United States Patent

[11] 3,633,023

[72] Inventors **Livio Castiglioni**
Via Morosini n. 51/1;
Gianfranco Frattini, Via Lanzone N. 2,
both of Milan, Italy

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[33] **Italy**
[31] **22254A/68**

[54] **ELECTRIC LIGHTING APPARATUS, PARTICULARLY FOR DECORATIVE USES**
5 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **240/10,** 313/1, 315/185, 339/52
[51] **Int. Cl.** **F21b 1/02**
[50] **Field of Search** ..... 240/10 T, 10, 211, 225, 2 B, 2 BV; 313/1, 110; 315/185; 339/52

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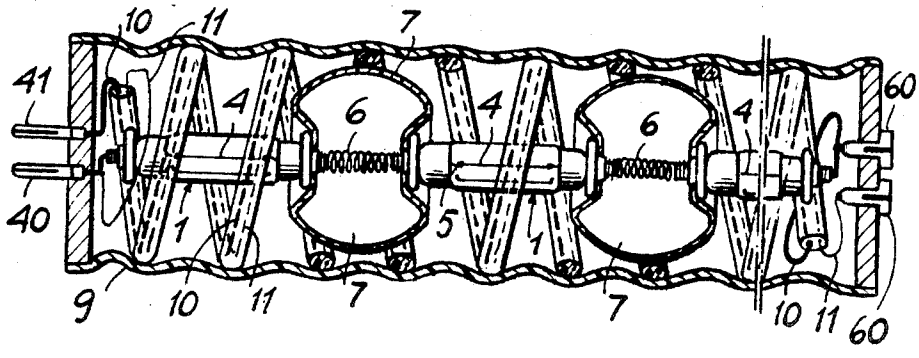
Primary Examiner—Louis J. Capozi
Attorneys—Guido Modiano and Albert Josif

ABSTRACT: A lighting apparatus consisting of a tube of transparent, translucent or similar material housing a plurality of series connected lamps which are spaced apart and supported by a number of spherical members.



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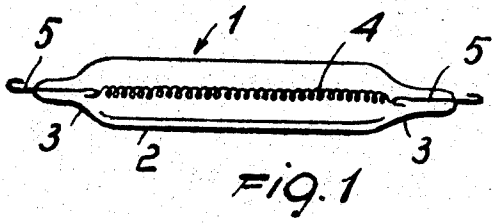
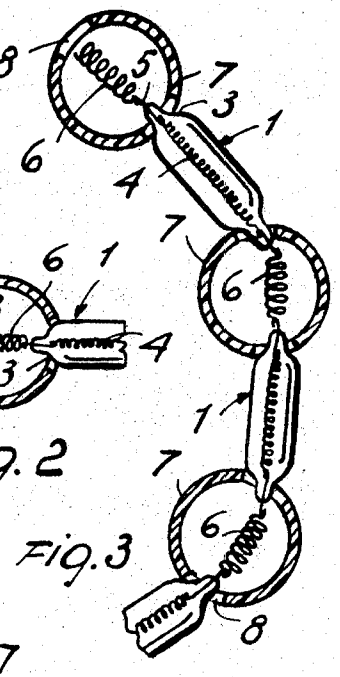


