July 22, 1947. R. J. ARNOLD 2,424,426

COILING MEANS FOR MAKING ELASTIC COIL STRUCTURES

Filed Aug. 25, 1944

Fig. 1

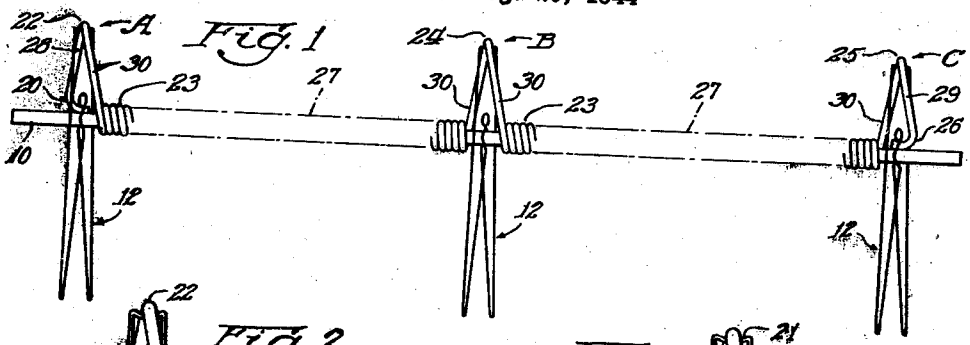


Fig. 2

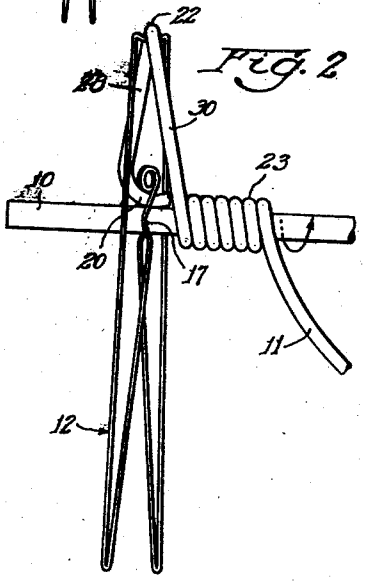


Fig. 3

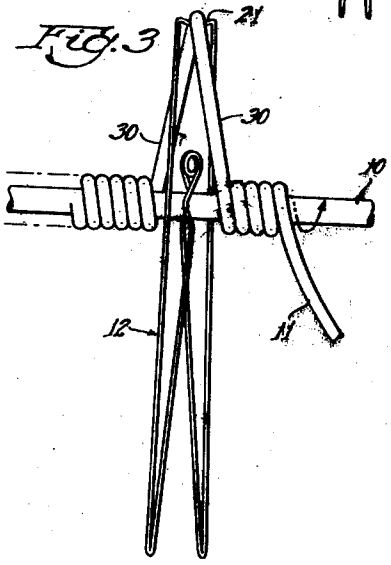


Fig. 4

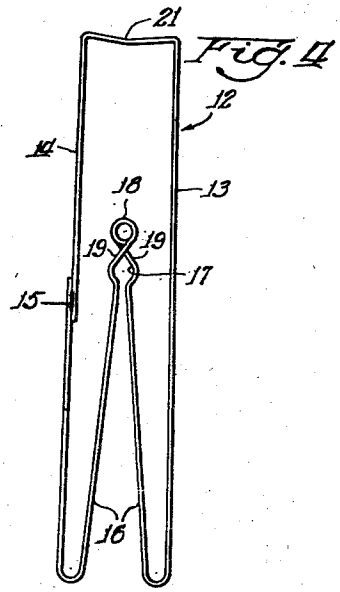
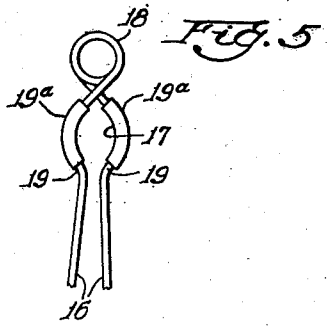


Fig. 5



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COILING MEANS FOR MAKING ELASTIC COIL STRUCTURES

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Application August 25, 1944, Serial No. 551,245

3 Claims. (Cl. 18—6)

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This invention relates to means for making elastic coil structures and more particularly coiling means therefor.

It is now well known that retractile and extensible extension cords or cables, for various purposes, principally electrical, may be satisfactorily constructed by providing a conductor or a plurality of conductors with a covering or sheath of incompletely vulcanized rubber or the like, then closely coiling it into the form of a helix, and then vulcanizing it, after which the cable will be readily extensible, as, for example, for extension cord purposes, without damage thereto while being automatically retracted by its own resilience to closely coiled helical formation when released.

In application of Paul C. Geraty, Serial No. 551,246, filed August 25, 1944, now Patent No. 2,394,762 improved methods and means are disclosed and claimed for the making of such cables, and the present application aims to provide further improved means therefor.

