

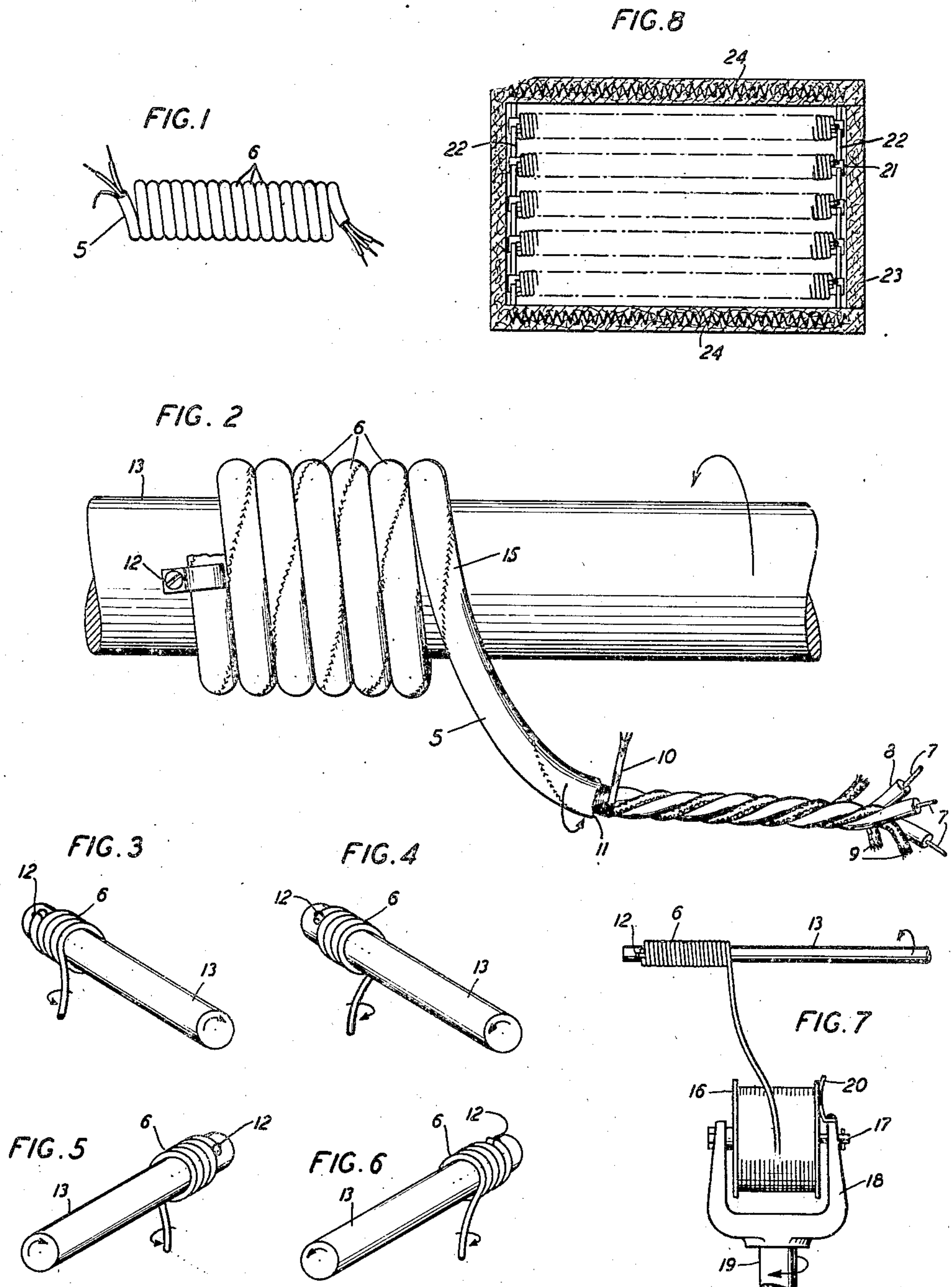
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RETRACTILE CORD

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RETRACTILE CORD

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1

This invention relates in general to retractile cords and more particularly to a rubber-covered retractile cord and its method of manufacture.

In the telephone field and in connection with various electrical appliances difficulty is often experienced due to the long length connecting cords becoming twisted and kinked and to overcome this difficulty retractile cords have been provided which normally are in a compact helical form but which may be extended by a slight tension and then return to the compact form when the tension is relieved. Various types of retractile cords having a textile braiding are satisfactory under normal conditions but when employed under severe humidity conditions such as occur, for example, in the tropics or when installed in laundries or similar places, it is highly desirable that the cord be provided with a rubber jacket to prevent the entrance of moisture. However, the use of such a jacket makes it difficult to provide a cord having the desired retractability and one which will maintain this characteristic during its useful life. It is therefore an object of the present invention to provide an efficient retractile cord and a method of manufacturing such a cord economically.

