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Sparrowhawk

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(45) **Date of Reissued Patent: Apr. 5, 2011**

(54) **DISCONTINUOUS CABLE SHIELD SYSTEM AND METHOD**

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(73) Assignee: **Leviton Manufacturing Co., Inc.**, Little Neck, NY (US)

(21) Appl. No.: **12/707,985**

(22) Filed: **Feb. 18, 2010**

Related U.S. Patent Documents

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(64) Patent No.: **7,332,676**
Issued: **Feb. 19, 2008**
Appl. No.: **11/277,744**
Filed: **Mar. 28, 2006**

U.S. Applications:
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(51) **Int. Cl.**
H01B 7/18 (2006.01)

(52) **U.S. Cl.** .... **174/102 R**; 174/102 SP

(58) **Field of Classification Search** .... 174/36, 174/102 R, 102 SP, 112
See application file for complete search history.

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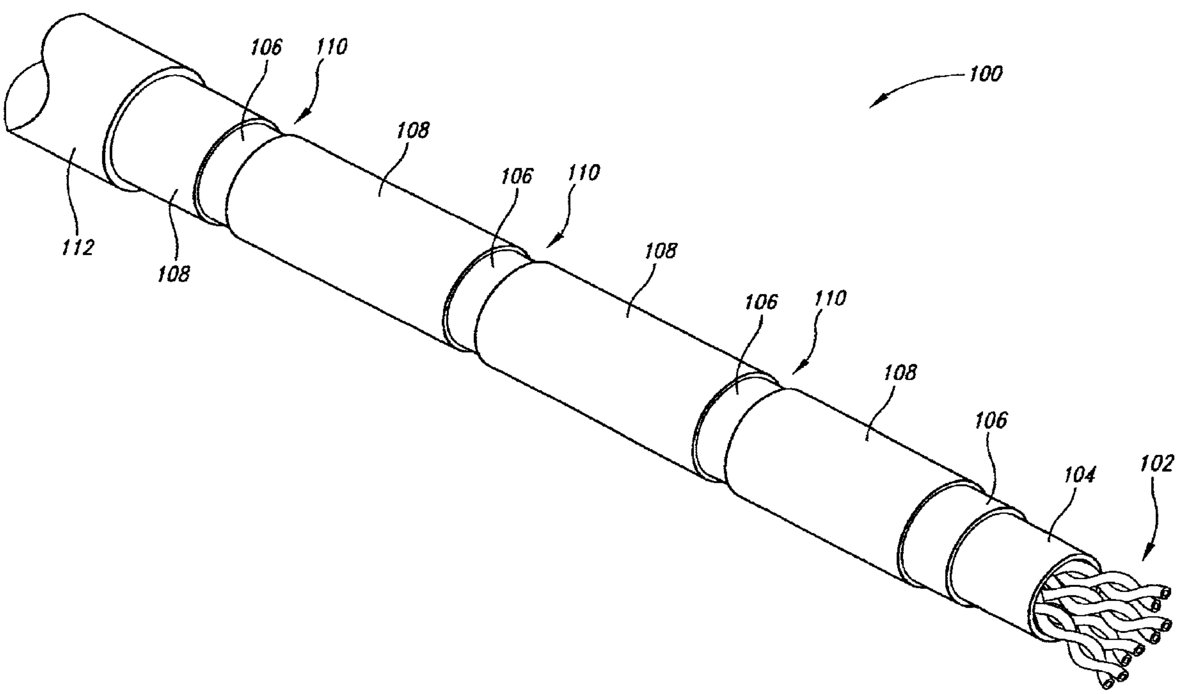
Primary Examiner—William H Mayo, III
(74) *Attorney, Agent, or Firm*—Nixon & Vanderhye PC

(57) **ABSTRACT**

Implementations of a discontinuous cable shield system and method include a shield having a multitude of separated shield segments dispersed along a length of a cable. The separated shield segments can serve as an incomplete, patch-worked, discontinuous, 'granulated' or otherwise perforated shield for differential transmission lines such as with twisted wire pairs.

53 Claims, 24 Drawing Sheets



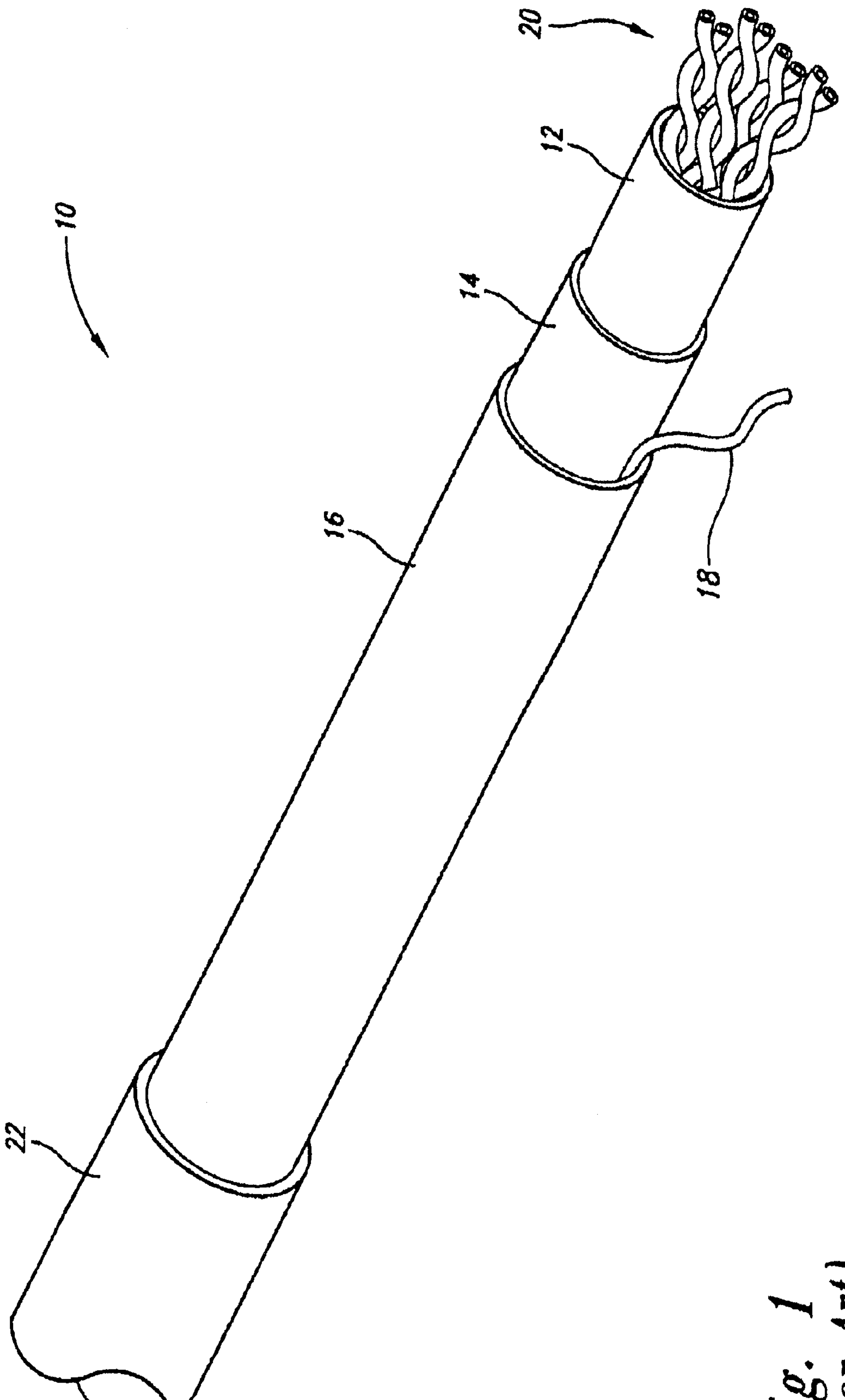


Fig. 1
(Prior Art)

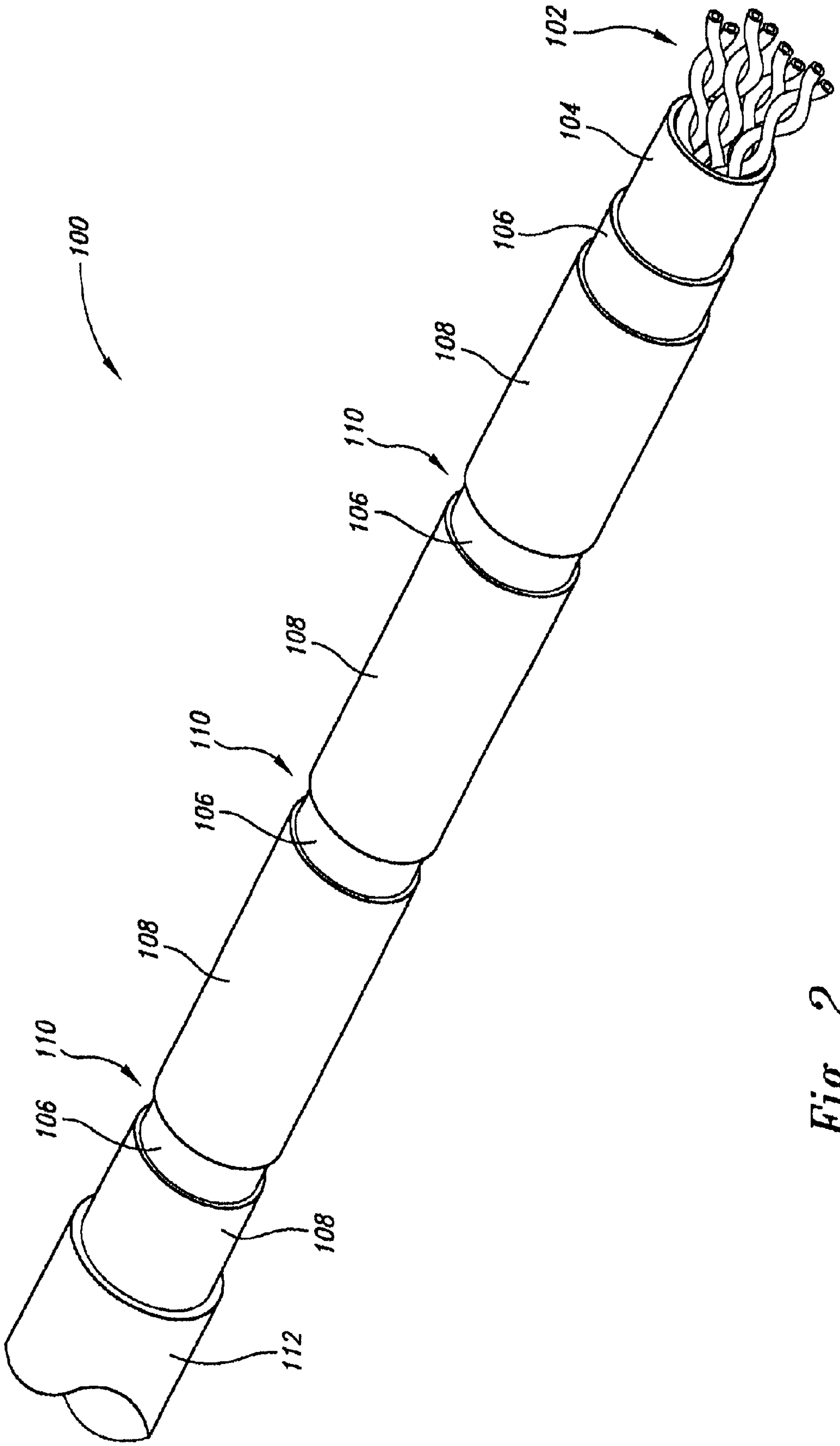


Fig. 2

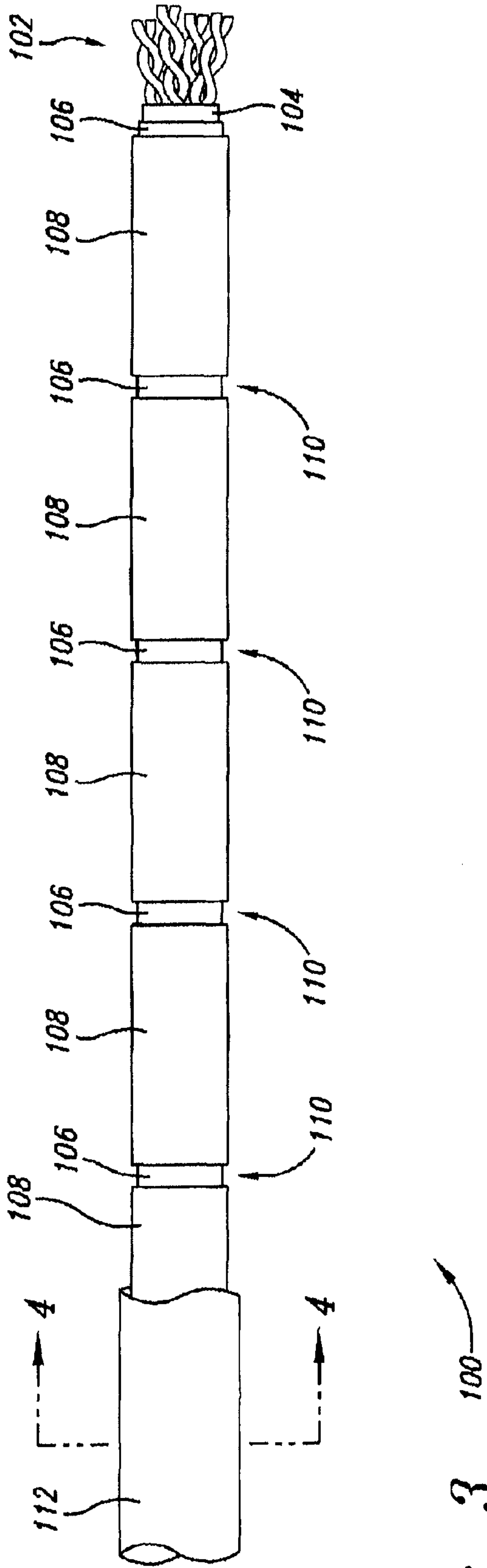

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Fig. 3

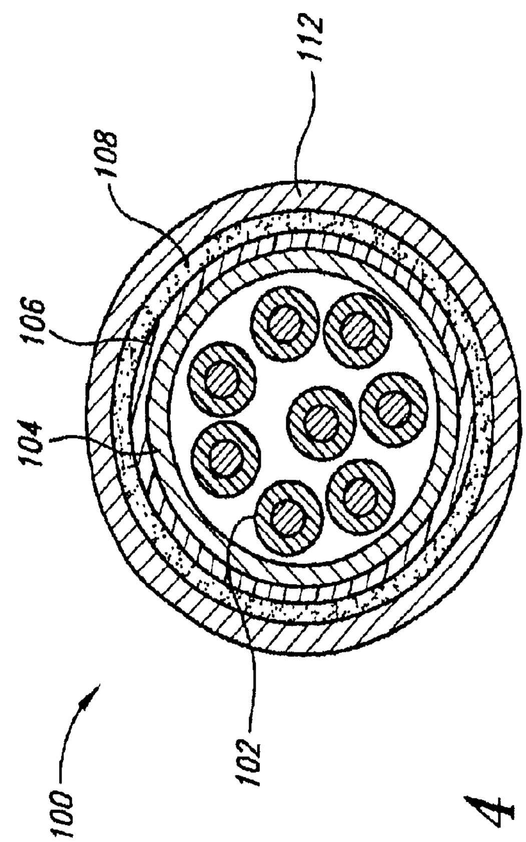
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Fig. 4

