

United States Patent

[11] 3,580,983

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 [21] Appl. No. **881,750**
 [22] Filed **Dec. 3, 1969**
 [45] Patented **May 25, 1971**
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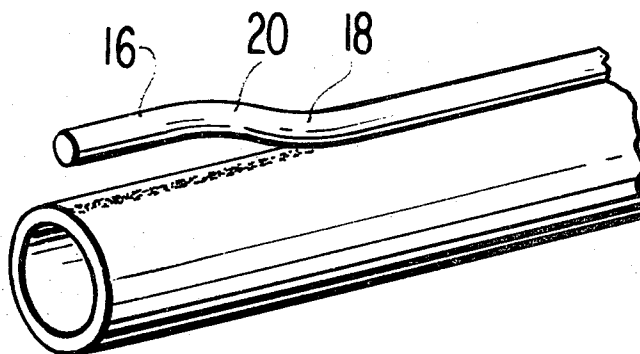
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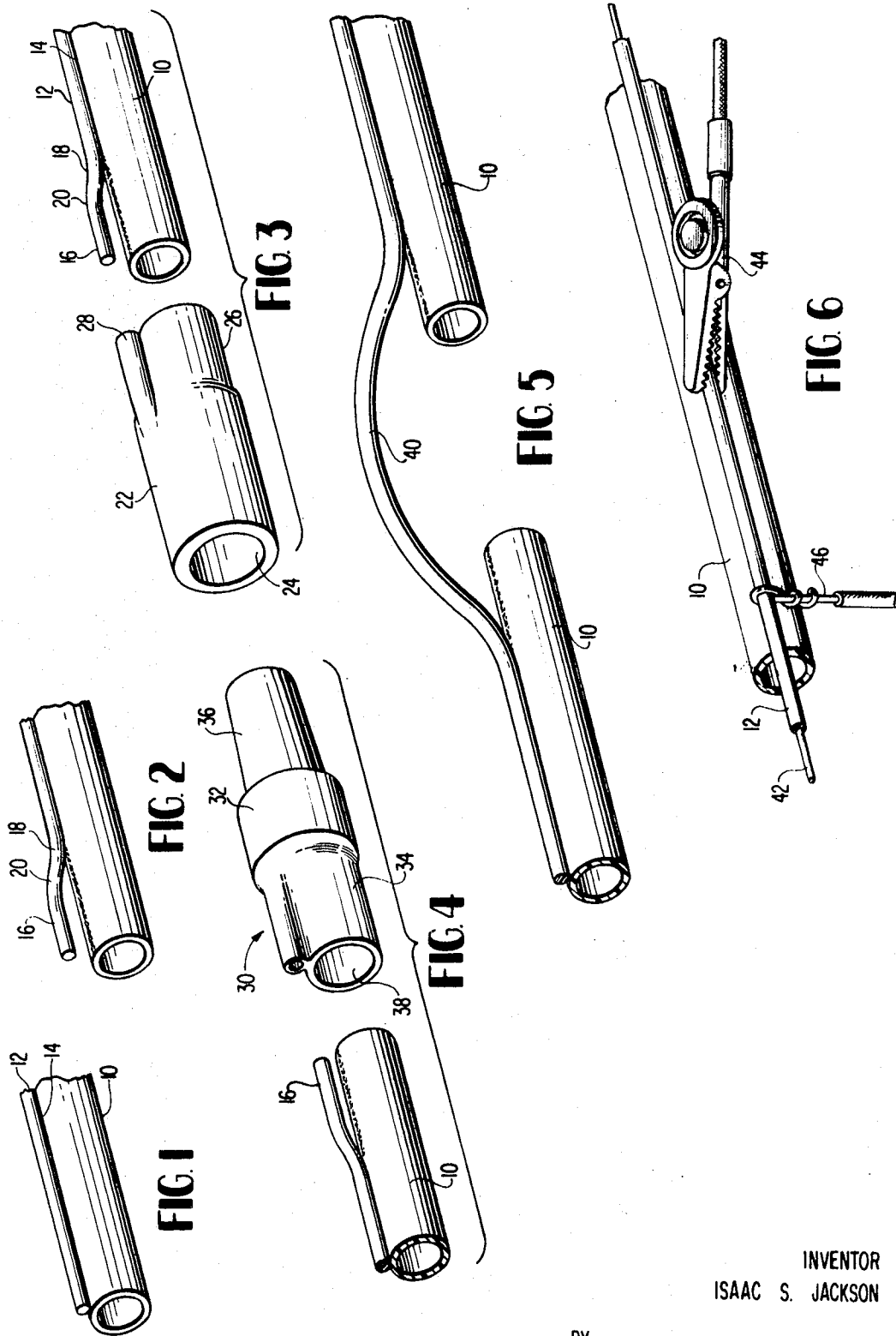
[54] **CONDUCTIVE LINE TUBE**
10 Claims, 6 Drawing Figs.

