

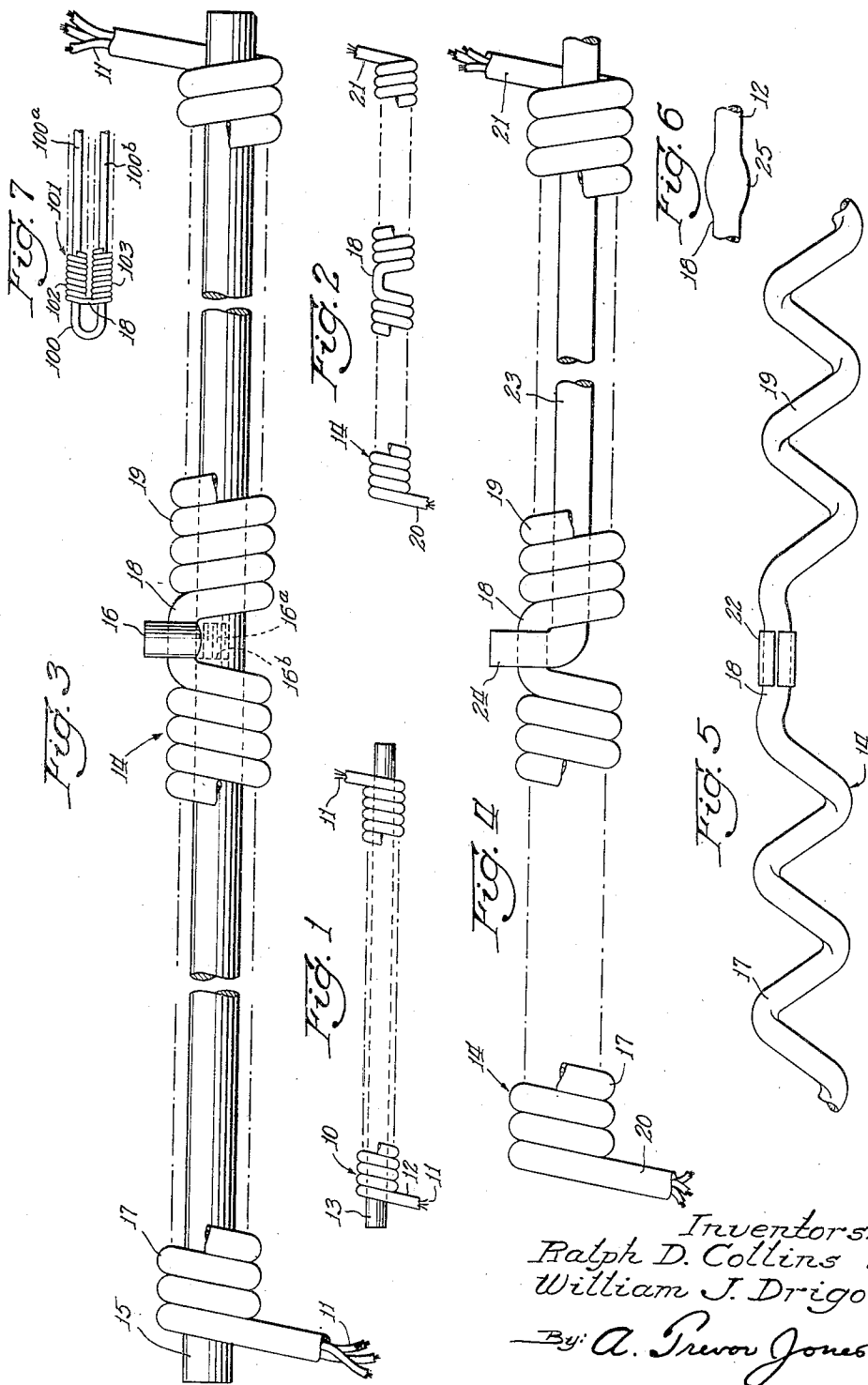
Oct. 26, 1948.