In application of Ralph D. Collins, Serial No. 577,111, filed February 9, 1945, improved methods and means are broadly disclosed for the making of such cables with tangent ends, and the present application aims to provide further improved means therefor.

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

Figure 1 is a view showing a rotatable mandrel with the cable coiled thereon for vulcanizing and showing improved means in accordance with the present invention for forming the cable;

Figure 2 is an enlarged view of a portion of the structure of Figure 1 but showing a free end of the cable in the process of being coiled;

Figure 3 is an enlarged view similar to Figure 2 but showing another portion of the structure of Figure 1, but also with a free end of the cable in the process of being coiled;

Figure 4 is an enlarged separated view of means employed in the making of the cables; and

Figure 5 shows a modified form of similar means.

In the said Geraty and Collins applications, it is pointed out that two objects are desirable in the making of cables of this type, one being the economy of manufacture accomplished by producing individual coiled lengths of the cable in preliminarily interconnected relationship, thereafter to be severed into individual lengths, and

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second to produce uncoiled connecting tails or tangents at each end of the final individual cables, and reference is desirably made to said Geraty and Collins applications for a description of the methods and means therein broadly described and claimed for accomplishing both of these objects, and as well as for a description of the preliminary uncoiled cable, with which the invention treats, and the final individual lengths of coiled cable in both compacted and extended form as when used say as an extension cord for any purpose.

In the practice of the present invention also the usual mandrel is employed, in the form here shown of an elongated metal rod 10 upon which is wound the cable 11, which may enclose one or more and usually a plurality of conductors such as electric wires and the conductors being encased in a vulcanizable sheath or covering of rubber-like material which may be somewhat raw conventional rubber or may be one of the many synthetic elastomers which are now on the market, all as more particularly described in said Geraty application.

In accordance with the improvements of the present invention, however, and to begin the coiling of the cable 11 on the rod 10 to provide an anchorage for the leading and trailing ends of the cable on the rod, as well as providing a hump in the cable at each end of each of the preliminarily interconnected individual cable lengths, improved means are here shown an embodiment of which, before being placed on the rod 10, is best shown in Figure 4 of the present drawings.

As will be there seen, such means comprises a spring clip indicated generally by the numeral 12 and which may be conveniently formed of spring wire 13 bent to form an outer closed elongated loop 14 as by having the otherwise free ends of the wire 13 soldered or brazed as at 15. One end of the loop 14 (in Figure 4, the lower end) is bent back in upon itself in a reentrant portion 16 which is first decreasingly tapered inwardly and then slightly enlarged at its inner end to provide an open inner spring loop 17. In the present example, the inner loop 17 is a continuation of a portion of the spring wire 13 which is carried still further inwardly and is coiled as at 18 to provide a torsion spring effect upon the arms 19 of the inner spring loop 17. The torsion coil spring 18 thus formed is placed under enhanced tension when the arms 19 of the inner spring loop 17 are spread apart, and thus the torsion coil spring 18 portion of the clip 12 tends

to compress the inner loop 17 for purposes next pointed out. The spring portion 18 also tends to stabilize the clip and prevent its losing shape under repeated usage.

The clip 12 may embody either round or flat stock metal and may be formed with the metal in a relatively soft state and then heat treated to give it the desired spring steel qualities, or it may be formed with the metal pre-hardened.

When it is desired to begin coiling of the cable 11 on the rod 10, the clip 12 is placed on the rod as at A, somewhat in the manner of a clothespin, the rod passing up through the re-entrant portion 16 of the clip and being lodged in the spring loop 17, the clip and rod being maintained in this relationship both by the spring effect of the decreasingly tapered re-entrant portion 16 of the clip as well as enhanced by the torsion effect of the coil spring 18 in the interior of the clip, the inner spring loop 17 being placed under tension when the rod 10 is received therein.

Furthermore, at the start of the winding of the cable on the rod, the leading end 20 of the cable, as already alluded to, may be also anchored to the rod by being received together with the rod within the spring loop 17, the loop yielding sufficiently both to receive the rod already under tension within the spring loop 17 and the end 20 of the cable, thus anchoring the latter in position for winding.

Next, the cable is run up over the end of the clip 12 opposite the end which has the reentrant portion 16 therein, and, at this other end, the clip is retuse as by being bowed in slightly as at 21 to provide a saddle for the cable passing thereover in the form of a hump, as at 22.

Next, the coiling of the cable on the rod 10 in compacted helical form, as at 23 is continued during which the rod 10 may be mechanically rotated by any suitable means. This coiling of the cable on the rod may be continued until any desired predetermined length is provided in coil form, and when sufficient of the cable has been coiled for the desired individual cable length, another of the clips 12 is placed upon the rod 10 as at B, the cable being passed over the end 21 of the clip to form another hump as at 24.