[52] U.S. Cl..... 174/47,
 128/2.05R, 128/348, 317/2R, 339/16R
 [51] Int. Cl..... **F16l 11/12,**
 H05f 3/02
 [50] Field of Search..... 174/15 C,
 47, 70 R, 113 AS, 117 AS, 115; 138/103, 118,
 138; 339/15, 16 R; 340/320; 317/2 R; 128/2.05 D,
 2.05 R, 348, 349 R, 350 R

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ABSTRACT: The fabrication of conductive line tubing or electrically conductive medicosurgical tubes by extruding from a mass of flexible plastic material an elongated tube contemporaneous with the extrusion of an elongated electrically conductive plastic filament that is secured to said tube in superimposed relationship piggyback arrangement. The plastic material used to form the conductive line tubes is compounded from dielectric polymers while the filament is formed from a flexible electrically conductive plastic material. The extrusion of the tube and filament is continuous with the filament being secured to the tube subsequent to its withdrawal from an extrusion die.





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CONDUCTIVE LINE TUBE

BACKGROUND OF THE INVENTION

The present invention pertains broadly to flexible pipes or tubular conduits and more specifically to conductive line tubes that are quite often referred to as nonsparking medico-surgical tubes, e.g., catheters, nasal cannulae, suction connecting tubes, oxygen connecting tubes, anesthesia administration tubes and feeding tubes. While these tubes may be formed from a variety of materials, the greater portion are fabricated from either rubber or vinyl plastics with present day practices being to use such tubes only once and then dispose of them. The tubes are usually fabricated from a vinyl plastic material that is compounded from dielectric polymers which are susceptible of acquiring an electrostatic charge upon frictionally contacting other bodies or surfaces such as textile elements. These conductive line or medicosurgical tubes are used extensively in surgical and medical treatments that are often carried on in areas such as operating rooms wherein a combustible anesthetic agent might readily be present. Thus, it is essential to eliminate the possibility of creating or causing an electrostatic spark discharge in such areas. Suitable grounding devices, such as sheeting, floor coverings, mats and other equipment may readily be used in these areas to reduce the sparking hazard.

It is well known from the teachings of the prior art that flexible fluid conduits, such as a hose composed of fiber or plastic, may have connected thereto a flexible metallic static wire. The U.S. Pat. No. 2,811,674 to Smith of Oct. 29, 1957, is illustrative of such a conduit for transferring flammable fluids which tend to generate static electric charges that could collect and cause a spark. The static wire is utilized to ground any charges that might collect on the hose or parts thereof, such as the nozzle. The prior art Pat. to Flynn U.S. Pat. No. 2,268,321 of Dec. 30, 1941, pertains to catheters or similar devices, wherein a strengthening or reinforcing filament of nylon or the like is embedded within the wall of the tubular member which is formed from a plasticlike material. In U.S. Pat. No. 3,070,132 to Sheridan dated Dec. 25, 1962, there is disclosed a tubular device formed from plastic material which has incorporated therein as an integral part thereof, a stripe or stripes of flexible electrically conductive plastic material. These stripes of plastic material may be connected to suitable grounding devices so that the tubular device is prevented from accumulating any electrostatic charge during its use in an area wherein an ignitable flammable gas might be present during a medical or surgical treatment.

SUMMARY OF THE INVENTION

The present invention is directed to the concept of securing to the surface of an extruded plastic tube an electrically conductive plastic filament that may be grounded so as to prevent the tube from accumulating any electrostatic charge. The plastic tube and the plastic filament are preferably extruded in separate and continuous operations with the plastic filament being subsequently affixed to the plastic tube. The plastic filament is secured to the peripheral surface of the plastic tube by a continuous welding operation. While not absolutely essential, it has been found highly desirable to weld the plastic filament to the plastic tube upon the completion of the extrusion operations so that there is one long continuous weld extending the entire length of the tube. The plastic filament may be readily separated from a section or area of the plastic tube to permit the removal of said tube section and the insertion of a suitable fitting or device into the tube while still being able to maintain electrical continuity from end to end of the tube. The positioning or mounting of the plastic filament upon the outer surface of the tube readily facilitates the attachment of static bonding clamps to the filament for grounding any electrostatic charge that might tend to accumulate. In lieu of such clamps, a suitable wire could be inserted between the filament and tube and then twisted about the filament to produce an effective ground for any charges that might be upon the tube.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a fragmentary portion of a conductive line tubing made in accordance with the present invention;

