] The width of each of the arms 316a, 316b may vary within the forked portion 404. The arms 316a, 316b may be tapered or flared gradually between the different widths. In one embodiment, a first section of each arm 316a, 316b adjacent the base 440 may be approximately 0.25 to 1.0 inches wide and a second section of each arm 316a, 316b adjacent the distal end 405 may be approximately 0.25 to 1.0 inches wide. In one embodiment, the first section of each

arm **316a**, **316b** is approximately 0.35 inches wide and the second section of each arm **316a**, **316b** is approximately 0.4 inches wide.

[0024] As shown in the side view of FIG. 4B, the height or thickness of the limb **316** varies through the unitary portion **402** and forked portion **404**. The height of the limb **316** is smaller within at least a portion of each of the flexing sections **410**, **420** as compared to the height of the transition section **430**. The height of the limb **316** also may be smaller within at least a portion of each of the flexing sections **410**, **420** as compared to the height of the limb **316** at the proximal and distal ends **403**, **405** adjacent the riser attachment and rotatable assembly, respectively. In one embodiment, the smallest height of at least a portion of the first flexing section **410** is approximately 0.15 to 0.5 inches. In one embodiment, the smallest height of at least a portion of the second flexing section **420** is approximately 0.15 to 0.5 inches. In one embodiment, the smallest height of the first flexing section **410** is approximately 0.25 inches and the smallest height of the second flexing section **420** is approximately 0.3 inches. In one embodiment, the height of the proximal end **403** of the limb, adjacent the riser attachment, is approximately 0.2 to 0.6 inches and the height of the distal end **405** of the limb, is approximately 0.3 to 0.6 inches. In one embodiment, the proximal end **403** has a height of 0.4 inches and the distal end **405** has a height of 0.5 inches. In one embodiment, the height of the transition section **430** is approximately 0.3 to 0.6 inches. In one embodiment, the height of the transition section **430** is approximately 0.5 inches.

[0025] In some embodiments, the width and height or thickness of each of the arms **316a**, **316b** is the same. In other embodiments, the width, height, or both width and height, of each of the arms **316a**, **316b** may be different and may be configured in order to further counteract torsional forces encountered by the limb **316** and arms **316a**, **316b** due to the lean of the cam **350**. Although the limb **316** with the one piece or unitary portion **402** may be less affected by such torsional forces, the precision of the bow **300** may be improved by the use of a different configuration for each of the arms **316a**, **316b**.

[0026] The limb **316** is typically approximately 10 to 16 inches long and in one embodiment is approximately 13.5 inches long. The transition section **430** may be located at different positions along the length of the limb **316** with corresponding changes in the lengths and proportions of the unitary portion **402**, the forked portion **404** and the first and second flexing sections **410**, **420**. In some embodiments, for example, each of the unitary portion **402** and forked portion **404** is approximately one half of the limb **316** with the transition section **430** being located approximately in the middle of the limb **316**. In other embodiments, the unitary portion **402** may be approximately two thirds of the length of the limb **316** and the forked portion **404** may comprise approximately one third of the length. A longer forked portion **404** may be provided to decrease the tip weight of the limb **316** and increase the performance of the bow **300** through the increased flexing section **420**. In contrast, for a traditional one piece or solid limb, the forked section is rigid and heavy and its length is typically kept to a size just long enough to accommodate the rotatable assembly.

[0027] Similarly, the length of the transition section **430** within the limb **316** may be varied with corresponding changes in the lengths and proportions of the first and second

flexing sections **410**, **420**. In some embodiments, the transition section **430** may be approximately 0.0625 to 1 inch long. In one embodiment, the transition section **430** is approximately 0.5 inches long. A shorter transition section **430** may enable larger first and second flexing sections **410**, **420** while trading off the strength and life of the limb **316**. A longer transition section **430** increases the strength of the limb **316** but reduces the overall flexing or working area in the first and second flexing sections **410**, **420**.

[0028] As illustrated in FIGS. 4A and 4B, the limb **316** may be tapered between the changes in height and/or width between the proximal end **403**, the transition section **430** and the distal end **405**. Within each of the flexing sections **410**, **420**, the portion or length of each section with the smallest height may be varied and the tapering between the flexing sections **410**, **420** and the transition section **430** also may be varied. As a result, each of the first flexing section **410** and second flexing section **420** may be configured independently with different heights and/or widths to tailor the flex and performance of the limb **316**. Similarly, the configuration of the length, width and height of the transition section **430**, along with the position of the transition section **430** within the limb **318**, may be varied to change the action of the two flexing sections **410**, **420**. It will be appreciated that the tapering of each portion of the limb **316** and changes in height or thickness in many embodiments is achieved by changes on the inner portion of the limb **316** and limb **318** as shown in FIGS. 3 and 4.

[0029] FIG. 5 illustrates a side view of an upper portion of the bow **300** with the limb **316** under flex. As described above, as the bowstring **340** is drawn, the first and second flexing sections **410**, **420** of the limb **316** flex or bend to store potential energy in the bow **300**. The transition section **430** remains rigid or primarily rigid and does not flex. As described above, the transition section **430** divides the total stress on the limb **316** into two components to reduce the concentration of stresses on the limb.

[0030] In one embodiment, as illustrated in FIG. 5 and also in FIG. 6, the transition section **430** includes a reinforcement mechanism **500**. The reinforcement mechanism **500** increases the strength of the transition section **430** and helps to prevent the splitting of the limb **316**, **318**. In one embodiment, the reinforcement mechanism **500** comprises a bore defined in the transition section **430** which may be threaded or configured to receive a mechanical member such as a screw, bolt, nut, pin or the like. A sample reinforcement mechanism **500** and bolt **510** are shown in FIGS. 5 and 6. FIG. 6 also illustrates the upper portion of a dual cam bow **600**.

