

March 3, 1936.

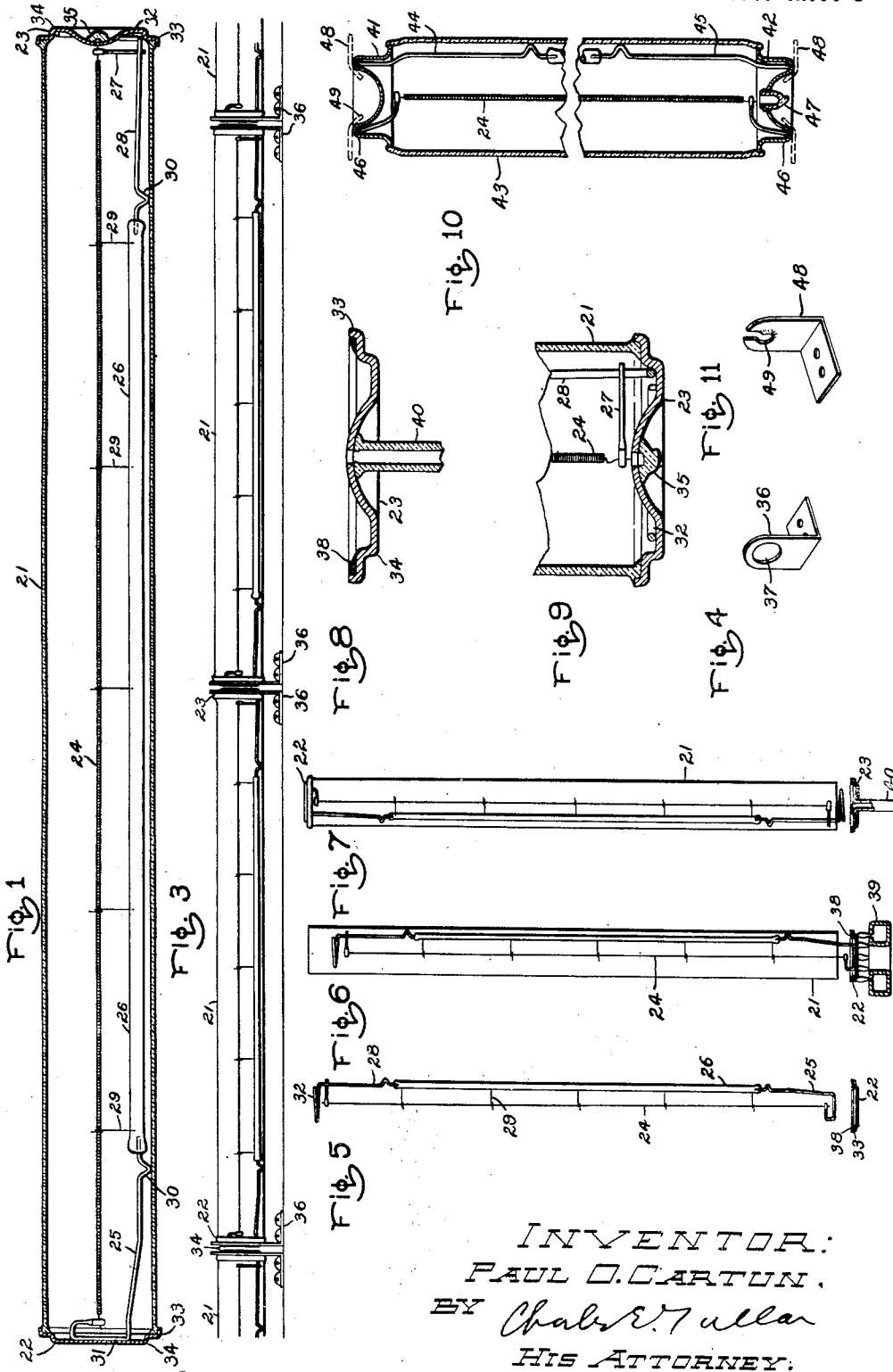
P. O. CARTUN

2,032,791

TUBULAR AND OTHER INCANDESCENT LAMPS AND THEIR MANUFACTURE

Filed April 20, 1933

2 Sheets-Sheet 1



INVENTOR:
PAUL O. CARTUN,
BY *Charles E. Tuller*
HIS ATTORNEY.