FIG. 2 is a perspective view of the tube of FIG. 1 showing a segment of the filament portion separated from the tube;

FIG. 3 is an exploded perspective view showing the tube of FIG. 2 and an end fitting for said tube;

FIG. 4 is an exploded perspective view of another end fitting for the tube of FIG. 2;

FIG. 5 is a perspective view of another form of conductive line tubing embodying the present invention; and

FIG. 6 is a perspective view of still a further variation of a conductive line tubing embodying the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, there is shown in FIGS. 1 and 2 a conductive line tube or tubing unit consisting of a tubular member 10 and an electrically conductive filament 12. The tube or tubular member 10 is made by extruding a plastic material through a suitable die of any well-known type so as to produce a elongated tube of constant and uniform thickness and diameter which has a smooth and uninterrupted inner surface or bore and a smooth outer or exterior surface. The filament member 12 is likewise formed by extruding a plastic material through an extrusion die of any well-known type, and said filament member is of diameter that is considerably less than the diameter of the tube 10.

The tube 10 may be formed from any suitable flexible waterproof plastic material, such as vinyl chloride, homopolymers or copolymers with other vinyl esters, such as vinyl acetate. In lieu of the foregoing, the tube may be formed from flexible or pliable forms of nylon, polyurethane, polyester plastics, polyethylene, vinylidene chloride polymers, cellulose esters, acrylic polymers and the like. The plastic material utilized in forming the tube 10 is preferably free of dyes and pigments so as to produce a clear transparent tube which permits a visual inspection of the tube throughout its length to ascertain if there is an obstruction or foreign matter within the bore of the tube. While the aforementioned type of tube is preferable, various dyes may be incorporated in the plastic material so as to produce a tube of a distinctive color that could be employed for a particular purpose or special treatment.

The electrically conductive filament member 12 is preferably made from the same plastic base material as tubular member 10, but is rendered electrically conductive by compounding the plastic material with a very finely powdered electrically conductive solid material. The conductive solid material may range anywhere from 5 percent to 40 percent of the plastic material and may be powdered carbon or a metal, such as, copper, silver or aluminum. The electrically conductive filament member 12 is preferably extruded through an extrusion die contemporaneous with and adjacent to the extrusion of the tube 10 so that the filament member may then be secured upon the exterior surface of the tube 10. As shown in FIGS. 1 and 2, the filament member 12 is secured to the tube 10 by a fusion or welding 14 of the two members in a continuous manner and at the time of extruding the two members through their respective dies. This manner or means of securing the filament member to the tube 10 readily permits the filament member 12 to be removed or torn away from the tube at any point throughout the length of the tube. Thus, an end portion 16 of the filament member 12 may be torn away from an end portion of the tube 10 and initially bent outwardly as in 18, in FIG. 2 and then bent back upon itself as at 20 in FIG. 2 whereby said end portion of the filament member will be arranged in spaced parallel relation to the end portion of the tube.

As shown in FIG. 3 the end portion of the tube 10 and filament member 12 of FIG. 2 are adapted to be connected to a funnel-type fitting or housing 22. The housing 22 is a molded fitting formed from a suitable conductive plastic which may be

of the same material employed in forming the filament member 12. The housing or fitting 22 is formed with a smooth inner passage or bore 24 and a smooth exterior surface that terminates in a reduced end portion 26 which is provided on its external surface with a socket 28. The bore 24 at the reduced end portion 26 of the fitting 22 is of a diameter slightly greater than the external diameter of the tube 10 while the internal diameter of the socket 28 is slightly larger than the diameter of the filament member 12. Thus, the fitting or housing 22 is positioned upon the end of the tube 10 with the end portion 16 of the filament 12 being inserted into the socket 28, and said fitting is then secured to the end of the tube 10 and filament member 12 by fusion or cementing.

There is disclosed in FIG. 4 an elongated end fitting 30 for the tube 10 and filament member 12 that is similar to the fitting 22 shown in FIG. 3 with the exception that the fitting shown in FIG. 4 is of the plug or connector type. The plug 30, like the housing 22, is a molded fitting formed from a suitable conductive plastic material with an enlarged boss 32 in the central portion thereof. The plug fitting 30 has formed on one side of the boss 32 an end portion 34 that is of a configuration complementary to the ends of the tube 10 and filament member 12 which are secured to the fitting by welding in the same manner that fitting 22 is secured to the tube 10. The fitting 30 is formed on the other side of the boss 32 with a tapered plug portion 36 which together with the boss 32 and end portion 34 have a smooth, continuous and uninterrupted inner passageway or bore 38.