[0031] Each of the limbs **316**, **318** may be constructed according to known methods such as lamination, compression molding or machine milling. Each of the limbs **316**, **318** may be constructed from known materials including, but not limited to, fiberglass, carbon, wood, compression molded composites or laminate materials. The first and second flexing sections **410**, **420** and the transition section **430** are thus comprised of the same material but with the configurations described above, are able to provide separate and an overall longer flexing sections or areas within the limbs **316**, **318**.

[0032] While this invention has been described in conjunction with specific embodiments thereof, it is evident that the invention is not limited to these specific embodiments. Rather, numerous alternatives, modifications and variations

will be apparent to those skilled in the art in light of the foregoing description, as well as the present specification as a whole including the claims. Accordingly, the purpose and intention of the inventors is to embrace and include all reasonably foreseeable alternatives, modifications and variations as fall within the broad scope of the invention as described and claimed herein.

1. A limb for a compound archery bow comprising:
 - a single elongate member, the single member having with a proximal end configured to engage a riser of the archery bow and a distal end configured to support a rotatable assembly;
 - said single elongate member having a unitary portion which extends from the proximal end and divides into a forked portion adjacent the distal end, the forked portion having first and second arms configured at the distal end to support the rotatable assembly;
 - wherein only the proximal end of the elongate member is configured to engage the riser, and
 - wherein, between the proximal end and the distal end said single elongate member does not engage the riser and is divided into three sections,
 - a first flexing section adjacent the proximal end,
 - a second flexing section adjacent the distal end, the first flexing section and the second flexing section each being configured to flex as the bow is drawn; and
 - a transition section disposed between the first flexing section and the second flexing section, the transition section being primarily non-flexing.
2. The limb of claim 1 wherein each of the first flexing section and the second flexing sections is configured to flex independently.
3. The limb of claim 1 wherein each of the first flexing section and the second flexing sections is longer than the transition section.
4. The limb of claim 1 wherein the transition section includes a base of the forked portion for the first and second arms of the second flexing section and wherein the transition section further comprises a mechanical reinforcement in the unitary portion of the single elongate member adjacent the base.
5. The limb of claim 4 wherein the mechanical reinforcement comprises a bore defined in the transition section and a corresponding mechanical member received within the bore.
6. The limb of claim 1 wherein each of the first flexing section and the second flexing sections has at least a portion with a height smaller than a height of the transition section.
7. The limb of claim 6 wherein the height of the transition section is 0.3 to 0.6 inches, the height of the portion of the first flexing section is 0.15 to 0.5 inches, and the height of the portion of the second flexing section is 0.15 to 0.5 inches.
8. The limb of claim 7 wherein the height of the transition section is 0.5 inches, the height of the portion of the first flexing section is 0.25 inches, and the height of the portion of the second flexing section is 0.3 inches.
9. The limb of claim 7 wherein the proximal end of the limb has a height of 0.2 to 0.6 inches and the distal end of the limb has a height of 0.3 to 0.6 inches.
10. The limb of claim 9 wherein the height of the proximal end of the limb is 0.4 inches and wherein the height of the distal end of the limb is 0.5 inches.
11. (canceled)
12. (canceled)

13. The limb of claim 1 wherein the transition section has a length of 0.0625 to 1 inch.

14. The limb of claim 13 wherein the length of the transition section is 0.5 inches.

15. The limb of claim 1 wherein the rotatable assembly comprises an archery bow cam or an archery bow wheel.

16. The limb of claim 1 wherein the first and second arms are configured independently and have different dimensions.

17. A compound archery bow comprising

a riser;

an upper limb and a lower limb, each of the upper limb and lower limb comprising

a single elongate member, the single member having a proximal end configured to engage the riser and a distal end configured to support a rotatable assembly; said single elongate member having a unitary portion which extends from the proximal end and divides into a forked portion adjacent the distal end, the forked portion having first and second arms configured at the distal end to support the rotatable assembly,

wherein only the proximal end of the elongate member is configured to engage the riser, and

wherein, between the proximal end and the distal end said single elongate member does not engage the riser and is divided into three sections,

a first flexing section adjacent the proximal end, and a second flexing section adjacent the distal end, the first flexing section and the second flexing section each being configured to flex as the bow is drawn; and

a transition section disposed between the first flexing section and the second flexing section, the transition section being primarily non-flexing;

a bow string routed between the upper limb and the lower limb; and

at least one power cable routed between the upper limb and the lower limb.

18. The compound archery bow of claim 17 wherein the rotatable assembly comprises a cam or wheel.

19. The compound archery bow of claim 17 wherein each of the first flexing section and the second flexing sections of the single elongate member is configured to flex independently.

20. The compound archery bow of claim 17 wherein each of the first flexing section and the second flexing sections of the single elongate member has at least a portion with a height smaller than a height of the transition section.

21. (canceled)

22. (canceled)

23. A limb for a compound archery bow comprising:

a single elongate member with a proximal end configured to engage a riser of the archery bow and a distal end configured to support a rotatable assembly;

said single elongate member having a unitary portion adjacent the proximal end and which unitary portion extends from the proximal end and divides into a forked portion adjacent the distal end, the forked portion having first and second arms configured to support the rotatable assembly;

wherein between the proximal end and the distal end, said single elongate member is freestanding, does not engage the riser, and is divided into three sections, a first flexing section in the unitary portion,

a second flexing section in the forked portion, the first flexing section and the second flexing section each being configured to flex as the bow is drawn; and a transition section disposed between the first flexing section and the second flexing section, the transition section being primarily non-flexing and the transition section comprising a base of the forked portion for the first and second arms.

* * * * *