FIG. 1



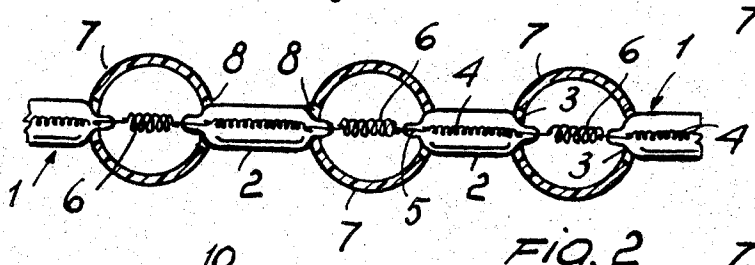


FIG. 2

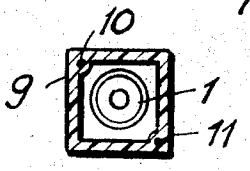


FIG. 5

FIG. 3

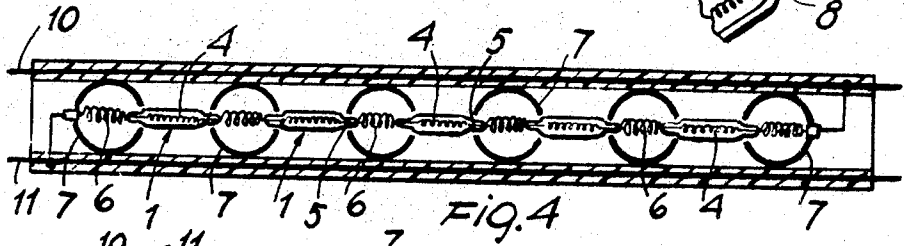


FIG. 4

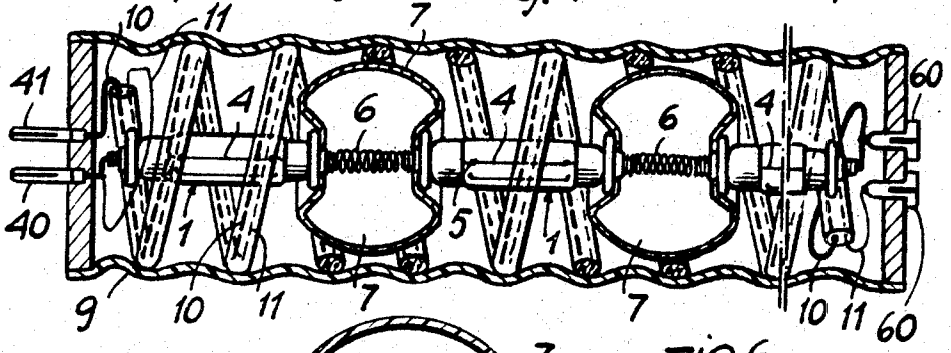


FIG. 6

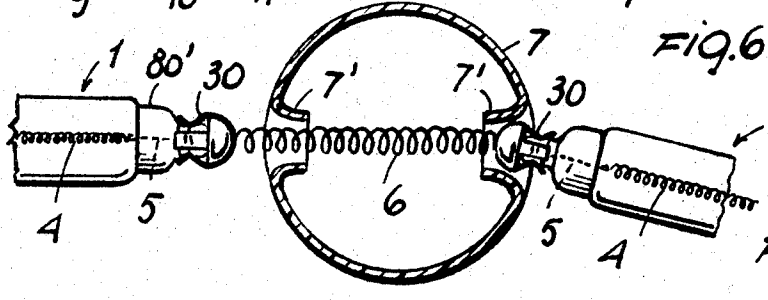


FIG. 13

INVENTORS
LIVIO CASTIGLIONI
GIANFRANCO FRATTINI

BY

AGENT

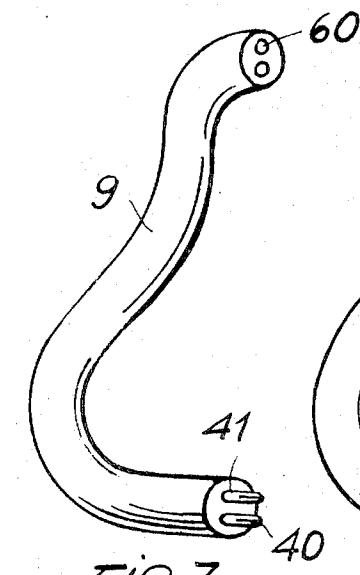


Fig. 7

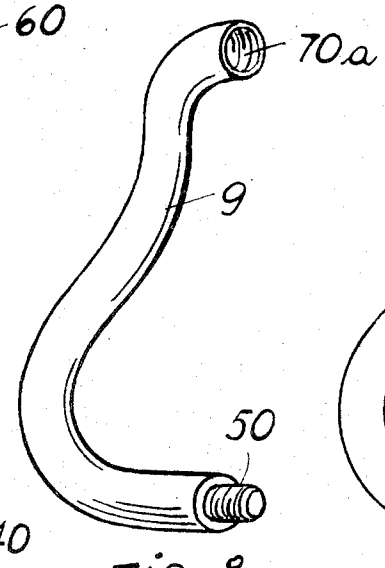


Fig. 8

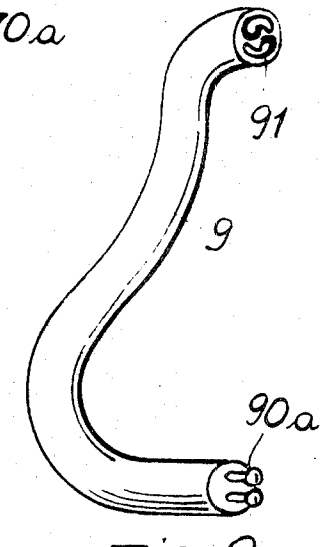


Fig. 9

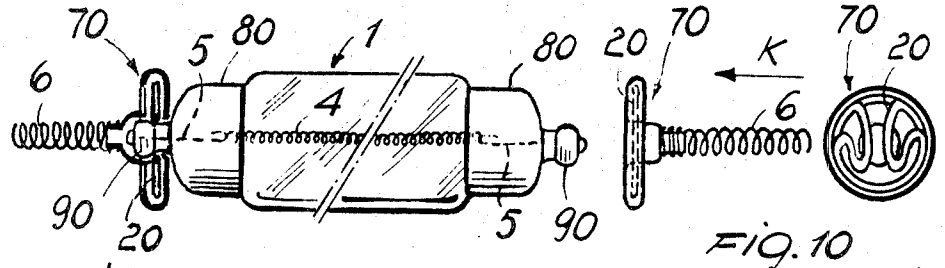


Fig. 10

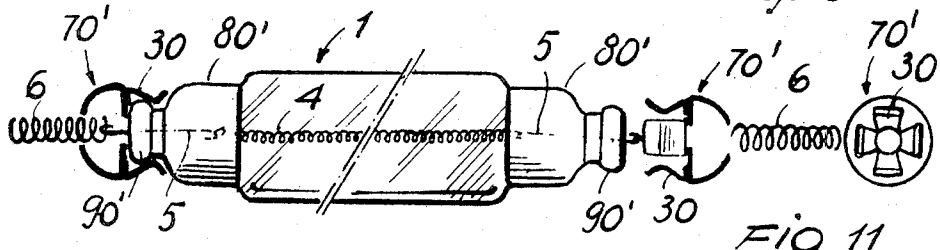


Fig. 11

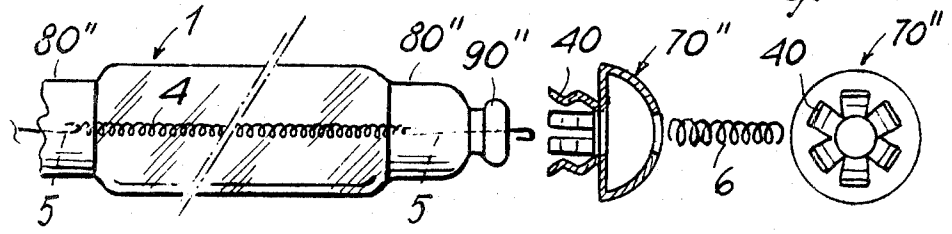


Fig. 12

INVENTORS
LIVIO CASTIGLIONI
BY GIANFRANCO FRATTINI
Albert J. ...
AGENT

ELECTRIC LIGHTING APPARATUS, PARTICULARLY FOR DECORATIVE USES

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for electric lighting, particularly for decorative purposes.

Various types of lighting devices are known which are used for obtaining particular decorative or choreographic effects.

These devices mainly present the disadvantage of being relatively complicated and hence costly, and not suitable for mass production at low price.

The main object of the present invention is that of substantially eliminating the disadvantages found in practice and inherent in conventional devices.

