United States Patent

Guerster

[15] **3,670,773**

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[54] TUBE

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[73] Assignee: **Ametek, Inc.,** New York, N.Y.

[22] Filed: **March 26, 1970**

[21] Appl. No.: **22,973**

[52] **U.S. Cl.**.....**138/155,** 52/108, 138/157, 138/177, 138/178, 242/54

[51] **Int. Cl.**.....**F16l 9/22**

[58] **Field of Search**.....138/121, 122, 129, 130–136, 138/144, 150, 154, 155, 157, 177, 178, 140; 52/108, 731; 61/63, 10; 29/173; 16/191; 267/74; 248/188.8; 242/54 A, 197

[56] **References Cited**

UNITED STATES PATENTS

2,143,072	1/1939	Johnson	61/10
2,316,349	4/1943	McMinn	138/177
3,451,182	6/1969	Lodrick	52/108
3,466,879	9/1969	Justice	61/63
3,357,456	12/1967	Grawey et al.	138/133

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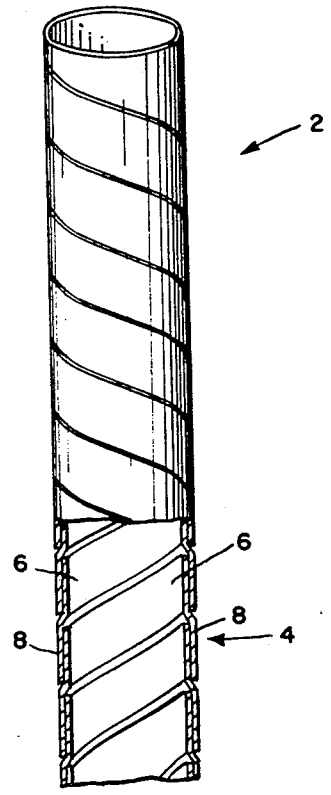
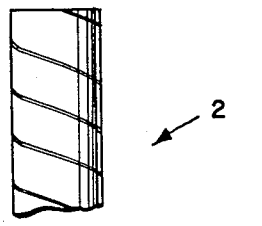
Attorney—Smith, Harding, Farley & Follmer

[57] **ABSTRACT**

A tube comprises a helical axially extending ribbon of spring material which has adjacent turns set to coil tightly in overlapping and telescoping engagement. The overlapped portion of the ribbon is offset inwardly to provide the tube with a constant outer diameter.

2 Claims, 5 Drawing Figures





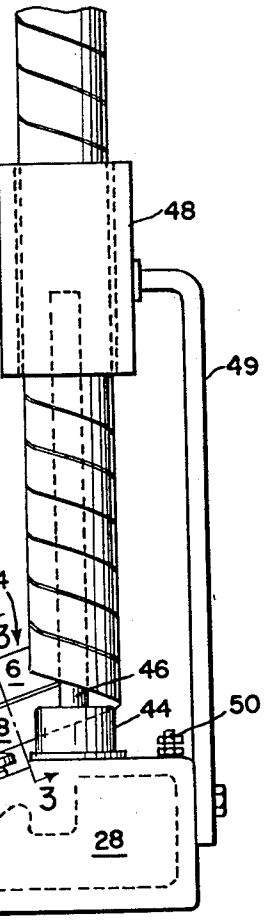


FIG. 1.

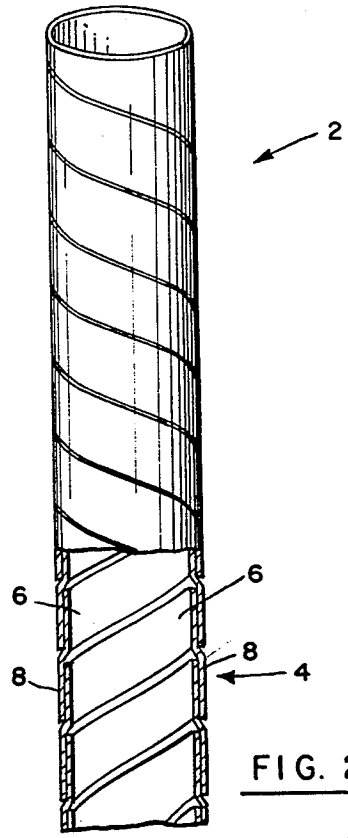


FIG. 2.

