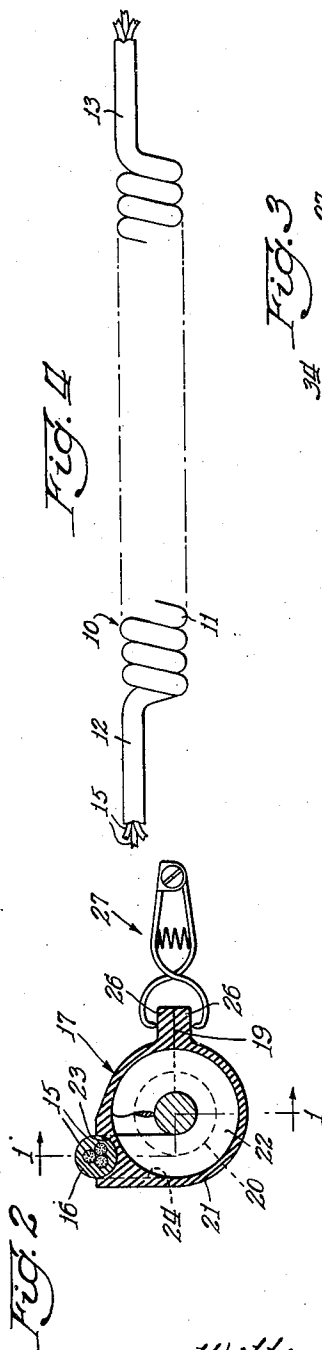
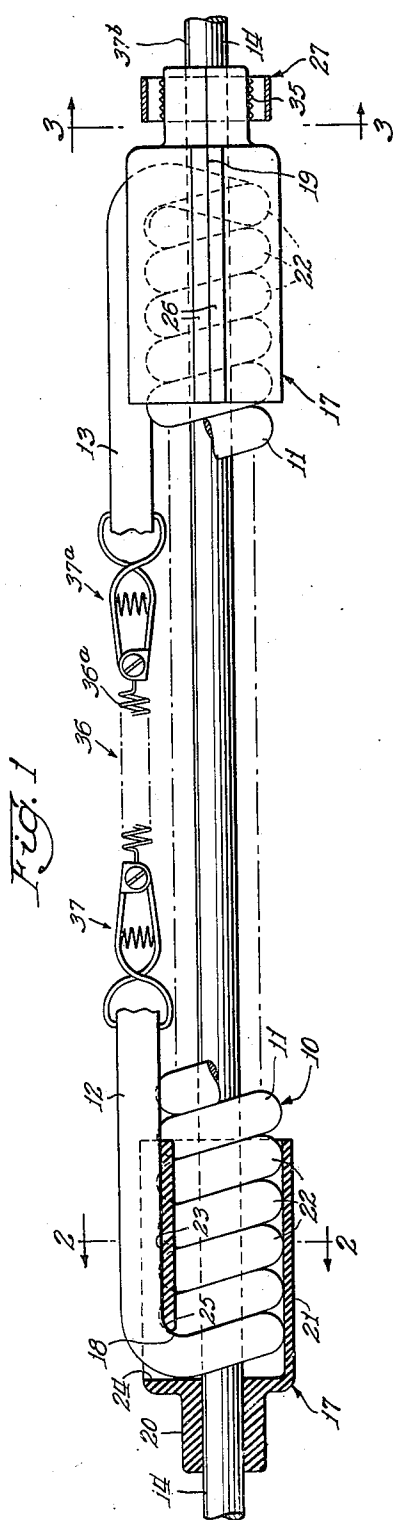


Oct. 26, 1948.