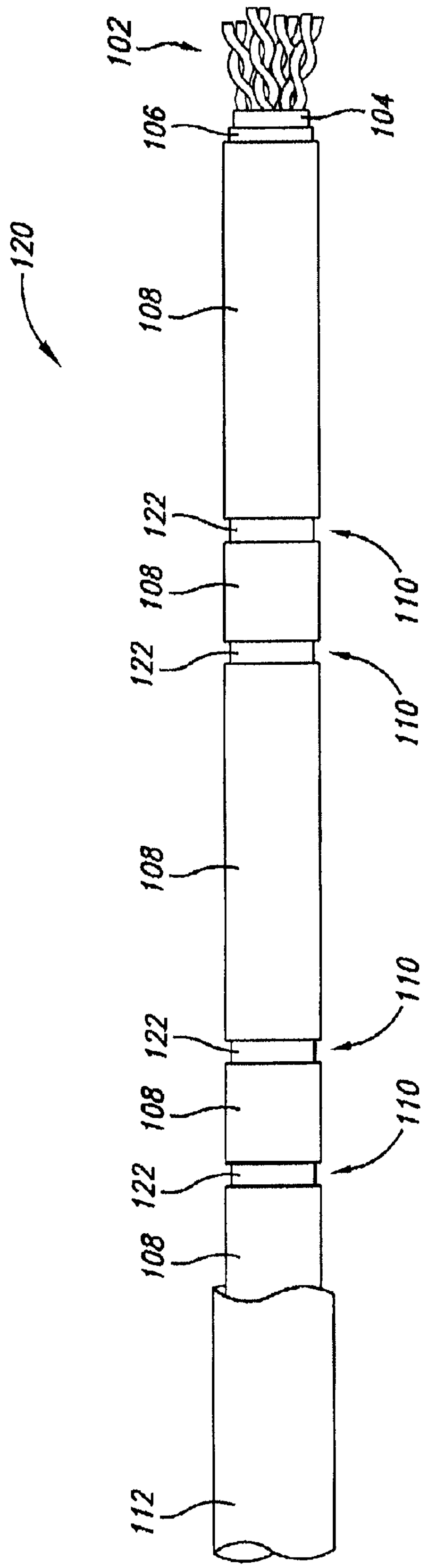


Fig. 5

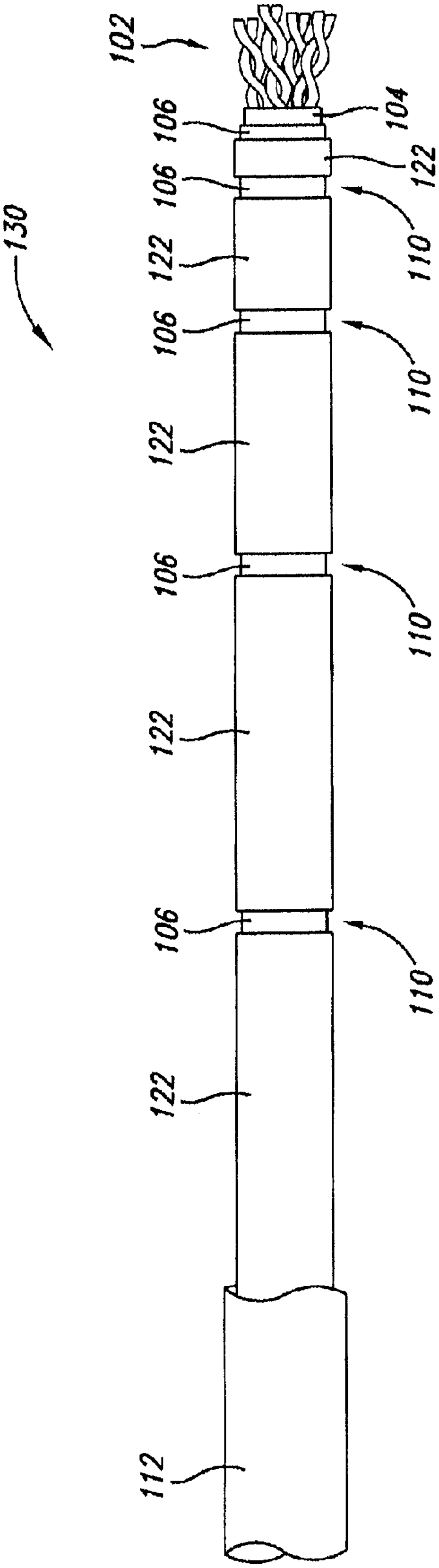
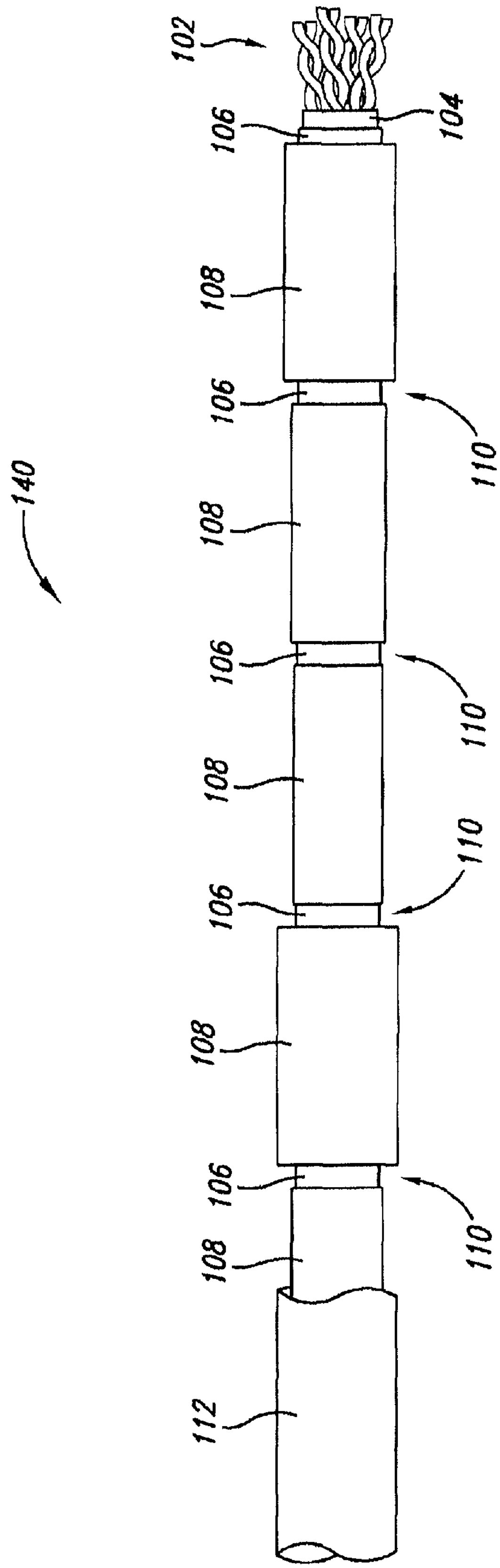


Fig. 6



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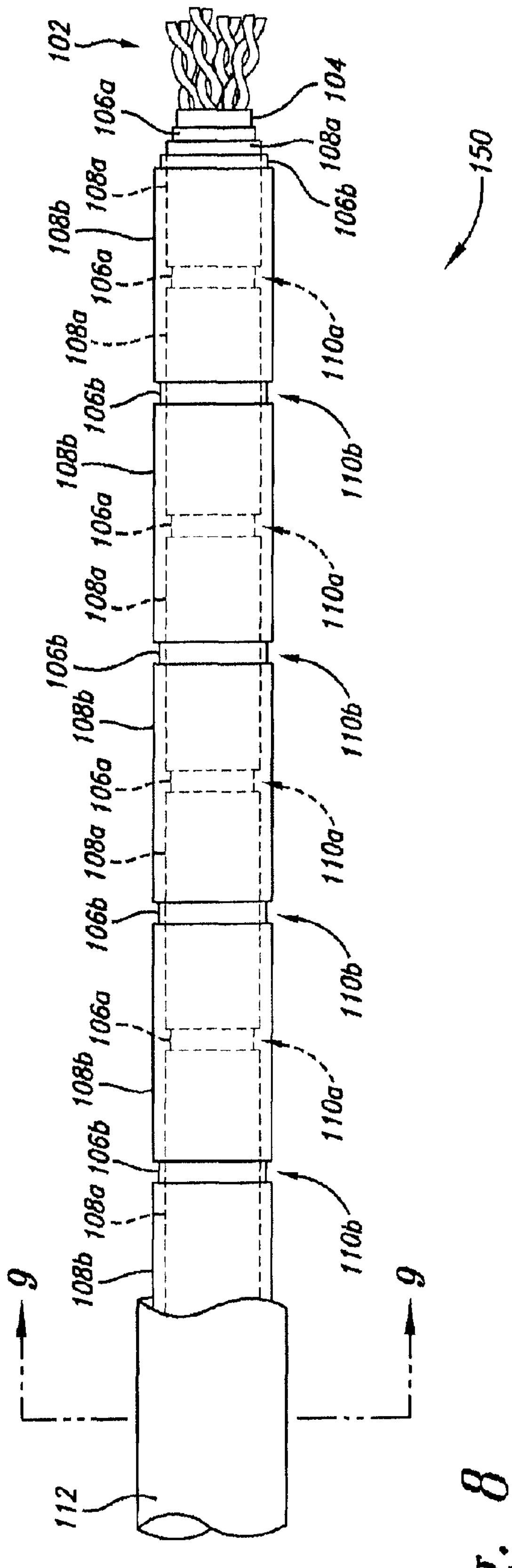
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Fig. 8

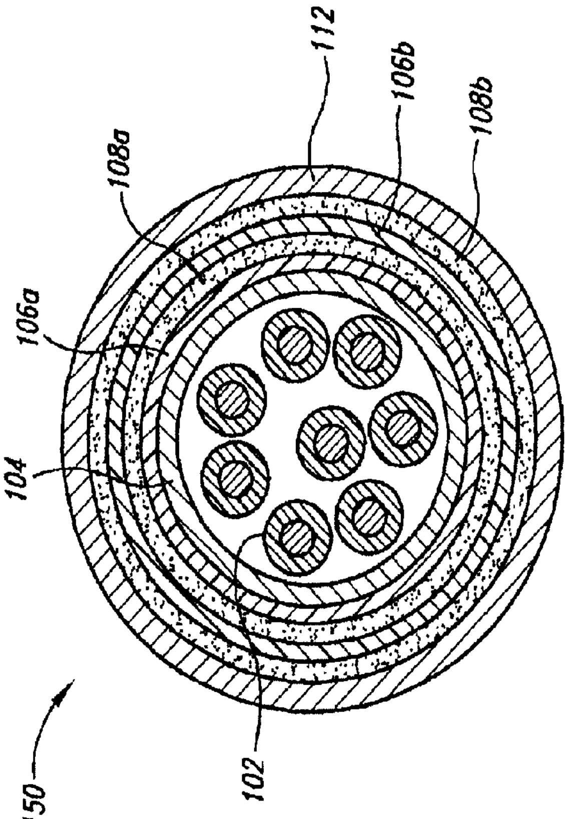
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Fig. 9

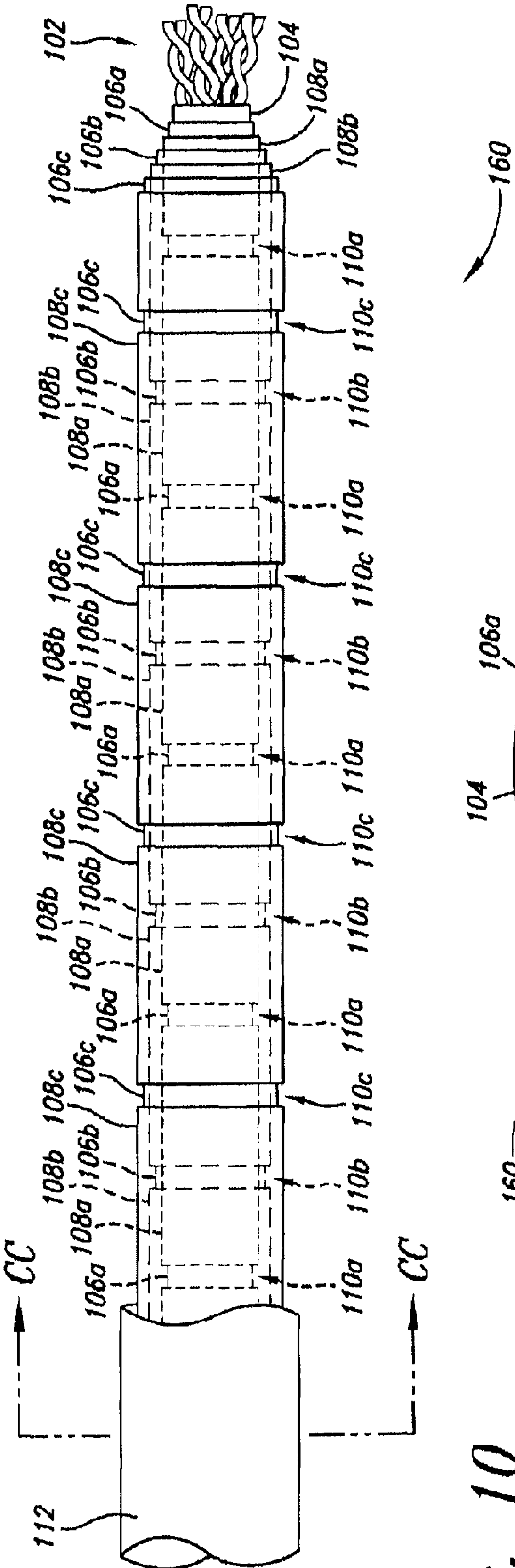
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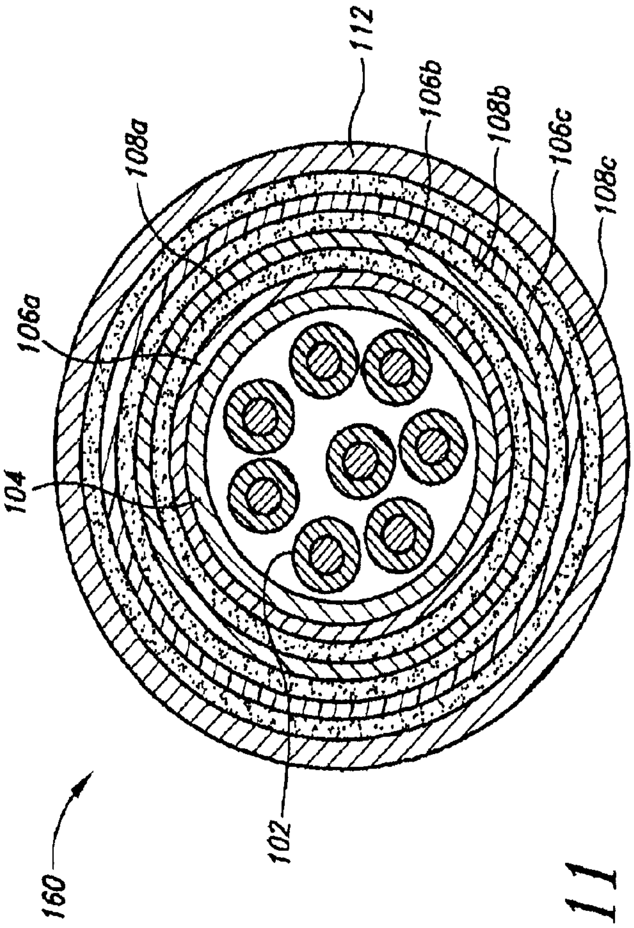
Fig. 10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108c
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Fig. 11

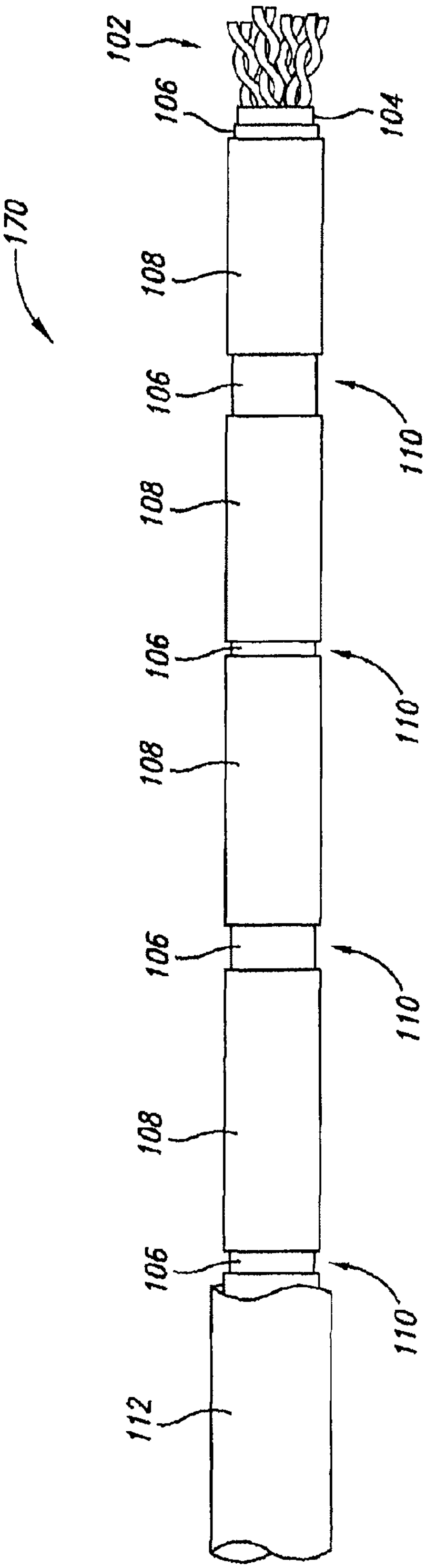
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Fig. 12

