

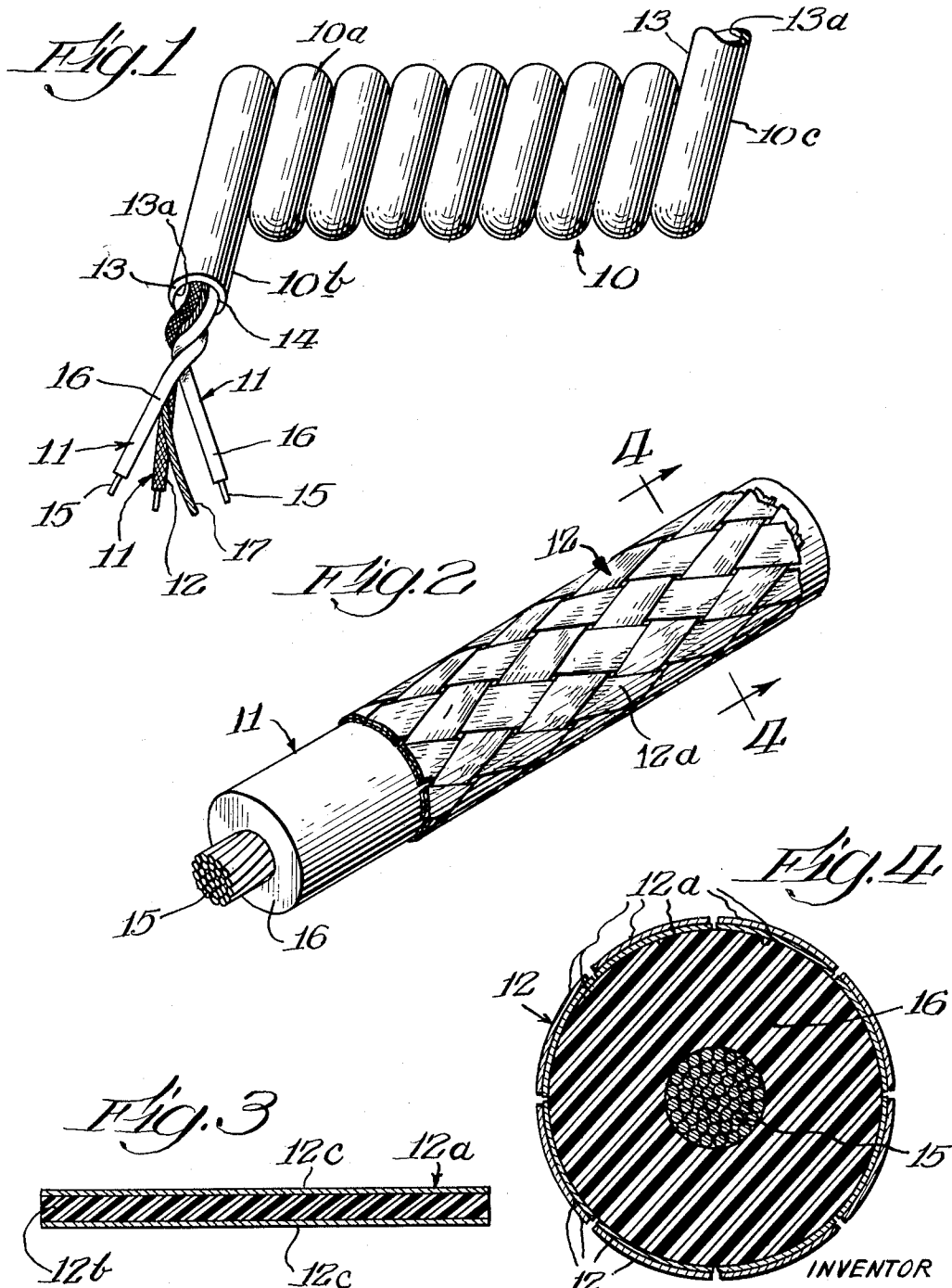
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R. D. MADDOX

