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SHIELDED EXTENSIBLE AND RETRACTABLE ELECTRIC CONDUCTORS

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Fig. 1

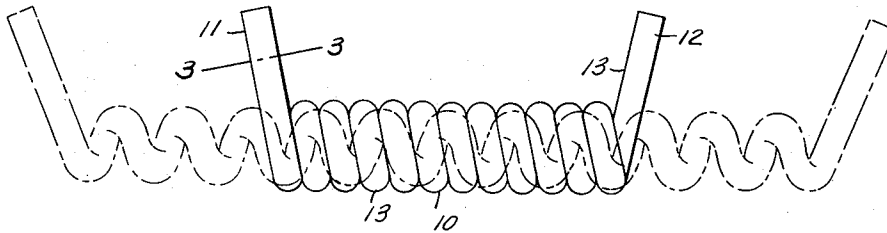


Fig. 2

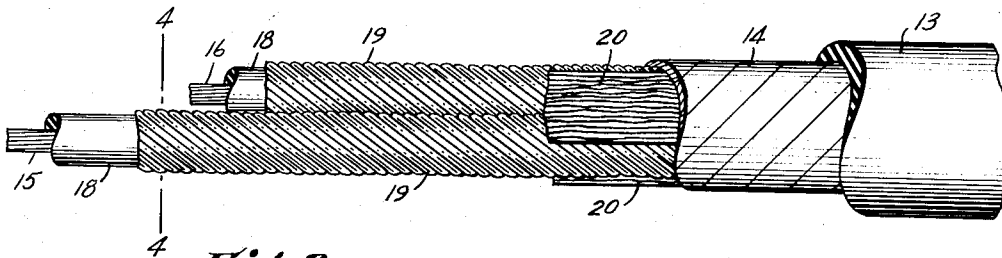


Fig. 3

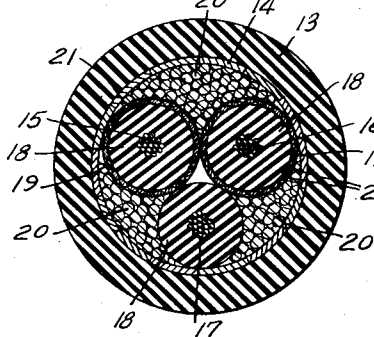


Fig. 4

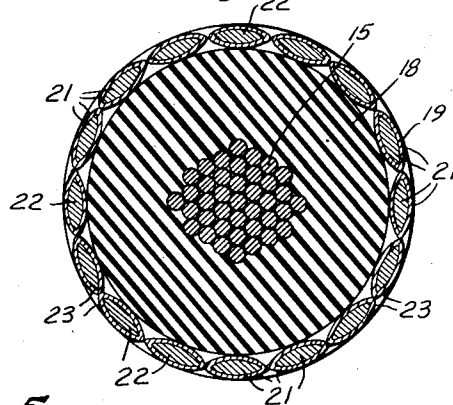


Fig. 5

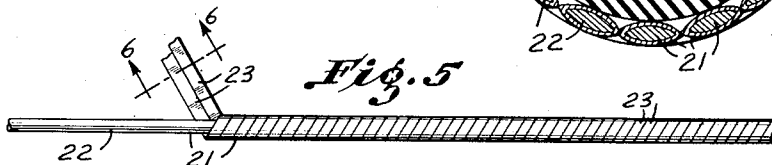


Fig. 6



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SHIELDED EXTENSIBLE AND RETRACTABLE ELECTRIC CONDUCTORS

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1, 1948. This application January 5, 1952, Serial No.
265,160

3 Claims. (Cl. 174—69)

The present invention relates to improvements in ex-
tensible and retractable coiled electric conductors, some-
times called retractile conductors or cords, and it relates
more particularly to shielded conductors of that char-
acter. Extensible and retractable electric conductors are
made in helical form and are extensible against the in-
herent elastic resistance of the structure to the axial
separation of its convolutions and are self-retracting by
the elastic forces stored in the structure which tend to
compact the convolutions toward each other.

For shielding on insulated wires, it has for many years
been usual to employ a metallic braid of fine bare or
tinned copper conductors. This well known practice was
adequate for production of satisfactory shielded electric
conductors that are straight or relatively so. However,
with the advent and increasing use of extensible and
retractable, or retractile, cord conductors of the type dis-
closed in the patent to Campbell No. 2,173,096, granted
September 19, 1939, there arose a demand for shielded
cord conductors of this retractile type. Attempts to
meet this need by using the conventional shielding means
resulted in failure. The coiled cord produced using
metallic braid shielding, for example, possessed no re-
tractile properties, or at least to only a quite insufficient
degree. This was found to be due to the stiffness im-
parted to the coiled conductor structure as a whole by
the shielding means. Moreover, it was found that ob-
taining effective shielding without at the same time
seriously interfering with the retractile properties of such
a coiled cord was a problem not easily solved in a
practical manner.