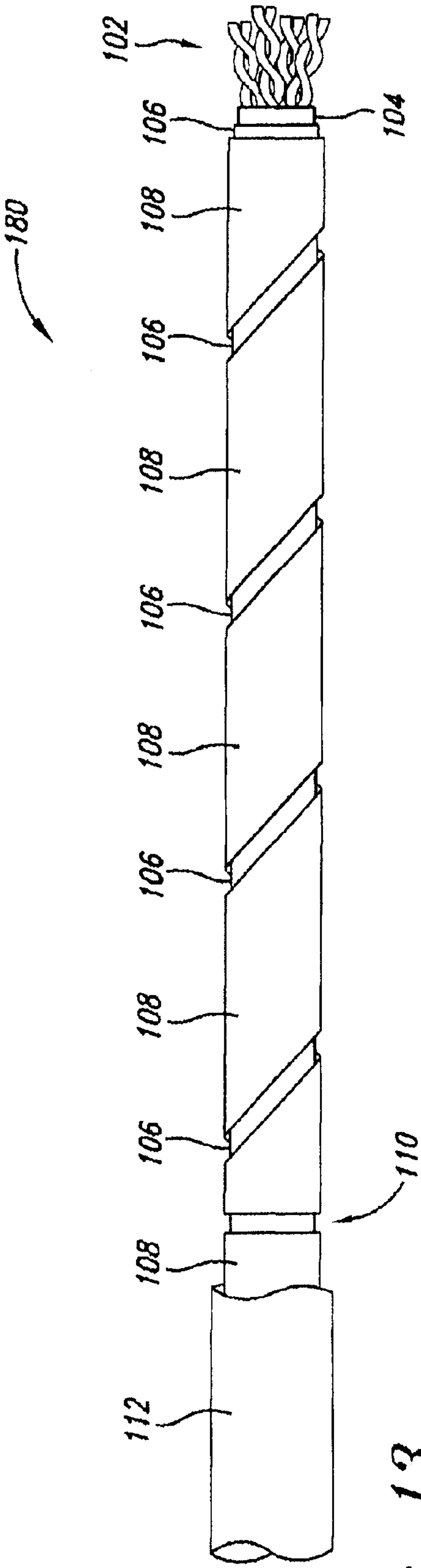
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Fig. 13

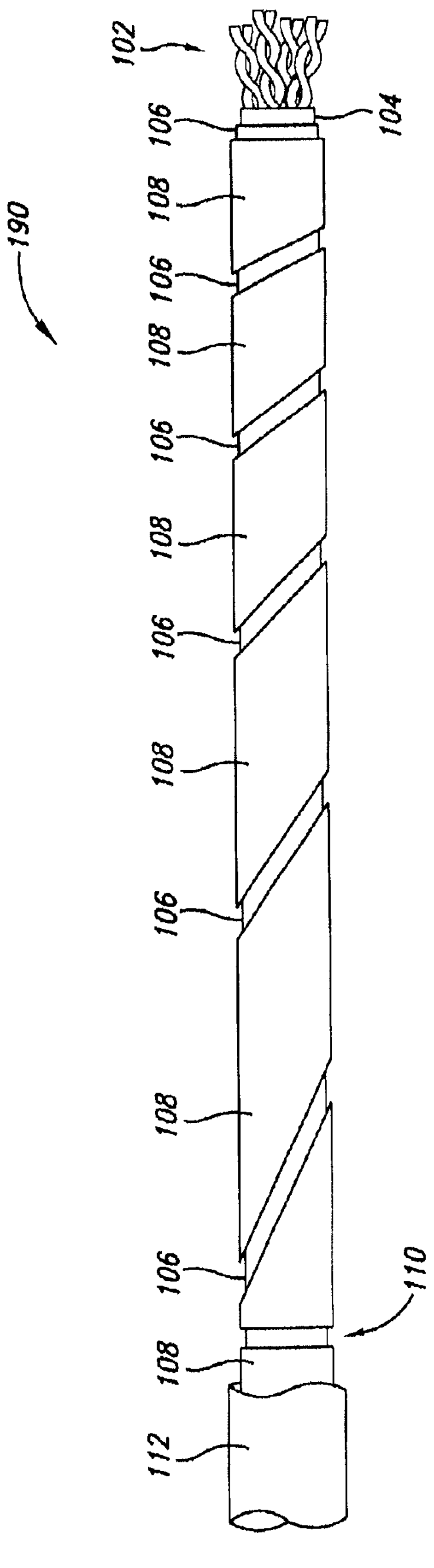


Fig. 14

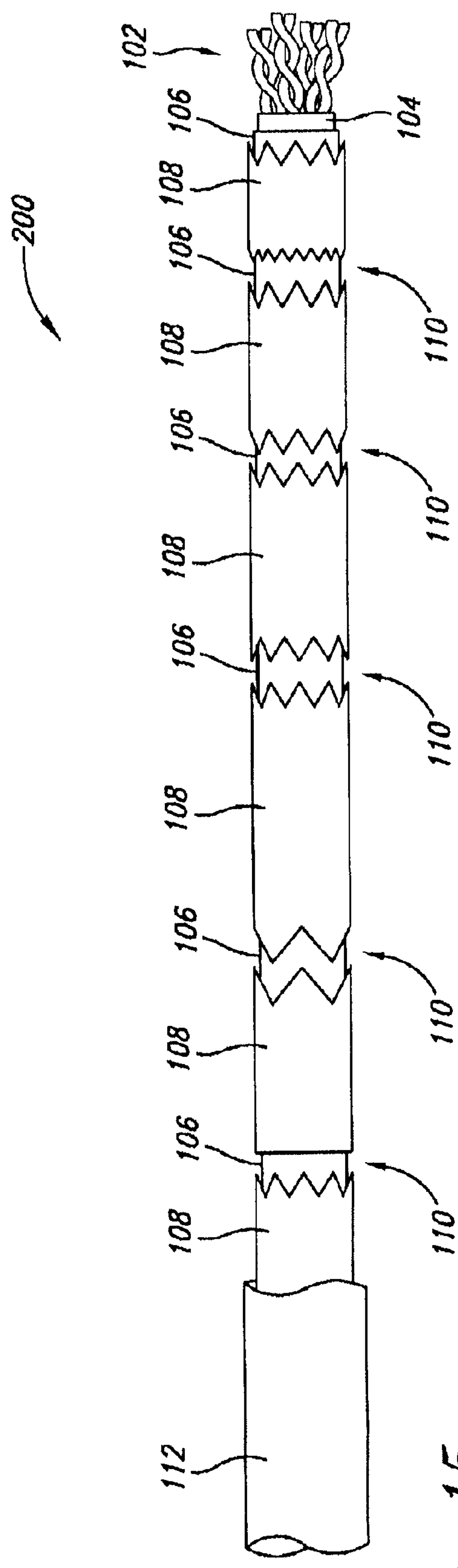
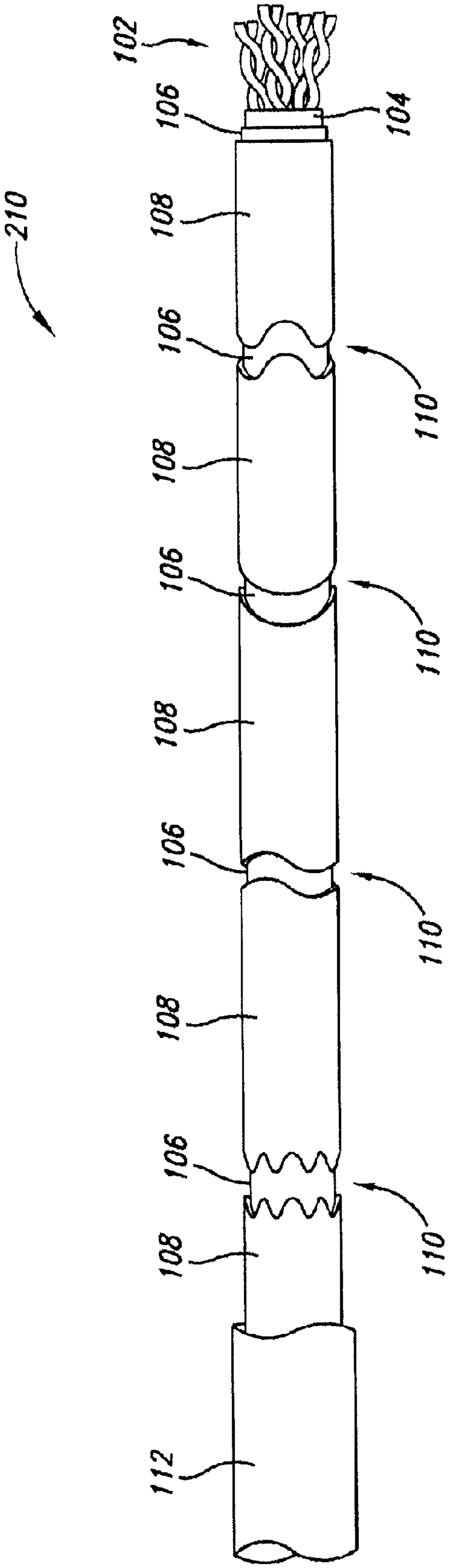


Fig. 15



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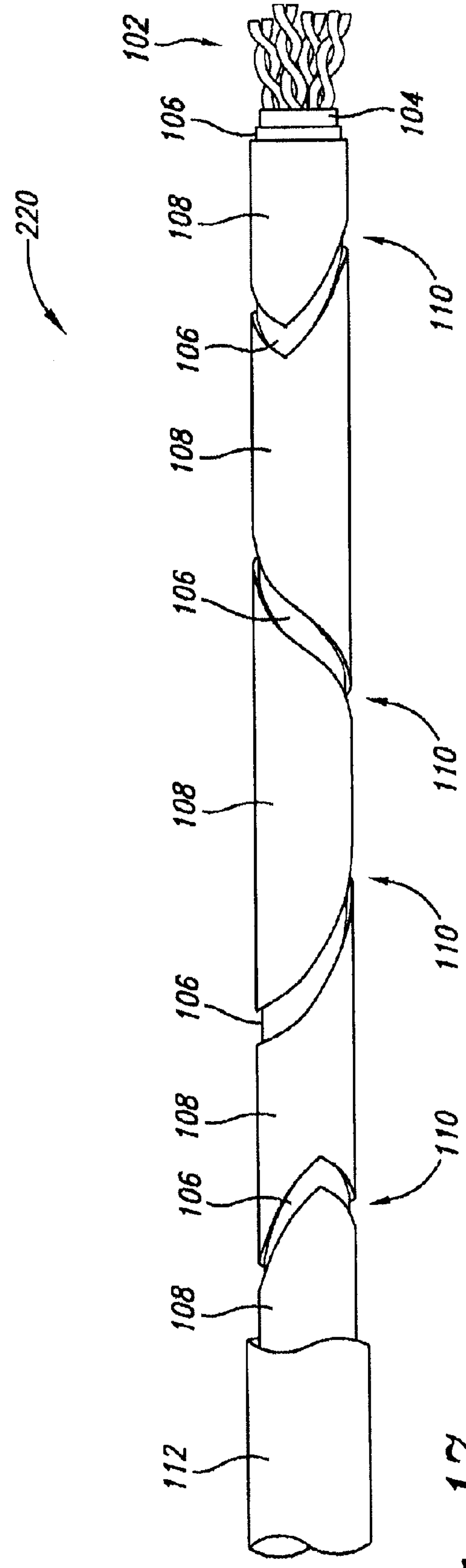
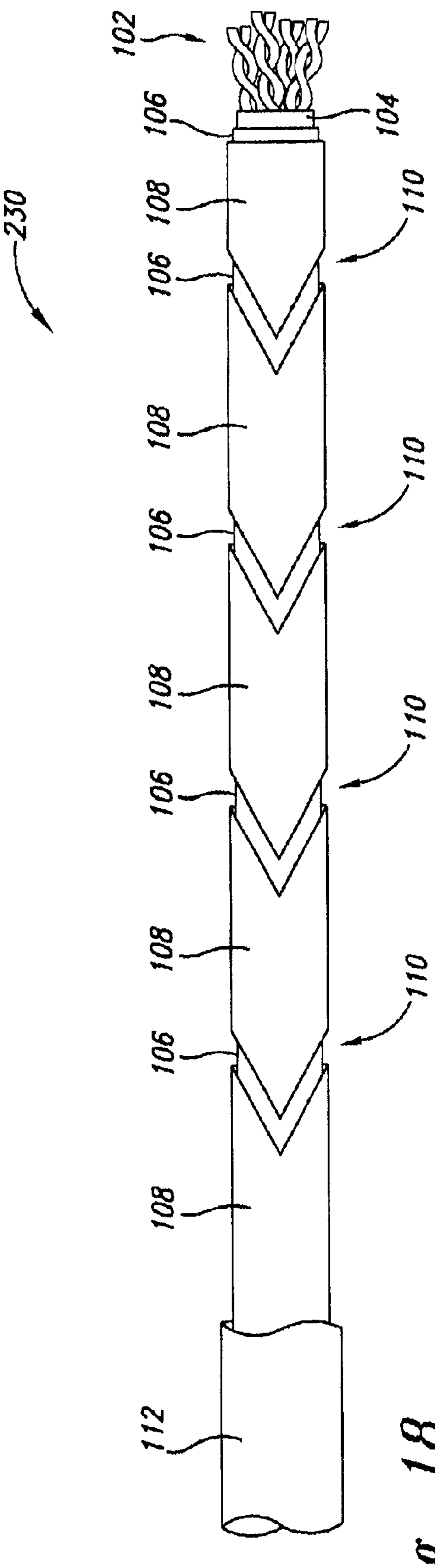


Fig. 17



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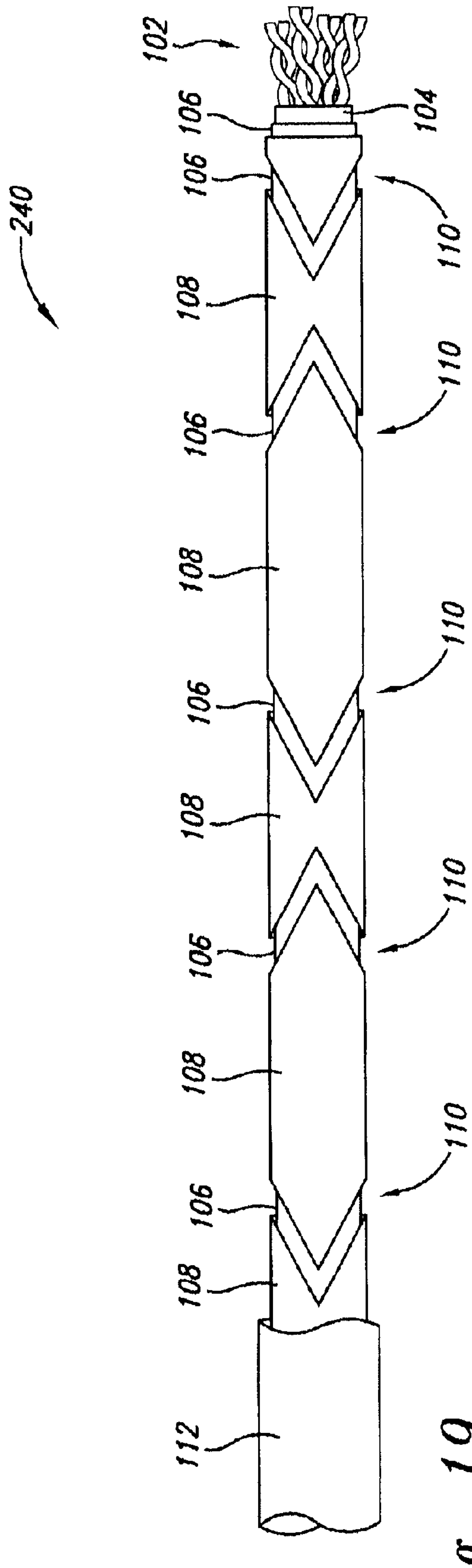