R. D. COLLINS ET AL
PRODUCTION OF VULCANIZABLE ELASTIC COIL CABLES
HAVING REVERSINGLY COILED PORTIONS

2,452,431

Filed Feb. 9, 1945

2 Sheets-Sheet 1



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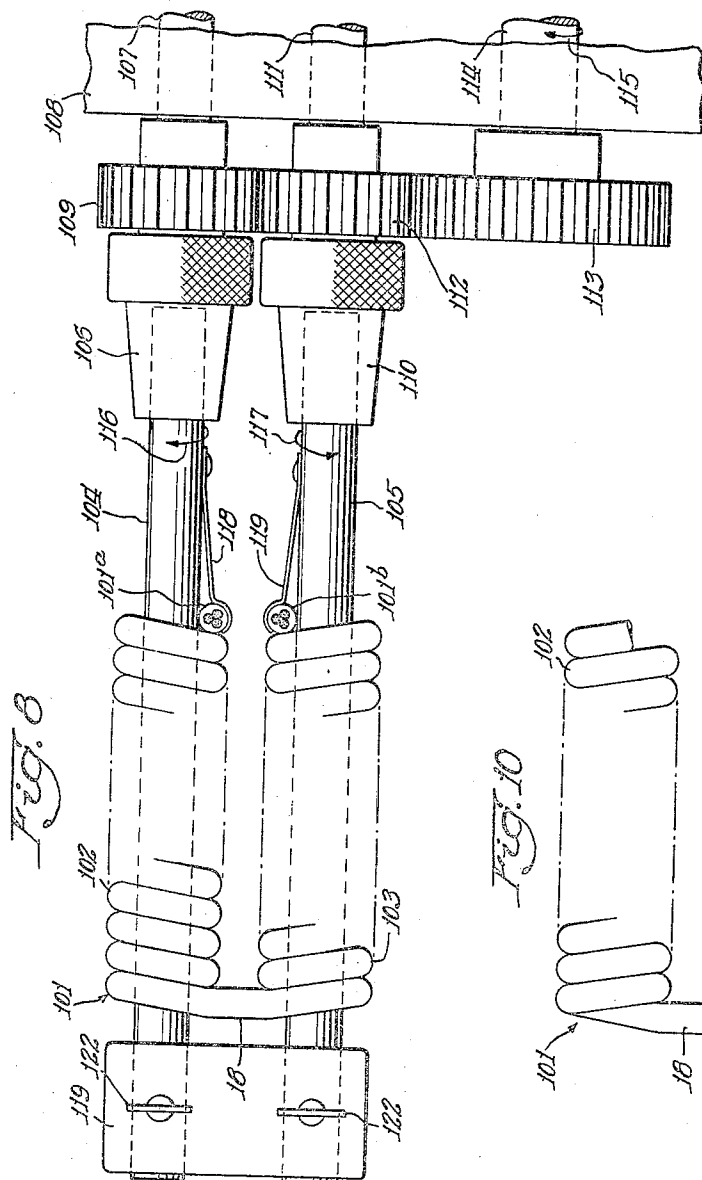


Fig. 8

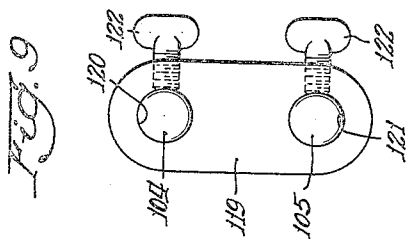


Fig. 9

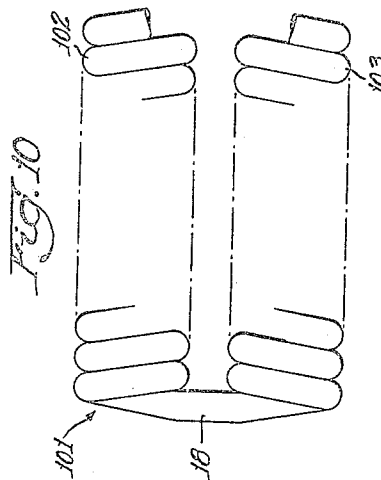


Fig. 10

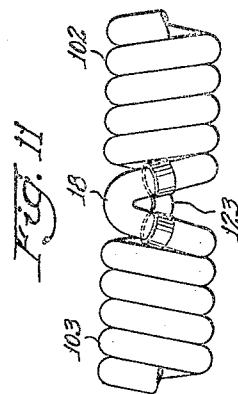


Fig. 11

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UNITED STATES PATENT OFFICE

2,452,431

PRODUCTION OF VULCANIZABLE ELASTIC
COIL CABLES HAVING REVERSINGLY
COILED PORTIONS

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2 Claims. (Cl. 18—48)

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This invention relates to elastic coil structures or cables more particularly such as retractile and extensible cords for various purposes, principally electrical, in which a conductor or a plurality of conductors with a covering or sheath of unvulcanized or incompletely vulcanized rubber or the like may be formed into a helix usually about a mandrel after which the mandrel and cable thereon are placed in an oven or subjected to other treatment to cure or further vulcanize the rubber-like material, after which the direction of pitch of the coils is reversed thus producing an extension cord, for example, which is readily extensible to a relatively great distance while being automatically retracted to helically coiled form only by its resilience when released.

