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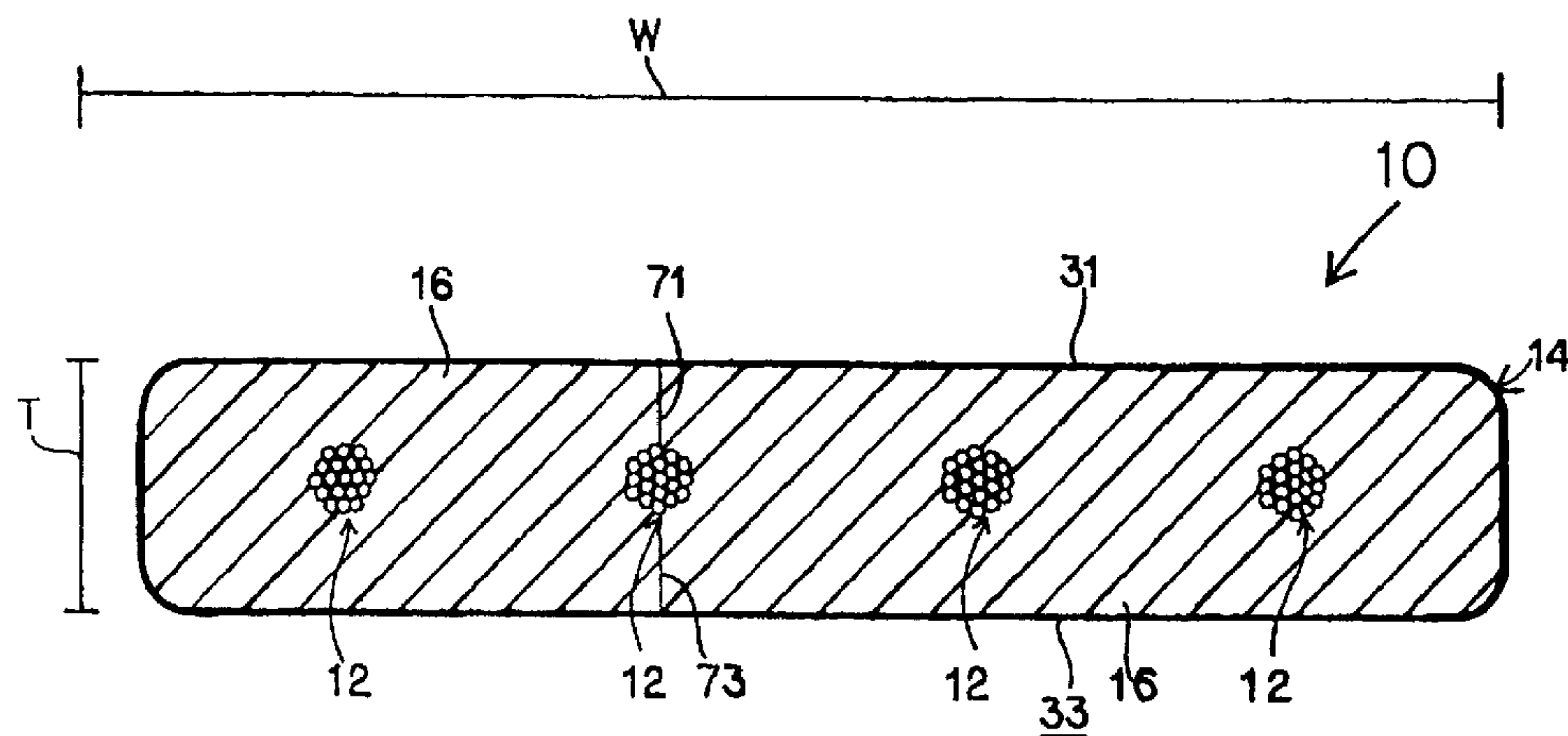
(71) PRECO NEW PRODUCTS CORPORATION, US

(51) Int.Cl.⁷ B65H 75/38, B65H 75/48, H04M 11/06, H04N 1/00

(30) 1999/04/01 (60/127,365) US

(54) **DISPOSITIF DE RETRACTION DE CABLE A FAIBLE
RESISTANCE ELECTRIQUE ET FORTE RESISTANCE AU
FEU POUR TELECOPIEUR ET MODEM**

(54) **FAX AND MODEM CABLE RETRACTOR WITH LOW
ELECTRICAL RESISTANCE AND HIGH FIRE RETARDANCY**



(57) The invention includes a cord retractor device, which operates by winding electrical cord inside a casing to allow extension of the cord or retraction of the cord, when desired. The invented cord winder has been designed to have low resistance to electrical current, which is exhibited by low temperature rise in the casing of the cord winder when voltage is applied to, and current is flowing in, the cord. The cord winder is also designed to be highly flame retardant, which is exhibited by low amounts of cable charring, melting, and releasing of burning particles in a standard flame test. This fire-safety performance is achieved in combination with a highly-effective, compact, and long-lived cord winder. This performance is achieved by using a combination of a relatively large diameter metal strand bundle, preferably of copper wire, inside a flat cable of insulator material having fire-retardant additives. The large diameter wire bundles are covered with a very thin layer of insulation, resulting in a surprisingly flexible and low-heat-producing cable that winds inside a 2 - 3 inch diameter retractor in lengths of up to 12 - 24 feet.



ABSTRACT

The invention includes a cord retractor device, which operates by winding electrical cord inside a casing to allow extension of the cord or retraction of the cord, when desired. The invented cord winder has been designed to have low resistance to electrical current, which is exhibited by low temperature rise in the casing of the cord winder when voltage is applied to, and current is flowing in, the cord. The cord winder is also designed to be highly flame retardant, which is exhibited by low amounts of cable charring, melting, and releasing of burning particles in a standard flame test. This fire-safety performance is achieved in combination with a highly-effective, compact, and long-lived cord winder. This performance is achieved by using a combination of a relatively large diameter metal strand bundle, preferably of copper wire, inside a flat cable of insulator material having fire-retardant additives. The large diameter wire bundles are covered with a very thin layer of insulation, resulting in a surprisingly flexible and low-heat-producing cable that winds inside a 2 - 3 inch diameter retractor in lengths of up to 12 - 24 feet.

Title: FAX AND MODEM CABLE RETRACTOR WITH LOW
ELECTRICAL RESISTANCE AND HIGH FIRE RETARDANCY

Inventor: Edwin Lee Wheeler, of Boise, Idaho

Field of the Invention.

This invention relates generally to automatic retractors or wind-up devices for electrical cords for equipment and appliances. More specifically, this invention relates to such a wind-up device with low electrical resistance and high flame retardancy.

Background of the Invention.