Another object of the invention is that of providing a lighting device of effective operation, rational structure and easy to manufacture.

SUMMARY OF THE INVENTION

According to the invention there is provided a lighting apparatus comprising at least one tube of transparent, translucent or similar material, a reinforcement structure for said tube, a plurality of lamps spaced apart inside said transparent tube, a distancing and support member between two consecutive lamps inside said tube, and electrical and mechanical connection elements between said lamps and each of said distancing support members arranged to give flexibility to the plurality of lamps, following a variety of curved line arrangements.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will better appear from the following detailed description of some preferred embodiments, illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is a longitudinal section through a lamp used in the invention;

FIG. 2 shows a plurality of series connected lamps with their corresponding spherical distancing support members, arranged in line;

FIG. 3 shows the arrangement of FIG. 2 deformed according to a curved line arrangement;

FIG. 4 is a basic electrical diagram of one embodiment of the invention;

FIG. 5 is a transversal sectional view of FIG. 4;

FIG. 6 illustrates diagrammatically another embodiment of the invention;

FIGS. 7, 8 and 9 diagrammatically illustrate three further distinct embodiments of the invention;

FIG. 10 is a partially full and partially sectional view of a lamp arranged according to the invention; the right end part of FIG. 1 is a view of a counter cap from the inside, provided with a counter spring;

FIGS. 11 and 12 are representations similar to those of FIG. 1 according two further embodiments;

FIG. 13 shows the method of assembling the various lamps and in particular a configuration according to the invention, and their distancing support members.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a lamp 1 used in the lighting device or apparatus according to the invention. It comprises a tube of glass 3 sealed in the form of a cone at its two extremities, and comprising a spiral filament 4 fixed to two connecting rheophores 5 and 0 hot welded in such a manner that the tube becomes sealed.

One of the two extremities of the weld acts during welding as an extraction end for the air so as to provide the vacuum in the tube and for any required introduction of rare gases such as nitrogen, argon, or krypton.

To each rheophore 5 is welded (FIGS. 2 and 3) an extendable spring 6 preferably of copper plated dehydrogenated steel in order to ensure good electrical connection. Each spring 6 crosses a spherical or polyhedral, hollow or solid distance piece 7 of electrically insulating material resistant to the heat of the lamps, which also acts as a support member. Each spring 6 is welded to the rheophore of the successive lamp and so on. The holes 8 for the passage of these springs which also act as conductors, must be of a suitable diameter to permit a certain jointing angle between one lamp and the successive one (FIG. 3).

According to the invention a sheath 9 is provided in the form of a transparent tube having any desired cross section, flexible or rigid (preferably plastic material or glass) and having an inner diameter slightly greater than that of the distance pieces 7 and comprising an electric wire 10 either embedded or joined in another manner (FIGS. 4, 5 and 6) for series connecting the lamps 1 and forming a reinforcing structure for said sheath 9.

In certain embodiments a wire 11 is provided for connecting successive lighting elements defined by each tube 9 to one another.

The sheath 9 can be of any color considered suitable.

Referring to FIGS. 7, 8 and 9, the extremities of the sheath 9 are arranged for an electrical "connector". Said connector in FIG. 7 comprises two resilient pins 40, 41. In FIG. 8, however, it consists of a screw connector 50 of Edison type, while in FIG. 9 it consists of two bayonet pins 90*a*. The other extremity of the sheath 9 can be arranged (FIGS. 7, 8 and 9) for connecting to other sheaths. For this purpose in FIG. 7 a socket 60 is provided for inserting the pins. In FIG. 8 a screw cap 70*a* is provided for a screw socket of Edison-type, in FIG. 9 a bayonet socket of the fluorescent lamp type is provided.

With reference to FIGS. 10–13, caps 80 are welded to the rheophores 5 of the filament 4 and in the embodiment according to FIG. 1 they are of cylindrical configuration with a rounded terminal 90. Said caps after having been electrically welded to the rheophores are fixed to the extremities of the lamp 1 by means of any suitable type resistant to heat. According to the invention counter caps indicated generically with reference numeral 70 are provided and have an incorporated spring 20 which cooperates with the rounded extremity 90 in such a manner as to create electro mechanical contact when acting by pressure in the direction of the arrow K.