W. J. CREHAN ET AL
 APPARATUS FOR MAKING ELASTIC COIL STRUCTURES
 WITH LONGITUDINAL ENDS
 Filed May 7, 1945

2,452,434



Inventors:
 William J. Crehan
 Ralph J. Arnold

By: A. Trevor Jones

UNITED STATES PATENT OFFICE

2,452,434

APPARATUS FOR MAKING ELASTIC COIL
STRUCTURES WITH LONGITUDINAL
ENDS

William J. Crehan, Chicago, and Ralph J. Arnold,
Western Springs, Ill., assignors, by mesne as-
signments, to Kellogg Switchboard and Supply
Company, Chicago, Ill., a corporation of Illi-
nois, and Ralph D. Collins, Beverly Hills, Calif.

Application May 7, 1945, Serial No. 592,398

5 Claims. (Cl. 18-6)

1

This invention relates to improvements in ap-
paratus for making elastic coil structures with
longitudinal ends.

It is now well known that retractile and extensi-
ble extension cords or cables, for various purposes,
principally electrical, may be satisfactorily con-
structed by providing a conductor or a plurality
of conductors with a covering or sheath of incom-
pletely vulcanized rubber or the like, then closely
coiling it into the form of a helix, and then vul-
canizing 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,
and that the resilience of the cable may be en-
hanced by reversing the direction of the coils as
broadly disclosed and claimed in the Campbell
Patent No. 2,173,096.

In the application of Ralph D. Collins, Serial
No. 588,043, filed April 12, 1945, there is shown
and broadly claimed a method and means of
forming such elastic coil cables with longitudinal
ends, and the present invention aims to provide
improved method and means for making cables
of this class, with enhanced simplicity and im-
proved results.

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

Figure 1 is a view, partly in section, of the
improved expedients of the present disclosure
and being in part a section taken on the line 1-1
of Figure 2;

Figure 2 is a section taken on the line 2-2 of
Figure 1;

Figure 3 is a section taken on the line 3-3 of
Figure 1 looking in the opposite direction; and

Figure 4 is a view showing the cable after being
reversed.

Referring in general to the drawings, it will be
understood that the cable 10 includes a coiled
portion and an uncoiled portion which is adapted
to serve as a connecting tail for the cable, and
in this instance, there are formed two such con-
necting tails, one at each end of the cable. The
intermediate coiled portion of the cable is here
given the numeral 11 with an uncoiled portion 12
at one end and 13 at the other end. The mandrel
14 is provided upon which is wound, before vul-
canizing and in the form of a helix, the coiled
portion 11. The cable 10 may comprise one or
more conductors 15 encased in a sheath 16 of

2

vulcanizable material, such as one of the syn-
thetic elastomers or rubber-like substitutes which
are now on the market, one known as "Buna-S"
having been used and found suitable.

5 In accordance with the present invention,
means are provided for holding one or both longi-
tudinal ends 12, 13 longitudinal of the coil, while
the material 16 of the cable is being vulcanized,
said means comprising a sleeve member 17 formed
10 of a soft rubber-like material which is not sub-
stantially hardened by the vulcanization treat-
ment of the cable, later more particularly referred
to, and which remains substantially softer than
the vulcanizable rubber-like material of the cable
15 to avoid marking of the cable, particularly at the
point 18 where the bend occurs between the coiled
and uncoiled portions.

The sleeve member 17 is preferably formed of
a synthetic material known as "Hycar" and which
20 is comprised of a copolymer of butadiene and
acrylonitrile having the required ingredients to
give it, when molded under heat and pressure to
the form here shown, a Shore durometer hard-
ness reading of the order of between 20 and 30
25 and so as to withstand a temperature of say 250°
Fahrenheit for the period of time, say, an hour
or so, during which the cable 10 is being sub-
jected to the vulcanizing temperature, without
being substantially hardened and while remaining
30 substantially softer than the vulcanizable ma-
terial 16 of the cable.

A suitable formula for the composition of the
sleeve member 17, as at present advised, is thought
to be as follows:

	Parts by weight
35 Hycar OR 15	100
Carbon black	50
Plasticizer	30
Anti-oxidant	3
40 Accelerator	1

Suitable accelerators are thought to be sele-
nium, thiurad, or thiazole types.