A further object is an efficient retractile cord which is provided with a jacket of rubber or similar material to prevent the entrance of moisture.

These and other objects of the invention are attained in accordance with the features of the invention by twisting the rubber jacketed conductor as it is wound in the form of a helix on a mandrel, the twist being applied in such a direction as to force the adjacent turns closely together. The mandrel with the helically wound cord clamped in position is then placed in an oven and subjected to a heat treatment which partially relieves the strains in the jacket and core to an amount such that the jacket retains its form in a closed helix when the clamps are removed but that certain torsional forces remain in the jacket and core to force the turns of the helix together.

The invention may be more clearly understood by reference to the accompanying drawing in which:

Fig. 1 discloses a retractile cord in its normal compact position;

Fig. 2 illustrates the method of winding the rubber-jacketed cordage on a mandrel to form a closed helix;

Figs. 3 to 6 disclose various methods of applying the winding;

Fig. 7 discloses one method of giving the cord-

2

age a predetermined twist as it is wound on the mandrel; and

Fig. 8 illustrates an oven in which the helically wound cord is subjected to heat treatment.

Referring to the drawing, a retractile cord is shown in which a length of cordage 5 is wound in the form of a closed helix and heat treated so that the individual turns 6, 6 are maintained normally in close relation to each other. The cordage 5 may be of standard construction and, as shown in detail in Fig. 2, comprises a plurality of conductors 7, 7, preferably tinsel, each insulated by a rubber covering or jacket 8 and twisted together to form a compact core. Textile filler threads 9, 9 are placed as shown in the interstices between the insulated conductors to give the core a circular shape and a serving 10 of textile threads maintains the conductors in position. Over this core is extruded a rubber composition which is vulcanized to provide the jacket 11 of flexible tough rubber or similar material. In forming the retractile cord of the invention as disclosed in Fig. 2, one end of a length of cordage 5 is secured by means of a clamp 12 to a mandrel 13 which is rotated in a direction indicated by the arrow by a source of power, not shown. As the cordage is wound upon mandrel 13 with the individual turns 6, 6 laid close together, it is twisted in a counter-clockwise direction, as shown by the arrow, so that the torsional strains produce a back-set between adjacent turns of the helix forcing the turns 6, 6 even closer together. The twisting introduced in the rubber jacket is illustrated by the feathered line 15.

Figs. 3 to 6 disclose schematically various ways in which the jacketed cord may be wound on a mandrel. In Fig. 3 which corresponds to the arrangement disclosed in Fig. 2, the end of the cord is fastened to the mandrel 13 by clamp 12 in such a way that winding takes place from left to right and the mandrel 13 is rotated in a clockwise direction. Thus, when viewed from the end of the mandrel opposite to the starting end, the turns 6 are applied in a counter-clockwise direction and to obtain the desired back-set which forces the turns closer together the jacketed cord as it is applied is twisted in a counter-clockwise direction. In the arrangement shown in Fig. 4, the winding also takes place on the mandrel from left to right and the mandrel is rotated in a counter-clockwise direction. Thus, when viewed from the far end of the mandrel, the turns are applied in a clockwise direction and to obtain the desired results the cord is twisted in a clockwise direction. The arrangement disclosed in Fig. 5 corre-

3

sponds to the arrangement shown in Fig. 3 except that the winding takes place from right to left. In this case the mandrel is rotated in a clockwise direction and the turns 6 are laid on the mandrel 13 in a counter-clockwise direction while the cord is twisted in a clockwise direction.

The arrangement of Fig. 6 corresponds to that of Fig. 4 except that the cord is clamped so that when winding from right to left the mandrel is rotated in a counter-clockwise direction thereby causing the turns to be wound on the mandrel in a clockwise direction when viewed from the end opposite to the starting end and the cord is twisted in a clockwise direction.

The amount of twisting desirable depends upon various factors, such as the cord structure, the thickness and diameter of the rubber jacket and the diameter of the mandrel upon which the cordage is to be wound. When using a mandrel having a diameter of approximately $\frac{3}{8}$ inch and a standard rubber-jacketed three-conductor cord of approximately $\frac{1}{4}$ inch diameter, satisfactory results are obtained by twisting the cordage one complete revolution for each revolution of the mandrel. Although this twisting can be performed by hand, more satisfactory and uniform results are obtained by means of the arrangement disclosed in Fig. 7 in which the supply spool 16 is rotatably mounted upon an arbor 17 supported by yoke 18. Shaft 19 is positively driven in the direction shown by the arrow and at the same speed or at a predetermined speed ratio with respect to the rotation of mandrel 13. In order to prevent over-running of the supply spool and to insure the cordage being uniformly wound on the mandrel and at the desired tension, a braking member 20 is applied as shown. After the desired length of cordage is wound on the mandrel the free end of the cordage is secured to the mandrel by means of a clamp 21 similar to clamp 12 which secured the other end of the cordage and the mandrel with the cordage wound thereon is then removed for heat treatment.

