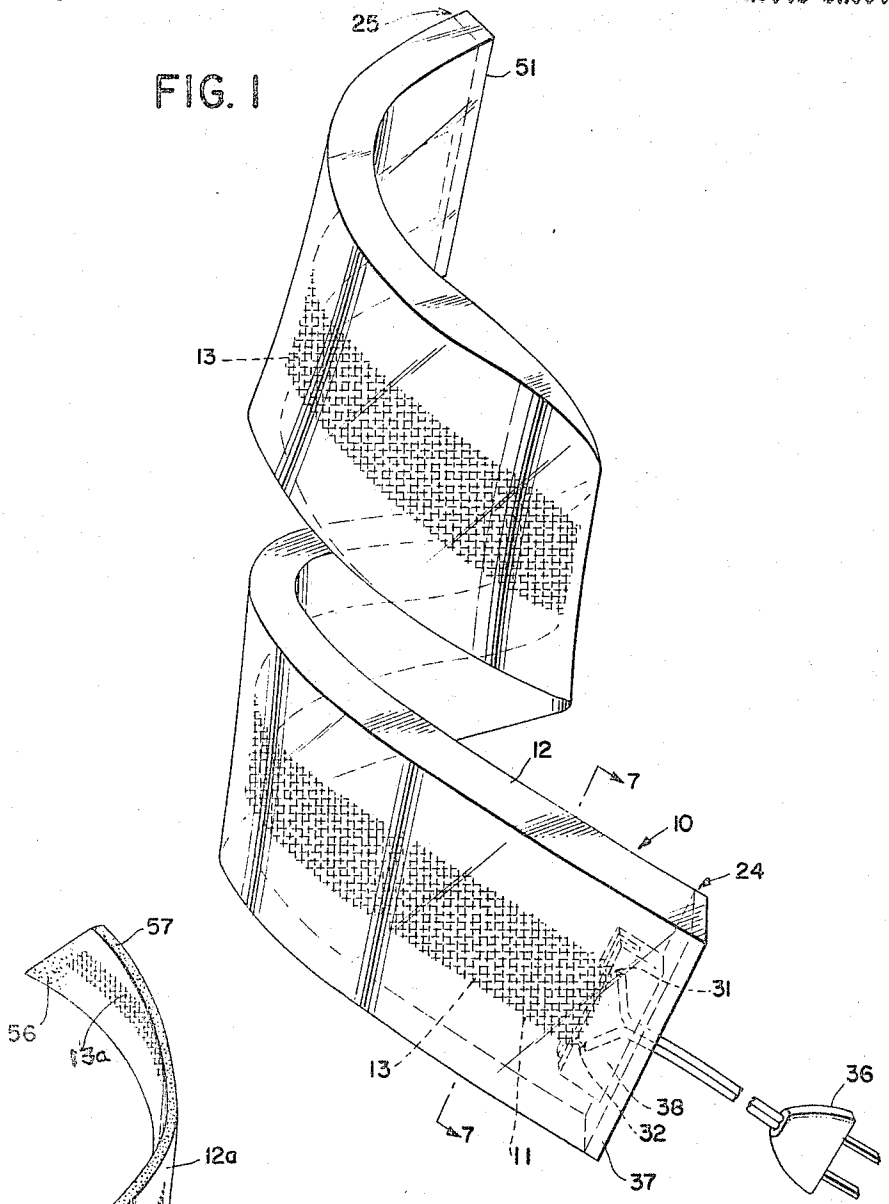
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ELECTROLUMINESCENT LAMP