March 3, 1936.

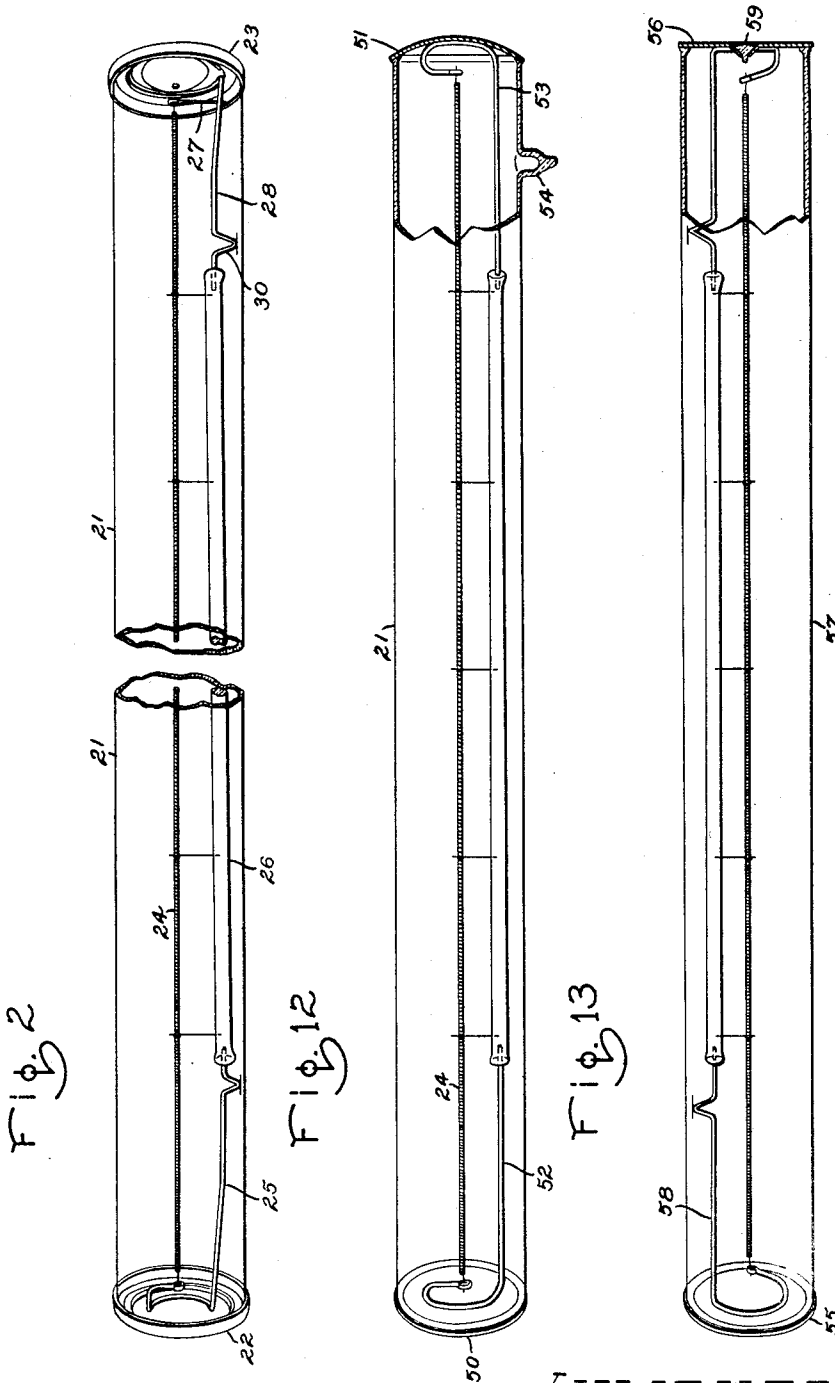
P. O. CARTUN

2,032,791

TUBULAR AND OTHER INCANDESCENT LAMPS AND THEIR MANUFACTURE

Filed April 20, 1933

2 Sheets-Sheet 2



INVENTOR:
PAUL O. CARTUN,
BY *Charles V. J. Ullman*
HIS ATTORNEY.

