Oct. 16, 1928. 1,688,178

C. B. DREVITSON

TUBING

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Fig. 5.

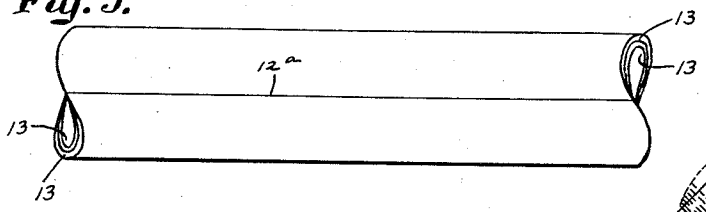
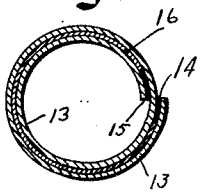


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



Inventor
Carl B. Drevitson
by Wright Brown Quinby & May
Attys.

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CARL B. DREVITSON, OF SOMERVILLE, MASSACHUSETTS.

TUBING.

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This invention relates particularly to tubing of relatively small diameter and of light weight, made from thin sheet metal and suitable for use in the manufacture of aeroplanes in which tubing is incorporated in the framing, and golf clubs in which tubing is employed in the shafts or sticks to which the club heads are attached.

The primary object of the invention is to provide a laminated tube composed of two or more layers formed from a single oblong blank of thin sheet metal, and constituting a tube wall, the cross section of which is practically continuous, in that the continuity of the metal is not interrupted by a butted and welded seam such as is essential in a tube, the wall of which is not laminated, and is composed of a single thickness, the tube being adapted to withstand severe shocks and strains, and having sufficient flexibility and resistance to enable it to be reasonably flexed and to assume its predetermined form after flexure, without liability of permanent deformation, the thickness of the tube wall being determined by the thickness of the sheet material and the number of layers, and the length of the tube being equal to the length of the blank, the shorter edges of the blank forming the opposite ends of the tube.

A laminated golf-club shaft embodying the invention, the layers of which are of sheet steel, has practically the same whipping qualities as wood, and is at the same time free from liability to be twisted by torsional strain, a liability that is inherent in wood.

A laminated frame member embodying the invention, the layers of which are of sheet steel, is more resilient and flexible than a non-laminated tube, the wall of which is composed of a single thickness of metal, and is at the same time stronger and less liable to break. Such frame members may also be of lighter weight than a single layer member.

Of the accompanying drawings forming a part of this specification,—

Figure 1 shows in side elevation a tube embodying the invention, constituting the shaft of a golf club, portions of the club being shown by dotted lines.

Figure 2 shows the oblong sheet metal strip from which the tube shown by Figure 1 may be made.

Figure 3 shows in perspective and on a larger scale, a portion of the tube shown by Figure 1.

Figure 4 is a cross section of the tube, showing a layer of fibrous material interposed between metal layers of the tube, for a purpose hereinafter stated.

Figure 5 shows in side elevation, a portion of a tube embodying the invention, adapted for use as an aeroplane frame member.

The same reference characters indicate the same parts in all of the figures.

A tube embodying the invention is composed of a scroll formed from a single oblong blank or piece 12 of thin sheet metal, into a plurality of convolutions 13, and means positively connecting convolutions of the scroll to maintain it in tubular form. The sheet metal is preferably steel, and the connecting means is a metallic bonding material interposed between and uniting proximate surfaces of the convolutions, to render permanent the tubular form imparted by the scrolling operation.

I apply the metallic bonding material to limited portions of the proximate surfaces, leaving other portions of said surfaces disconnected from each other, so that the tube is more flexible than would be the case if the bonding material were coextensive with the proximate surfaces. This is particularly desirable in golf-club shafts.

In Figures 3 and 4, 14 designates a relatively narrow longitudinally extending metallic bond, uniting the inner surface of the outer edge portion of the scrolled blank with the outer surface of the convolution overlapped thereby, and 15 designates a similar metallic bond, uniting the outer surface of the inner edge portion of the scrolled blank with the inner surface of the convolution underlapped thereby. The arrangement is such that the intervening portions of the convolutions are unconnected or free from positive connection with each other. The bonds 14 and 15 and the sheet metal portions united thereby, form outer and inner lap joints, extending from end to end of the tube.

The bonds 14 and 15 may be provided by applying any suitable fusible metal or alloy to the areas 14^a and 15^a, indicated by Figure 2 on the blank 12.

After the blank is scrolled, it may be heated to fuse the bonding material, and then confined until the bonding material is solidified by cooling.

In some cases the inner bond 15 may be omitted, the outer bond 14 being sufficient

to maintain the tubular form imparted by the scrolling operation. When only the outer bond 14 is employed, this bond may be provided by applying a suitable flux to the strip area 14a then applying fused bonding material to the fluxed area and pressing it against the overlapped convolution.