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FIG. 1



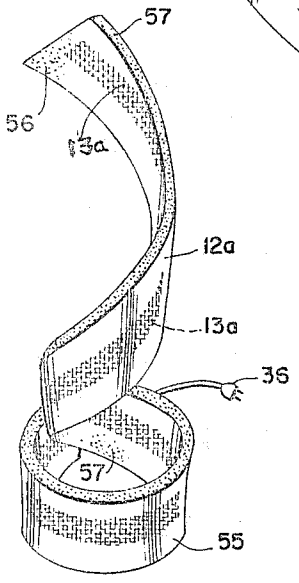


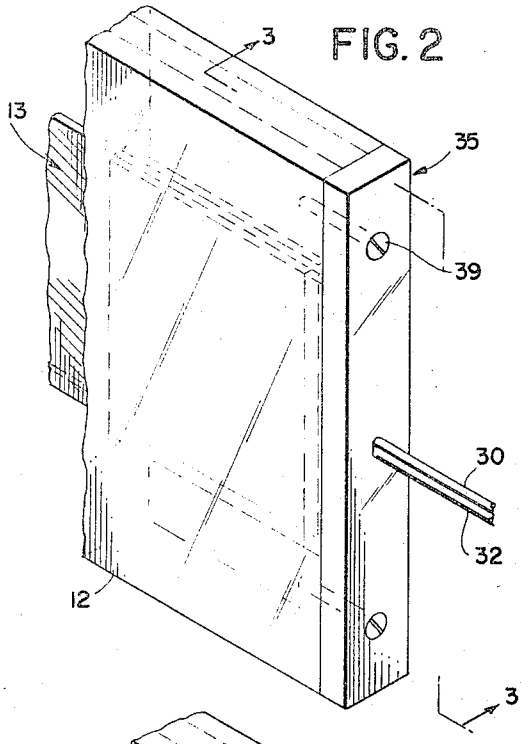
FIG. 9

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FIG. 2



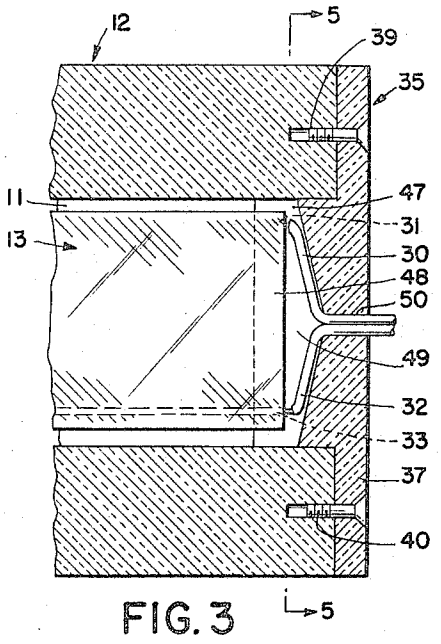


FIG. 3

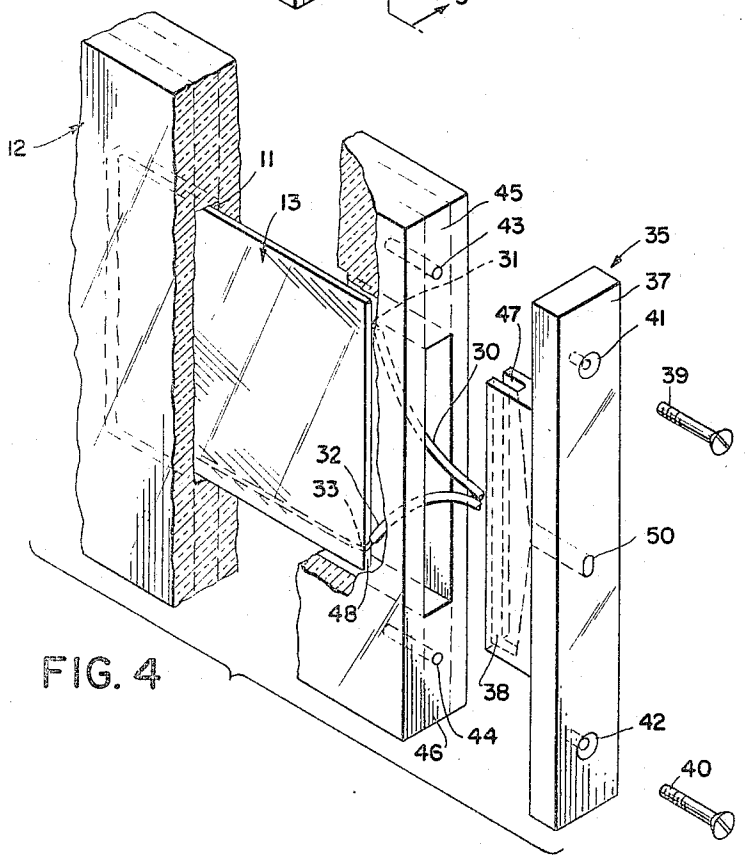


FIG. 4

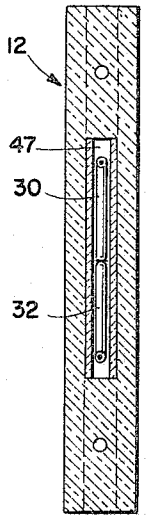


FIG. 5

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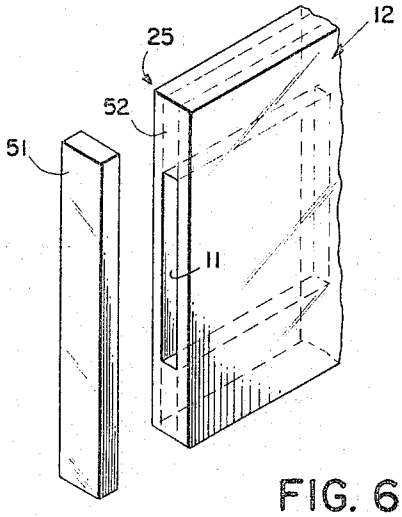


FIG. 6

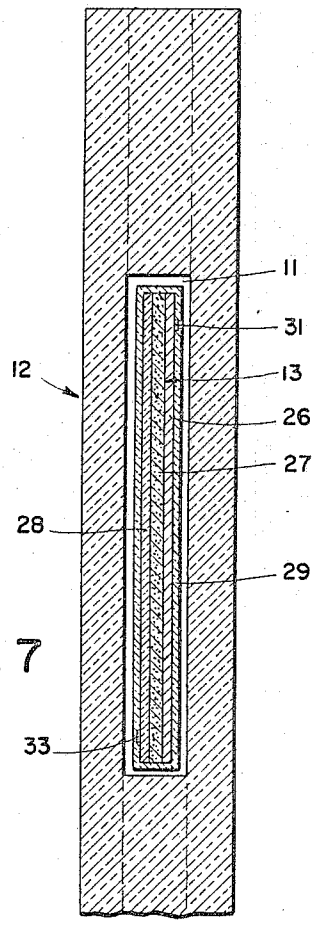
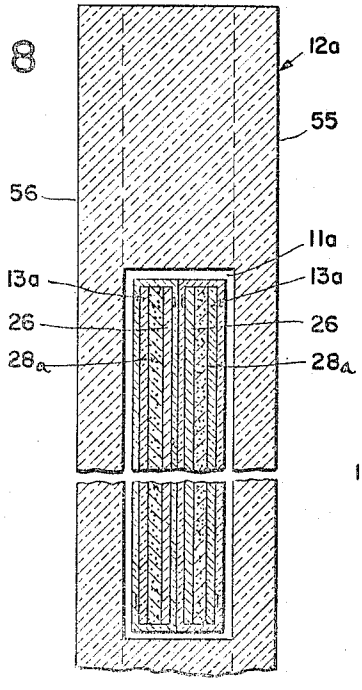


FIG. 7

FIG. 8



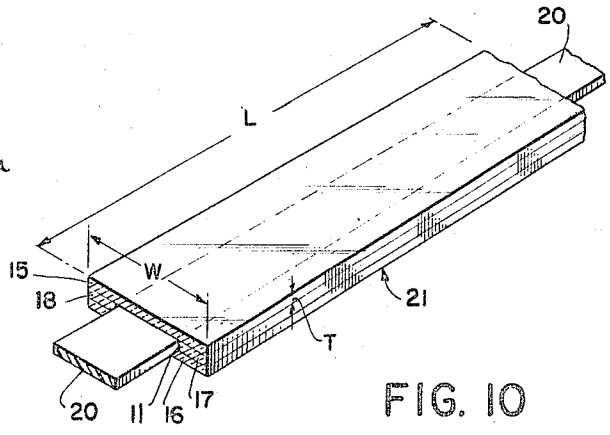


FIG. 10

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ELECTROLUMINESCENT LAMP

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9 Claims. (Cl. 240—2.25)

ABSTRACT OF THE DISCLOSURE

An electroluminescent lamp having a transparent rigid elongate body of artistic shape through which extends a passageway and having a flexible electroluminescent tape extending through the passageway which is removable and replaceable; a removably mounted closure plug at one end of the passageway through which the lead in wires extend being provided to facilitate the replacement of the electroluminescent tape.

This invention relates to electroluminescent lamps and particularly to such lamps having the electroluminescent light emitting element mounted within a light transmitting housing which maintains the light emitting element in fixed, unusual and decorative shape.