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SHIELDED CONDUCTOR IN AN EXTENSIBLE CABLE

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INVENTOR
RICHARD D. MADDOX, DECEASED,
BY CLARA A. MADDOX, EXECUTRIX

By Soars, Anderson, Lundeka & Feltz

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3,240,867 SHIELDED CONDUCTOR IN AN EXTENSIBLE CABLE

Richard D. Maddox, deceased, late of Richmond, Ind., by
Clara A. Maddox, executrix, Richmond, Ind., assignor
to Belden Manufacturing Company, Chicago, Ill., a
corporation of Illinois

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This application is a continuation-in-part of appli-
cation Serial No. 183,573, filed March 29, 1962, now
abandoned.

This invention relates to coiled electrical cords and
more particularly to an extensible and retractable elec-
tric cord of the type which includes at least one insulated
wire having suitable shielding thereabout.

The use of shielded type coiled cords has become
increasingly more prevalent, and such cords are incor-
porated in numerous electrical measuring and communi-
cation systems. For example, coiled cords are commonly
utilized on telephone receivers, as microphone cables for
radio transceivers, as probe cables for Geiger counter
equipment, etc. These coiled cords generally employ
one or more insulated signal carrying wires which re-
quire suitable electromagnetic and/or electrostatic shield-
ing. The function of the shielding is to preclude extra-
aneous voltages or signals from being picked up and ad-
versely affecting the signal carried by one or more of
the wires contained in the coiled conductor and/or in-
hibit signals from being transmitted by the shielded sig-
nal carrying wires.

When shielding is employed, it is necessary that the
coiled cord or conductor retain the extensible and
retractable properties which characterize such cords.
Initially attempts were made to utilize a braided form
of shielding similar to that which proved satisfactory as
shielding for insulated conductors or wires included in
various cable structures. However, attempts to incor-
porate this type of braided shielding in coiled cords did
not meet with great success.

More particularly, attempts to use the round strands
conventionally incorporated in braided shields led to a
diameter buildup larger than is desirable in retractile
or coiled cords. In addition, the nature of the conven-
tional braided shields is such that the degree of flexi-
bility and pliability required in coiled cords cannot be
realized. Moreover, previous shielding braided from
conductive textiles, plastics and elastomers have not
proven to possess the most effective electrical shielding
properties.

To overcome the problems incident to the use of the
previously available braided shields, recourse has been
made to producing retractile cords by providing shield-
ing about selected insulated wires contained therein
in the form of spirally wound metallic wire or in the form
of a plurality of helically wrapped metallic ribbons.
These latter and other non-braided forms of shielding,
while proving satisfactory for certain applications, do
not possess the advantageous qualities of braided shield-
ing as required in coiled cord constructions.

It is a prime object of the present invention to pro-
vide an improved retractile cord construction includ-
ing at least one insulated wire having a flexible braided
metallic shield thereabout.

A further object of the invention resides in the pro-
vision of a retractile cord including at least one wire
shielded with flexible metallic braid that possesses the
highly desirable properties of extensibility and retract-
ability.

Still another object of the invention is to provide
a retractile cord including at least one insulated wire

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shielded with a flexible metalized braid which can with-
stand numerous extension and retraction cycles and which
is relatively economical to manufacture.

Other objects and advantages of the present invention
will become apparent from the following description
thereof when considered in conjunction with the accom-
panying drawings wherein:

FIGURE 1 is a perspective view, partially broken
away, of one type of extensible and retractable coiled
cord embodying the principal features of the present in-
vention;

FIGURE 2 is an enlarged perspective view of one
of the insulated wires shown in FIGURE 1 having an
improved braided metallic shield of the type contem-
plated by the present invention;

FIGURE 3 is an enlarged cross-sectional view of a
filamentary strand of a flexible metalized film utilized in
the braided shield illustrated in FIGURE 2; and

FIGURE 4 is a cross-sectional view taken along the
line 4-4 of FIGURE 2.