Electrical cord wind-up devices are known. For example, the owner of this invention issued U.S. Patent Numbers 4,646,987, 5,114,091, 5,230,481, 5,354,954, 5,516,986 and 5,655,726 relating to such cord wind-up devices, and to the cords to be wound up in such devices.

The Preco New Products Corporation of Boise, Idaho has produced and patented flat wire cable for use in telephone cord winders and has found "tensile wire" of about 10 thousandths of an inch (0.010") in diameter to be an optimum design for windable cable in a retractor of about 2 inches outer diameter. In this case, the "tensile wire" preferably comprises CAD-Copper metal ribbon wound around a polymer core. The 10 thousandths inch tensile wire is typically encased in thermoplastic insulation to result in a cable with cross-sectional dimensions of 0.20 inches thick and 0.155 inches wide. Typically, such telephone cables are up to 20 feet long and wound up inside a 2 inch diameter retractor. Such retractable telephone cable is disclosed in U.S. Patent Number 5,516,986.

In some uses, safety certification of a cord winder device is desired or necessary. Some of the important safety criteria relate to fire prevention, including specifications for maximum heat buildup within the shell or housing of the winding device and flame retardancy of the winding device and its electrical cord. Examples of such safety specifications are the UL Heating and Horizontal-specimen Flame Tests, Fault Current Test, Millivolt Drop Test, Drop Test, Leakage Current Test, Dielectric Withstand Test, Strain Relief Test, and Crush Test.

Conventional telephone winding devices, such as those described above containing cable with tensile wire, are not appropriate in fax and modem applications requiring the UL safety tests be passes.

The tensile wire is known to be extremely flexible, and, hence, excellent for wind up devices, but creates sufficient heat to heat the retractor casing beyond the UL limits. Also, such a cable based on tensile wire and thermoplastic insulation does not typically pass the UL flame tests or the UL temperature rise limits due to the heat generated by " I^2R ."

Therefore, there is still a need for a wind-up device for fax/modem/telephone cable that passes UL certification. There is still a need for such a device that includes a cable flexible enough to easily and repeatedly extend from and retract into a compact retractor, for example, one of about 2 -3 inches diameter. There is still a need for such a cable that is compact and flexible enough so that 12 - 24 feet fit in a 2- 3 inch diameter retractor. The present invention addresses these needs.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an especially-safe cord winder or "cord retractor" product for telephone, fax, and modem applications. A particular object is to provide a cable in a winder that passes Underwriter Laboratory (UL) heating, flame, and other tests for communication circuit accessories. A particular object is to provide a durable double-pull cord winder, from which two oppositely-oriented cables unwind and retract, that passes UL heating and flame tests while properly transmitting telephone, fax, or modem communications. Another object is to provide such a retractor that is compact enough to be attractive in an office or home setting, that is, preferably 2 - 3 inches in diameter and about 1 inch wide.

The present invention comprises a cord retractor device, which operates by winding electrical cord inside a casing and which is herein also referred to as the "cord winder." The invented cord winder has been adapted to exhibit low resistance to electrical current, which is exhibited by low temperature rise in the casing of the cord winder when voltage is applied to, and current is flowing in, the cord. The cord winder and its cable are also adapted to be highly flame- retardant, which is exhibited by low amounts of cable charring, melting, and releasing of burning particles or drops in a standard flame test. This fire-safety performance is achieved, surprisingly, in combination with a highly-effective, compact, and long-lived cord winder, which also means that the cable is extremely flexible and durable. This performance is achieved by using a unique combination of a relatively large

diameter metal strand bundle inside a very thin, flat cable of insulator material having fire-retardant additives. Surprisingly, the invented composition, including many larger strands in bundles surrounded by a thin layer of fire-retardant insulation, is flexible and compact, and yet efficient in transmission, cool, and safe for fax and modem applications.

BRIEF DESCRIPTION OF THE DRAWINGS

There will now be described preferred embodiments of the invention with regard to the drawings, by way of illustration, in which drawings like reference characters denote like elements and in which:

Figure 1 is a cross-section of one embodiment of a cord winder cable according to the present invention, which shows four wire bundles passing through the insulator material having fire retardant additives (not to scale).

Figure 2 is a detail cross-section of components of a single wire bundle according to one embodiment of an invented cord winder cable.

Figure 3 is a front view of one embodiment of a cord winder according to the present invention, in a telephone application.

Figure 4 is a side view of another embodiment of a cord winder according to the present invention, in a modem application.

Figure 5 is a detail cross-section of components of a single wire bundle according to another embodiment of a cord winder cable.

Figure 6 is a close-up side view of one embodiment of a double-pull retractor according to the invention, that includes low resistance, flame retardant fax/modem cable.

Figure 7 is an exploded view of the retractor of figure 6, with cables fully retracted.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the Figures, there is described an embodiment of the instant cord winder invention, having cord that is made of low-resistance electrical wire with flame retardant insulating material. Surprisingly, the low-resistance wire, of substantially greater diameter than conventional flat winder cord wire, is thin and flexible enough to wind and un-wind consistently well inside a casing by means of a spring-biased system.

One would expect that eliminating the "tensile wire" and/or increasing wire diameter would lower the cable's flexibility and, hence, would reduce windability and fatigue life. That is, increasing wire diameter would be expected to make the wire difficult and too-bulky to wind in a reasonably-sized casing, and would be expected to make the wire fail by breaking after fewer flexes/retractions. The present cable invention surprisingly provides excellent windability and long life in a small retractor, even though the cable includes large diameter wire.

In Figure 1 is depicted a cross-section of one cord winder cable 10 according to the present invention. Cable 10 has a plurality of wire bundles 12 encased in a flat insulator material 14 containing a fire retardant additive 16. Presently, four wire bundles 12 in the cable are preferred, but the invented cable 10 may have more than four, or less than four, wire bundles 12. The dimensions of flat insulator material 14 may vary, however, the present preferred flat cable including four wire bundles is about 0.156" wide and 0.030" thick. Preferably, no matter how many wire bundles are included, the cable is less than or equal to 0.035" thick, to optimize flexibility and compactness of the cable. At the most, the invented cable is preferably only 0.04 inches thick for alternative embodiments described below with larger diameter strands or more strands. When fully retracted into a 2" diameter retractor, 6 feet of the 0.030" inch thick cable forms about 22 wraps inside the retractor on one side of the rotating plate holding the retracted cable, and, therefore, the full 12 feet of cable retracted inside the retractor forms about 22 wraps per side on both sides of the plate. Preferably, the cable is 0.156" wide for a four wire-bundle design, but the cable may be wider for more wire bundles. For example, an 8 wire-bundle design, the cable is about 0.31" wide. One may see from these dimensions that the preferred cable has a thickness that is less than or equal to about 0.25 times the width of the cable, and preferably about 0.2 times the width of the cable. For wider cables, for example, with eight bundles of wire, the width is less than about 0.13 times the width.