Electroluminescent lamps are well known in which the light is produced by exciting an electroluminescent phosphor by an electric field. In one known type of such lamps the phosphor is embedded in a plastic material and the phosphor is sandwiched between a flexible metallic base plate material forming one electrode and a flexible transparent electrical conductor sheet material forming the other electrode, and the two electrodes with the phosphor sandwiched between them are encapsulated within a watertight, hermetically sealed integument of transparent flexible film of plastic material. Those electroluminescent devices are made in elongate, flexible form and such a device is often referred to as an electroluminescent tape. Such flexible electroluminescent tapes are available in the market. And they are available with phosphors which emit different colors of light. Some emit a yellowish or gold-like color light, others a greenish color, others emit other colors of light, depending upon the particular phosphor used.

While these flexible electroluminescent tapes are useful for many decorative purposes, they are not rigid and hence, if used alone, do not lend themselves to producing lamps in which the light emitting surface can be shaped into decorative forms wherein the light emitting strip can be maintained in fixed rigid form in space. Furthermore, if the tape were to be made in decorative shapes in rigid form, by modifying the hermetically sealed integument which surrounds the assembly of electrodes and phosphor to render it rigid, the entire device would have to be discarded, when the phosphor has been spent, or, if for some other reason, the phosphor element fails to glow. Also, if a different color of light is wanted in the device, the entire device would have to be discarded and replaced with a new rigid tape because the electrodes with the phosphor sandwiched between them are sealed within the transparent integument surrounding them.

In accordance with this invention an electroluminescent lamp is provided which comprises an elongate housing of transparent material which may be formed to a desired decorative rigid shape, the elongate preformed transparent housing having a passageway through the length of its body into which may be replaceably inserted, with a snug slidable fit, a flexible electroluminescent tape of the kind already available in the market, the conductor leads which connect with the electrodes of the tape passing

through a suitable removable closure element at one end of the passageway. Thus an electroluminescent lamp is provided which may be made in almost any desired decorative rigid shape and which employs a replaceable flexible electroluminescent tape as its light source. In the event the flexible light emitting element becomes spent or fails, it is only necessary to replace the used tape with a new one. Or if a different color of light is wanted in the lamp, this is easily and readily accomplished by removing the closure plug and pulling out the old tape from the transparent rigid housing and inserting another one of the desired different color.

In accordance with a preferred manner of making the lamp, there is first provided an elongate housing member of a suitable thermoplastic transparent material of substantial thickness which will remain rigid at ordinary temperatures and having a passageway therethrough. This hollow housing member, in its initial flat shape, for convenience of description, may be referred to as a lamp housing blank. The passageway in the housing blank is of a rectilinear cross section which will be slightly larger than the rectilinear cross section of the electroluminescent tape that is to be used as the light emitting source, so that when the hollow housing is formed to its ultimate desired decorative shape, the tape may be inserted into the passageway with a snug fit. But the size of the passageway is such as to permit the tape to be pulled out and replaced with another tape. In order to shape the flat hollow housing blank to its ultimate desired form, an elongate bendable core, having a cross section normal to its long axis of a size and shape to correspond with the cross section of the passageway, is inserted into the passageway, the core being made of a material which not only is bendable but one which will not adhere to the material of the housing blank. The assembly of the hollow housing blank and the inserted core is then heated to a temperature at which the thermoplastic material of the housing is softened to an extent which will permit bending and shaping of the housing blank with the core in the passageway. The assembly, in its heated condition, is then formed to desired decorative shape, such, for example, as looped shaped, helix or helix-like shape, or such other artistic shape as may be wanted. The assembly of hollow housing blank and core is then cooled while maintaining it in the desired artistic shape. The housing will now remain rigid in its formed shape and the core is removed.

An electroluminescent tape of a predetermined length is then inserted into the hollow passageway and the open ends of the passageway are closed with suitable closure members, one, at least, of said closures being in the form of a removable closure element or plug through which the lead wires connected with the electrodes of the tape extend for connection to a suitable connector, such as an ordinary pronged electric plug for insertion into a receptacle in the conventional electric power circuit.