UNITED STATES PATENT OFFICE

2,032,791

TUBULAR AND OTHER INCANDESCENT LAMPS AND THEIR MANUFACTURE

Paul O. Cartun, Cleveland Heights, Ohio, assignor to General Electric Company, a corporation of New York

Application April 20, 1933, Serial No. 667,011

23 Claims. (Cl. 176—29)

My invention relates to electric lamps and the like, and to their manufacture. It is especially adapted to incandescent lamps of the "double ended" tubular type, although some of its features may advantageously be applied to other lamps. The invention also relates to the mounting and current connections of tubular lamps in service, and their combination end to end to give a substantially continuous line of light. In suitable forms, the invention affords a tubular lamp in which the incandescent filament extends practically the whole length of the lamp, and in which the transparent tubular bulb or envelope extends unshaded substantially to the extreme ends of the lamp. Not only is the useful or luminous lamp length virtually undiminished by the terminal and mounting devices at the ends, but a series of lamps can be mounted end to end practically without intervening structures that would interrupt the line of light. Such lamps are very simple and rugged in construction, and easy and economical to manufacture. Further features and advantages of the invention will appear from the following description of species thereof and from the drawings.

In the drawings, Fig. 1 is a longitudinal section through an incandescent lamp of my invention; Fig. 2 is a perspective side view of the same lamp, with a mid portion broken out; Fig. 3 is a side elevation of a series of such lamps mounted end to end; Fig. 4 is a perspective view of a mounting bracket for holding one end of the lamp; Figs. 5, 6 and 7 are side elevations of various steps in the process of manufacture of the lamp; Figs. 8 and 9 are sections on an enlarged scale of one end of the lamp during and after manufacture; Fig. 10 is a vertical section through a modified lamp of my invention; Fig. 11 is a perspective view of a mounting bracket for the lamp of Fig. 10; and Figs. 12 and 13 are perspective side views of other modified lamps, each with part of one end in section.

The lamp shown in Figs. 1 and 2 has a tubular bulb or envelope 21, of glass. To the ends of the tube 21 are sealed metal discs 22 and 23 which form end walls for the envelope and contact terminals for the lamp,—the ends of the filament 24 enclosed in the tube 21 being connected to these discs. In the lamp mount, one end of the filament 24 is attached to a terminal wire 25 which is fused into the end of a glass rod 26, while the other end of the filament is attached to a spur wire 27 welded to a terminal wire 28 which is fused into the other end of the rod 26. The filament 24 is supported at intervals by wires 29

fused into the rod 26. The wires 25 and 28 are offset at 30 to engage the tube 21 and keep the rod 26 from rattling against it.

The mount comprising the filament 24 and its supporting structure, may itself be mounted on the disc 22 by attaching to the disc the terminal wire 25. For this purpose, an intermediate portion of the wire 25 is bent at right angles and curved semi-circularly at 31 in contact with the disc 22, and welded thereto, thus connecting this end of the filament 24 to the disc. The other end of the filament 24 may be connected to the disc 23 by engagement of the wire 28 with the disc 23. For this purpose, the portion of wire 28 beyond the spur 27 is bent at an angle and curled into a coil 32 (of less than one full turn) whose plane is approximately perpendicular to the axis of the tube 21, and whose convolution may engage inside a shoulder afforded by the tube wall or by the conformation of the disc 23. To assure a definite position of the mount in the tube 21, prevent vibration of the mount, and assure ample contact pressure between disc 23 and terminal 28, the "mount"—or its filament-supporting structure—may be made resiliently compressible longitudinally. With a suitable resilient wire 28, its coil portion 32 beyond spur 27 will compress lengthwise of the tube 21 enough for this purpose, by deflecting sidewise of the coil. Thus localizing the compression of the mount beyond the spur 27 has the advantage of not affecting the proper tautness of the filament 24.