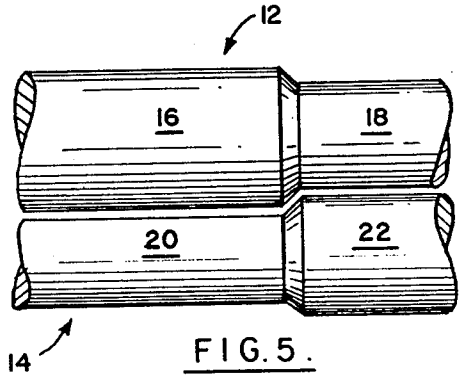


FIG. 5.

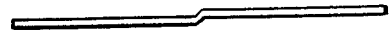


FIG. 3.

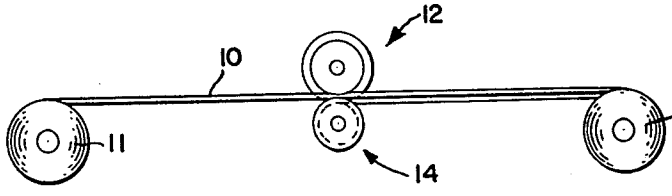


FIG. 4.

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TUBE

BACKGROUND OF THE INVENTION

The tube of this invention is an improvement on the tube disclosed in U.S. Pat. No. 3,467,329 issued Sept. 16, 1969 to C.M. Giltner. This patent discloses a helical axially extending ribbon of spring material having adjacent turns set to coil in tight over lapping and telescoping engagement. The repeated overlapping of the ribbon results in a progressive increase in the outer diameter of the tube from the upper end of the tube to the lower end of the tube. This results in a practical limit on the length of the tube. Further, it presents a problem when it is desired to closely guide, adjacent to the lower end, a stored tube as it extends due to the progressive increase in the diameter of the guided portion of the tube. These problems are solved by this invention. Further, the tube of the invention is advantageous in that it has an extremely high compressive load capability. In addition, the bending strength is substantially increased over that of the tube disclosed in U.S. Pat. No. 3,467,329.

SUMMARY OF THE INVENTION

The tube of the invention has a helical axially extending ribbon of spring material having adjacent turns set to coil in tight overlapping and telescoping engagement. The overlapped portion of the ribbon is offset inwardly from the remainder of the ribbon, advantageously, by an amount equal to the thickness of the ribbon.

It is preferred to use a ribbon of metal, advantageously, spring steel. However, for many purposes a plastic (synthetic resin) such as, for example, a resilient phenolic or polyester resin may be employed.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the tube in accordance with the invention in association with winding drum means;

FIG. 2 is an enlarged view of the tube of FIG. 1, partially broken away;

FIG. 3 is a section taken on the plane indicated by the line 3—3 in FIG. 1;

FIG. 4 is a schematic view showing the forming of the offset in the ribbon of spring material forming the tube of FIG. 1; and

FIG. 5 is a front elevational view, partially broken away, of suitable forming rolls for forming the offset portion in the ribbon of spring material forming the tube of FIG. 1.

PREFERRED EMBODIMENT

Referring to FIG. 2, a tube 2 in accordance with the invention has a ribbon 4 of spring material set to coil in tight overlapping and telescoping engagement. The tube is readily formed by employing the method of U.S. Pat. No. 3,007,239 issued on Nov. 7, 1961. In lieu of setting the ribbon to coil in a cylindrical coil, the ribbon is set with a helix angle so that the ribbon will naturally coil in a helical coil to form a tube in accordance with U.S. Pat. No. 3,467,329. For simplicity of manufacture, each increment of the ribbon may be set to the same radius although varying radii, such as increasing or decreasing radii, may be used so long as the adjacent coils are in tight contact. In this method of making the tube, the ribbon is formed to introduce residual compressive and tensile stresses which resist the straightening of the coils by first setting the ribbon of spring material to coil tightly on itself and then reverse bending the material to set each increment so that it still tends to coil tightly on itself in the same direction but on a radius larger than the radius of the initial set as disclosed in U.S. Pat. No. 3,007,329. These residual stresses markedly increase the stiffness and bending failure load capability of the tube which is also true of the tube disclosed in U.S. Pat. No. 3,467,329.