Although the novel features which are believed to be characteristic of the invention are pointed out in the annexed claims, the invention itself as to its objects and advantages and the manner in which it may be carried out may be better understood by reference to the following more detailed description, taken in connection with the accompanying drawings, forming a part hereof, in which—

FIG. 1 is a view in elevation of an electroluminescent lamp embodying the invention;

FIG. 2 is an end view in perspective to larger scale showing the lead in end of the transparent lamp housing where the passageway is closed with a removable closure

element, the lead wires being shown extending through the closure element;:

FIG. 3 is a view in section on line 3—3 of FIG. 2;

FIG. 4 is an exploded view in perspective and partly broken away of the same lead in end, showing the removable closure structure and the position of the electroluminescent tape in the hollow transparent lamp housing;

FIG. 5 is a view in section on line 5—5 of FIG. 3;

FIG. 6 is an exploded view in perspective of the closure and hollow housing at the end opposite the lead in end;

FIG. 7 is a partial view in cross section on line 7—7 of FIG. 1, showing a single electroluminescent tape positioned in the passageway of the transparent housing;

FIG. 8 is a partial view in cross section of the transparent housing having a passageway in which two electroluminescent tapes are inserted, positioned back to back;

FIG. 9 is a view of a modified shape of lamp housing and in which two tapes are inserted in the passageway, as illustrated in FIG. 8, so that a light emitting luminescent surface is exposed to both the inside and outside flat surfaces of the shaped hollow transparent housing; and

FIG. 10 is a view, largely diagrammatic, to illustrate the assembly of hollow housing blank and core prior to heating and shaping.

Referring now to the drawings, in which like reference characters indicate similar parts throughout the several views, the electroluminescent lamp in the decorative and artistic shape shown in FIG. 1 comprises an elongate, hollow transparent housing **10** having a passageway **11** extending throughout the length of the body **12** of the housing. As shown, the body **12** is shaped in heloid form, although it will be understood that the body portion of the transparent housing may be formed to any desirable shape into which an elongate housing blank may be shaped when in heated bendable condition such, for example, as loops, curves, helixes, twists, and the like.

As shown, the lamp housing **10** is made of an acrylic type resin, and still more particularly for illustrative purposes, is the type sold in the market under the trademark of tradename Lucite. This thermoplastic resin is available having the characteristics of remaining rigid and transparent at ordinary room temperature and upon heating may be softened so that in strip or elongate form it becomes workable so that it can be bent to curved forms. Other types of thermoplastics such as the polyethylene terephthalate resins or other thermoplastics having similar characteristics, may be used. As shown in FIG. 1, the housing is made of transparent Lucite.

One manner of making the hollow transparent lamp housing **10** is as follows: A pair of strips **15** and **16** (see FIG. 10) of Lucite of predetermined length L and width W and substantial thickness T and a pair of spacer strips **17, 18** are provided. As shown, the length L of the strip is approximately two feet, the width W approximately four inches and the thickness T approximately one-quarter inch. The lamp may be made in any desired length. The width and thickness of these strips may differ for different lamps but are selected to provide a housing of the desired cross sectional area and to provide a passageway of desired rectilinear cross sectional area to accommodate an electroluminescent tape **13**. The spacer strips **17** and **18** are placed in spaced relation along the edges of the strips **15** and **16** and are secured thereto by a suitable solvent adhesive which will cause the contacting surfaces of the four strips to merge together to form the shape illustrated in FIG. 10. For convenience of description, it may be said that wide flat strip **15** forms a top or front wall, wide flat strip **16** forms a bottom or rear wall and the narrower flat strips **17, 18** form side or edge walls of the hollow housing.

Having formed the strips into an elongate integral housing blank **21**, having a tunnel-like passageway **11** therethrough, a core **20** is then inserted through the passageway of the hollow housing blank **21** which may be referred to as the body portion of the housing. The core **20** may be of thermoplastic material, preferably of another type, but one which will be rendered flexible or workable when heated and it should have a cross sectional area, normal to its long axis, corresponding to the cross sectional area and shape of the passageway.

A core made of thermoplastic tetrafluoroethylene polymer resin, sold under the trademark or tradename Teflon, is admirably suited for this purpose for it can be obtained in a type that is sufficiently flexible for insertion into the passageway **11** in the blank **21**, is sufficiently rigid to hold its shape when heated to the temperature necessary for softening the Lucite for working; and it will not adhere to the Lucite when it is desired to remove it from the Lucite housing body after the housing body has been heated and formed to desirable decorative shape and cooled. The Teflon core may comprise a number of superimposed thinner separate strips to build up a core of the desired thickness and cross sectional shape.