Preferably, the invented cable 10 is installed in a double-pull winder device, in which the cable is installed in the retractor, passes through the rotating plate in the retractor, to wind up on both sides of the rotating plate and then to pass out of the retractor through two ports. Thus, the cable is used uncut in the retractor. There is no potential for broken or weakened connections between portions of cable, and there is no need for special rotatable conductive connectors to connect two separate portions of cable. In other words, in a double-pull retractor, about half of the cable winds up on each side of a rotating plate inside the winder, and the two ends of the cable pull out from the retractor in generally opposite directions. Alternatively, single-pull retractors may be provided, that is, retractors from which only one cord end is pulled out in one direction, especially if a shorter total length of extendible cable is desired.

The preferred cable of less than or equal to 0.030" thick is especially advantageous in that 12 feet of cable may be wound in a double-pull 2 inch diameter retractor, with each of the two extendible cable ends being about 6 feet in length.

In the preferred cable 10, it is important that wire bundle 12 have a diameter D about 0.0205 inches, ± 0.0005 ". The wire bundles 12 of preferably 0.0205" diameter may be comprised of 19 strands of twisted 40 gauge copper wire (3 thousandths inch diameter). The strands of each bundle are typically twisted around each other enough to preserve the bundle's structure. The diameter of bundles 12 may vary slightly, for example, ± 0.0005 ", but careful control of this diameter dimension during manufacture is considered to be crucial for the invention. Careful control of this dimension provides consistently low resistance of the wire, that is, approximately 0.031 ohms/ft resistance, and allows a consistently thin, flat cable to be formed from the wire. Stranded wire with an total diameter of 0.0205 inches may be described as very close to the same outer diameter as a "25 AWG (American Wire Gauge)" stranded conductor.

In Figure 2, a wire bundle 12 of diameter D with nineteen wire strands 18 is depicted. Nineteen strand wire inside the flat insulator is believed to be optimum, because this configuration gives excellent flexibility and life, while not requiring a high-torque spring in the retractor. A high tensile strength spring may be used to wind 12 feet (6 feet on each side in retractor) of such a cable. Increased strands has been found to improve the cable flexibility and fatigue resistance, that is, the life of cable before breaking, but are expensive to manufacture.

Also, preferably each wire bundle 12 is comprised of substantially pure copper wire strands, rather than alloys, tensile wire, or other composition besides pure, solid, copper strands. For example, pure copper stranded wire that is appropriate for inclusion in the invented cable may be obtained from Phelps Dodge corporation. Oxygen-free copper is preferably used, but is not necessarily required. As an alternative, silver-coated or tin-coated copper strands may be used, and such strands with thin coatings of the silver or tin may be obtained commercially.

Cable 10 made according to the preferred embodiment of the invention, therefore, provides an optimum combination is obtained: low resistance, from larger diameter bundle 12; high conductivity, from the pure copper wire; and high flexibility, from 19 or more strands of wire in each bundle and the preferred insulation composition. These features result in less heat being produced by the cable, and less heat build-up in the casing of the invented electrical cord wind-up device during operation. Surprisingly, the heat build-up from the many wraps of cable inside the invented retractor does not heat the retractor to near the UL temperature limits. Surprisingly, the copper wire strands of the preferred design, even of the preferably large diameter when compared to conventional windable communications cable, are flexible enough to give good fatigue life, that is, they withstand many thousands of extensions and retractions without the wire strands breaking and failing.

The insulator material 14 that encases the preferred wire bundles of the present invention preferably comprises a fire retardant additive 16 blended with the insulating material prior to forming of the insulator 14 around the wire bundles. Insulator material 14 is preferably 6333 Pebax™ provided by Elf Atochem, or other block polyamide material(s), or other thermoplastic material(s), plus the fire retardant. The preferred block polyamide contributes very high dielectric strength to the insulator 14, and abrasion resistance and inertness to a large number of solvents. Other suitable insulator materials, however, may also be used. Fire retardant additive 16 is preferably 243S™ provided by Thermoguard, but other fire/flame retardants may be used. Preferably, the Pebax™ and 243S™ are used in a 60/40 relative wt% blend, respectively, to produce insulator material 14 containing a fire retardant additive 16. The preferred amount of fire retardant additive 16 is present at less than or equal to 40 wt-%, and preferably 35-40 wt%. Optionally, additional additives may be used in amounts from a trace up to about 5 wt-percent, wherein the block polyamide and fire retardant additive being in about a 60/40 relative wt-% blend. For example, carbon black or other colorant may

be added, or other additive for optimizing the insulator or further enhancing fire retardancy. For example, an example may comprise 58 wt% Pebax™, 39 wt-% 243S™, and 3 wt-% "other additive."

The preferred amount of fire retardant should be carefully monitored, and the fire retardant should be homogeneously mixed into the block polyamide or other thermoplastic prior to extrusion around the wire bundles, as too much retardant or uneven concentrations along the cable may negatively effect flexibility, dielectric, and/or abrasion of cable against cable or cable against retractor structure.

An alternative insulation material may be inherently fire retardant, and, hence, not require a separate fire retardant additive. For example, Kynar™ by Elf Atochem may be used, which is itself a fire retardant material.

The preferred cable 10 may be made by melting the insulator and fire retardant mixture, extruding it around the wire bundles, and then cooling the cable to harden the insulator. Careful quality control should be used to ensure consistent and exact dimensions throughout the cable and bubble-free extrusion. Preferably, there is no coating around the wire bundles except the insulator, which is a substantially homogeneous material completely surrounding and closely contacting the wire bundles, without any significant air or other space between the insulation and the wire bundles.

In Figure 3 is depicted a telephone device 20 with a wind-up device 22 according to the present invention for the cord 24 connecting to the phone headset 26. In Figure 4 is shown the preferred use of the invented cable 10 and retractor 22, that is, as a modem cord and/or fax line cord, for example, connecting a computer 51 to a modem 53.

A cable retractor made according to the present invention has been tested and meets all current UL requirements for communication accessories. For example, 12 feet of cable 10 (19 strand, 0.0205" diameter wire bundles) in a 2 inch retractor was tested by standard UL procedures as follows:

1. Heating Test (Test results acceptable if temperature rise of retractor less than 30 degrees C above room ambient): Results = Passed. Highest temperature attained at ac and dc voltages was 9 degrees C above ambient.
2. Horizontal-Specimen Flame Test: Results = Passed. The length of charred portion of cable did not exceed 100 mm. The particles or drops emitted by the specimen during or after application of the gas flame did not ignite the cotton around the base of the burner, on the wedge, or on the floor of the enclosure used in the test.