Instead of the Hycar, other synthetic elastomers
45 may be suitable, as, for example, in general a co-
polymer of a hydrocarbon derivative and acrylo-
nitrile. One such polymer is known as Perbunan,
which may be used.

In any case, it is believed desirable to avoid
50 a composition for the sleeve member 17 which
contains elemental sulphur, so that no substan-
tial subsequent vulcanization or setting of the
material of the sleeve occurs after its initial for-
mation in the soft state here described, such
55 setting as occurs during its initial formation de-
sirably exhausting the active cross-linking action

of the molecule chains under the influence of the accelerator, say, and thus leaving the sleeve member permanently soft, but elastic.

As here shown, the sleeve member 17 is split throughout its length as at 19 so that it may be readily slipped over the mandrel 14. A reduced portion 20 of the sleeve snugly encircles the mandrel at the outer end of the sleeve. At its inner end, the sleeve is enlarged as at 21 to form a cup-like portion which receives and telescopes over the adjacent coils 22 of the cable 10. Upon the outer periphery of the enlarged portion 21 of the sleeve is a longitudinally extending groove 23 in which the longitudinal end 12 or 13 as the case may be, is received and laid. A perforation or passageway 24 from the interior of the enlarged portion 21 of the sleeve to the groove 23 passes the cable end therethrough. The edge of this opening 24, as at 25, is rounded or beveled so as to further safeguard against marking the cable, particularly at this place where the bend 18 in the cable occurs.

At the place where the sleeve member 17 is split longitudinally, as at 19, the sleeve may be laterally extended on each side of the split to form a pair of lips 26 by which the sleeve member may be clamped together, after having been locked in position on the mandrel and coiled cable, the clamp 27 being suitable for this purpose. As an alternative, and as shown at the right-hand end of Figure 1, the clamp 27 may be applied about the reduced portion 20 of the sleeve member 17, as is also shown in section in Figure 3. The clamp here shown is in the form of a pair of interlocking spring fingers 28 and 29 secured together at their base as by screw 30. One of these spring fingers, such as 28, passes through a slot 31 in the other finger 29 so as to cross at their free ends 34, and a compression coil spring 32 within the bight portions 33 of the clamp 27 forces the fingers apart at the bight and the free spring ends 34 of the fingers together. These spring ends may be toothed as at 35 to grip the sleeve member 17.

It will now be understood that, as here shown, there are two of the sleeve members 17, one at each end of the cable, the sleeve members being identical but reversed in direction so that the two reduced portions 20 extend in opposite directions axially and the two split portions 19 extend in opposite directions laterally. Thus the cup portions 21, which telescope over the cable coils 22, extend in the opposite direction but toward each other.

Further in accordance with the present invention, the uncoiled longitudinally extending portions 12 and 13, which lap the coiled portion 11 of the cable and extend toward each other, may be held in position in the grooves 23 respectively by being connected together as here shown by a resilient member 36 such as comprising a relatively light coil spring 36a attached at its ends to clamps 37 and 37a, which may be similar to the clamp 27, which grip the ends of the cable portions 12 and 13. The coil spring 36 accommodates any changes in length of these cable ends which may occur during the vulcanization treatment. When only one longitudinal end is desired, say the end 12, the resilient member 36 may be extended and the clamp 37a secured to the mandrel 14 at 37b.

It is to be understood that when the sleeve member 17 at the left-hand end of Figure 1 was first placed on the mandrel and cable, the cable end 12 was threaded through the passageway 24 of the sleeve member and then the cable was

wound on the mandrel to at least the extent of a few coils such as 22 whereupon the sleeve member 17 at the left-hand end of Figure 1 was placed about the coils and clamped together as by the clamp 27. Then the remainder of the cable was coiled. Then the cable end 13 was threaded through the passageway 24 in the sleeve member 17 at the right-hand end of Figure 1. Then this latter sleeve member was placed about the mandrel and coil and clamped as shown as by another of the clamps 27. Then the two ends of the cable ends 12 and 13 were connected together by the resilient connection 36, the ends then lying in the grooves 23.