After the hollow Lucite housing blank **21** and inserted elongate Teflon core **20** are assembled, as illustrated in FIG. 10, the assembly is then heated to an extent sufficient to soften the thermoplastic material so that the assembly may be worked, that is, so that it can be curved or formed into the desired shape, for example, the artistic shapes illustrated in FIGS. 1 and 9, or it may be formed to other decorative or artistic shapes. The heating may be done in an oven or by utilizing any other suitable heating means. The heated assembly is then formed into the desired shape while in heated, workable condition and the assembly is then allowed to cool in that shape, for example, a shape as illustrated in FIG. 1 or FIG. 9, or other desired shape. After cooling the assembly, the Teflon core **20** is removed and the shaped lamp housing having the desired passageway **11** therethrough will retain its shape under the ordinary temperatures to which decorative lamps are normally subjected. It has been found that the employment of a core in the hollow housing blank **21** has the advantage of preventing the walls of the housing body, when worked and shaped in heated condition, from collapsing or distorting and deforming into a shape that will close off or restrict the cross sectional area of the passageway **11**.

After the lamp housing blank **21** has been shaped to form the hollow body portion **12** (see FIG. 1), an electroluminescent tape **13** of predetermined length, to extend from the lead in end **24** of the passageway **11** to the opposite or dead end **25** of the housing body, is inserted in the passageway. The electroluminescent tape **13** comprises essentially a flexible metallic conductor plate **26** forming one electrode, a luminescent phosphor layer **27**, the composition of which may vary but is well known in the art, and a transparent flexible conductor layer **28**; the phosphor layer **27** being sandwiched between the two electrode layers **26, 28**; and the assembled layers being encapsulated in a waterproof flexible transparent film **29** which forms a hermetic seal surrounding the electrodes. Such electroluminescent tapes are known and available in the market from various manufacturers. It has been found that an electroluminescent tape sold in the market under the trademark Panelescent Tapelite is satisfactory. A lead in wire **30** is connected to conductor post **31** on one of the electrodes **26** and the other lead in wire **32** is connected to a conductor post **33** on the other electrode **28**.

Lead in wires **30, 32** extend through a removable closure element or plug **35** and these wires are connected to an ordinary pronged electric plug **36** which may be inserted into a conventional receptacle in a circuit carrying conventional 110 v. alternating current. When connected into an A.C. circuit the phosphor, as is well known, becomes excited, emitting light of very pleasing glow over its entire surface, the light rays passing through the trans-

parent walls of the housing in the areas where the light emitting surface is exposed.

The removable closure plug member **35**, which may also be made of plastic or other suitable rigid material, comprises a flange portion **37** having a size to extend over the ends of the body portion **12** of the housing, and a split tongue portion **38** extending outwardly at right angles from the flange. The tongue **38** is of a size to extend into the passageway **11** with a slidable fit. However, the plug may be removed, if desired, it being held in place by threaded screws **39**, **40** extending through bores **41**, **42** which register with threaded bores **43**, **44** in the ends of the side wall **45**, **46** of the lamp housing body portion.

The tongue **38** has a slot **47** into which the end **48** of the tape **13** extends with a tight fit, while leaving a space **49** having a V-shaped bottom for the wires, there being a bore **50** through the flange **37** through which the wires **30**, **32** extend. It will now be seen that the closure plug **35** and tape **11** are readily removable for replacement with another tape.

The dead end of the hollow housing body is closed with a blind flange **51** (see FIG. 6) made preferably of the same material as the body portion of the lamp. It may be secured to the end edges **52** of the body by means of a solvent adhesive so that the contacting surfaces are fused or merged together.

The lamp may be mounted on a suitable base (not shown) for resting it on a horizontal surface, such as a table or stand, or it may be mounted on a wall by means of a suitable wall bracket (not shown). Numerous ways of mounting or hanging the lamp for decorative and artistic effects will suggest themselves.

The modified form of lamp, as shown in FIG. 9, illustrates a different decorative and artistic shape. In this modification the body portion **12*a*** of the lamp is provided with a passageway **11*a*** (see FIG. 8) of larger cross sectional area than passageway **11** of FIG. 1, and two electroluminescent tapes **13*a***, **13*a*** positioned back to back, so that electroluminescent surfaces **28*a***, **28*a*** are exposed, one on the front wall **55** and one on the rear wall **56** of the lamp. The lead wires being suitably connected to terminate in a common electric light plug, such as the pronged plug **36** as shown in FIG. 1.