The discs 22 and 23 are preferably of a metal or alloy which has the same thermal coefficient of expansion as glass and will adhere and seal easily to glass by fusion or thermal softening and pressure. For this purpose, I prefer an iron alloy containing about twenty-five per cent of chromium, and particularly an alloy marketed by the Allegheny Steel Company as "Allegheny 55", of which the following is a typical percentage-by-weight analysis:

Iron	67.5 to 71.5
Chromium	26 to 30
Manganese	under 1
Nickel	under .6
Silicon	under .6
Carbon	under .25
Sulphur	under .025
Phosphorus	under .025

As shown in Fig. 1, the ends of the tube 21 seat or abut against the discs 22, 23 at the seals, and the discs have lips 33 around their seats (of low height, comparable to the thickness of the glass), 55

to the inside of which lips the glass also adheres. The outer sides of the discs 22, 23 have protuberances 34, formed by outward embossment of the sheet metal of the discs, with annular shoulders around them. However, the central portion the protuberance of disc 23 is deflected or recessed inward, thus accommodating and sheltering a glass seal 35 for an exhaust opening through the disc at the bottom of the recess. Thus the embossment of this disc 23 is in effect an annular outstanding ridge. The lips and embossments not only give greater sealing contact with the glass and assist in mounting the lamp as hereinafter described, but also stiffen the discs.

Fig. 3 shows a series of the lamps of Figs. 1 and 2 ranged end to end, each mounted between resiliently separable holding and connective devices or brackets 36 shown in Fig. 4 as having round openings 37 in their upstanding spring arms to engage around the protuberances 34. These leaf spring brackets 36 press resiliently against the shoulders around the disc protuberances 34. The brackets 36—36 for adjacent ends of adjacent lamps are separated a very small distance that allows either bracket to deflect enough to permit removal of its lamp.

In making up the lamp, the mount is assembled as shown in Fig. 5 and its terminal wire 25 is welded to disc 22 as shown in Fig. 6. After this, the disc 22 may be properly squared to the axis of the mount (filament 24), if necessary, by bending the wire 25 slightly one way or another. A ring of readily fusible powdered glass 38, specifically "French sealing glass", is preferably placed on the tube-end seat of disc 22 inside the lip 33; the mount is inserted in the tube 21 as in Fig. 6, and the disc is heated by flames from the annular burner 39 until the powdered glass is fused. Thereupon the lower end of the tube 21, which may also have been heated by suitable flames, not shown, is pressed down on the disc seat into the fused sealing glass. Air may also be blown into the upper end of the tube 21, to expand its softened lower margin very slightly against the lip 33. The thus assembled tube and mount may now be inserted over the disc 23 as shown in Fig. 7, and the tube end sealed to the disc 23 substantially as in the case of the disc 22,—the mount being left compressed between the discs 22, 23 slightly by the sealing pressure used in making the seal. However, the mount is preferably made slightly longer than the tube 21, so that the pressure used in making the end seals will also compress the mount lengthwise a very little. At this stage, the disc 23 may have a glass exhaust tube 40 sealed thereto at its central opening as shown in Figs. 7 and 8,—besides the ring of powdered glass 38. After the lamp has been evacuated (and charged with suitable gas, if desired) through tube 40, the tube is fused and sealed off, and the resulting tip is fused down into a squat form such as shown in Fig. 9, wholly contained and sheltered in its recess in the disc 23.

The lamp shown in Fig. 10 has end discs 41, 42 of different form from those of Figs. 1-9; and instead of abutting endwise against the disc sides, the ends of the tube 43 are drawn in slightly and sealed around the edges of the discs. In making the lamp, both discs 41, 42 are preferably welded to the terminal wires 44, 45, before the mount is inserted in the tube 43. The mount is made of just the right length to suit the tube 43, and undergoes no compression—unless required to

compensate for slight dimensional errors. The forms of both discs 41, 42 are the same, resembling disc 23 in Figs. 1-9; but they have no lips, and the annular ridges 46 embossed outward in them are much higher than that of disc 23. The curled ends of the terminal wires 44, 45 engage and are welded in the bottoms of the annular trough inside the external disc ridges. The spur 27 is dispensed with, and the filament 24 attached directly to the inward extending ends of the terminal wires 44, 45. The sealed exhaust tip 47 finds ample shelter in the deep disc end recess, without being fused down as in Figs. 1 and 9.