As shown in Fig. 8, mandrels with lengths of rubber-jacketed cordage wound thereon are placed in suitable racks 22, 22 mounted in an oven 23 provided with suitable heating means, such as the electrical coils 24, 24. The temperature of the oven is then raised to a value such that the strains in the rubber jacket are relieved to an amount such that the rubber jacket takes on a permanent set and retains its helical shape when repeatedly extended and retracted. This heat treatment, however, only partially relieves the torsional strains in the jacket and core which tend to force the adjacent turns together and, as a result, the completed cord is retractile to a much greater degree than it would be had the torsional strains in the cordage not been introduced.

A heat treatment which has been found to give satisfactory results consists in raising the temperature of the oven to 280° F., opening the heating circuit and allowing the oven to slowly cool over night. In general, the temperature of the oven should be raised to a value of from 275° F. to 300° F. and then allowed to cool slowly, the period of time required depending somewhat on the type of cord used and the composition of the compound used for the rubber jacket.

When employing a cord including a number of conductors twisted together as illustrated in Fig. 2 the twist of the conductors should be in a direction such that when the cord is extended the resulting twist in the cord will loosen the twist

4

of the conductors rather than twisting them closer together.

What is claimed is:

1. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding said jacketed cord in the form of a helix while simultaneously twisting the cord structure to produce a back-set between adjacent turns and then subjecting the wound cord to heat treatment.

2. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding said jacketed cord upon a mandrel to form a close-wound helix while simultaneously twisting said cord in a direction such as to produce torsional strains which force adjacent turns of said helix more closely together and then subjecting the helically wound cord to heat treatment before removal from said mandrel.

3. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding said jacketed cord on a mandrel in the form of a helix while simultaneously twisting said cord in the same direction as the turns of said helix are wound on the mandrel when viewed from the end of the mandrel opposite to the starting end and then subjecting the wound cord to heat treatment.

4. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding said jacketed cord upon a mandrel in a counter-clockwise direction when viewed from the end of the mandrel opposite the starting end and simultaneously twisting said jacketed cord in a counter-clockwise direction as it is wound upon the mandrel and then subjecting the wound cord to heat treatment before removal from said mandrel.

5. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding said jacketed cord on a mandrel in the form of a helix while simultaneously twisting said cord a predetermined amount for each turn wound on the mandrel, the direction of twist being such as to produce torsional strains which force adjacent turns of said helix more closely together and then subjecting the wound cord to heat treatment before removal from said mandrel.

6. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding said jacketed cord in the form of a close-wound helix while simultaneously twisting said cord approximately one revolution for each turn wound upon said mandrel, the direction of twist being such as to produce torsional strains which force adjacent turns of said helix more closely together and then subjecting the wound cord to heat treatment before removal from said mandrel.

7. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding on a mandrel said jacketed cord in the form of a helix while simultaneously twisting said cord in a direction such as to produce torsional strains which force adjacent turns of said helix more closely together and then placing the wound cord in an oven while clamped on the mandrel and subjecting it to a heat treatment such as to relieve the strains in said jacket an amount sufficient to cause said jacket to retain its helical shape when repeatedly extended and retracted while retaining a portion

5

of the torsional strains which force the adjacent turns together.

8. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding on a mandrel said jacketed cord in the form of a helix while simultaneously twisting said cord in a direction such as to produce torsional strains forcing adjacent turns of said helix more closely together, and then placing the wound cord in an oven while clamped on the mandrel and subjecting it to a heat treatment sufficient to cause said jacket to take a permanent set while retaining an appreciable portion of the torsional strains tending to force adjacent turns more closely together.

9. The method of producing a retractile cord which consists in providing a conducting cord with an elastic jacket, winding on a mandrel said jacketed cord in the form of a helix while simul-

6

taneously twisting said cord in a direction such as to produce torsional strains forcing adjacent turns of said helix more closely together, and then placing the wound cord in an oven while clamped on the mandrel and subjecting it to a heat treatment which consists in raising the temperature of the oven to a temperature of from 275° F. to 300° F. and allowing it to slowly cool.

10. The method of producing a retractile cord which consists in providing a conducting cord with an elastic vulcanized jacket of rubber, winding said jacketed cord in the form of a helix while simultaneously twisting the cord structure to produce a back-set between adjacent turns and then subjecting the wound cord to heat treatment.

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