Again coiling of the cable on the rod is continued until another predetermined length has been provided and finally the third clip 12 is placed on the rod as at C. If, as here shown, this clip C is adjacent the trailing end of the cable, the cable is merely humped thereover as at 25 and the otherwise free end of the cable 26 is clamped to the rod 10 by the clip 12 just as the leading end 20 of the cable was so clamped.

It will be recognized that for economy of operation the rod or mandrel 10 must be rotated at considerable speed to avoid unnecessary slowness in the production of the coiled cable, and, at such speeds of rotation as are desirable for this purpose considerable centrifugal force is generated so that the clip ends 21 and the cable humps thereon have appreciable moments of inertia at say the points 22, 24 and 25. These forces would tend to shake or vibrate the rod 10, to an objectionable extent, if they were not balanced on a diametrically opposite side of the rod 10, and this is accomplished in this instance as by having the clip 10 extend transversely on opposite sides of the axis of the rod, that is, the end of the clip having the reentrant portion 16 extending to one side of the axis of the rod and the other end of the clip having the retuse portion 21 extending to the diametrically opposite

side of the rod, and thus each tending to balance the other and eliminating or at least satisfactorily minimizing vibration of the rod or mandrel during rotation. To further enhance this effect when the cable itself is humped over the clip 21, the opposite end having reentrant portion 16 is made somewhat longer, measuring from the center of the inner spring loop 17, than the end over which the cable is humped, thus equalizing the forces referred to.

It will now be understood that the rod 10 with the cable thereon as shown in Figure 1 may next be placed in an oven for curing or otherwise subjected to a vulcanizing temperature to cause the rubber or rubber-like sheath of the cable 11 to become resilient and to set the coils of the cable in helical form so that when extended, as when used for an extension cord, these will so automatically retract by their own resilience to closely compact helical form when released, thus minimizing the space occupied by the cord and avoiding entanglement with other objects.

As will be understood, after such curing, the preliminary interconnected cable lengths 27 are severed adjacent the apex of the hump 24, and also the leading end portion 28 of the cable and the trailing end 29 are cut off adjacent the apex of each of the humps 22 and 25, respectively. This leaves each of the individual cable lengths 27 desirably with a connecting tail or tangent 30 at each end.

As shown in Figure 5, the arms 19 of the open inner spring loop 17 of the clip 12 may be provided with a friction surface, for enhanced gripping action, as for example by being provided with sleeves 19a of rubber or rubber-like material. As an alternative the mandrel could carry the friction creating material.

The spring clip 12 may be used advantageously to clip the leading end or trailing end of the cable to the rod even though the tangent ends for the cable be not desired, in which case the hump formations of the cable may be omitted.

It is to be understood that the invention is not intended to be limited to details of construction shown for purposes of exemplification, and such changes may be made as fall within the scope of the appended claims without departing from the invention.

The invention having been described, what is here claimed is:

1. Means for making elastic coil cables comprising a vulcanizable material and embodying a mandrel, a spring clip device clipped to the mandrel by movement transverse thereto and bent to form an outer closed elongated loop having two ends, one end of the device having a re-entrant portion directed inwardly and then slightly enlarged at its inner end to provide an open inner spring loop adjacent the center of the device to grip the mandrel, said inner spring loop having a continuation formed into a coil to provide a torsion spring and the other end of the device being formed to receive the cable thereon spaced from the mandrel and said torsion spring, the re-entrant portion of the device being longer than the remaining portion of the device for balancing effect when a portion of the cable is carried thereon and the mandrel is rotated to coil another portion of the cable thereon, said clip being adapted to hold the portion of the cable thereon substantially fixedly with respect to the mandrel during vulcanization of said material.

2. Means for making elastic coil cables com-

prising a vulcanizable material, embodying a rotatable mandrel for coiling the cable, a member engageable with the mandrel by movement transverse thereto and having substantial portions extending transversely and on opposite sides of the axis of said mandrel, said member being provided with means for selectively and releasably securing said member to said mandrel and for holding a portion of said cable transversely of the mandrel spaced from the mandrel during vulcanization of the material, that portion of the member extending to the side of the mandrel opposite the side at which the cable is held being the heavier of said member portions, whereby to provide a balancing effect when a portion of the cable is carried on the member and the mandrel is rotated.

3. Means for making elastic coil cables comprising a vulcanizable material, embodying a rotatable mandrel for coiling the cable thereon, a spring clip member engageable with the mandrel by movement transverse thereto and having substantial portions extending transversely and on opposite sides of the axis of said mandrel, said member being provided with a central open loop portion for grippingly passing a portion of the mandrel and an end portion of the cable therethrough to hold said portion of said cable in contact with the mandrel during rotation of the mandrel and vulcanization of the said material, the cable being held between the mandrel and bight of said loop portion, that portion of the member extending to the side of the mandrel opposite the side at which the cable is held being the heavier of said member portions, whereby to provide a balancing effect when the mandrel is rotated.

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