3. Fault Current Test: Results = Passed. Dielectric Withstand potential was 1000 Vac applied between live parts and enclosure. A fire hazard would be indicated by the charring or burning of the cheesecloth or emission of flame or molten metal from the test sample, but, for the subject invented cable, at 2.2 amps and at 7.0 amps, no fire hazard was noted.
4. Millivolt Drop Test (maximum allowable millivolt drop per terminal junction is 300 mV): Results = Passed. At ac and dc voltages, millivolt drop was less than 56.
5. Drop Test: Results = Passed. "No damage" at 1000 V ac.
6. Leakage Current Test: Results = Passed. At 600 volts, less than 10 μ a.
7. Dielectric Withstand Test: Results = Passed.
8. Strain Relief Test: Results = Passed. No damage.
9. Crush Test: Results = Passed. No damage.

In layman's terms, a retractor passing these tests is sturdy and should not burn a person who touches it after long term use. A flame coming near the cable should not cause the cable to burst into flame or emit burning particles or drops to its surroundings.

Alternative cable compositions may be within the scope of the invention to achieve the requirements of low resistance and high flexibility cable in a small retractor. Such alternative compositions are especially appropriate for retractors larger than 2 inches in diameter up to and including about 3 inches in diameter. For example, 12 feet of total cable in a double-pull, 3 inch diameter retractor allows slightly larger diameter wire to be used. In such an application, 19 strand wire bundles of larger strand diameter may be used, with each strand being of 4 thousandths inch diameter, resulting in wire bundles each about 0.028" in diameter rather than the 0.0205" diameter resulting from 19 strands of 3 thousandth inch diameter. After surrounding the bundles of larger diameter strands with the preferred insulation, the resulting cable is about 0.040" thick rather than 0.030" thick.

Higher numbers of strands are preferred, especially 19 - 37, because of increased flexibility offered by the high numbers of strands. Therefore, another alternative composition involves increasing the number of strands in each wire bundle to higher than 19 strands. For example, a 12 foot total length of cable in a double-pull, 3 inch diameter retractor may be made with wire bundles (112) of 37 strands (30) of 40 gauge all-copper wire, resulting in a cable of about 0.040" thickness. Figure 5

portrays a cross-sectional view of one bundle of 37 strands that may be used according to the invention.

Alternatively, the number of strands may be decreased below 19 strands, although this results in less preferred embodiments. Seven (7) strands may be used, for example, with each strand being of a larger diameter, preferably about 0.0068" diameter. A seven strand, 0.0068" inch stand diameter, embodiment would result in wire bundle diameters of 0.0205 inches, and cable thickness of 0.030 inches.

One may see that the length of cable in a retractor may be varied. For example, wind up devices with different lengths of cable may be created according to the invention, ranging from about 4 feet to about 24 feet. The high end of this range is expected to be double-pull, 3 inch diameter retractors including the 0.03" thick cable described above.

One embodiment of the invented retractor 22 is shown in Figure 6, including cable 10, conventional modular plugs 44, and generally cylindrical retractor casing 45 with internal winding mechanism 46. Figure 7 illustrates one embodiment of such a casing in exploded format, including a first portion 61 of the casing and a second portion 62 of the casing that close around an internal space that receives the cable, first and second extendible cable ends 63, 64 on rotating plate 65, and spring-biased winding mechanism 46 (internal spring not shown). The winding mechanism 46 may be of various conventional designs, preferably like the spring-biased winding mechanisms described in U.S. Patents 5,797,558 and 5,230,481. One may therefore describe the invented cable, and the as including a thin, flat, and flexible cable that produces a low level of heat and is fire retardant. The cable is preferably 0.03 - 0.40 inches thick from first flat side to second flat side. Preferably, the cable is about 0.156 - 0.32 inches wide, for 4 - 8 wire bundle cables, but may include any number of wire bundles laying parallel in a plane corresponding to the width of the cable. All-copper (99.999%+) stranded wire bundles are preferred, and the wire bundles are preferably each of diameter of about 0.020-0.030 inches. The insulation on the cable preferably surrounds each wire bundle, without any significant air or other space between the insulation and the wire bundles. The insulation thickness on "top" and "bottom" of the wire bundles (71 and 73, respectively), therefore, is from 0.0047 - 0.006 inches thick, depending on whether a thinner cable (0.03 inch thick) for a 2 inch retractor or a thicker cable (0.04 inch thick) for a 3 inch retractor is desired. By "on top" is meant between the wire bundles and the first

“top” flat outer surface 31, and by “on bottom” is meant between the wire bundles and the second “bottom” flat outer surface 33 of the cable.

Although this invention has been described above with reference to particular means, materials and embodiments, it is to be understood that the invention is not limited to these disclosed particulars, but extends instead to all equivalents within the scope of the following claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A fire retardant and low resistance fax or modem cable retractor comprising:
 - a retractor casing having an internal space;
 - a flat cable in the internal space and extending out of an opening in the casing, the cable retractable into a wound position inside the internal space and extendable into an unwound position extending out from the retractor casing ; and
 - a winding mechanism inside the internal space that biases the cable into the wound position;
 wherein the cable comprises:
 - a plurality of wire bundles, each bundle comprising at least 19 conductive wire strands, each strand having a length and having a diameter of 0.003-0.004 inches, wherein the bundles extend parallel to each other in a plane;
 - insulating material comprising thermoplastic material and a fire retardant material, the insulating material surrounding the bundles and being generally rectangular in cross-section normal to the lengths of the bundles, the insulating material having a width parallel to the plane of the wire bundles and a thickness normal to the plane of the wire bundles, the thickness being less than or equal to about 0.04 inches, and the thickness being less than or equal to about 0.25 times the width of the cable;
 wherein the retractor passes Underwriter's Laboratory Horizontal-Specimen Flame Test and Heating Test for Communication Accessories.
2. The retractor of Claim 1, wherein the conductive wire strands are copper.
3. The retractor of Claim 1, wherein the conductive wire strands are oxygen-free copper.
4. The retractor of Claim 1, wherein the conductive wire strands are tin-coated copper.
5. The retractor of Claim 1, wherein the conductive wire strands are silver-coated copper.