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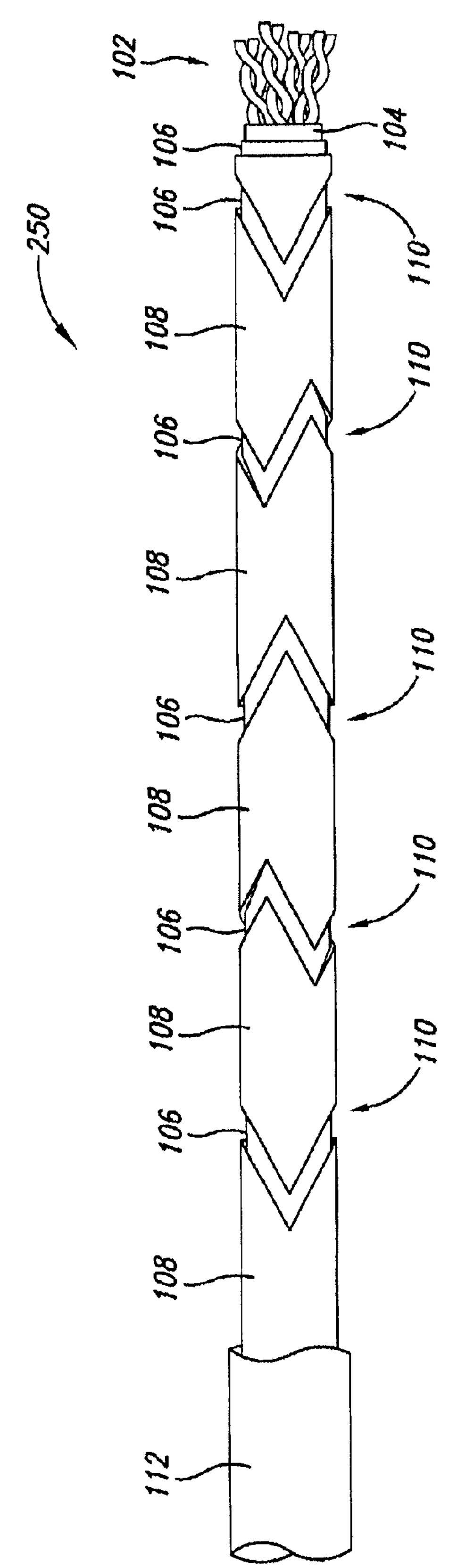
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Fig. 20

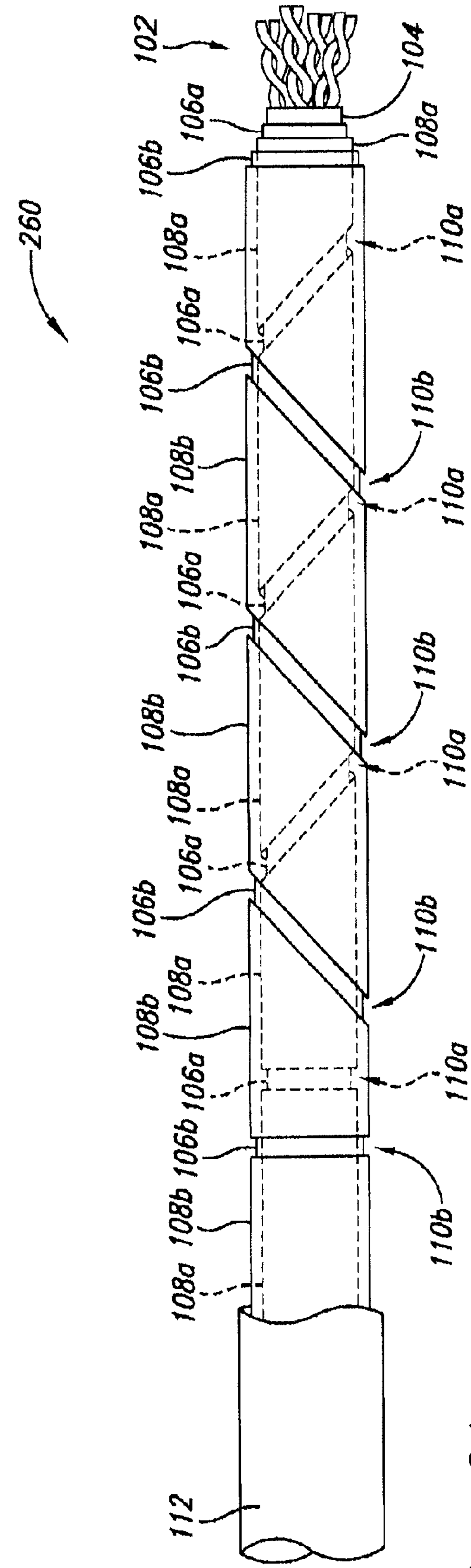
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Fig. 21

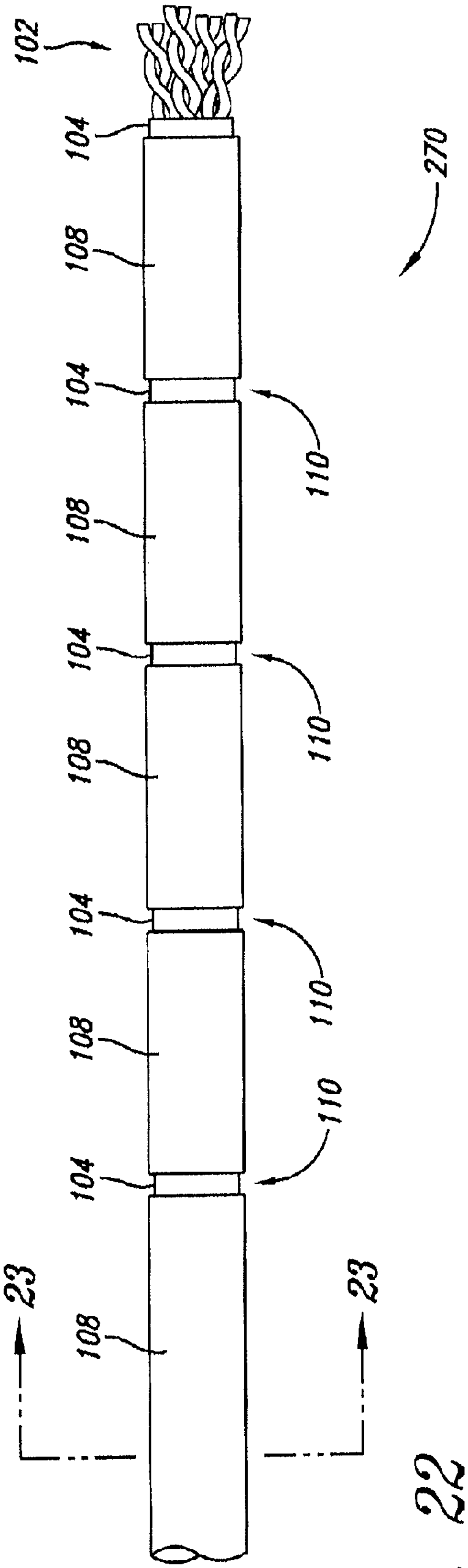
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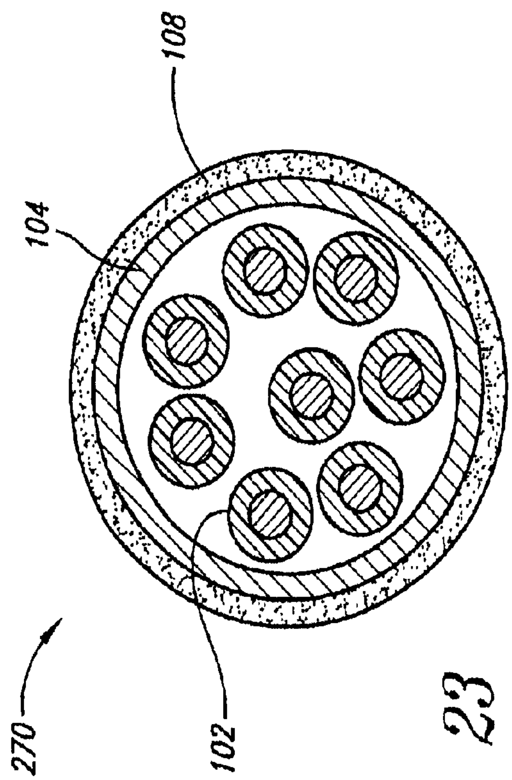
Fig. 22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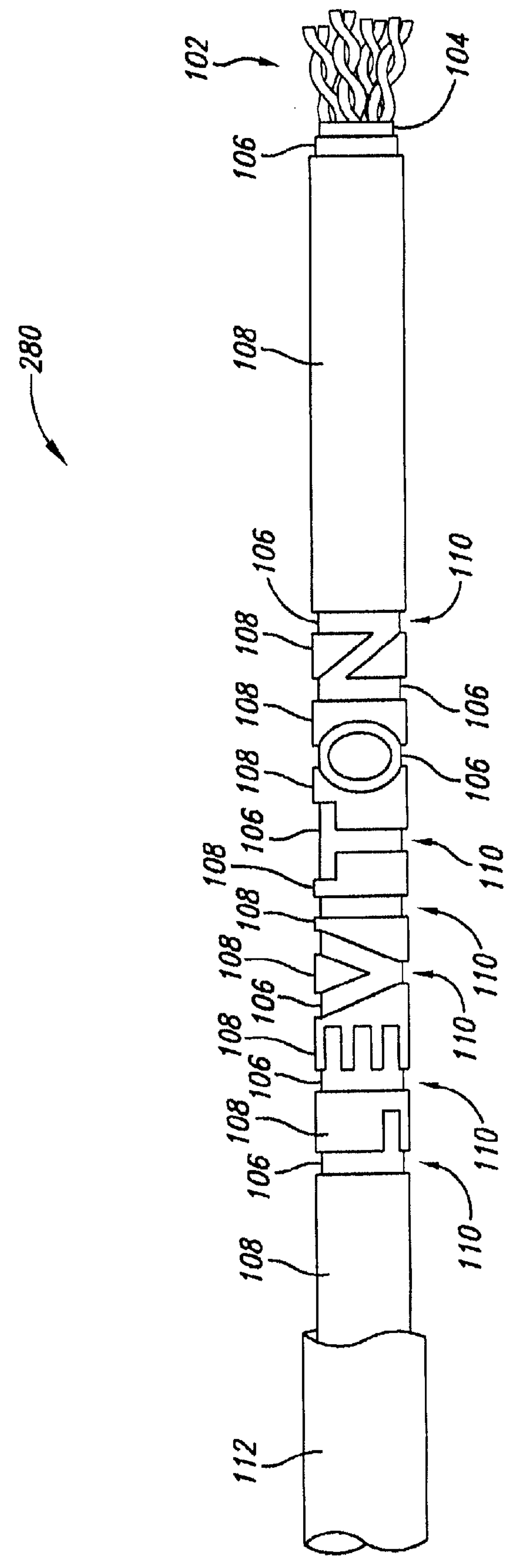

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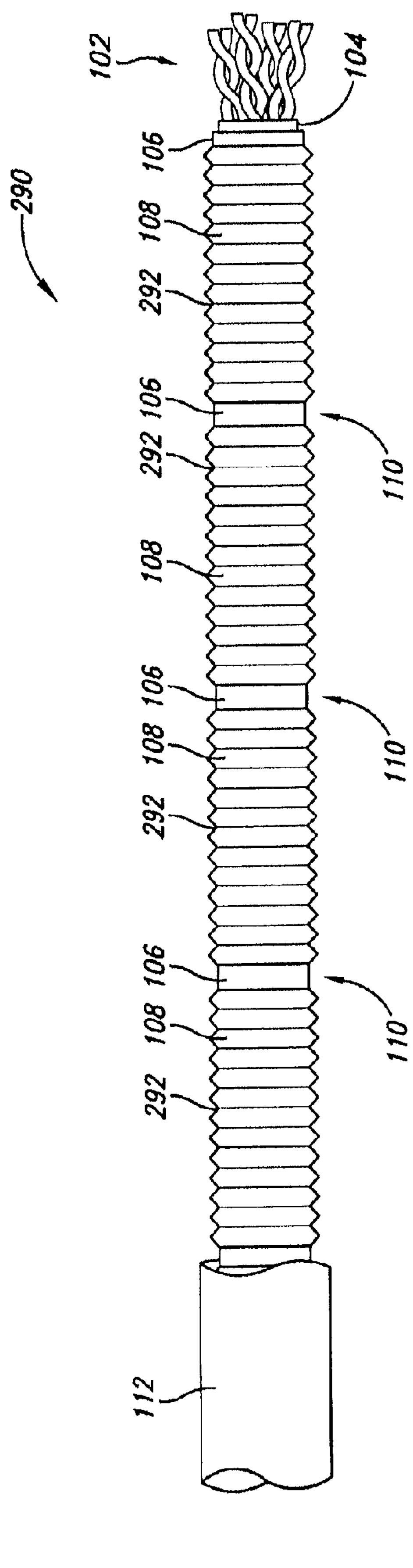
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Fig. 25

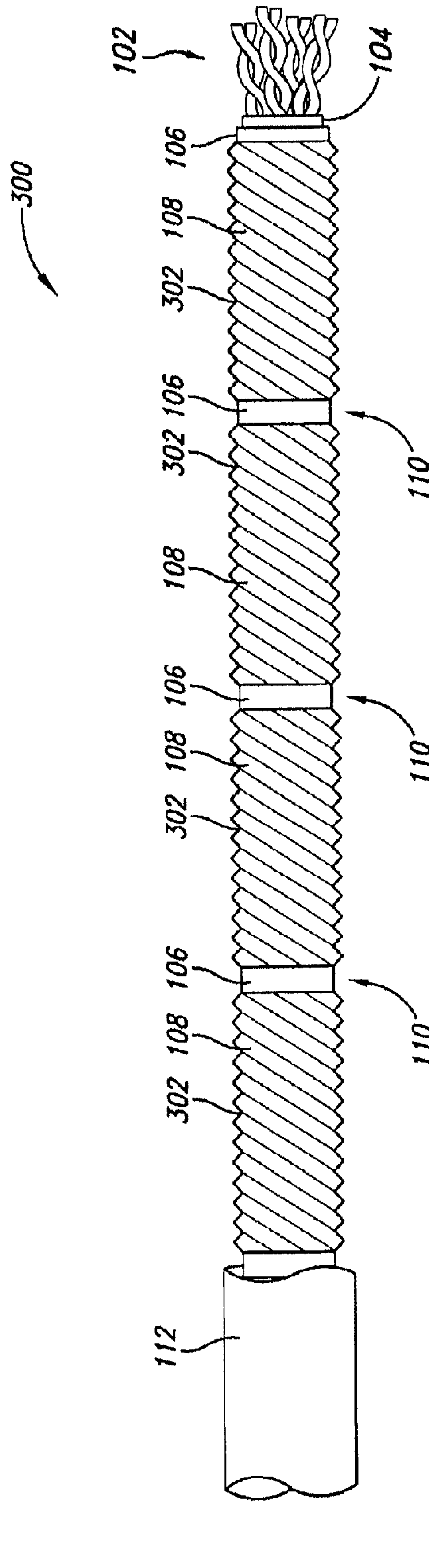
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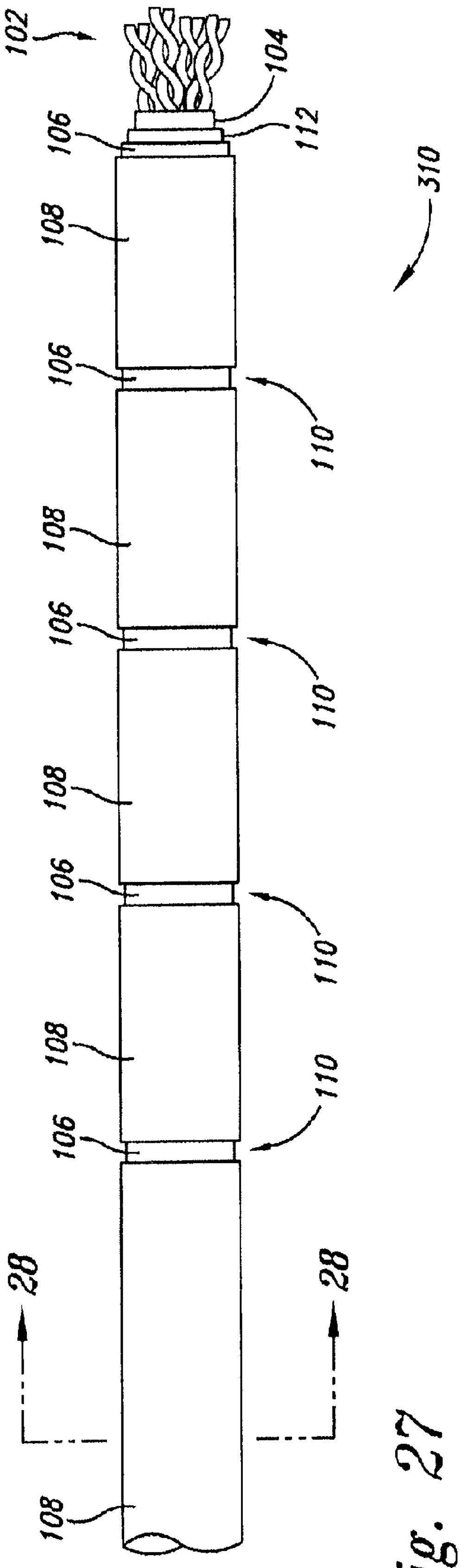
Fig. 26