Fig. 11 shows a resilient holding and connective bracket 48 for the lamp of Fig. 10, with an outstanding lip 49 around its opening for engaging inside the disc ridge 46, as indicated in dotted lines in Fig. 10.

Fig. 12 shows a lamp resembling that of Figs. 1 and 2, but with the discs 50, 51 abutting and sealed against the tube ends made protuberant by mere outward spherical embossing. Each of the terminal wires 52, 53 lies entirely in one plane, having a bent form resembling a fishhook. The lamp is shown as exhausted and tipped off from the side at 54. This lamp is adapted to be mounted between the brackets 36—36 of Figs. 3 and 4.

Fig. 13 shows a lamp (most nearly resembling that of Figs. 1-9) with two plain, flat end wall and contact discs 55, 56 abutting and sealed against the ends of its tube 57, and only the disc 55 welded to the terminal wire 58. The inward bevelled exhaust opening in the disc 56 has been sealed with a body or tip of glass 59 housed in the bevel of the opening, and even protruding inward slightly. This may be done by fusing off an exhaust tube (not shown) like that in Figs. 7 and 8 very close to the disc, and carefully working the resulting glass inward into the opening, while still hot, with the air of a blow flame. This lamp may be mounted and held between the resilient connective brackets of Figs. 3 and 4, or in any other suitable holding means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination of a series of double-ended tubular incandescent lamps, each comprising a glass tube with metal discs sealed to its ends as its end walls and contacts, said discs having outward protuberances, and said lamps being ranged end to end to provide a substantially continuous line of light; and holding and connective devices engaging said discs around their protuberances, and thereby removably holding the tubes individually, and also supplying them with current, said holding and connective devices constituting the sole means of support for said tubes.

2. The combination of a series of double-ended tubular incandescent electric lamps, each comprising a glass tube with metal discs abutting and sealed against its ends as its end walls and contacts, said lamps being ranged end to end to provide a substantially continuous line of light; and holding and connective devices engaging said discs and thereby removably holding the tubes individually, and also supplying them with current, said holding and connective devices constituting the sole means of support for said tubes.

3. The combination of a series of double-ended tubular incandescent electric lamps, each

comprising a glass tube with metal discs sealed to its ends as its end walls and contacts, said discs having outward protuberances, and said lamps being ranged end to end to provide a substantially continuous line of light; and resiliently separable bracket arms abutting against said end discs and engaged around their protuberances, and thereby removably holding the tubes individually, and also supplying them with current, said abutting brackets constituting the sole means of support for said tubes.

4. The combination of a series of double-ended tubular incandescent electric lamps, each comprising a glass tube with metal discs abutting and sealed against its ends as its end walls and contacts, said lamps being ranged end to end to provide a substantially continuous line of light; and leaf spring connectors abutting sidewise against said end discs and thereby removably holding the tubes, individually, and supplying them with current, said abutting leaf spring connectors constituting the sole means of support for said tubes.

5. The combination with a double ended tubular electric lamp or the like comprising a glass tube with metal discs abutting and sealed against the tube ends as end walls and contacts, and having on their outer sides protuberances with shoulders therearound; of spring bracket arms hollowed to take said protuberances and resiliently separable to receive the lamps between them.

6. The combination with a pair of resiliently separable apertured contacts, of a double ended tubular incandescent electric lamp or the like comprising a glass tube with metal discs sealed to the tube ends, as end walls and contacts, and having outward embossments for engaging in the contact apertures, with shoulders around said embossments for abutting against the edges of said apertures.

7. A double ended tubular incandescent electric lamp or the like comprising a glass tube with metal end-wall and contact members sealed to the walls of the openings at the ends of said tube and leaving the tube unshaded substantially to its very ends, and adapting it to be connected in circuit by being held between holding and contact means engaging said ends.