The present invention aims to provide an improved cable of this class in which torque or twisting strains are minimized or eliminated while retaining the advantages of the compact helical arrangement when retracted and the relatively great extensibility of the cable when pulled upon and stretched, for any purpose, such as, for example, to cause the cord to follow the user in markedly extreme variations of position or posture. It has been well known in the use of such cables that with their many attendant advantages, a disadvantage has been found in the torque or twisting strain which the helical formation of the coils tends inherently to exert upon the connections to which the terminations of the cable are attached, and this is particularly disadvantageous when such connections are in the appliance field, or are of a character which is intended to be disconnected by a twisting action.

The present invention discloses means for eliminating or at least minimizing such undesirable twisting action, while retaining the other advantages of the helical formation, by coiling one portion of a continuous cord in one direction and other portion of the same cord in the opposite direction, before vulcanization, and then reversing each portion after vulcanization and thus one portion neutralizing the uncoiling action of another portion when extended, the natural uncoiling tendency of the cord being expended intermedially of the cord instead of at its ends.

The invention will be understood by reference to the following description, taken together with the accompanying drawings, of an illustrative embodiment thereof, and in which drawings—

Figure 1 is a reduced view showing a cable of this type as it may conventionally appear when

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wound about a mandrel, either immediately before or immediately after baking;

Figure 2 is a view of a cable embodying the present invention without the mandrel;

Figure 3 is an enlarged view of one means for forming the cable of Figure 2;

Figure 4 is a view on the scale of Figure 3 and showing another means for forming the cable of Figure 2;

Figure 5 is a view on the scale of Figures 3 and 4 showing an extended fragment of a cord constructed in accordance with the present invention and with an additional element thereof not shown in Figure 2;

Figure 6 is a fragmentary view of a further modification;

Figure 7 shows a method modification; and

Figures 8, 9, 10 and 11 show additional modifications.

Referring in detail to the illustrative construction shown in the drawings, the cable 10 shown in Figure 1 is conventional to elastic coil cables of this class, and comprises, say, a plurality of insulated electrical conductors 11 twisted together and upon which has been extruded a cylindrical sheath or covering 12 of rubber-like material and preferably one of the successful synthetic substitutes or elastomers now on the market, and which has characteristics of initial plasticity and later toughness, elasticity, extensibility and resilience after vulcanization or what is commonly known as curing, in which process it is understood that polymerization of the molecules of the material occurs with the advantageous end product thereby attained.

The cable 10 is commonly formed helically, prior to curing, upon a rod or mandrel such as that indicated at 13 and by any suitable manual or mechanical means not here necessary to be described, and the mandrel with the cable 10 thereon is then placed in an oven for baking or curing, whereupon the material 12 sets to a strong, springy condition, and thereafter, in one well known practice, after removal from the mandrel the coils of the cable 10 are then reversed in pitch direction, for example, as disclosed and claimed in the Campbell Patent No. 2,173,096, which reversing of pitch direction has many desirable advantages including an enhanced resilience of the cable and more rapid and certain retraction thereof automatically by its own resilience to compact helical formation when an end of the cable is released.

In accordance with the present invention, it has been found that if the cable is arranged so

that the coils are pitched in one direction for a portion of its length and pitched in another direction for a portion of its length, vulcanized in this form, and then each portion reversed after vulcanization, a compositely coiled cable of the present invention as shown at 14 (Fig. 2) has improved characteristics not found in the conventional cable 10 while retaining the desirable characteristics of the cable 10.

For forming the cable 14, for example, the expedients illustrated in Figure 3 may be employed. In this instance, instead of the simple straight mandrel or rod 13, the mandrel 15 may be employed which has, say, a centrally transverse post 16 projecting therefrom. With the use of the mandrel 15 a portion of the cable 14, as for example, a leading portion 17, may be wound around the mandrel 15 in the usual way, and, when it has been so wound up to the post 16 on the mandrel, the cable then is looped about the post as at 18 and the direction of the pitch of the turns reversed to produce the coils of the trailing portion 19 of the cable with the pitch reversed. Next, the mandrel 15 with the cable 14 thereon may be placed in the oven for curing, at which time the material of the rubber-like substance is set. After suitable curing, the stud 16 may be removed from the mandrel, the stud for example having a threaded end 16a which is received in the tapped hole 16b in the mandrel, and the cable 14 thereupon slid off the mandrel. The cable will then have the form as shown in Figure 2, the end tails 20 and 21 of the cable being suitable in the usual manner for making electrical connections as desired.