6. The retractor of Claim 1, wherein the thermoplastic is block polyamide.
7. The retractor of Claim 6, wherein the insulating material is a 40/60 weight ratio fire retardant/block polyamide.
8. The retractor of Claim 1, wherein each bundle has a diameter of 0.0205 inches +/- 0.0005 inches.
9. The retractor of Claim 1, wherein the cable is about 12 feet in length and has two ends with modular plugs, wherein each of the two ends extend out from the retractor and are extendable about 6 feet and retractable substantially entirely into the retractor.
10. A fire retardant and low resistance fax or modem cable retractor comprising:
 - a retractor casing having an internal space;
 - a cable in the internal space and extending out of an opening in the casing, the cable retractable into a wound position inside the internal space and extendable into an unwound position extending out from the retractor casing ; and
 - a winding mechanism inside the internal space that biases the cable into the wound position;
 wherein the cable comprises:
 - a plurality of wire bundles, each bundle comprising 19 conductive wire strands, each strand having a length and having a diameter of about 0.003 inches, wherein the bundles extend parallel to each other in a plane and are spaced apart from each other; and
 - insulating material comprising thermoplastic material and a fire retardant material, the insulating material surrounding the bundles and being generally rectangular in cross-section normal to the lengths of the bundles, the insulating material having a width parallel to the plane of the wire bundles and a thickness normal to the plane of the wire bundles, the thickness being less than or equal to about 0.03 inches, and the thickness being less than or equal to about 0.25 times the width of the cable;
 wherein the retractor passes Underwriter's Laboratory Horizontal-Specimen Flame Test and Heating Test for Communication Accessories.

11. The retractor of Claim 10, wherein the conductive wire strands are copper.
12. The retractor of Claim 10, wherein the conductive wire strands are oxygen-free copper.
13. The retractor of Claim 10, wherein the conductive wire strands are tin-coated copper.
14. The retractor of Claim 10, wherein the conductive wire strands are silver-coated copper.
15. The retractor of Claim 10, wherein the thermoplastic is block polyamide.
16. The retractor of Claim 15, wherein the insulating material is fire retardant is 35-40 weight percent fire retardant and 65 - 60 weight percent block polyamide.
17. The retractor of Claim 10, wherein each bundle has a diameter of 0.0205 inches +/- 0.0005 inches.
18. The retractor of Claim 10, wherein the retractor casing has a generally cylindrical outer surface having about a 2 inch diameter.
19. A fire retardant and low resistance fax or modem cable retractor comprising:
 - a retractor casing having a generally cylindrical outer surface having about a 2-3 inch diameter and an internal space;
 - a flat cable in the internal space and extending out of an opening in the casing, the cable retractable into a wound position inside the internal space and extendable into an unwound position extending out from the retractor casing; and
 - a winding mechanism inside the internal space that biases the cable into the wound position;wherein the cable comprises:

a plurality of wire bundles, each bundle comprising 19 conductive wire strands, each strand having a length and having a diameter of about 0.004 inches, wherein the bundles extend parallel to each other in a plane spaced apart from each other; and

insulating material comprises thermoplastic material and a fire retardant material, the insulating material surrounding the bundles and being generally rectangular in cross-section normal to the lengths of the bundles, the insulating material having a width parallel to the plane of the wire bundles and a thickness normal to the plane of the wire bundles, the thickness being less than or equal to about 0.04 inches, and the thickness being less than or equal to about 0.25 times the width of the cable;

wherein the retractor passes Underwriter's Laboratory Horizontal-Specimen Flame Test and Heating Test for Communication Accessories.

20. The retractor of Claim 19, wherein the conductive wire strands are copper.
21. The retractor of Claim 19, wherein the conductive wire strands are oxygen-free copper.
22. The retractor of Claim 19, wherein the conductive wire strands are tin-coated copper.
23. The retractor of Claim 19, wherein the conductive wire strands are silver-coated copper.
24. The retractor of Claim 19, wherein the thermoplastic is block polyamide.
25. The retractor of Claim 24, wherein the insulating material is fire retardant is 35-40 weight percent fire retardant and 65 - 60 weight percent block polyamide.
26. A fax or modem cable retractor comprising:
a retractor casing having a generally cylindrical outer surface having about a 2-3 inch diameter and an internal space;

a flat cable in the internal space and extending out of an opening in the casing, the cable retractable into a wound position inside the internal space and extendable into an unwound position extending out from the retractor casing ; and

a winding mechanism inside the internal space that biases the cable into the wound position; wherein the cable comprises:

a plurality of wire bundles, each bundle comprising 7 - 19 conductive wire strands, each strand having a length and having a diameter of about 0.003-0.004 inches, wherein the bundles extend parallel to each other in a plane spaced apart from each other; and

insulating material comprises thermoplastic material and a fire retardant material, the insulating material surrounding the bundles and being generally rectangular in cross-section normal to the lengths of the bundles, the insulating material having a width parallel to the plane of the wire bundles and a thickness normal to the plane of the wire bundles, the thickness being less than or equal to about 0.04 inches, and the thickness being less than or equal to about 0.25 times the width of the cable;

wherein the retractor passes Underwriter's Laboratory Horizontal-Specimen Flame Test and Heating Test for Communication Accessories.

27. The retractor of Claim 26, wherein each bundle is made of 7 conductive strands and each bundle has a diameter of 0.0205 inches +/- 0.0005 inches.