The resilient articulation springs 6 are connected to the counter caps 70 for the various lamps chain connected as described above.

In the embodiment shown in FIG. 11 instead of a single spring the counter cap 70′ is constructed in an intrinsically resilient manner, comprising fins 30 in a broken line arrangement which cooperate with one extremity 90′ of the cap 80′ shaped in a complementary manner. It comprises one or two solid members rigidly fixed together.

The embodiment shown in FIG. 12 is substantially analogous to that of FIG. 11 with the exception of the provision at the extremities 90″ of the cap 80″ mushroom shaped and cooperating with a counter cap 70″ comprising two members welded together of which one has resilient fins 40 corresponding substantially to the fins 30 of FIG. 11. The other member of the cap comprises a hole for the passage and securing of the spring 6. All the counter caps of FIGS. 10, 11 and 12 have an external configuration of spherical or pseudospherical form so as to adapt to flaring 7′ which converges inwards the inside of the distance piece 7, as better seen in FIG. 13. Consequently a bell notch is firmed in a position corresponding to the holes of the distance piece 7 so as to increase the angulation of the articulation between the lamp carrying cap and that connected to it on the other side of the distance piece, and consequently to facilitate the articulation of said lamps through the distance piece connected by the spring member.

In substance the connection between the lamp and the electrically conducting spring member takes place by a system similar to that of the pressure connectors used in recent technology in the electrical and electronic fields, used for example in connecting small batteries into transistor radios and torches.

As can be noted the system according to the invention has the particular characteristics of not requiring any particular equipment for its assembly.

By using different supply voltages, tubular lighting members of different lengths can be constructed. By varying the absorbed power in watts of the lamps and consequently varying the sections of the sheath **9** and the nature of the distance pieces according to the heat developed by the assembly, different light intensities are obtained. For low illumination the lamp voltage is lowered, with considerable advantage as regards the problems connected with heating of the lamps. As stated above the distance pieces **7** inside the sheath **9** have dimensions which substantially correspond to those of the internal diameter of the sheath **9** so as to constitute support and resting members for the lamps themselves.

Obviously the invention is not limited to the embodiments represented here, and in particular in those cases in which a number of sheaths are connected in series, only one electrical return wire is necessary, preferably sunk in the wall of the sheath **9**. Furthermore a number of through holes may be formed in the sheath **9** in order to provide air passages for heat transfer purposes.

We claim:

1. A lighting apparatus having a substantially tubular casing structure of transparent or translucent flexible material, a reinforcing means inside said tubular casing structure to allow said structure to assume a variety of stable curved line arrangements, a plurality of supporting means arranged spaced apart inside said tubular casing structure and said reinforcing means in engagement therewith, a plurality of lamps each arranged between two of said supporting means, electrical connection means between said lamps arranged inside said supporting means to electrically connect one of said lamps to the following lamp, and conductor means for supplying electric power to said plurality of lamps.

2. An apparatus as claimed in claim **1**, wherein said reinforcing means comprise at least one spiral member wound inside said tubular casing structure in engagement therewith said spiral member including an electric wire forming said conductor means for supplying electric power to said lamps.

3. An apparatus as claimed in claim **1**, wherein said lamps arranged between said supporting means have an elongated tubular shape and two ends having a rounded portion at least partially shaped as a part of a spherical surface.

4. An apparatus as claimed in claim **3**, wherein said supporting means comprise a substantially spherical hollow body having two diametrical opposite openings forming seats for said rounded portions of the ends of said tubular lamps, said body having a diameter substantially equal to the diameter of a wind of said spiral of wire material.

5. An apparatus according to claim **4**, wherein said tubular lamps include end caps having counter-caps mounted by pressure on said caps, said counter-caps having an external configuration of substantially hemispherical form for cooperating with said seats of said spherical hollow bodies, and allowing angular displacement of said tubular lamps with respect to said spherical hollow bodies.

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