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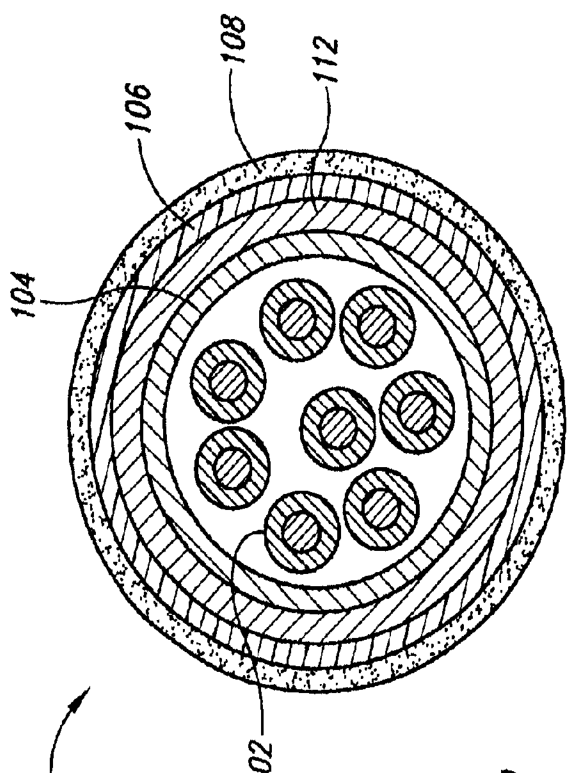

Fig. 28

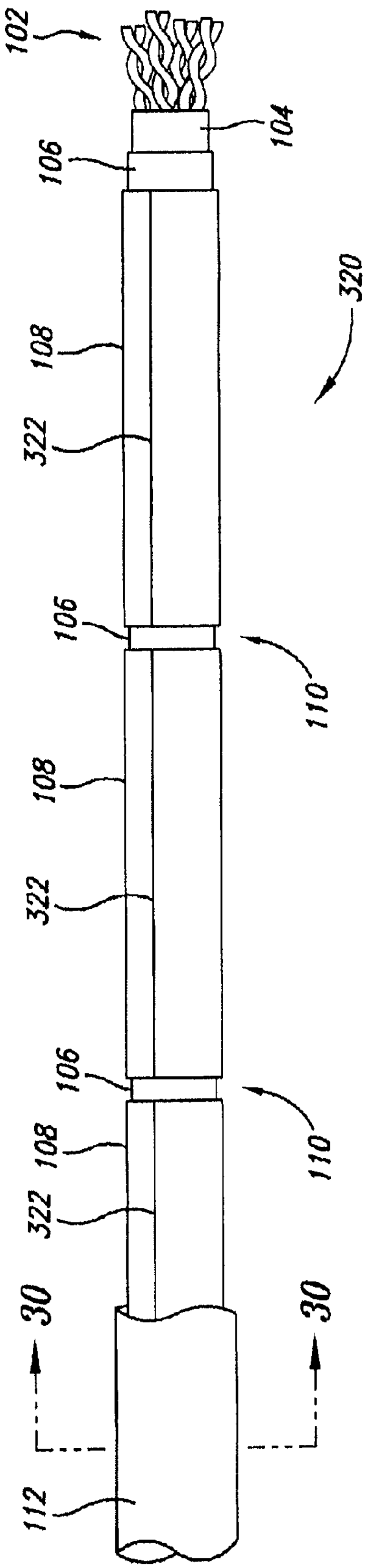
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Fig. 29

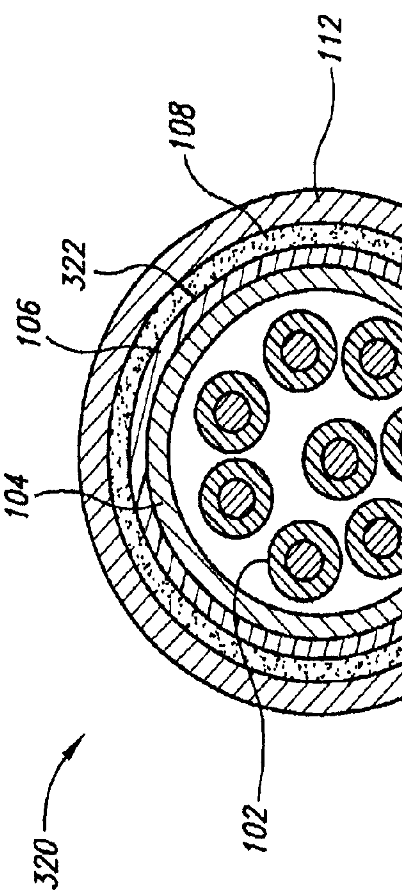
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Fig. 30

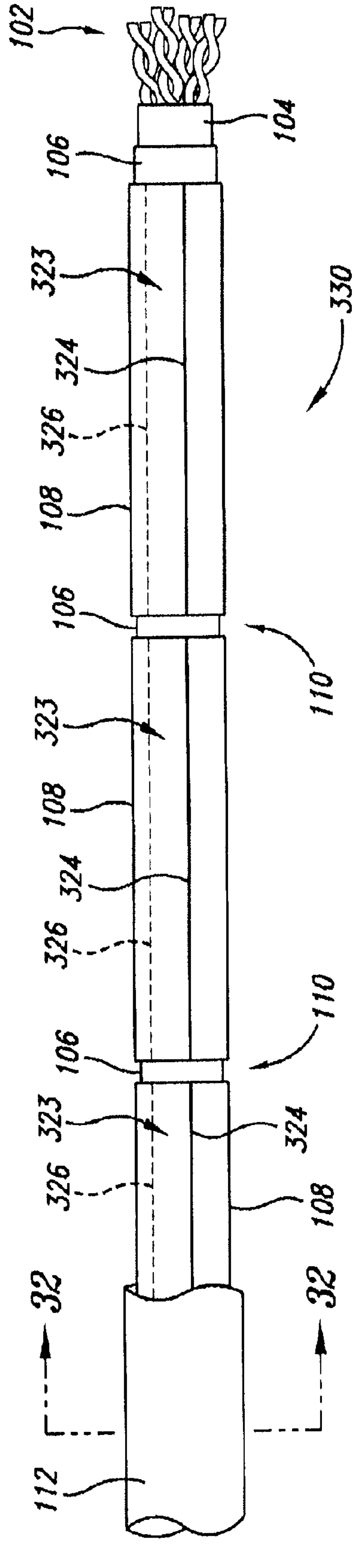
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Fig. 31

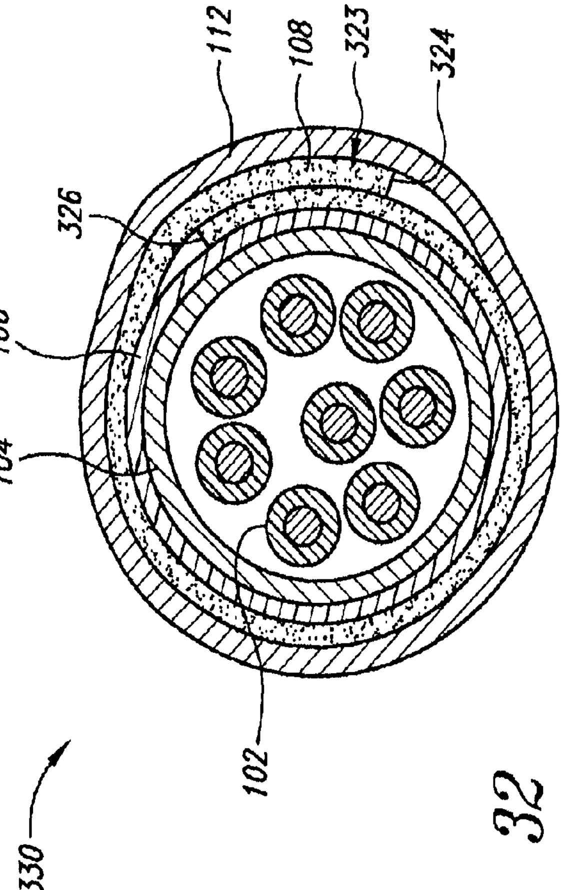
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Fig. 32

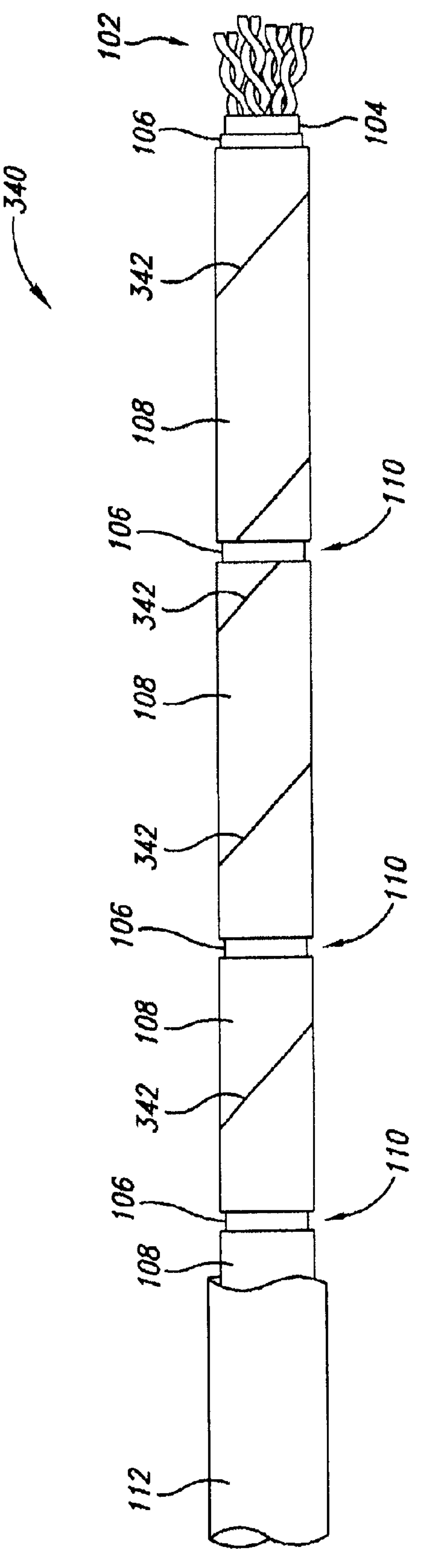
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Fig. 33

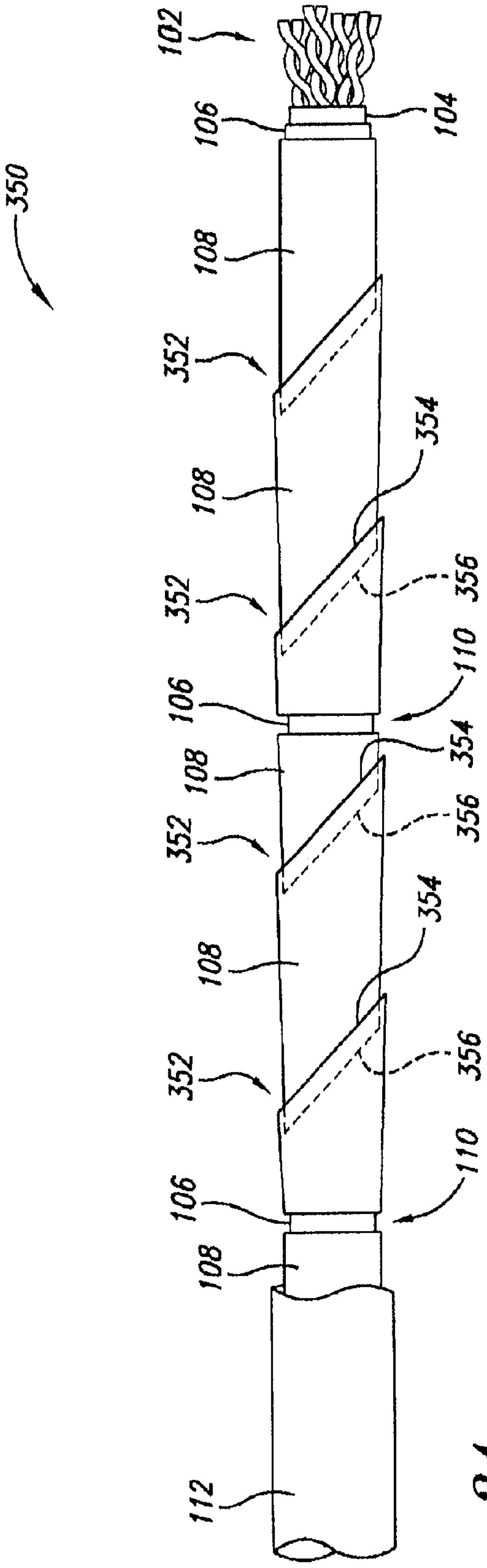
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Fig. 34