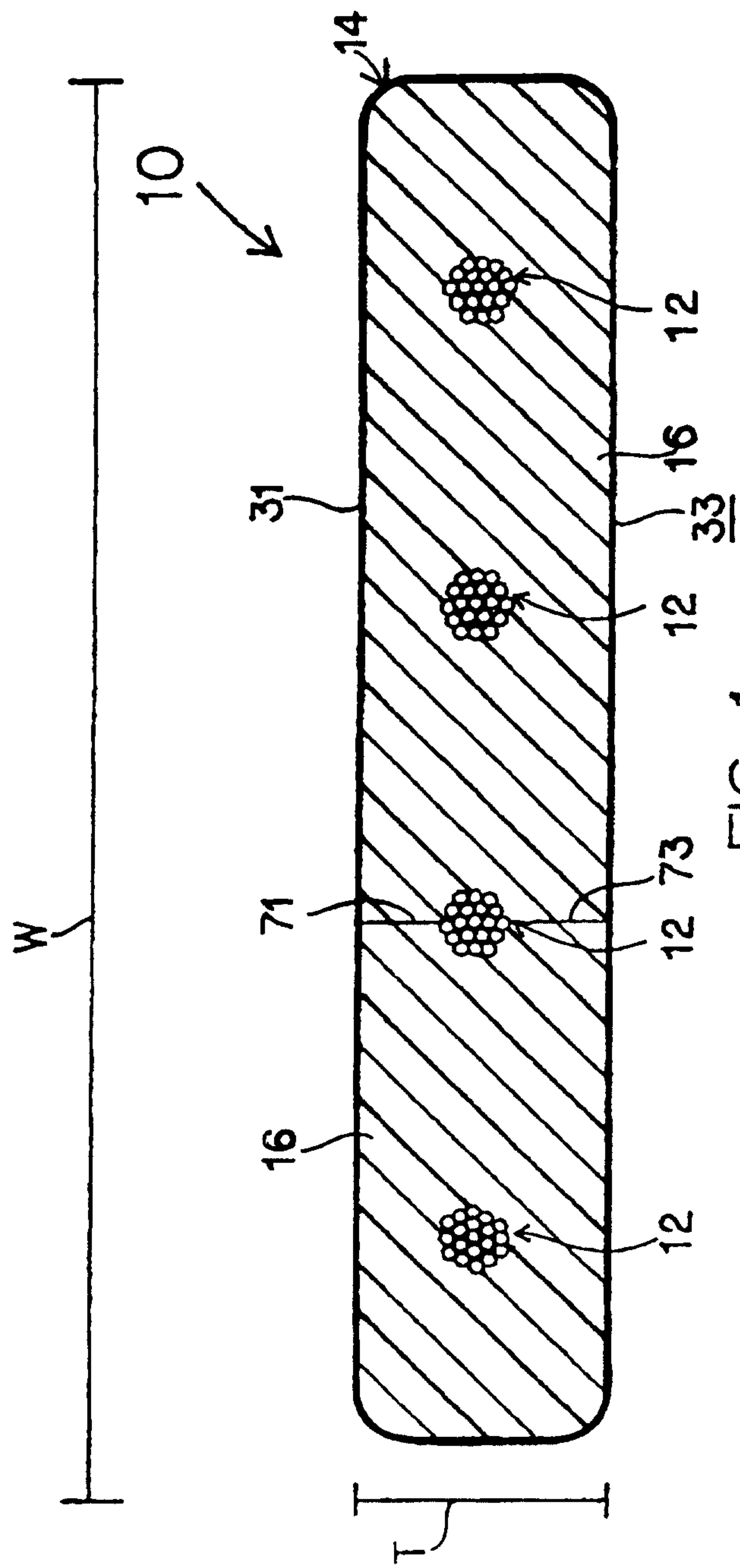


FIG. 1

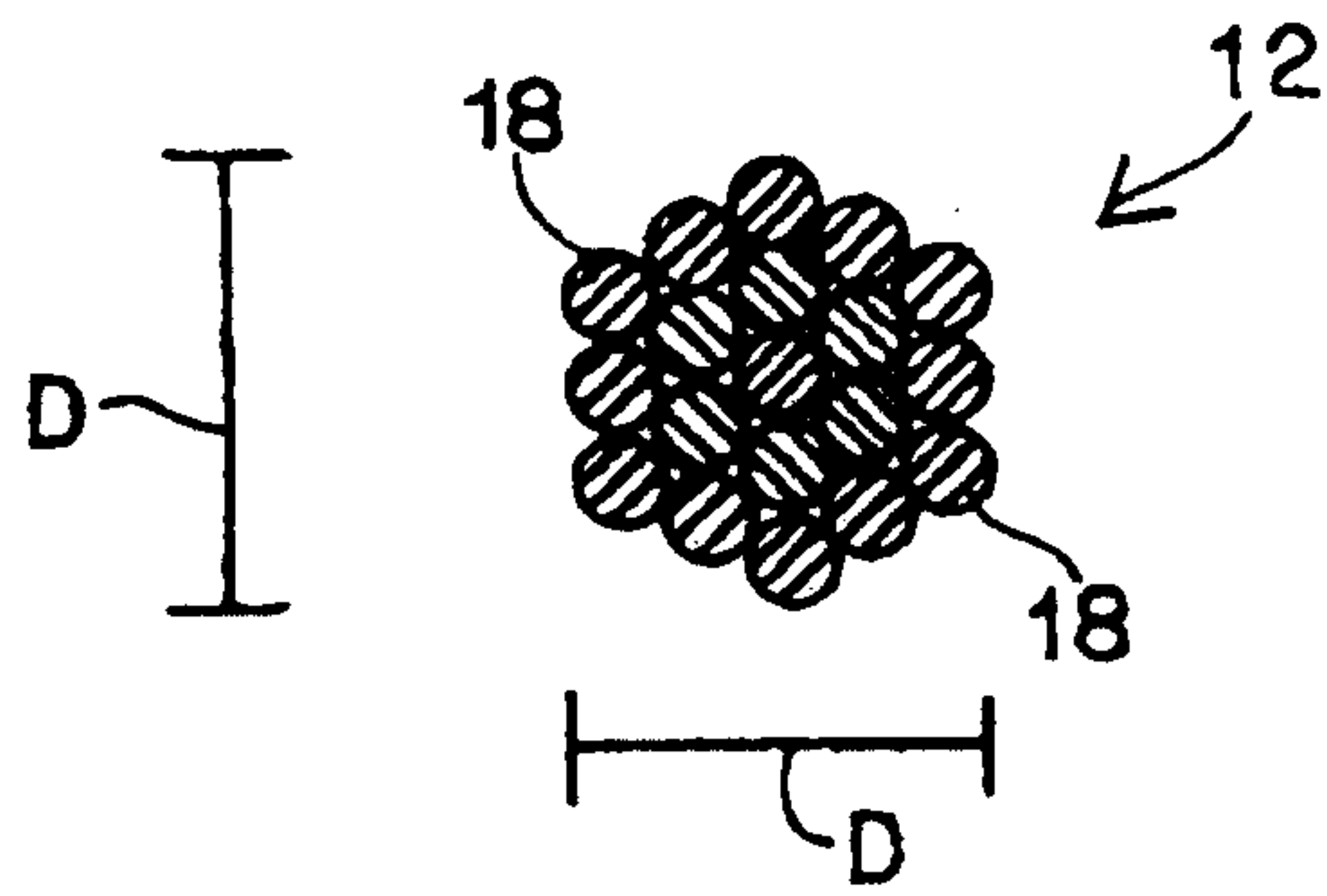


FIG. 2