When thus formed, the connecting portion 18 of the cable 14, having been baked to this condition, will retain its shape and position in the coils, even though the coils be stretched to the extent suggested by Figure 5 or even to a greater extent to almost straighten the cable. If, however, the connecting portion 18 be not initially formed during the baking step or if for any reason it be desired to stabilize the connecting portion 18, means are here provided, such for example as a metallic split sleeve 22 which may be placed upon the connecting portion 18 before the cable goes into use.

It has been mentioned that the cables 14 may be formed by other means than that illustrated by Figure 3, and other expedients for this purpose are illustrated in Figure 4 hereof. In other words, a mid-portion of the cable 14 as at 12 is looped about the finger 24 of the mandrel 23 and then the trailing portion 19 of the cable 14 looped about the mandrel 23 with its coils pitched in the opposite direction to the pitch of the leading portion 17 of the cable. Thereupon the looped connecting portion 18 may be slipped off of the mandrel finger 24 and the portion 19 of the cable slipped entirely off of the mandrel.

Howsoever formed, a cable of such as illustrated, in Figure 2, has the advantage of relieving torque or twisting strains which would be otherwise exerted on the cable terminations 20 and 21. Furthermore, it has been found that it requires less force to extend it to a given length than if the entire cable were to have its coils reversed in pitch after having been initially formed in one direction. At the same time, the retractive capacity of the cord is substantially unimpaired.

It is to be understood that the cable of the present invention might be arrived at by means of other manufacturing expedients and, furthermore, that the cable itself might in some in-

stances have other forms while still falling within the present invention, such, for example, as having alternate portions of the cable pitched in opposite directions. Furthermore, the metallic stabilizing sleeve 22 might be replaced by a thicker integral portion of the material body 12 itself initially formed therein and cured therewith in the baking or vulcanizing step, for example, as shown in Figure 6 at 25.

Figure 7 shows for example a mandrel 100 of U-shape which may be employed in place of say the mandrel 15 (Fig. 3), and on which the cord 101 has one portion, such as 102, coiled in one direction, on one leg 100a of the mandrel, and the other portion thereof, such as 103, coiled in the opposite direction, on the other leg 100b of the mandrel, while still maintaining a connecting portion 18 between the cord portions 102 and 103, similar to such portion as shown in the other views of the drawings. The cord 101 when baked on and then removed from the mandrel 100 may finally be straightened out to the form of the cord 14 shown in Figure 5.

With respect to any of the forms here shown, or the methods of arriving thereat, it has been found that the connecting portion 18 may be varied in its location in the cord. That is to say, a shorter portion of the cord may constitute the leading portion 17 of the cord and a longer portion the trailing portion 19, or vice versa, depending upon the results desired at the place of connection of the cord to the electrical appliance with which it is to be used, of greater extensibility with less torque, or vice versa, as will be readily apparent to those skilled in the art having the benefit of the present disclosure.

Figures 8, 9 and 10 show a further modified method following the present invention, and which finds particular utility as another method of forming the cord 101 as shown in Figure 7.

Referring specifically to Figure 8 of the drawings, in place of the U-shaped mandrel of Figure 7, the two initially separate parallel reaches or mandrels 104 and 105 may be employed. The mandrel 104 is shown mounted in a chuck 106 which is carried by a shaft 107 rotatable in a frame 108. The shaft 107 may carry a spur gear 109. Mounted parallel to the mandrel 104 is the similar mandrel 105, already referred to, and held by a chuck 110 carried by a shaft 111 also rotatable in the frame 108 and also carrying a spur gear numbered 112, which meshes with the spur gear 109. A third spur gear 113 carried by a driving shaft 114 on the frame 108 meshes with the spur gear 112, and thus drives the gears 109 and 112 in opposite directions. In this instance, the driving shaft 114 may be understood to be rotated (by means not necessary to be here described) in the direction of the arrow 115, which will thus rotate the mandrel 104 in the same direction, that is, in the direction of the arrow 116, and at the same time will rotate the mandrel 105 in the opposite direction, that is, in the direction of the arrow 117.