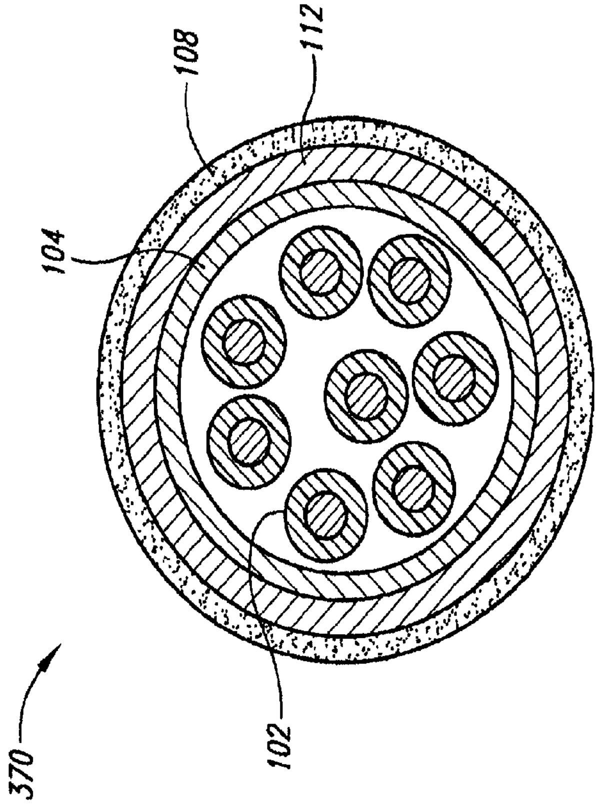


Fig. 36

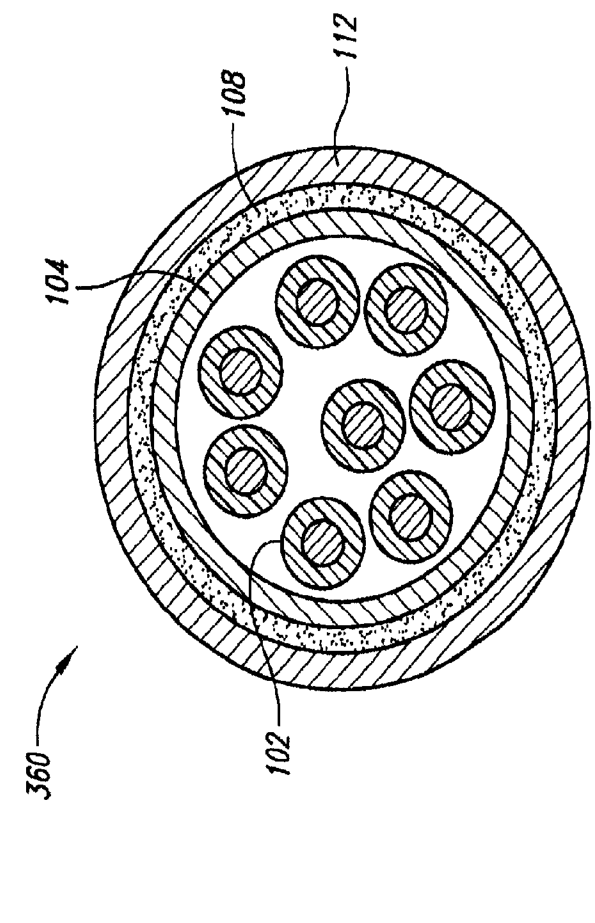


Fig. 35

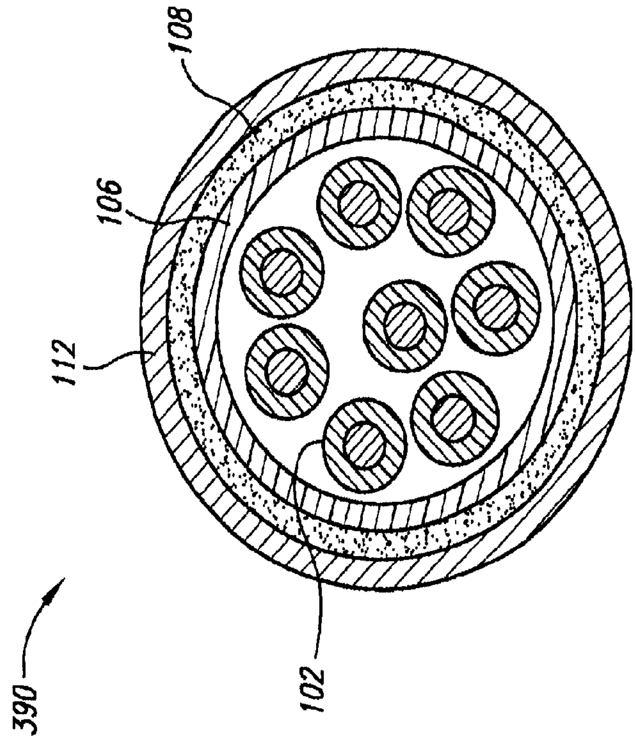


Fig. 38

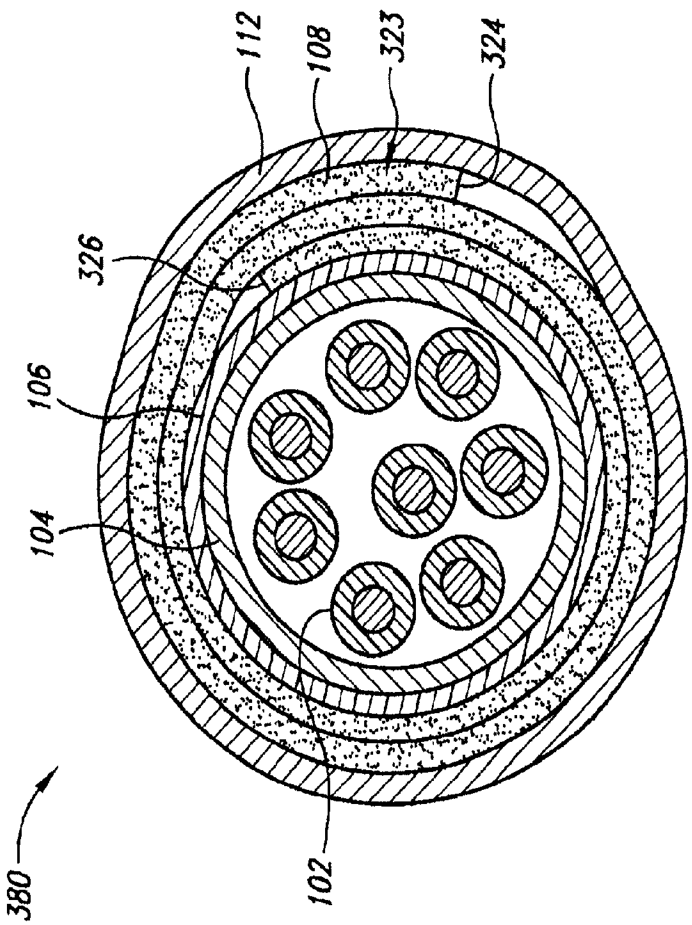
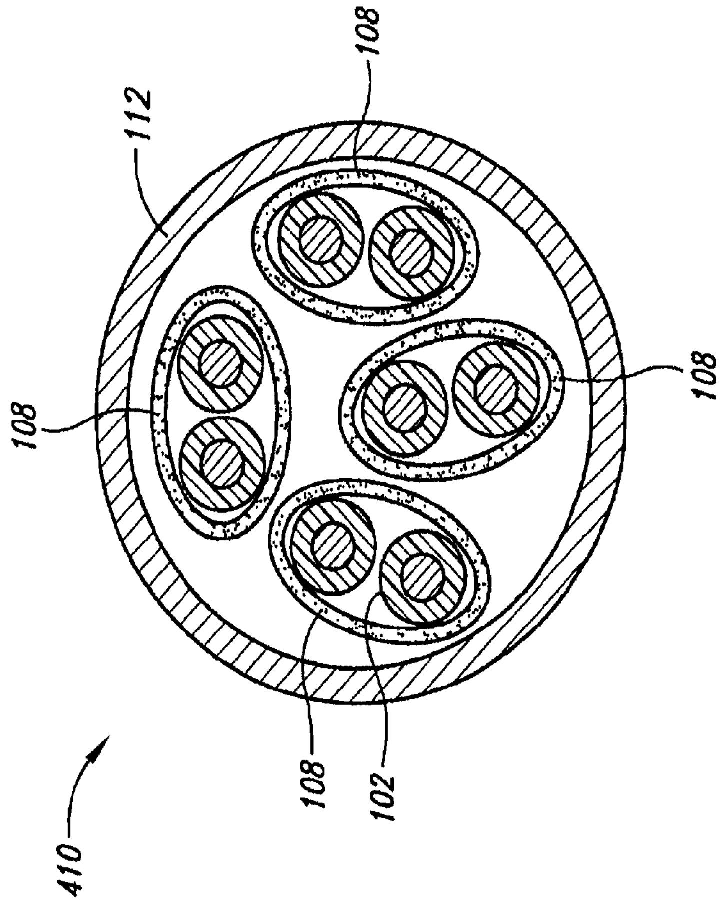


Fig. 37



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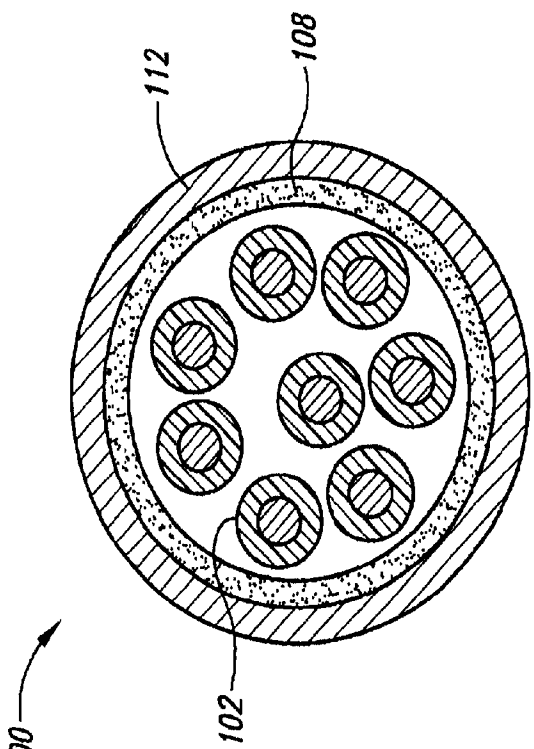

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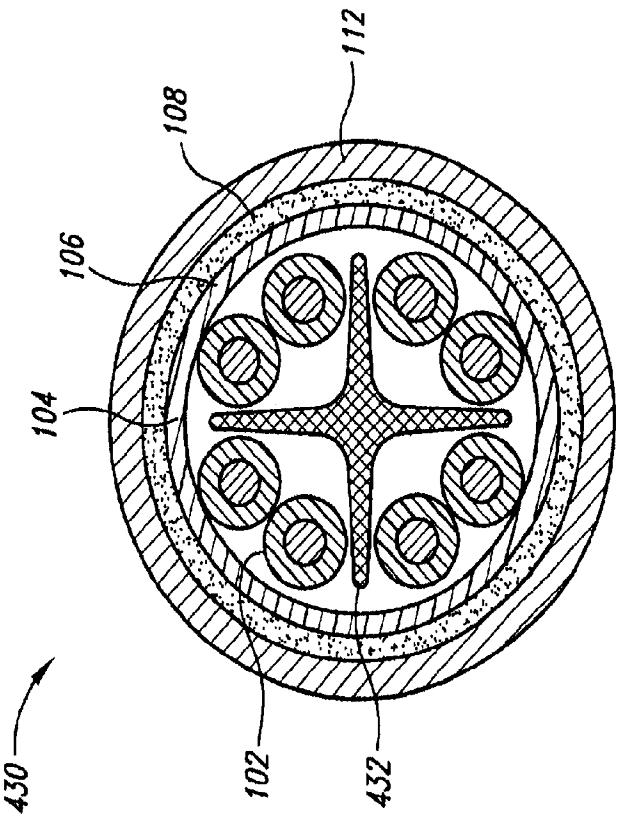

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Fig. 42

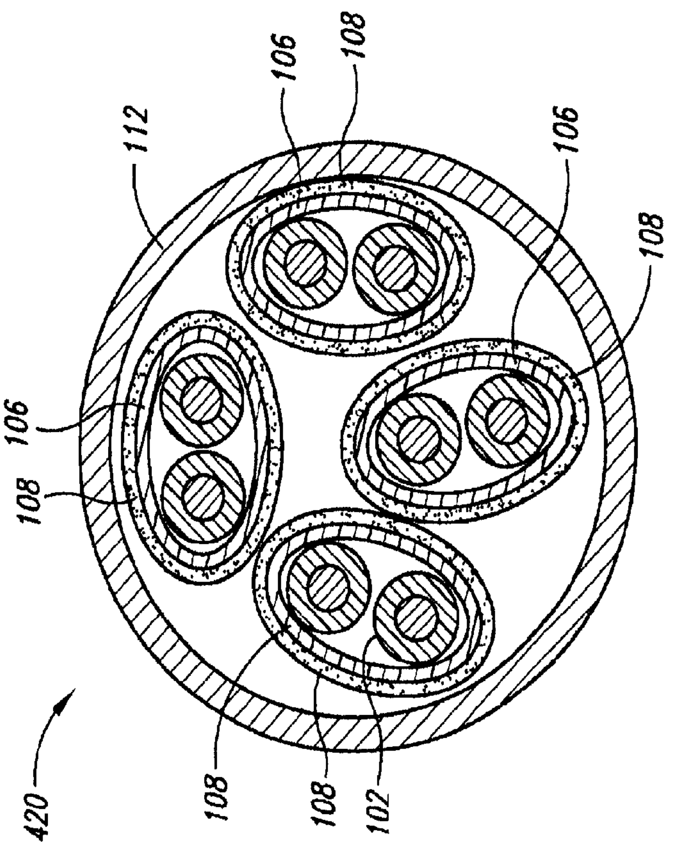

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Fig. 41

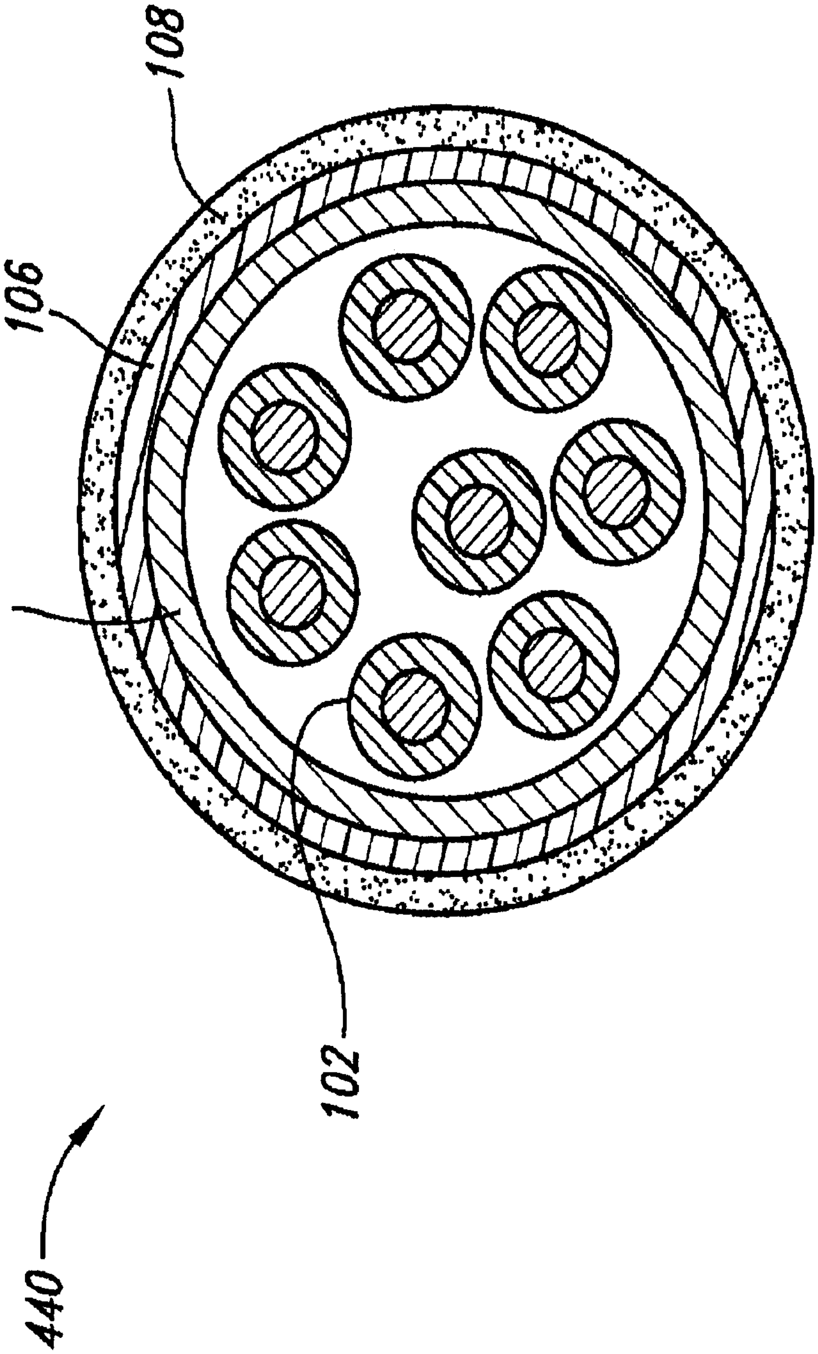

Fig. 43

DISCONTINUOUS CABLE SHIELD SYSTEM AND METHOD

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority benefit of provisional application Ser. No. 60/665,969 filed Mar. 28, 2005.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is generally related to cable for transmitting signals, and more particularly related to reduction of crosstalk experienced between the signals.

2. Description of the Related Art

A metal based signal cable for transmitting information across computer networks, generally have a plurality of wire pairs (such as pairs of copper wires) so that a plurality of signals, each signal using a separate wire pair, can be transmitted over the cable at any given time. Having many wire pairs in a cable can have advantages, such as increased data capacity, but as signal frequency used for the signals is increased to also increase data capacity, a disadvantage becomes more evident. As signal frequency increases, the individual signals tend to increasingly interfere with one another due to crosstalk due to the close proximity of the wire pairs. Twisting the two wires of each pair with each other helps considerably to reduce crosstalk, but is not sufficient as signal frequency increases.