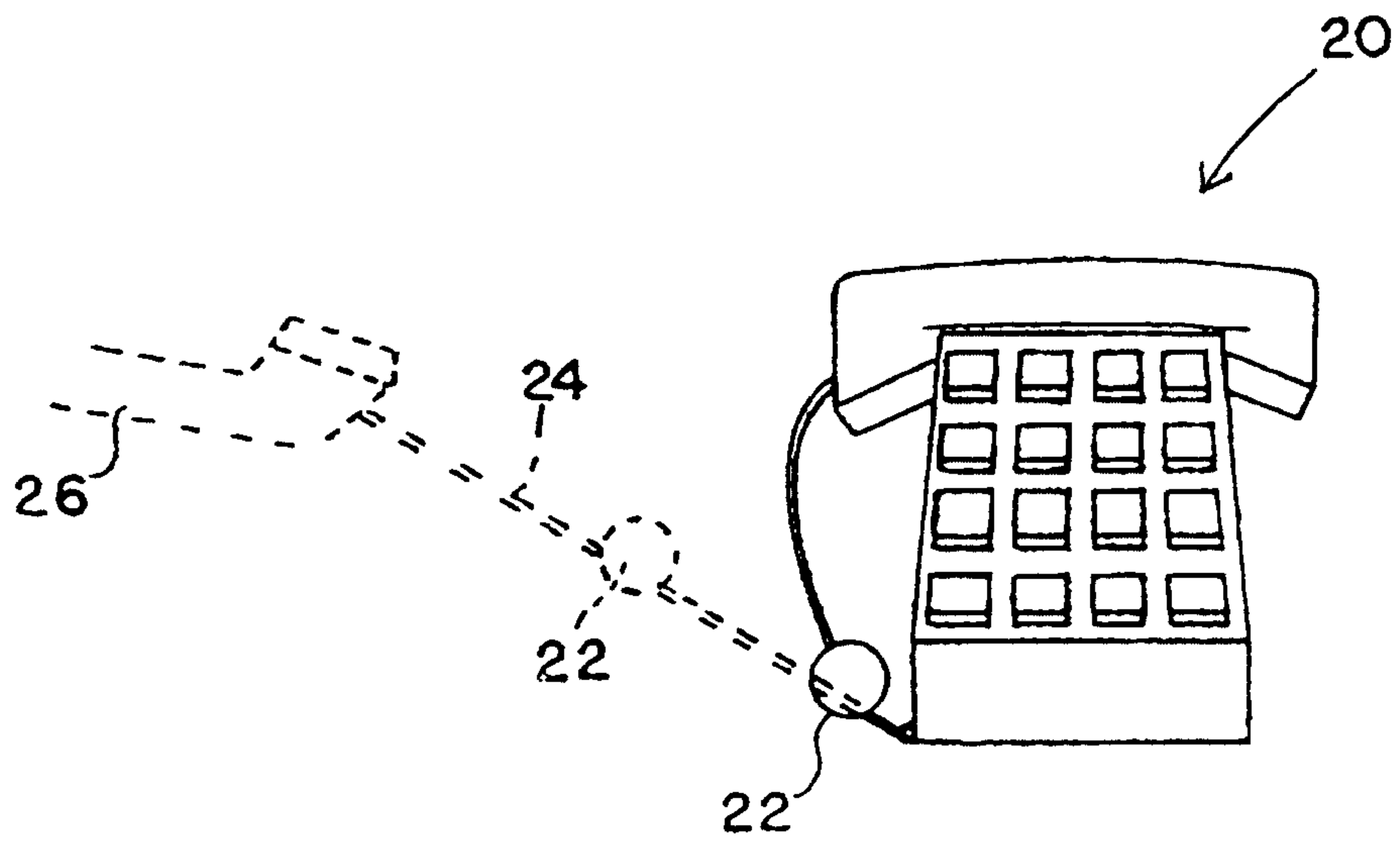


FIG. 3

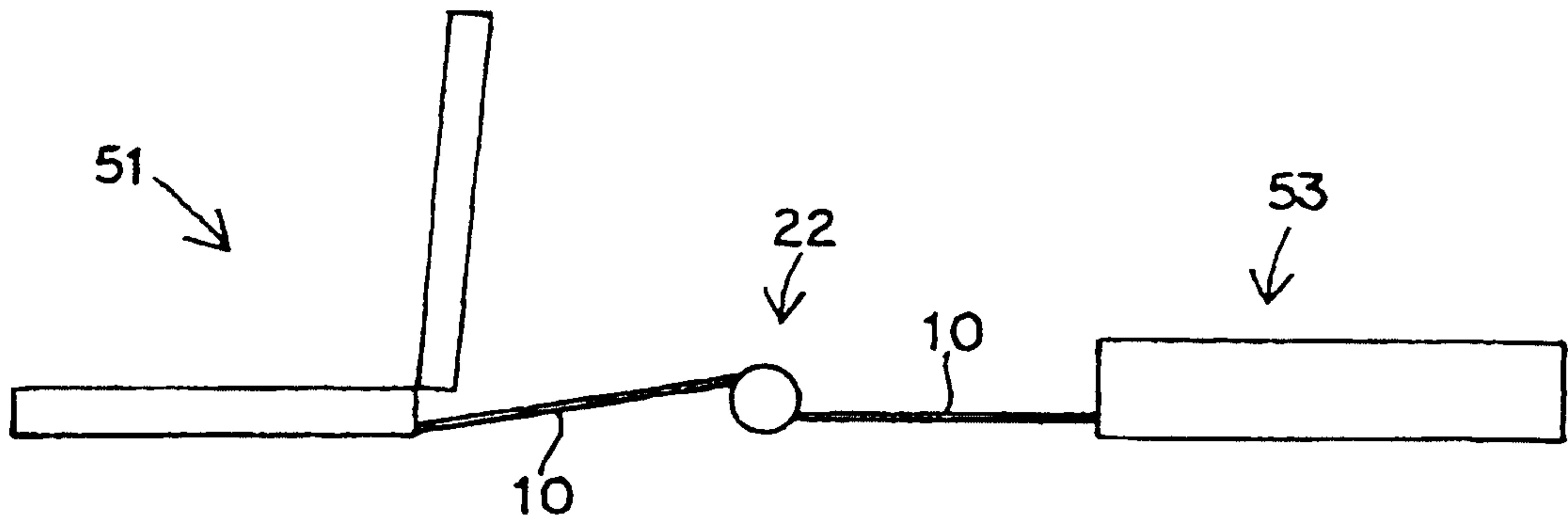


FIG. 4