It is accordingly a principal object of the present in-
vention, heretofore unattained in the art, to provide an
effectively shielded extensible and retractable shielded
electric conductor having its elements so constructed and
arranged, however, that its shielding-means does not
materially interfere with the desired extensibility and re-
tractability or spring-like action of the coiled conductor
structure.

Another object of the present invention, also hereto-
fore unattained, is to provide an electric conductor of the
character referred to and having its elements so con-
structed and arranged that its shielding-means does not
become so set in either the extended or retracted posi-
tion of its convolutions as to materially interfere with the
aforesaid spring-like action of the coiled conductor struc-
ture.

In order to make clear the underlying principles of the
invention, a typical embodiment thereof in especially
advantageous practical form will be hereinafter described
in detail, and is illustrated in the accompanying draw-
ings wherein:

Fig. 1 is a view in side elevation of a shielded exten-
sible and retractable coiled electric conductor embody-
ing the present invention and shown by full lines in its
normal or retracted condition and shown by broken lines
temporarily stretched into extended position;

Fig. 2 is a view in side elevation of a fragment of

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the coiled electric conductor structure of Fig. 1, with
various layers thereof stripped back for clarity of illus-
tration but on a larger scale than the showing of Fig. 1;

Fig. 3 is a transverse sectional view taken on the line
3—3 of Fig. 1 but on a larger scale;

Fig. 4 is a transverse sectional view taken on the line
4—4 of Fig. 2 but on a greatly enlarged scale;

Fig. 5 is a view in side elevation of a fragment of com-
posite shielding cord suitable for use in carrying out the
present invention; and

Fig. 6 is an enlarged-scale sectional view taken on the
line 6—6 of Fig. 5.

So far as concerns its external form and appearance,
as well as its general properties of elastic extensibility
and retractability, the shielded coiled electric conductor
of the present invention, as seen in Fig. 1, superficially
resembles the unshielded retractile coiled conductors so
long known and widely used as telephone extension cords
as well as for other purposes. The retention of those
highly desirable retractile properties, substantially un-
diminished, in the novel coiled conductor structure, de-
spite the inclusion in said structure of metallic means
operative to shield effectively the main conductor or
conductors, is accomplished according to the present in-
vention by employing shielding means of such character
and so disposed with relation to the main conductor
means on the one hand and, on the other, to the helical
convolutions of the retractile shielded coiled conductor
structure as a whole that the interference with or de-
struction of the desired retractile properties of the coil,
formerly encountered when it was attempted to incor-
porate therein shielding means for the main conductor,
is entirely avoided or substantially so.

Referring to the form of the invention illustrated in
the drawings, the retractile shielded electrical conductor
structure is shown in Fig. 1 to comprise a plurality of
helical turns or convolutions 10 forming a coil of uni-
form diameter, from whose opposite ends extend, ap-
proximately tangentially, substantially straight terminal
portions 11 and 12, respectively, of the coiled con-
ductor. As here shown, said conductor includes an outer
insulating and retractor sheath or jacket 13, directly be-
neath which is a binding layer 14 which envelops the
main conductor means comprising at least one flexible
wire insulated and shielded as will now be described in
detail.

In the present instance said main conductor means is
constituted by three (although there may be more or less
than three) multiple-strand electric wires 15, 16, and
17, electrically insulated from each other and each, in
turn, composed of a plurality of fine metal wires or
tinsel to afford maximum flexibility. Each of the said
electric wires is enveloped by an inner insulating sheath
18.

The respective insulating sheaths 18 of the electric
wires 15 and 16 are, in turn, helically wrapped with
flexible linear secondary conductor means to provide
each of them with a shielding layer which is designated
generally by the reference character 19 in Figs. 2, 3 and
4, and will presently be described in detail.

In a manner common in the art, groups of textile
filler-strands 20 are arranged in what would otherwise
be voids between the grouped wires 15, 16 and 17 (con-
sidered in conjunction with their respective laterally en-
veloping layers) to provide a substantially circular cross-
sectional form around which the binding layer 14 and
outer insulating sheath 13 extend, as shown in Fig. 3.