Other conventional approaches can be also used to help reduce crosstalk such as using physical spacing within the cable to physically separate and isolate the individual twisted wire pairs from one another to a certain degree. Drawbacks from using additional physical spacing include increasing cable diameter and decreasing cable flexibility.

Another conventional approach is to shield the twisted pairs as represented by the shield twisted pair cable **10** depicted in FIG. **1** as having an internal sheath **12** covered by insulation **14** (such as Mylar), and covered by a conductive shield **16**. A drain wire **18** is electrically coupled to the conductive shield **16**. The conductive shield **16** can be used to a certain degree to reduce crosstalk by reducing electrostatic and magnetic coupling between twisted wire pairs **20** contained within the internal sheath **12**.

An external sheath **22** covers the conductive shield **16** and the drain wire **18**. The conductive shield **16** is typically connected to a connector shell (not shown) on each cable end usually through use of the drain wire **18**. Connecting the conductive shield **16** to the connector shell can be problematic due to additional complexity of installation, added cable stiffness, special connectors required, and the necessity for an electrical ground, available at both ends of the cable **10**. Furthermore, improper connection of the conductive shield **16** can reduce or eliminate the effectiveness of the conductive shield and also can raise safely issues dye to improper grounding of the drain wire **18**. In some improper installations, the conventional continuous shielding of a cable segment is not connected on one or both ends. Unconnected ends of conventional shielding can give rise to undesired resonances related to the un-terminated shield length which enhances undesired external interference and crosstalk at those resonant frequencies

Although conventional approaches have been adequate for reducing crosstalk for signals having lower frequencies, unfortunately, crosstalk remains a problem for signals having higher frequencies.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIG. **1** is an isometric view of a conventional cable shield system.

FIG. **2** is an isometric view of a first implementation of a discontinuous cable shield system.

FIG. **3** is a side elevational view of the first implementation of FIG. **2**.

FIG. **4** is a cross sectional view of the first implementation of FIG. **2**.

FIG. **5** is a side elevational view of a second implementation of the discontinuous cable shield system.

FIG. **6** is a side elevational view of a third implementation of the discontinuous cable shield system.

FIG. **7** is a side elevational view of a fourth implementation of the discontinuous cable shield system.

FIG. **8** is a side elevational view of a fifth implementation of the discontinuous cable shield system.

FIG. **9** is a cross sectional view of the fifth implementation of FIG. **8**.

FIG. **10** is a side elevational view of a sixth implementation of the discontinuous cable shield system.

FIG. **11** is a cross sectional view of the sixth implementation of FIG. **10**.

FIG. **12** is a side elevational view of a seventh implementation of the discontinuous cable shield system.

FIG. **13** is a side elevational view of an eighth implementation of the discontinuous cable shield system.

FIG. **14** is a side elevational view of a ninth implementation of the discontinuous cable shield system.

FIG. **15** is a side elevational view of a tenth implementation of the discontinuous cable shield system.

FIG. **16** is a side elevational view of an eleventh implementation of the discontinuous cable shield system.

FIG. **17** is a side elevational view of a twelfth implementation of the discontinuous cable shield system.

FIG. **18** is a side elevational view of a thirteenth implementation of the discontinuous cable shield system.

FIG. **19** is a side elevational view of a fourteenth implementation of the discontinuous cable shield system.

FIG. **20** is a side elevational view of a fifteenth implementation of the discontinuous cable shield system.

FIG. **21** is a side elevational view of a sixteenth second implementation of the discontinuous cable shield system.

FIG. **22** is a side elevational view of a seventeenth implementation of the discontinuous cable shield system.

FIG. **23** is a cross sectional view of the seventeenth implementation of FIG. **22**.

FIG. **24** is a side elevational view of an eighteenth implementation of the discontinuous cable shield system.

FIG. **25** is a side elevational view of a nineteenth implementation of the discontinuous cable shield system.

FIG. **26** is a side elevational view of a twentieth implementation of the discontinuous cable shield system.

FIG. **27** is a side elevational view of a twenty-first implementation of the discontinuous cable shield system.

FIG. **28** is a cross sectional view of the twenty-first implementation of FIG. **27**.

FIG. **29** is a side elevational view of a twenty-second implementation of the discontinuous cable shield system.

FIG. **30** is a cross sectional view of the twenty-second implementation of FIG. **29**.

FIG. **31** is a side elevational view of a twenty-third implementation of the discontinuous cable shield system.

FIG. **32** is a cross sectional view of the twenty-third implementation of FIG. **31**.

FIG. **33** is a side elevational view of a twenty-fourth implementation of the discontinuous cable shield system.

FIG. **34** is a side elevational view of a twenty-fifth implementation of the discontinuous cable shield system.

FIG. **35** is a cross-sectional view of a twenty-sixth implementation of the discontinuous cable shield system.

FIG. **36** is a cross-sectional view of a twenty-seventh implementation of the discontinuous cable shield system.

FIG. **37** is a cross-sectional view of a twenty-eighth implementation of the discontinuous cable shield system.

FIG. **38** is a cross-sectional view of a twenty-ninth implementation of the discontinuous cable shield system.

FIG. **39** is a cross-sectional view of a thirtieth implementation of the discontinuous cable shield system.

FIG. **40** is a cross-sectional view of a thirty-first implementation of the discontinuous cable shield system.

FIG. **41** is a cross-sectional view of a thirty-second implementation of the discontinuous cable shield system.

FIG. **42** is a cross-sectional view of a thirty-third implementation of the discontinuous cable shield system.

FIG. **43** is a cross-sectional view of a thirty-fourth implementation of the discontinuous cable shield system.

DETAILED DESCRIPTION OF THE INVENTION

As discussed herein, implementations of a discontinuous cable shield system and method include a shield having a multitude of separated shield segments dispersed along a length of a cable to reduce crosstalk between signals being transmitted an twisted wire pairs of a cable. Implementations include a cable comprising a plurality of differential transmission lines extending along a longitudinal direction for a cable length, and a plurality of conductive shield segments, each shield segment extending longitudinally along a portion of the cable length, each shield segment being in electrical isolation from all other of the plurality of shield segments, and each shield segment at least partially extending about the plurality of the differential transmission lines.

A first implementation **100** of the discontinuous cable shield system is shown in FIG. **2**, FIG. **3**, and FIG. **4** as having a plurality of twisted wire pairs **102** contained by an inner cable sheath **104** and covered by insulation **106** (such as a Mylar layer). The insulation **106** is covered by shield segments **108** physically separated from one another by segmentation gaps **110** between the adjacent shield segments. An outer cable sheath **112** covers the separated shield segments **108** and portions of the insulation **106** exposed by the segmentation gaps **110**. The first implementation **100** has approximately equal longitudinal lengths and radial thickness for the separated shield segments **108** and approximately equal longitudinal lengths for the segmentation gaps **110**. In the first implementation, each of the segmentation gaps **110** have constant longitudinal length for each position around the cable circumference so that the separated shield segments **108** have squared ends.

The separated shield segments **108** serve as an incomplete, patch-worked, discontinuous, 'granulated' or

otherwise perforated shield that has effectiveness when applied as shielding within the near-field zone around differential transmission lines such as the twisted wire pairs **102**. This shield 'granulation' may have advantage in safety over a long-continuous un-grounded conventional shield, since it would block a fault emanating from a distance along the cable.

Various shapes, overlapping and gaps of the separated shield segments **108** may have useful benefit, possibly coupling mode suppression or enhancement, fault interruption (fusing), and attractive patterns/logos. In some implementations, a dimensional limit of shielding usefulness may be related to the greater of twist rate pitch or differential pair spacing of the twisted wire pairs **102** since the shielding tends to average the positive and negative electrostatic near-field emissions from the twisted wire pairs. Magnetic emissions may be averaged in another manner; only partially blocked by eddy currents countering the emitted near field related to each of the twisted wire pairs **102**.

Implementations serve to avoid or reduce external field interference with inner-cable circuits, channels, or transmission lines. Reciprocity can apply to emissions avoidance as well. Implementations allow for installation without having to consider a shield when terminating differential cable pairs. Safety standards usually require safe grounding or insulation of such large conductive parts, however this is often ignored in actuality so the implementations may have a practical safety benefit. Implementations may also help to avoid negative effects of ground loops, such as associated with spark gaps in conventional cable shields for purpose of isolating all but transients.

Implementations involve differential transmissions lines, such as the twisted wire pairs **102**. The twisted wire pairs **102** can be typically balanced having an equal and opposite signal on each wire. Use of twisted (balanced) pairs of wires mitigates loss of geometric co-axiality that results in radiation, particularly near-field radiation. Implementations serve to lessen crosstalk, such as unwanted communications and other interference by electrostatic, magnetic or electromagnetic means between closely routed pairs. Crosstalk can include alien crosstalk between separately sheathed wires.

Some implementations address requirements under TIA/EIA Commercial Building Telecommunications Cabling Standards such as those applied to balanced twisted pair cable including Category 5, 5e, 6 and augmented 6. Other implementations address other standards or requirements. Some implementations can serve to modify unshielded twisted pair cable having an outer insulating jacket covering usually four pairs of unshielded twisted wire pairs. Modifications can include converting to a form of shielded twisted pair cable having a single shield encompassing all four pairs under an outer insulating sheath. Some effects involved with implementations involve near field that is typically at less than sub-wavelength measurement radii where the angular radiation pattern from a source significantly varies from that at infinite radius.

Crosstalk between the various twisted wire pairs **102** and other interference originating from outside of the cable can be reduced to various degrees based upon size and shape of the separated shield segments **108**. For instance, a more irregular pattern for the segmentation gaps **110** can assist in reduction of alien crosstalk and other interference whereas a more regular and aligned patterns for the segmentation gaps may be less effective in reducing alien crosstalk.

Use of the separated shield segments **108** can help to protect from crosstalk and other interference originating both internally and externally to the cable. This electromagnetic based crosstalk and other interference can be further reduced by use of irregular patterns for the segmentation gaps **110** so that the separated shield segments **108** are sized differently and consequently do not interact the same way with the same electromagnetic frequencies. Varying how the separated shield segments **108** interact with various electromagnetic frequencies helps to avoid having a particular electromagnetic frequency that somehow resonates with a majority of the separated shield segments to cause crosstalk associated with the resonant electromagnetic frequency.

The separated shield segments **108** can also be sized so that any potential resonant frequency is far higher than the operational frequencies used for signals being transmitted by the twisted wire pairs **132**. Additionally a combination of small size or randomized size and irregular shape for the separated shield segments **108** could further offset tendencies for resonant frequencies or at least offset a tendency for a predominant resonant frequency to cause crosstalk. Some of the separated shield segments **108** could also be made of various compositions of conductive and resistive materials to vary how the separated shield segments interact with potentially interfering electromagnetic waves.

Short lengths of the separated shield segments **108** can move related resonances to higher frequencies, above the highest frequency of interest as used for cable data signaling. Selection of optimal length, shape and material loss factors related to the separated shield segments **108** and possible materials in the insulation **106** or otherwise between the separated shield segments in the segmented gaps **110** can serve to eliminate need for termination of a shielding and can provide enhanced shielding aspects. Consequential interruption of ground loops, such as undesired shield currents and noise caused by differences in potential at conventional grounding points at the ends of the cable can avoid introduction of interference onto the twisted wire pairs **102** that would otherwise be emanating from noise induced by conventional shield ground loop current. As mentioned elsewhere, higher resonances can be mitigated, softened, dulled, and de-Q'ed by shaping the separated shield segments **108** and in some implementations by adding electrically lossy medium surrounding or within the separated shield segments.

For instance, a resistive lossy component could be added to the segmentation gaps **110** to dissipate energy that would otherwise cause crosstalk. Further variations to the separated shield segments **108** could include incorporating slits into the separated shield segments. Also, the separated shield segments **108** could vary in thickness amongst one another or individual separated shield segments could have irregular thickness to further help offset tendencies for frequency resonance and resultant crosstalk.

Further implementations can position between layers of the insulation **106** other layers of various shapes of the separated shield segments **108**. In these layered implementations, portions of some of the separated shield segments **108** could be positioned on top of portions of other of the separated shield segments to vary in another dimension how the separated shield segments are effectively shaped and sized.

The separated shield segments **108** can also allow for enhanced cable flexibility depending in part on how the segmentation gaps **110** are shaped. Furthermore, the implementations need not include a drain wire so can also avoid associated issues with such. Some implementations can further include use of conventional separators to physically separate each of the twist wire pairs **102** from one another as discussed above in addition to using the separated shield segments **108**. Other variations can include having the separated shield segments **108** positioned directly upon the twisted wire pairs **102** or on the outer cable sheath **112**.

The separated shield segments **108** can be formed by various methods including use of adhesive on foil, foil applied to a heated plastic sheath such as immediately after extrusion of the plastic sheath, molten metalized spray upon masking elements, molten metalized spray on irregular surfaces whereupon excessive metal in raised areas are subsequently removed, use of conductive ink deposited by controlled jet or by pad transfer process.

A second implementation **120** of the discontinuous cable shield system is shown in FIG. **5** as having different longitudinal lengths for the separated shield segments **108** with segments having short longitudinal length positioned between segments having longer longitudinal length. The second implementation also includes lossy material **122** covering those portions of the insulation **106** aligned with the segmentation gaps **110** that are not covered by the separated shield segments **108**. The lossy material **122** acts as a dissipative factor to reduce possibilities of crosstalk or other interference due to resonance as discussed above.

A third implementation **130** of the discontinuous cable shield system is shown in FIG. **6** as having different longitudinal lengths for the lossy material **122** separated by segmentation gaps **110** and becoming progressively shorter along a longitudinal direction.

A fourth implementation **140** of the discontinuous cable shield system is shown in FIG. **7** as having different radial thickness for the separated shield segments **108** with segments becoming progressively shorter along a longitudinal direction.

A fifth implementation **150** of the discontinuous cable shield system is shown in FIG. **8** and FIG. **9** as having first layer components of insulation **106**a and shield segments **108**a separated by segmentation gaps **110**a underneath second layer components of insulation **106**b and shield segments **108**b separated by segmentation gaps **110**b. The first layer components are longitudinally shifted with respect to the second layer components.

A sixth implementation **160** of the discontinuous cable shield system is shown in FIG. **10** and FIG. **11** as having first layer components of insulation **106**a and shield segments **108**a separated by a segmentation gaps **110**a, underneath second layer components of insulation **106**b and shield segments **108**b separated by segmentation gaps **110**b, underneath third layer components of insulation **106**c and shield segments **108**c separated by segmentation gaps **110**c. The first layer components, the second layer components, and the third layer components are longitudinally shifted with respect to one another.

A seventh implementation **170** of the discontinuous cable shield system is shown in FIG. **12** as having different longitudinal lengths for the segmentation gaps **110**.

An eighth implementation **180** of the discontinuous cable shield system is shown in FIG. **13** as having a spiral pattern for the segmentation gaps **110**.

A ninth implementation **190** of the discontinuous cable shield system is shown in FIG. **14** as having spiral patterns having different pitch angles for the segmentation gaps **110**.

A tenth implementation **200** of the discontinuous cable shield system is shown in FIG. **15** as having varying jagged shaped patterns for the segmentation gaps **110**.

A eleventh implementation **210** of the discontinuous cable shield system is shown in FIG. **16** as having varying wave patterns for the segmentation gaps **110**.

A twelfth implementation **220** of the discontinuous cable shield system is shown in FIG. **17** as having irregular patterns for the segmentation gaps **110**.

A thirteenth implementation **230** of the discontinuous cable shield system is shown in FIG. **18** as having similar angular patterns for the segmentation gaps **110**.

A fourteenth implementation **240** of the discontinuous cable shield system is shown in FIG. **19** as having opposing angular patterns for the segmentation gaps **110**.

A fifteenth implementation **250** of the discontinuous cable shield system is shown in FIG. **20** as having multiple angular patterns for the segmentation gaps **110**.

A sixteenth implementation **260** of the discontinuous cable shield system is shown in FIG. **21** as having first layer components of insulation **106**a and shield segments **108**a separated by a segmentation gap **110**a spiraling in a first direction underneath second layer components of insulation **106**b and shield segments **108**b separated by a segmentation gap **110**b spiraling in a second direction opposite the first direction.