If desired, the surface of the housing body may be etched or milled as indicated at **57** (FIG. 9) or otherwise treated over selected parts of, or over the entire surface for various artistic effects, the etched or roughened or matted surface causing a diffusion of the light rays emitted from the glowing phosphor surfaces of the electroluminescent tape to produce a pleasing appearance, appealing to the aesthetic sense.

In the foregoing, one method of producing the hollow transparent body of the lamp has been disclosed for illustrative purposes but it will be understood that other methods might be used. For example, a flat strip of plastic material of predetermined width and thickness may be milled out to provide a wide groove to accommodate the electroluminescent tape and then a cover strip of plastic material of the same width may be adhesively secured to the milled out strip, to define a passageway for the tape. Or, the body portion might be molded or extruded in a manner to provide the passageway through the body portion, or the body portion might be produced in other ways.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. An electroluminescent lamp which comprises a rigid elongate transparent lamp housing body having walls of substantial thickness and having a passageway therethrough, an electroluminescent tape extending through said passageway, said tape comprising a phosphor layer sandwiched between a pair of hermetically sealed electrodes, said walls of said body portion defining said passageway and dimensioned so that said passageway has a cross-sectional area in a plane normal to the long axis of the passageway slightly larger than the cross-sectional area of said tape in a plane normal to its long axis, said tape extending through said passageway with a slidable fit, a closure closing one end of said passageway, a removably mounted closure plug closing the other end of said passageway and lead-in wires extending through said removable closure plug, one of which is connected within said housing to one of said electrodes and the other of which is connected to the other of said electrodes.

2. An electroluminescent lamp according to claim **1** in which said body portion is made of a thermoplastic resin of the acrylic type which is rigid at room temperature and which upon heating may be rendered soft enough to be formed into curved shape.

3. An electroluminescent lamp which comprises a rigid elongate transparent lamp housing body portion having a rectilinear cross section normal to the long axis of said body and having a passageway therethrough, an electroluminescent tape extending through said passageway, said tape comprising a phosphor layer sandwiched between a pair of hermetically sealed electrodes, said body portion comprising a front wall, a rear wall, and two side walls defining said passageway and dimensioned so that said passageway has a cross sectional area in a plane normal to the long axis of the passageway slightly larger than the cross sectional area of said tape in a plane normal to its long axis, said tape extending through said passageway with a slidable fit, a closure closing one end of said passageway, a removably mounted closure plug closing the other end of said passageway, lead-in wires extending through said removable closure plug, one of hich is connected within said housing to one of said electrodes and the other of which is connected to the other of said electrodes.

4. An electroluminescent lamp in accordance with claim **3** in which said body portion is made of a thermoplastic resin of the acrylic type which is rigid at room temperature and which upon heating may be rendered pliable enough to be formed into curved shape.

5. An electroluminescent lamp according to claim **3** in which at least a part of the surface of said body portion is roughened to provide a matted surface which diffuses the light rays emitted by said luminescent tape.

6. An electroluminescent lamp according to claim **4** in which at least a part of the surface of said lamp body is roughened to diffuse the light rays emitted from said phosphor layer.

7. An electroluminescent lamp which comprises a rigid elongate transparent lamp housing body portion formed into artistic shape having a rectangular cross section normal to the long axis of said body and having a passageway therethrough, a pair of electroluminescent tapes extending through said passageway, each of said tapes comprising a phosphor layer sandwiched between a metallic electrode and a transparent conductor electrode and a transparent film surrounding said electrodes, said body portion comprising a front wall, a rear wall, and two side walls defining said passageway and dimensioned so that said passageway has a rectangular cross sectional area in a plane normal to the long axis of the passageway large enough to accommodate therein said pair of tapes with a slidable fit, said tapes extending through said passageway with a slidable fit, one of said tapes positioned to expose its luminescent surface to said front wall and the other of said tapes positioned to expose its luminescent surface to said rear wall, a closure closing one end of said passageway, a removably mounted closure plug closing the other end of said passageway, lead-in wires ex-

tending through said removable closure plug, one of which is connected within said housing to said metallic electrodes and the other of which is connected to said transparent electrodes.

8. An electroluminescent lamp according to claim 7 in which said lamp body is made of acrylic type thermoplastic resin.

9. An electroluminescent lamp according to claim 8 in which at least a part of the surface of said body portion is roughened to diffuse light rays emitted from said phosphor layer.

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