8. A double ended tubular incandescent electric lamp or the like comprising a glass tube with metal end members sealed to the walls of the openings at the ends of said tube and leaving the tube unshaded substantially to its very ends and having outward protuberances for resisting sidewise displacement of the lamp when abutting endwise against hollowed holding means.

9. A double ended tubular incandescent electric lamp or the like comprising a glass tube with metal contact discs sealed to the walls of the openings at tube ends and leaving the tube unshaded substantially to the very ends, and an incandescent filament in said tube connected to said discs.

10. A double ended tubular incandescent electric lamp or the like comprising a glass tube with metal discs abutting and sealed against the walls of the openings at its ends, and a filament in the tube connected to said discs.

11. A double ended tubular electric lamp or the like comprising a glass tube with outward convex metal discs sealed to the walls of the openings at its ends, and a filament in the tube connected to said discs.

12. A double ended tubular electric lamp or

the like comprising a glass tube with metal discs abutting and sealed against the walls of the openings at its ends, and having outward embossments with shoulders around them, and a filament in the tube connected to said discs.

13. A double ended tubular electric lamp or the like comprising a glass tube with metal discs sealed to the walls of the openings at its ends as end walls and contacts, said discs being embossed outward into annular ridges, and a filament in the tube connected to said discs.

14. A double ended tubular incandescent electric lamp or the like comprising a glass tube provided with end walls, and a mount in said tube including a filament with supporting structure therefor, resiliently compressible lengthwise, extending from end wall to end wall of the tube and held compressed between said end walls.

15. A double ended tubular incandescent electric lamp or the like comprising a glass tube provided with end walls, and a mount in said tube including a filament with supporting structure therefor extending from end to end of the tube and including a spring coil at one end of said structure lying in the plane approximately perpendicular to the tube axis, said supporting structure being compressed between the end walls of the tube by resilient sidewise deflection of said coil.

16. A tubular incandescent electric lamp or the like comprising a glass tube with metal discs sealed to its ends, and a mount in said tube including a filament with supporting structure therefor having a terminal for one end of the filament attached to one of said discs, and a resilient terminal for the other end of the filament pressed and resiliently deflected against the other disc and engaged with a circumferential shoulder thereat, so that the filament is connected between said metal end walls and kept in a definite position in the tube.

17. In an electric lamp or the like, the combination of a glass envelope; a metal disc sealed to the end of said envelope and forming an end wall therefor, said disc having a recess at its outer side with an opening from said recess through the discs; and a seal for said opening sheltered in said recess.

18. In an electric lamp or the like, the combination of a glass envelope; a metal disc sealed to the end of said envelope and forming both an end wall and an abutting contact terminal for the lamp, said disc being embossed outward to resist sidewise displacement of the lamp end when engaged endwise against a recessed contact terminal, but having an inward recess in its embossed portion, with an opening from said recess through the disc; and a seal for said opening sheltered in said recess.

19. In an electric lamp or the like, the combination with a metal disc having a peripherally lipped seat at one side and an outward embossment at the other side surrounded by a shoulder opposite said seat, of a glass envelope abutting endwise against said seat and sealed thereto and to said lip.

20. In an electric lamp or the like, the combination with a metal disc having a peripherally lipped seat at one side and annularly embossed on the other side, of a glass envelope abutting endwise against said seat and sealed thereto and to said lip.

21. A combined end wall and contact, for an electric lamp or the like, comprising a metal disc

presenting at one side a peripherally lipped seat of metal readily sealable to glass, for sealing against and around the end of a glass envelope, and at its outer side embossed outward and shouldered around its embossment, for engaging in and around a hollow in a coating mounting terminal.

22. A combined end wall and contact, for an electric lamp or the like, comprising a sheet metal disc adapted to be sealed to the end of a glass envelope and annularly embossed outward at one

side, with a seating shoulder around the embossment.

23. A combined end wall and contact, for an electric lamp or the like, comprising a metal disc adapted to be sealed to the end of a glass envelope and having a recess at its outer side with an opening from said recess through the disc, and a glass tube fused to said disc at said opening and adapted to be fused down, after use, into a fused seal sheltered in said recess.

PAUL O. CARTUN.