A seventeenth implementation **270** of the discontinuous cable shield system is shown in FIG. **22** and FIG. **23** as having the separated shield segments **108** directly covering the inner cable sheath **104**.

A eighteenth implementation **280** of the discontinuous cable shield system is shown in FIG. **24** as having the segmentation gaps **110** shaped to spelled a company name, Leviton.

A nineteenth implementation **290** of the discontinuous cable shield system is shown in FIG. **25** as having the separated shield segments **108** containing radially oriented corrugations **[242]** *292* to aid in bending the implementation.

A twentieth implementation **300** of the discontinuous cable shield system is shown in FIG. **26** as having the separated shield segments **108** containing diagonally oriented corrugations **[242]** *302* to aid in bending the implementation.

A twenty-first implementation **310** of the discontinuous cable shield system is shown in FIG. **27** and in FIG. **28** as having the insulation **106** covering the outer cable sheath **112** and the separated shield segments **108** covering the insulation.

A twenty-second implementation **320** of the discontinuous cable shield system is shown in FIG. **29** and FIG. **30** as having the separated shield segments **108** formed with a longitudinally abutted seam **322**.

A twenty-third implementation **330** of the discontinuous cable shield system is shown in FIG. **31** and FIG. **32** as having the separated shield segments **108** formed with a longitudinally overlapping seam **323** with an overlap portion between a first boundary **324** and a second boundary **326**.

A twenty-fourth implementation **340** of the discontinuous cable shield system is shown in FIG. **33** as having the separated shield segments **108** formed with a spirally abutted seam **342**.

A twenty-fifth implementation **350** of the discontinuous cable shield system is shown in FIG. **34** as having the separated shield segments **108** formed with a spirally overlapping seam **[342]** *352* with an overlap portion between a first boundary **354** and a second boundary **356**.

A twenty-sixth implementation **360** of the discontinuous cable shield system is shown in FIG. **35** as having the outer cable sheath **112** covering the separated shield segments **108**, which are covering the inner cable sheath **[102]** *104*.

A twenty-seventh implementation **370** of the discontinuous cable shield system is shown in FIG. **36** as having the separated shield segments **108** covering the outer cable sheath **112**, which is covering the inner cable sheath **[102]** *104*.

A twenty-eighth implementation **380** of the discontinuous cable shield system is shown in FIG. **37** as having the separated shield segments **108** formed with a longitudinally double overlapping seam **323** with an overlap portion between the first boundary **324** and the second boundary **326**.

A twenty-ninth implementation **390** of the discontinuous cable shield system is shown in FIG. **38** as having the insulation **106** covering the twisted wire pairs **102**.

A thirtieth implementation **400** of the discontinuous cable shield system is shown in FIG. **39** as having the separated shield segments **108** covering the twisted wire pairs **102**.

A thirty-first implementation **410** of the discontinuous cable shield system is shown in FIG. **40** as having the individual instances of the separated shield segments **108** covering individual ones of the twisted wire pairs **102**.

A thirty-second implementation **420** of the discontinuous cable shield system is shown in FIG. **41** as having individual instances of a first layer **108**a underneath a second layer **108**b of the separated shield segments **108** both covering individual ones of the twisted wire pairs **102**.

A thirty-third implementation **430** of the discontinuous cable shield system is shown in FIG. **42** as having the twisted wire pairs **102**, the inner cable sheath **104**, the insulation **106**, the separated shield segments **108** and the outer cable sheath **112** in an arrangement similar to the first implementation **100**. In addition, the thirty-third implementation **430** has a spacer **432** to separate the individual twisted wire pairs **102** from one another.

A thirty-fourth implementation **440** of the discontinuous cable shield system is shown in FIG. **43** as having the separated shield segments **108** without the outer cable sheath **112**.

From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

The invention claimed is:

1. A cable having a length along a longitudinal dimension, the cable comprising:

a plurality of differential transmission lines extending along the longitudinal dimension;

a first plurality of shield segments, each shield segment extending along the longitudinal dimension along a portion of the cable length, each of the shield segments of the first plurality of shield segments extending circumferentially about the plurality of the differential transmission lines;

a second plurality of shield segments, each shield segment extending along the longitudinal dimension along a portion of the cable length, each of the shield segments of the second plurality of shield segments extending circumferentially about the plurality of the differential transmission lines, each of the shield segments of the first and second pluralities of shield segments being in electrical isolation from all other shield segments of the first and second pluralities of shield segments, each of the shield segments of the first and second pluralities of shield segments being separated from a shield segment adjacent thereto by a segmentation gap, each segmentation gap extending circumferentially about the plurality of the differential transmission lines, the shield segments of the first plurality of shield segments varying in form from the shield segments of the second plurality of shield segments.

2. The cable of claim **1** wherein the shield segments of the first plurality of shield segments vary in form from the shield segments of the second plurality of shield segments by extending different amounts along the longitudinal dimension.

3. The cable of claim **1** wherein the shield segments of the first plurality of shield segments vary in form from the shield segments of the second plurality of shield segments by having different shapes.

4. The cable of claim **1** wherein at least some of the shield segments of the first plurality of shield segments vary in form from one another and at least some of the shield segments of the second plurality of shield segments vary in form from one another.

5. The cable of claim **1** wherein the shield segments of the first and second pluralities of shield segments are made from an electrically conductive material.

6. The cable of claim **1** wherein each of the differential transmission lines is a twisted wire pair.

7. The cable of claim **[2]** *6* wherein each of the twisted wire pairs are covered by a different group of the shield segments of the first and second pluralities of the shield segments.

8. The cable of claim **1** wherein the shield segments of the first and second pluralities of shield segments are shaped so that each of the shield segments of the first plurality of shield segments extend circumferentially about the plurality of the differential transmission lines at a different angle than each of the shield segments of the second plurality of shield segments extend circumferentially about the plurality of the differential transmission lines.

9. The cable of claim **1** wherein each of the shield segments of the first plurality of shield segments have a first shape and each of the shield segments of the second plurality of shield segments have a second shape other than the first shape.

10. The cable of claim **9** wherein the first shape and the second shape are different jagged patterns.

11. The cable of claim **9** wherein the first shape and the second shape are different wave patterns.

12. The cable of claim **9** wherein the first shape and the second shape are different irregular patterns.

13. The cable of claim **9** wherein the first shape and the second shape have different angular patterns.

14. The cable of claim **1** wherein the shield segments of the first plurality of shield segments are differently oriented from the shield segments of the second plurality of shield segments.

15. The cable of claim **1** further comprising an electrically lossy material extending about each of the segmentation gaps.

16. The cable of claim **1** wherein the segmentation gaps include a first plurality and a second plurality, each of the first plurality being of a different form than each of the second plurality.

17. The cable of claim **1** further comprising an inner cable sheath and insulation extending about the plurality of the differential transmission lines wherein the shield segments of the first and second pluralities of shield segments extend about the inner cable sheath and the insulation.

18. The cable of claim **1** further comprising an outer cable sheath extending about the plurality of differential transmission lines and the shield segments of the first and second pluralities of shield segments.

19. The cable of claim **1** further comprising an outer cable sheath extending about the plurality of differential transmission lines wherein the outer cable sheath extends about the segmentation gaps.

20. The cable of claim **1** further comprising a third plurality of shield segments and a fourth plurality of shield segments wherein the shield segments of the third plurality of shield segments vary in form from the shield segments of the fourth plurality of shield segments, each of the shield segments of the third plurality of shield segments extending along the longitudinal dimension along a portion of the cable length and extending circumferentially about at least a portion of the shield segments of the first plurality of shield segments and extending about the plurality of the differential transmission lines, each of the shield segments of the third plurality of shield segments being in electrical isolation from the shield segments of the first, second and fourth pluralities of shield segments and from others of the shield segments of the third plurality of shield segments, and each of the shield segments of the fourth plurality of shield segments extending along the longitudinal dimension along a portion of the cable length and extending circumferentially about at least a portion of the shield segments of the second plurality and extending about the plurality of the differential transmission lines, each of the shield segments of the fourth plurality of shield segments being in electrical isolation from the shield segments of the first, second and third pluralities of shield segments and from the others of the shield segments of the fourth plurality of shield segments.

21. The cable of claim **1** wherein the shield segments of the first and second pluralities of shield segments are formed from at least one of the following: adhesive backed foil, foil thermally coupled with plastic sheath, metalized spray, and ink.

22. A method comprising:

providing a plurality of differential transmission lines;

providing a plurality of shield segments;

positioning each of the plurality of shield segments within proximity of the differential transmission lines to substantially reduce potential of field interference;

positioning each of the plurality of shield segments to be in electrical isolation from one another; and

selecting at least some of the plurality of shield segments to vary from each other in form to vary how the selected shield segments interact with electromagnetic energy across a spectrum of frequencies to diminish the number of the selected shield segments that would otherwise have a resonant interaction with electromagnetic energy of a particular frequency of the spectrum of frequencies.

23. The method of claim **22** wherein the selecting at least some of the plurality of shield segments to vary from each other includes selecting according to at least one of the following: size of the at least some of the plurality of shield segments and shape of the at least some of the plurality of shield segments.

24. The method of claim **23** wherein the selecting at least some of the plurality of shield segments to vary from each other includes selecting according to a dimension limit for the shield segments related to at least one of the following: twist rate pitch and differential pair spacing of the differential transmission lines.

25. The method of claim **23** wherein positioning each of the plurality of shield segments within proximity of the differential transmission lines to substantially reduce potential of field interference of at least one of the following types: field interference imparted upon the differentially transmission lines from an external source and field interference emitting from the differential transmission lines.

26. An electrical signal transmission cable comprising:

at least one differential transmission line pair of twisted insulated conductive wires extending longitudinally along a length of cable for carrying electrical signals there-along; and

a plurality of electrically isolated conductive shield segments extending longitudinally along and at least partially circumferentially around respectively corresponding portions of at least one differential transmission line pair sufficient to effect, while in use carrying electrical communication signals there-along:

(a) substantial electrostatic coupling to each wire of at least one differential transmission line pair thereby tending to average together positive and negative electrostatic near-field emissions from the at least one differential transmission line pair, and

(b) substantial magnetic coupling via eddy currents to each wire of at least one differential transmission line pair thereby tending to average together oppositely directed magnetic field emissions from the at least one differential transmission line pair.

27. An electrical signal transmission cable as in claim 26 wherein at least some of said plurality of electrically isolated conductive shield segments extend entirely about the circumference of a respectively associated at least one differential transmission line pair.

28. An electrical signal transmission cable as in claim 27 wherein said at least some of said plurality of electrically isolated conductive shield segments provide a continuous electrically conductive path about the circumference of the respectively associated at least one differential transmission line pair.

29. An electrical signal transmission cable as in claim 26 wherein:

while in use carrying electrical communication signals there-along, each wire of said at least one differential transmission line pair exhibits a substantially equal and opposite electrical potential vis-à-vis the other wire of that pair along said length; and

a plurality of said differential transmission line pairs are encompassed by said plurality of electrically isolated conductive shield segments sufficiently to effect substantially equal electrostatic coupling to each wire of each of said plurality of differential transmission line pairs along respectively corresponding portions of said cable length.

30. An electrical signal transmission cable as in claim 26 wherein each said shield segment extends longitudinally for a distance that is at least a substantial portion of one differential transmission line twist rate pitch period.

31. An electrical signal transmission cable as in claim 26 wherein said plurality of electrically isolated conductive shield segments are of at least two different sizes.

32. An electrical signal transmission cable as in claim 31 wherein said different sizes comprise at least one of: (a) different longitudinal lengths, (b) different shapes, and (c) different thicknesses.

33. An electrical signal transmission cable as in claim 26 wherein minimum and maximum dimensions of each shield segment establish corresponding resonant frequencies higher than a highest intended frequency of electrical signals to be transmitted along said cable while in use carrying electrical communication signals there-along.

34. An electrical signal transmission cable as in claim 26 wherein at least some of said shield segments are spirally wrapped about the at least one differential transmission line.

35. An electrical signal transmission cable as in claim 26 wherein said shield segments are electrically isolated from each other by gaps between longitudinally adjacent shield segments.

36. An electrical signal transmission cable as in claim 26 further comprising an electrically lossy dissipative material disposed between at least some longitudinally adjacent shield segments.

37. An electrical signal transmission cable as in claim 26 wherein variations are provided along said cable length in at least one of: (a) shield segment lengths, (b) shield segment shapes, (c) shield segment thicknesses, (d) gap dimensions between shield segments, (e) gap shapes between shield segments, and (f) gap orientations between shield segments.

38. An electrical signal transmission cable as in claim 26 wherein:

said plurality of shield segments are divided into at least electrically isolated first and second groups of electrically isolated shield segments; and

said second group being spaced radially outwardly from said first group and longitudinally interleaved with said first group to provide shield segments of the second group overlapping gaps between shield segments of the first group.

39. An electrical signal transmission cable as in claim 26 wherein at least some of said shield segments are wrapped circumferentially around said at least one differential transmission line with longitudinally extending overlapped edges.

40. An electrical signal transmission cable as in claim 39 wherein said overlapped edges are in electrical contact to provide circumferentially continuous electrical conductivity within a respectively corresponding shield segment.

41. An electrical signal transmission cable as in claim 26 wherein at least some of said shield segments are wrapped circumferentially around said at least one differential transmission line with longitudinally abutting edges.

42. An electrical signal transmission cable as in claim 41 wherein said longitudinally abutting edges are in electrical contact to provide circumferentially continuous electrical conductivity within a respectively corresponding shield segment.

43. An electrical signal transmission cable as in claim 26 wherein said plurality of shield segments establish an irregular pattern of segments to assist in reduction of interference including alien crosstalk.

44. An electrical signal transmission cable as in claim 26 wherein said plurality of shield segments provide a combination of small sizes and irregular shapes of shield segments to offset tendencies for resonant frequencies and/or to reduce cross-talk.

45. An electrical signal transmission cable as in claim 26 further comprising an insulating material interposed between adjacent edges of separate ones of said plurality of conductive shield segments.

46. An electrical signal transmission cable as in claim 26 wherein at least some of said plurality of shield segments contain radially oriented corrugations to aid in bending the transmission cable.

47. An electrical signal transmission cable as in claim 46 wherein said radially oriented corrugations are diagonally oriented with respect to the longitudinal length of said cable.

48. An electrical signal transmission cable comprising:

at least one twisted wire pair differential transmission line extending longitudinally along a length of cable; and *a plurality of electrically isolated conductive shield segments extending longitudinally along respectively corresponding portions of said cable length in proximity to both wires of said at least one twisted wire pair for at least a substantial portion of one twist period sufficient to effect, while in use carrying electrical communication signals there-along:*

(a) substantial electrostatic coupling to each wire of said at least one twisted wire pair thereby tending to average together positive and negative electrostatic near-field emissions from the at least one twisted wire pair, and

(b) substantial magnetic coupling via eddy currents to each wire of said at least one twisted wire pair thereby tending to average together oppositely directed magnetic field emissions from the at least one twisted wire pair.

49. An electrical signal transmission cable as in claim 48 wherein said shield segments also extend circumferentially completely around said at least one twisted wire pair.

50. An electrical signal transmission cable as in claim 48 wherein variations are provided along said cable length in at least one of: (a) shield segment lengths, (b) shield segment shapes, (c) shield segment thicknesses, (d) gap dimensions between shield segments, (e) gap shapes between shield segments, and (f) gap orientations between shield segments.

51. An electrical signal transmission cable comprising:

at least one differential transmission line having a pair of insulated wire conductors extending along a longitudinal direction of cable length; and

a plurality of electrically isolated conductive shield segments extending longitudinally along respectively corresponding portions of said cable length in proximity to both wires of at least one said differential transmission line sufficient to effect, while in use carrying electrical communication signals there-along:

(a) substantial electrostatic coupling to each wire thereby tending to average together positive and negative electrostatic near-field emissions from the at least one differential transmission line, and

(b) substantial magnetic coupling via eddy currents to each wire thereby tending to average together oppositely directed magnetic field emissions from the at least one differential transmission line.

52. An electrical signal transmission cable as in claim 51 wherein said shield segments also extend circumferentially around said at least one differential transmission line.

53. An electrical signal transmission cable as in claim 51 wherein variations are provided along said cable length in at least one of: (a) shield segment lengths, (b) shield segment shapes, (c) shield segment thicknesses, (d) gap dimensions between shield segments, (e) gap shapes between shield segments, and (f) gap orientations between shield segments.

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