In the particularly desirable specific embodiment of the
invention here illustrated, each of the shielding layers
19 before referred to comprises flexible linear secondary
conductor means provided in this instance by a plurality
of composite shielding cords each generally designated

3 by the reference character 21. Moreover, each of the said shielding layers 19 is preferably formed by simultaneously wrapping around the given inner insulating sheath 18, helically and in contact with each other as shown, a plurality of said composite shielding cords 21 5 so that the pitch of the said shielding cords will be greater than would be the case were but a single shielding cord to be employed. Even as many as about sixteen shielding cords 21 may be simultaneously wrapped about a given insulating sheath. Each composite shielding 10 cord 21 comprises in this instance a core of textile material 22 and two (more or less) relatively wide and thin metallic ribbons 23 helically wrapped around the said core in contact with each other as is clearly shown in Fig. 5. The shielding layer 19 thus produced is virtually 15 in the form of a continuous yet flexible cylindrical sleeve, as is apparent.

The insulating sheaths 13 and 18 may be formed of rubber, synthetic resins or other suitable elastic insulating material, while the elements 14, 20 and 22 may 20 be conveniently formed of cotton, silk or other non-metallic textile material. The elements 15, 16, 17 and 23 may be formed of copper or other suitable low-resistance metals.

As the elements 13 to 23 are thus constructed and arranged, the metallic ribbons 23 form relatively minute helices throughout the relatively major helix 10 of the 25 entire structure as illustrated in Fig. 1, with the result that the helices 10 may be separated from each other in extending the electric conductor and may return to normal and substantially abutting positions, as indicated in Fig. 1, without the said minute helices exerting appreciable resistance to the said extension and contraction. It 30 should be noted that this effect is also furthered by the fact that the helices in which the composite shielding cords 21 are wrapped about the underlying insulating sheaths 18 are also very much smaller than the afore- 35 said relatively major helices 10 of the coiled conductor structure as a whole.

Furthermore, by virtue of the construction and arrangement of the elements above described, the metallic ribbons 23 do not become so distorted from their normal helical path when the structure is either fully 40 stretched or fully contracted, as to become set.

The extensible and retractable electric conductor in the form illustrated in Fig. 1 may be produced in accordance with the usual practice well known in the art, 45 by wrapping a conductor embodying the features 13 to 23 inclusive helically around a mandrel with the respective opposite ends of the coil left substantially straight to provide the terminal ends 11 and 12. The mandrel together with the helically wrapped conductor may then be 50 subjected to a heating operation to set the external insulating and retractor sheath 13 in helical form. It is the usual practice, after the structure has become cool, to reverse the direction of the helices in order to make the contractive tension of the structure more pronounced.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and 55 the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

This application is a continuation of my prior co- 60 pending application Serial No. 62,834, filed December 1, 1948, now abandoned.

I claim:

1. A shielded electric conductor having a coiled main conductor portion consisting substantially of a series of coiled convolutions of said conductor portion, said coiled convolutions normally being adjacent one another in retracted relation, and being spreadable apart to extended relation, and said coiled conductor portion comprising 65 in combination: a flexible electric wire extending along the interior of and as part of said coiled conductor portion; a flexible insulating sheath extending along the interior of and as part of said coiled conductor-portion and enveloping said electric wire; a shielding layer extending along the interior of and as part of said coiled conductor portion and enveloping said flexible wire and said inner insulating sheath, and comprising at least one composite shielding cord extending helically around said 70 insulating sheath, each said composite shielding cord consisting substantially of a flexible textile core and at least one relatively wide and thin flat metallic ribbon extending flatwise helically around said textile core; and an elastic retractor sheath extending along and as part of said 75 coiled conductor portion and enveloping said flexible wire and said insulating sheath and said shielding layer, and elastically resisting spreading apart movement of said coiled convolutions toward their extended relation, and elastically urging said coiled convolutions from their 80 extended relation toward their retracted relation.

2. In a retractile shielded electrical conductor structure having the form of an extensible, self-retracting helical coil, the combination comprising a main conductor portion including at least one flexible electric wire 85 which is sheathed in flexible insulating material and extends along the interior of and as part of the coiled conductor structure, and a flexible shielding layer encasing the insulated main conductor portion and formed by flexible linear secondary conductor means helically wrapped about and encasing the same, said secondary conductor means being in the form of composite cord comprising a 90 flexible core with at least one thin flexible low-resistance metal conductor helically wrapped about and encasing said core, together with a flexible elastic outer sheath of insulating material, set in helical form, enveloping the foregoing main and secondary conductor assemblage, which sheath elastically resists axial separation of the convolutions of the complete coiled structure and normally maintains them in retracted relation; the helical 95 convolutions of the metal wrapping in said flexible secondary conductor means being relatively minute as compared to those of the shielded conductor as a whole.

3. The retractile shielded electrical conductor structure defined by claim 2, wherein said shielding layer comprises a plurality of such composite cords simultaneously wrapped helically about said insulated main conductor portion.

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