A tube 10 and filament member 12 which have a fitting secured to each end, such as fitting 22 to one end of the tube and fitting 30 to the other end of the tube, constitute a unit that is electrically conductive from one end to the other. Such a unit may readily be grounded so as to prevent the tube 10 from accumulating any electrostatic charge while being used in a medical or surgical treatment that might be carried on in an area wherein a combustible agent might be present.

In FIG. 5 there is shown a tube 10 which has had a portion or section removed therefrom to permit the mounting or insertion in said tube of a suitable fitting or device, not shown. Prior to removing the section of the tube 10, a portion 40 of the filament member 12 has been separated from the tube by tearing or breaking the weld 14 which permits the retention of the continuity of the electrical conductivity from one end of the tube to the other.

The tubular member 10 shown in FIG. 6 has a filament member 12 secured thereto by a continuous weld with the filament member having a wire core member 42. The use of a wire 42 in the center of the filament member would still permit it to retain its flexibility, but at the same time, it would function as an added conductor which would tend to lower the resistance of the filament member 12. There is also shown in FIG. 6, the use of conventional static bonding clamps 44 for readily engaging the filament 12 in order to ground any electrostatic charge that might accumulate on the tube 10. Another form of grounding any electrostatic charge that had accumulated on the tube 10 is shown in FIG. 6, wherein, one end of a wire 46 is first inserted between the tube 10 and filament member 12, and then is twisted about the filament member 12 to effect a tight clamping connection. The clamps 44 as well as the grounding wire 46 are readily susceptible of use with the filament member 12 and tube 10 illustrated in FIGS. 1 through 5 due to the mounting of the filament member upon the outer surface of the tube 10. The positioning of the filament member upon the outer surface of the tube, as shown in FIGS. 1 through 6, not only permits the positive grounding of the tube 10 by securely engaging the filament

member 12, but permits the tube 10 to be formed with walls of a uniform thickness throughout, wherein, the bursting strength and tensile strength of said tube are of importance.

Although the foregoing description is necessarily of a detailed character in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

What I claim:

1. A conductive line tubing comprising an elongated tubular member formed of flexible, dielectric, waterproof plastic material, an elongated filament member secured to the exterior surface of said tubular member in superimposed relationship therewith, said filament member being formed of flexible, electrically conductive, waterproof plastic material, said filament member being capable of being connected to ground to prevent the accumulation upon said tubular member of any electrostatic charge.

2. A conductive line tubing as set forth in claim 1 wherein said filament member is secured throughout its length to said tubular member by welding.

3. A conductive line tubing as set forth in claim 1 wherein each end of said tubular member and filament member is connected to a fitting formed of electrically conductive plastic material.

5. A conductive line tubing as set forth in claim 1 wherein static bonding clamps are connected to said filament member for grounding said tubular member.

6. A conductive line tubing as set forth in claim 1 wherein said filament member is formed with a wire core member.

7. A conductive line tubing as set forth in claim 1 wherein said filament member is welded to the exterior surface of said tubular member from one end to the other whereby a portion of said filament member may be separated from said tubular member to permit the removal of a section of said tubular member while still maintaining electrical conductivity of said tubular member.

4. A conductive line tubing as set forth in claim 3 wherein each fitting is formed with an end having a configuration complementary to the end of the tubular member with the filament member mounted thereon.

8. Plastic tubing that is capable of being electrically connected to ground to prevent accumulation thereon of an electrostatic charge comprising:

- a. an elongated tube formed of flexible, dielectric, waterproof plastic material, said member having a substantially uniform continuous exterior wall and,
- b. an elongated filament having a diameter substantially less than the diameter of said tube formed of flexible, electrically conductive, waterproof plastic material,
- c. said filament being completely external of said tube and secured to said tube only along a line of tangential contact between the exterior wall of the filament and the exterior wall of the tube whereby said filament may be separated from the tube along any selected length by pulling the filament away from the tube without any substantial disturbance to said exterior wall of the tube.

9. Plastic tubing of claim 8 wherein said filament is of solid cross section throughout its length and contains 5 to 40 percent by weight of powdered electrically conductive material selected from the group consisting of carbon, copper, silver and aluminum.

10. Plastic tubing of claim 8 wherein said filament consists of a wire core encased with plastic material.