As depicted in the drawings, a preferred embodiment
of the present invention includes a retractile cord hav-
ing an outer insulating sheath set in helical form and
having at least one insulated wire contained therein
which is provided with a braided metallic shield. In
accordance with the provisions of the invention, the
braided metallic shield is fabricated of a plurality of thin
metalized ribbon-like strands or filaments which exhibit
good flexible properties and are capable of withstand-
ing the normal tensile stress imparted thereto. These
characteristics of the braided shielding contemplated
by the invention insure that the coiled cord containing
the shielded wire retains the desired elastic properties
and is capable of withstanding numerous expansion and
retraction cycles.

Referring in particular to FIGURE 1, there is dis-
closed one form of retractile cord 10 which includes at
least one insulated wire 11 having a braided metallic
shield 12 of the type contemplated by the present inven-
tion. The coiled cord 10 is formed with a plurality of
helical turns or convolutions 10a having a substantial-
ly uniform diameter. Oppositely disposed substantially
straight end portions 10b and 10c of the cord 10 ex-
tend tangentially from the coiled central portion and act
as terminals for the cord. The cord includes an outer
insulating sheath or jacket 13 which is fabricated of a
material such as an extruded synthetic rubber. A thin
coating 14 of a protective tissue-like material, preferably
composed of cellulosic fibers, is provided along the
inner peripheral surface 13a of the sheath.

In a preferred embodiment of the invention, the jacket
or sheath 13 is extruded about a plurality of individual
wires 11, each of which preferably includes a stranded
central conductor 15 and an insulating sleeve 16 fabri-
cated of a material such as rubber, plastic, etc. The
individual wires 11 are wound in spiral fashion about
each other to provide a compact cord and the coating
14 serves to protect the wires during the extrusion of the
sheath 13.

At least one of the insulated wires 11 is provided with
the braided metallic shield 12 which extends along the
outer periphery of the sleeve 16. As previously described,
the shield serves to isolate a selected wire 11 from stray
electrical signals that may have an adverse effect on the
operation of the system wherein the cord is utilized
and/or precludes signals from being transmitted by the
shielded wires. The cord 10, which is illustrative of only
one of the many types of cords wherein the braided metal-
lic shield 12 can be utilized, also includes a drain or
ground wire 17 that is wound in spiral fashion with and
around the shielded and unshielded wires 11. The drain

wire may also be woven in the braid itself or laid parallel thereto.

Referring to FIGURES 2-4, the braided shield 12 which extends along the outer peripheral surface of the insulating sleeve 16 of the signal carrying wire 11, is fabricated in accordance with conventional braiding methods from a plurality of metalized filamentary strands or ribbon-like members 12a. Each of the filamentary strands or members 12a is extremely thin and is characterized by a high degree of flexibility. These characteristics of the strands which comprise the braid insure that the elastic properties of extensibility and retractability are maintained in the composite coiled cord 10 including the braided shielding.

As shown in FIGURE 3, each metalized filamentary strand 12a includes a thin central or base layer 12b formed of a suitable flexible material, which in one embodiment of the invention has a thickness of approximately .002" and a width of approximately .02". The preferred thickness and width of the filamentary strands will of course vary when braided shielding fabricated therefrom is utilized with insulated wires of different diameter.

Although the flexible base layer must be sufficiently thin to preclude substantial diameter build up in the coiled cord incorporating the braided shielding, the material must be sufficiently strong to withstand the tensile stress imparted thereto during normal use of the cord. Materials which satisfy these requirements and which can be satisfactorily utilized as the thin flexible base material are polyethylene terephthalate, polytetrafluoroethylene and polychlorotrifluoroethylene. These materials are commercially available under the trade marks Mylar, Teflon and Kel-F, respectively. Mylar is the preferred base material since it is relatively inexpensive and has high tensile strength in small cross section. In addition, extremely thin coatings or layers 12c (e.g. .00035") of conductive materials such as aluminum, silver, copper, etc. can be readily bonded to each surface of a Mylar strand so that during subsequent expansion and retraction of the cord incorporating the shield, the continuity of the metallic coatings is not disturbed.