Figure 4 shows a layer 16 of fibrous material, such as paper, interposed between the proximate surfaces of the unconnected portions of the convolutions 13. In Figure 3 this layer is omitted.

The employment of scrolled sheet metal and metallic bonding material in many cases renders it unnecessary to harden or temper the formed tubing, thus preventing the liability of weakness due to improper tempering.

The sheet metal employed is preferably a semi-hard sheet steel and the scrolling operation is preferably performed by wrapping the blank around a mandrel. By making a laminated tube as described, I obtain several advantages over a non-laminated tube composed of a single thickness and having a butted and welded seam. I am thereby enabled to use thin sheet steel, say .003" thick, and roll or scroll it until a tube wall say .015" thick is formed. This wall has a practically continuous cross section and is much stronger and more flexible than a non-laminated wall of the same thickness, united by a joint between two abutting edges.

I find that the strength of the tubing is materially increased by imparting a spiral or helical form to the longitudinal edges 12a of the blank during the scrolling operation, so that the bonds, which are parallel with these edges, form helical seams or lap joints between proximate convolution surfaces, preferably extending once around the periphery of the tube from end to end thereof and surrounding the tube, as indicated by Figure 1. I thus distribute the strain on the seam or joint evenly around the tube. This distribution is particularly desirable in a golf-club shaft.

When the tube is tapered, as is customary in a golf-club shaft, the blank 12 is correspondingly tapered, as shown by Figure 2. A tube of uniform diameter, as indicated by Figure 5, is made from an oblong blank, the longitudinal edges of which are parallel with each other. The edges 12a and the bonds conforming thereto may, in this instance, be straight instead of helical.

I am not limited to a tube which is circular in cross section. The cross section may have a square, triangular, or other form, if desired.

The blank when made of sheet steel, is preferably provided with a coating of copper which can be easily soldered or fused. In each of the illustrated embodiments of the invention the length of the tube is equal to the length of the oblong blank, the shorter edges or ends of the blank forming the ends of the tube. The number of convolutions is therefore the same in any cross section of the tube

I claim:

1. A resilient tube comprising a scrolled oblong blank of thin resilient sheet metal, the length of which is substantially equal to the length of the tube, and metallic bonding material interposed between limited portions of the convolutions of the scroll to maintain the latter in tubular form, and leave other portions of the convolutions free from positive connection with each other, one longitudinal edge portion of the blank overlapping a portion of a convolution of the scroll and being united to the latter by the bonding material to form a longitudinal lap joint extending from end to end of the tube.

2. A resilient tube comprising a scrolled oblong blank of thin resilient sheet metal, the length of which is substantially equal to the length of the tube, and metallic bonding material interposed between limited portions of the convolutions of the scroll to maintain the latter in tubular form, and leave other portions of the convolutions free from positive connection with each other, one longitudinal edge portion of the blank overlapping a portion of a convolution of the scroll and being united to the latter by the bonding material to form a longitudinal lap joint extending from end to end of the tube, the longitudinal edges of the blank and the bonding material being helically arranged relative to the axis of the tube, so that the lap joint extends helically and surrounds the tube.

3. A resilient tube comprising a scrolled oblong blank of thin resilient sheet metal, the length of which is substantially equal to the length of the tube, and metallic bonding material interposed between limited portions of the convolutions of the scroll to maintain the latter in tubular form, and leave other portions of the convolutions free from positive connection with each other, one longitudinal edge portion of the blank overlapping a portion of a convolution of the scroll and being united to the latter by the bonding material to form a longitudinal lap joint extending from end to end of the tube, the blank being of decreasing width from one end to the other, so that the tube is tapered, the tapered tube being proportioned to serve as a golf club shaft.

4. A resilient tube comprising a scrolled oblong blank of thin resilient sheet metal, the length of which is substantially equal to the length of the tube, the outer longitudinal edge portion of the blank overlapping a limited portion of a convolution of the scroll, and a relatively narrow longitudinal metal-

lic bond uniting only the overlapping edge portion to said convolution portion, to form a lap joint extending from end to end of the tube, and leaving other portions of the convolutions free from positive connection with each other.

5. A resilient tube comprising a scrolled oblong blank of thin resilient sheet metal, the length of which is substantially equal to the length of the tube, the outer longitudinal edge portion of the blank overlapping a portion of a convolution of the scroll, and the inner edge portion of the blank underlapping another portion of a convolution, a relatively narrow metallic bond uniting the overlapping edge portion to the overlapped convolution, to form an external lap joint, and a relatively narrow metallic bond uniting the underlapping edge portion to the underlapped convolution, to form an internal lap joint, said joints extending from end to end of the tube, and being spaced apart, leaving the intervening portions of the convolutions free from positive connection with each other.

In testimony whereof I have affixed my signature.

CARL B. DREVITSON.