Tube 2 differs from the tube disclosed in U.S. Pat. No. 3,467,329 in having a portion 6 of ribbon 4 offset from the remaining portion 8 of ribbon 4. In the completed tube the direction of offset is inwardly, that is to say, towards the center of the tube. Advantageously, the amount of offset is equal to the thickness of the ribbon 4. Thus, for example, if the thickness of the ribbon 4 is 0.006 inches, the radius of the outer surface of portion 8 of ribbon 4 would be 0.006 inches greater than the radius of the outer surface of portion 6 of ribbon 4. Under these circumstances, the tube 2 has a constant diameter from one end to the other as will be evident from an inspection of FIG. 2. The division between portions 6 and 8 of ribbon 4 is selected so that the offset portion 6 will neatly accommodate the portion 8.

The offset portion 6 is readily formed, for example, by taking a helical axially extending ribbon of spring material having adjacent turns set to coil in tight overlapping and telescoping engagement which has been formed as described above and storing it on a drum. The ribbon is then run through stepped rolls either employing cold forming or hot forming and stored on a second drum. As illustrated in FIG. 4, such a ribbon 10 of spring material is run from a storage drum 11 and through opposed stepped rolls 12 and 14 to a storage drum 16. Typical stepped rolls are shown in greater detail in FIG. 5. As seen in FIG. 5, roll 12 has an enlarged portion 16 and a reduced portion 18 which are respectively opposed to a reduced portion 20 of roll 14 and an enlarged portion 22 of roll 14.

The tube 2 can be rolled up and stored in the same manner as are the tubes in U.S. Pat. No. 3,467,329. They may be either wound directly on a drum or backwound onto a drum. By way of one illustration, there is shown in FIG. 1, a drum 26 for winding up the ribbon 4. Drum 26 is mounted for rotation on a metal base 28 and is connected to a crank 30 which can be locked in position by a pin 32 which passes through an opening 34 in crank 30 and an opening 36 in base 28. A latch member 38 is biased towards an opening 40 in drum 26 by means of a spring 42 all as shown in greater detail in U.S. Pat. No. 3,467,329. A rotatable guide member 44 is provided at the base of a guide pin 46 which penetrates part way up into a fixed guide sleeve 48 mounted on base supported bracket 49.

A suitable terminal 50 is secured to base 28 for the connection of a lead when the tube is to be employed as an antenna.

OPERATION

Operating crank 30 is rotated to wind the ribbon 4 onto drum 26 until the upper end of the tube is retracted inside guide sleeve 48 at which point pin 32 is inserted to lock crank 30. On the removal of pin 32, the ribbon 4 unwinds from drum 26 and moves upwardly into its helical form to extend the tube 2 upwardly until latch 38 enters the opening 40 to stop the rotation of drum 26.

In use, the base 28 will be of metal and it will be mounted in or on an insulating receptacle (not shown) for an antenna application.

It will be appreciated that the tubes of the invention will have numerous other uses such as, for example, as structural support members.

It will be understood that the foregoing is by way of illustration and is not intended to be limiting.

I claim:

1. A self-erecting and collapsible tube comprising:
a helical axially extending ribbon of spring material having adjacent turns set to coil in tight overlapping and telescoping engagement,
the overlapped portion of said ribbon being offset inwardly from the remainder of the ribbon to reduce the variation in the outer diameter of the tube from one end of the tube to the other end of the tube and providing a substantially constant outer diameter, said tube being self-erecting and collapsible along its axis with extensive relative movement between turns.

2. A tube in accordance with claim 1 in which the material is steel.

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