The braid 12 provided about the insulating sleeve 16 of the conductor 11 differs from the usual ribbon-like conductive shield that is helically or spirally wound about a wire disposed within a coiled cord. In this connection, the thin metalized strands forming the braid 12 possess flexible properties which particularly lend the shielding braided therefrom to advantageous use in coiled cords. Moreover, when problems of R-F pickup are encountered, the individual filamentary strands forming the braid and crossing each other repeatedly do not develop or sustain any inductive effect as would be the case with conventional spirally served shielding.

It has been found that the flex life of shielding braided from the metalized filamentary strands has been substantially improved and the noise level in a coiled cord incorporating such a braid is minimized when the individual filamentary strands 12a are braided so that the various strands merge to define a braid angle of less than about 45° and greater than about 17° (where the braid angle is equal to the angle defined between a longitudinally extending line that bisects the angle at which two strands merge and one of the strands). For braid angles less than this, the strand of the braid on the outside of a bend is subject to undesirable stretching. It has further been found that such advantageous results are optimized when the aforescribed braid angle is approximately 26°.

To provide adequate shielding when utilizing filamentary strands having the dimensions described above in connection with one preferred embodiment, sixteen such strands were braided to provide an overall coverage of approximately 95%. Since the braid is relatively thin, this coverage is achieved without any substantial build-

up in the diameter of the cord incorporating the conductors provided with the braided shielding. Preferably, the overall coverage should not exceed approximately 95%.

An extensible and retractable coiled cord including at least one insulated wire having a thin metalized shield braided thereabout can be produced in any desired length in accordance with conventional coiled cord producing methods. That is, the several interwound conductive members or wires 11 are enclosed by the extruded outer sheath or jacket 13, and the entire cord is helically wound about a mandrel with the ends thereof remaining substantially straight to provide the terminal portions 10b and 10c. Thereafter, the mandrel together with the cord wrapped in helical fashion thereabout is subjected to successive heating and cooling steps which effect a "setting" of the sheath in coiled form. Preferably, the coiled cord is worked after cooling to reverse the direction of the convolutions 10a and thereby increase the tendency of the cord to remain in a contracted state.

It should be understood that the foregoing description embodied in the present application is merely illustrative of the application of the invention. Various modifications in the structural features of the described coiled cord incorporating a shield braided of thin strands of metalized flexible material incorporated therein could be devised by those skilled in the art without departing from the invention.

Various features of the invention are set forth in the accompanying claims.

What is claimed is:

1. In an extensible and retractable coiled cord that includes an outer insulating sheath formed with a plurality of helical convolutions with the insulating sheath set in such helical formation, a plurality of insulated wires disposed within the sheath and extending along the length thereof, a flexible braided shield provided about at least one of said insulated wires, which shield comprises a plurality of ribbon-like strands of a thin, strong, flexible non-conductive base material having a thin layer of conductive material bonded to each surface thereof, said conductive layers being substantially thinner than the thickness of said ribbon-like strands of said non-conductive material, the braid on said one insulated wire having a braid angle of between approximately 17° and 45°, whereby a minimum of stretching is imparted thereto.

2. In an extensible and retractable coiled cord that includes an outer insulating sheath formed with a plurality of helical convolutions with the insulating sheath set in such helical formation, a plurality of insulated wires disposed within the sheath and extending along the length thereof, a flexible braided shield provided about at least one of said insulated wires, which shield comprises a plurality of ribbon-like strands of a thin, strong, flexible non-conductive base material having a thin layer of conductive material bonded to each surface thereof, the braid on said one insulated wire having a braid angle of approximately 26° whereby a minimum of stretching is imparted thereto.

3. The product of claim 1 in which the non-conductive base material is polyethylene terephthalate.

4. The product of claim 2 in which the non-conductive base material is polyethylene terephthalate.

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JOHN F. BURNS, *Primary Examiner*.

JOHN P. WILDMAN, *Examiner*.