The cord 101, in the method as shown in Figure 8 of the drawings, may have its free ends 101a and 101b respectively secured (as by spring clips 118 and 119 carried respectively by the mandrels 104 and 105), to the mandrels 104 and 105 respectively. Rotation of the shaft 114 may now be effected and it will be readily understood that the portion 102 of the cord 101 will be helically wound up on the mandrel 104 with the turns or pitch of its coils in the direction of what may be termed analogous to a left-hand screw-thread.

while, simultaneously, the cord 103 will be wound up on the mandrel 105 with the turns or pitch of its coils in the direction of what may be termed analogous to a right-hand screw-thread, until the connecting portion 18 of the cord 101 between the portions 102 and 103 is slightly taut, whereupon the actuation of the shaft 114 may be discontinued.

Next, a holder may be provided for holding the mandrels 104 and 105 together in the same parallel relation as they maintain in the chucks, said holder to permit removal of the mandrels from the chucks and the placing of the mandrels together (with the wound cord 101 thereon) in a heating oven or the like for subjection of the cord to vulcanizing temperatures. The holder 119 here shown is representative of expedients for this purpose. It will be understood that the holder 119 is not placed on the mandrels until the cord has first been wound thereupon as already described.

The holder 119 may comprise in this instance a block-like body somewhat elongated in directions both transversely and longitudinally of the mandrels and is here shown in somewhat oval form. The body has cylindrical passages 120 and 121 therein which receive the ends respectively of the mandrels 104 and 105 when the holder is passed thereover after the cord has been wound. A clamping set-screw 122 may be provided for each passage which may be tightened after the mandrel has been received therein. The mandrels may now be removed from the chucks 106 and 110, and the two mandrels with the holder 119 thus constitute together a rigid somewhat U-shaped contrivance for holding the cord 101 in the desired form during vulcanization.

As a final advantageous step in the production of the cord, the cord after vulcanization and removal from the mandrels, may have each of its portions individually reversed in the direction of the pitch of their coils. This may be done in accordance with the Campbell Patent No. 2,173,096 previously referred to, as is now well understood by the workers in the art and which need not be here specifically described. For example, referring to the cord 101 when so reversed, as shown in Figure 10, the portion 102 of the cord 101 will now have a right-hand screw-thread as it were, and the portion 103 a left-hand screw-thread so to speak, these portions of the same cord being still thus oppositely coiled, with the uncoiled connecting portion 18 therebetween. When extended under tension, with its ends 101a and 101b extending in opposite directions, the cord 101 will function with the similar desirable results already described with reference to the cord 14, and, under tension, will assume substantially the same form as the cord 14 has in Figure 5. It will be understood that if desired a stabilizing member, such as the metal clip 123, may be placed on the connecting portion 18 either before

or after the reversal of the cord to the formation shown in Figure 10, to maintain the sections 102 and 103 of the cord substantially in line on a common axis as shown in Figure 11.

In each case also, the cord is permitted to freely untwist intermedially as it is stretched, the connecting portion 18 (with either the extraneous stabilizing element 22 or 123 or the integral stabilizing element 25 thereon) rotating as the cord is stretched and thus expending the inherent untwisting tendency of the cord intermedially of the cord instead of at its ends.

It is to be understood that this invention is not intended to be limited to the specific form or steps of manufacture here illustrated by way of exemplification of the invention, and that such modifications are intended to be included within the invention as are covered by the appended claims.

Having described our invention, what is here claimed is:

1. The method of production of elastic coil structures characterized by the steps of: providing a flexible cord-like member comprising a cable portion of vulcanizable material, helically coiling respective portions of the member in opposite directions, vulcanizing the material while the member is still coiled, and subsequently reversing the directions of the coils of the individual member portions whereby the member has portions helically coiled in opposite directions and each portion is reversed in direction from that in which it was initially coiled and vulcanized.

2. The method of production of elastic coil structures characterized by the steps of: providing a flexible cord-like member comprising a cable portion of vulcanizable material, helically coiling respective portions of the member in opposite directions simultaneously each upon one of a plurality of parallel mandrels, vulcanizing the material while the member is still coiled upon the mandrels, removing the member from the mandrels, and subsequently reversing the direction of pitch of each coiled portion whereby the member has portions helically coiled in opposite directions and each portion is reversed in direction from that in which it was initially coiled and vulcanized.

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WILLIAM J. DRIGOT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,641,156	Clulee -----	Sept. 6, 1927
1,989,066	Shaw -----	Jan. 22, 1935
2,039,475	Campbell -----	May 5, 1936
2,173,096	Campbell -----	Sept. 19, 1939
2,322,757	Ward -----	June 29, 1943
2,365,952	Hanson -----	Dec. 26, 1944