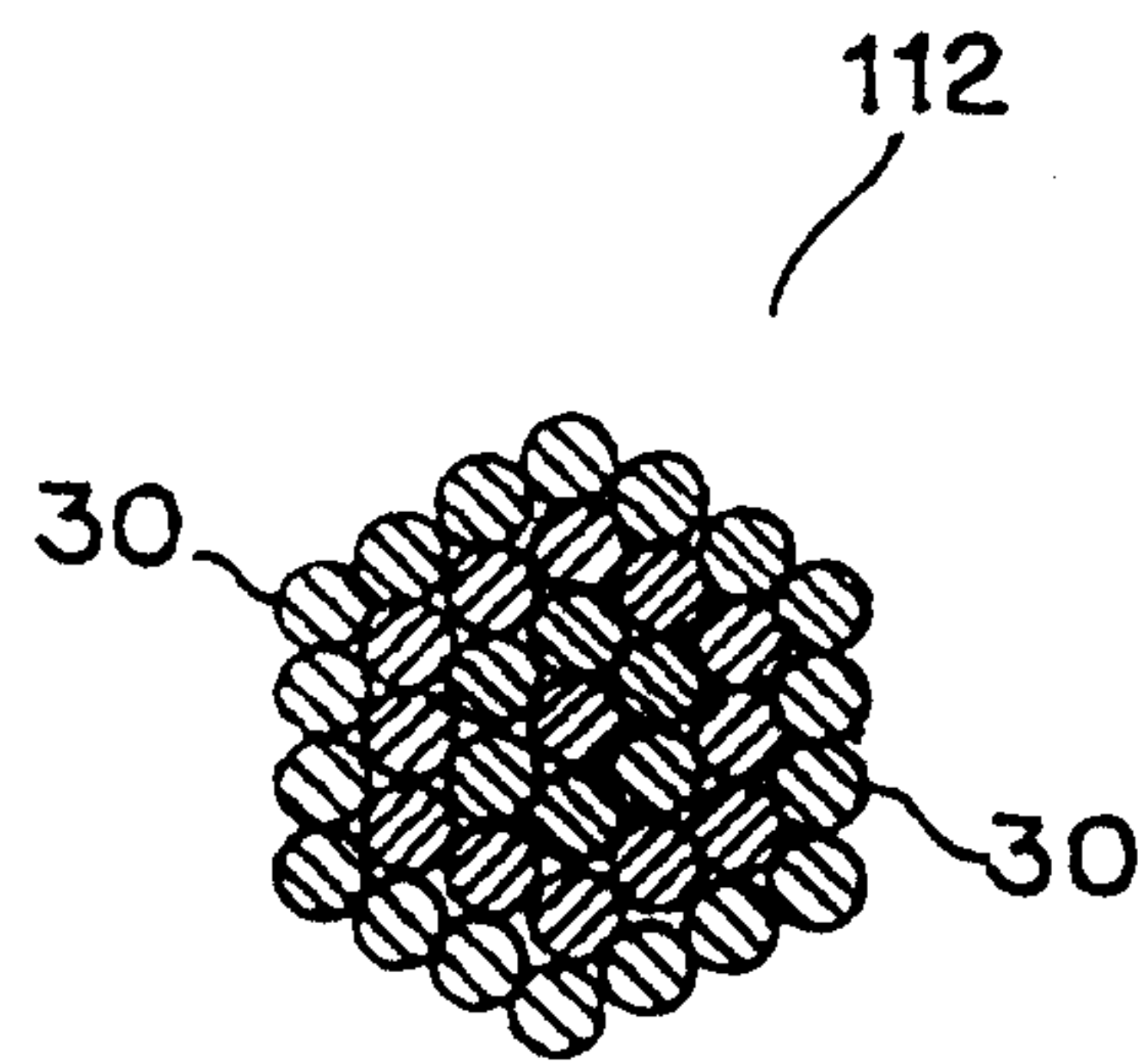


FIG. 5

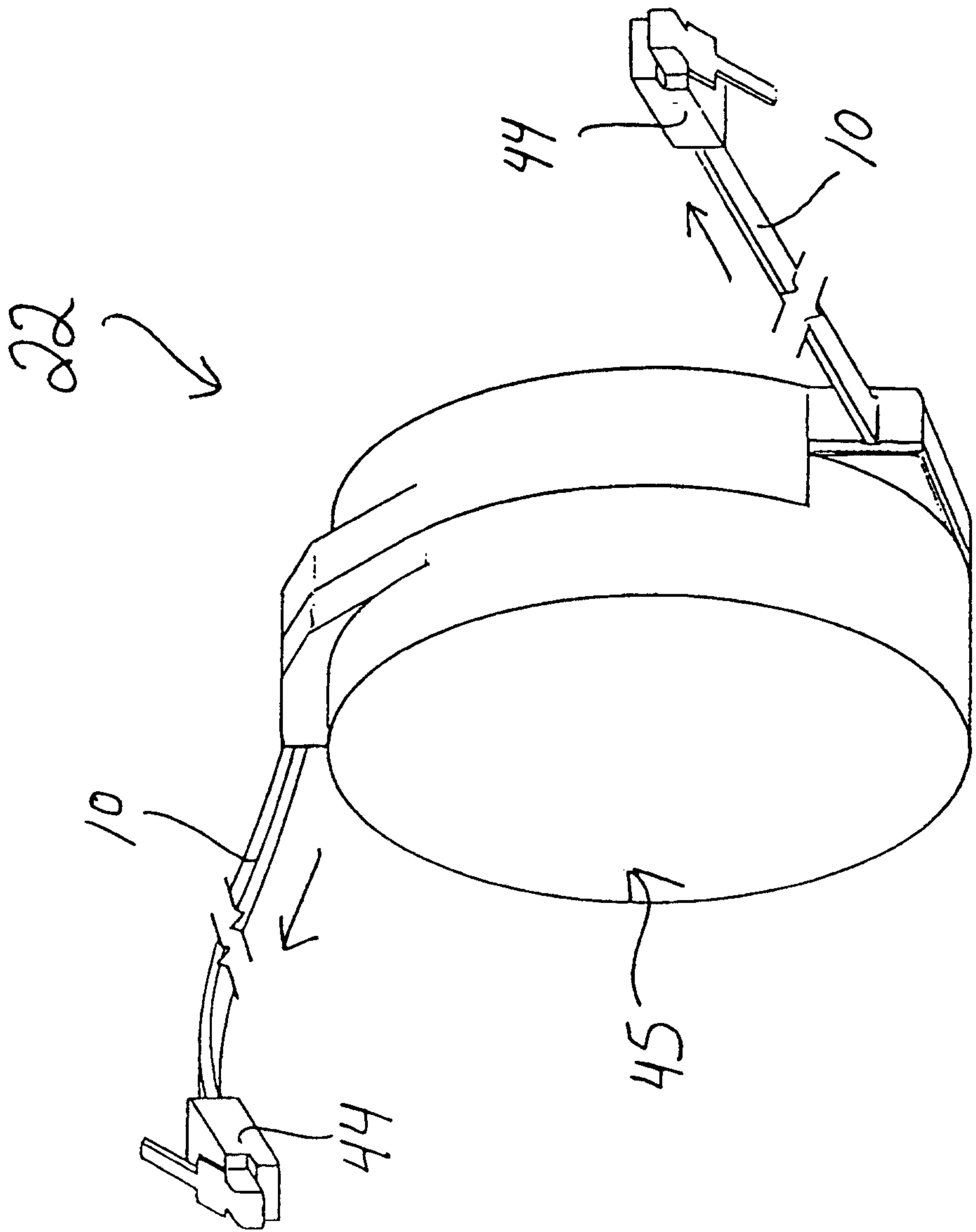


FIG. 6