The cable while on the mandrel as shown in Figure 1 may now be subjected to a vulcanization treatment of any suitable character, such for example, as by being placed in an oven having a temperature of say 250° Fahrenheit or thereabouts, by which treatment the vulcanizable rubber-like material 16 of the cable 10 is cured and given a permanent set which makes the cable resilient and elastic. During this treatment the sleeve members 17 do not substantially change in character, the material thereof as already described being such as not to be affected by this heat treatment, and they thus remain soft and pliable so as not to mark the cable, as already mentioned.

The vulcanizing treatment having been completed and the sleeve members 17 still remaining soft and pliable as already mentioned, the clamps 37 are released and the resilient element 36 disconnected from the cable. Thereupon the sleeve members 17 are removed and the cable removed from the mandrel. Finally the cord may be reversed or inverted in direction of pitch as already alluded to so as to change the direction of the turns of the coils from a right-hand screw-thread, so to speak, as in Figure 1, to the similitude on a left-hand screw-thread as shown in Figure 4, thereby enhancing the resilience of the cord as a whole and increasing its retractibility, and causing ends 12, 13 to extend outwardly.

When the clamp 27 is applied to the sleeve as at the right-hand end of Figure 1 and in Figure 3 it also advantageously keeps the sleeve from relative rotation with respect to the mandrel.

It is to be understood that the term cable as here used includes tubular or solid cable-like structures, with or without conductor wires.

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 structures of the class described embodying a vulcanizable material, comprising a mandrel for coiling a cable thereon in the form of a helix when the said material is incompletely vulcanized, sleeve means extending longitudinally of said mandrel at each end of the cable for supporting during vulcanization an uncoiled portion of said cable extending longitudinally of and lapping said helix during vulcanization of the cable material to form an uncoiled connecting tail therefor at each end thereof, and means for connecting said uncoiled portions together to hold them longitudinal of and lapping the cable helix during vulcanization.

2. The structure of claim 1 wherein the sleeve means comprises a member of soft rubber-like material which is not substantially hardened by the vulcanization treatment of the cable and which remains substantially softer than the ma-

5

terial of the cable to avoid marking of the cable.

3. The structure of claim 1 wherein the sleeve means comprises a member of soft rubber-like material which is not substantially hardened by the vulcanization treatment of the cable and which remains substantially softer during vulcanization of the cable than the rubber-like material of the cable to avoid marking the cable, said soft rubber-like material having a Shore durometer hardness reading of between 20 and 30.

4. Means for making elastic coil structures with longitudinal ends comprising, a pre-formed longitudinally split sleeve member of soft rubber-like material longitudinally grooved on its periphery for placing about a coiled portion of said structure and having a perforation therein at one end of the groove communicating between the interior of the sleeve and said groove for passing an uncoiled portion of said structure into said groove, an integral reduced sleeve extension portion adjacent said end of said member for placing about a mandrel upon which said coiled portion is coiled, and integral adjacent lips on the member spaced peripherally thereon from said groove whereby the sleeve member may be clamped about said coiled portion and said mandrel.

5. The method of making elastic coil structures

6

with longitudinal ends which is characterized by the steps of encasing a conductor in a sheath of vulcanizable material to form a cable, forming a portion of the cable into a coil, forming other portions of the cable at each end uncoiled and extending longitudinally of the coil, connecting the said uncoiled portions together during vulcanization to hold them longitudinal and lapping the coil, vulcanizing the material while maintaining the said coiled and uncoiled portions in said forms, and inverting the direction of pitch of the coils whereby the uncoiled portions extend longitudinally beyond the coil after reversal and serve as connecting tails for the cable.

WILLIAM J. CREHAN.
RALPH J. ARNOLD.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
25 458,115	Thomson	Aug. 18, 1891
2,323,286	Ward	June 29, 1943
2,339,683	Cox	Jan. 18, 1944