Sept. 2, 1958 E. P. NEMES 2,850,661

LAMP

Filed Dec. 3, 1956

FIG. 2.

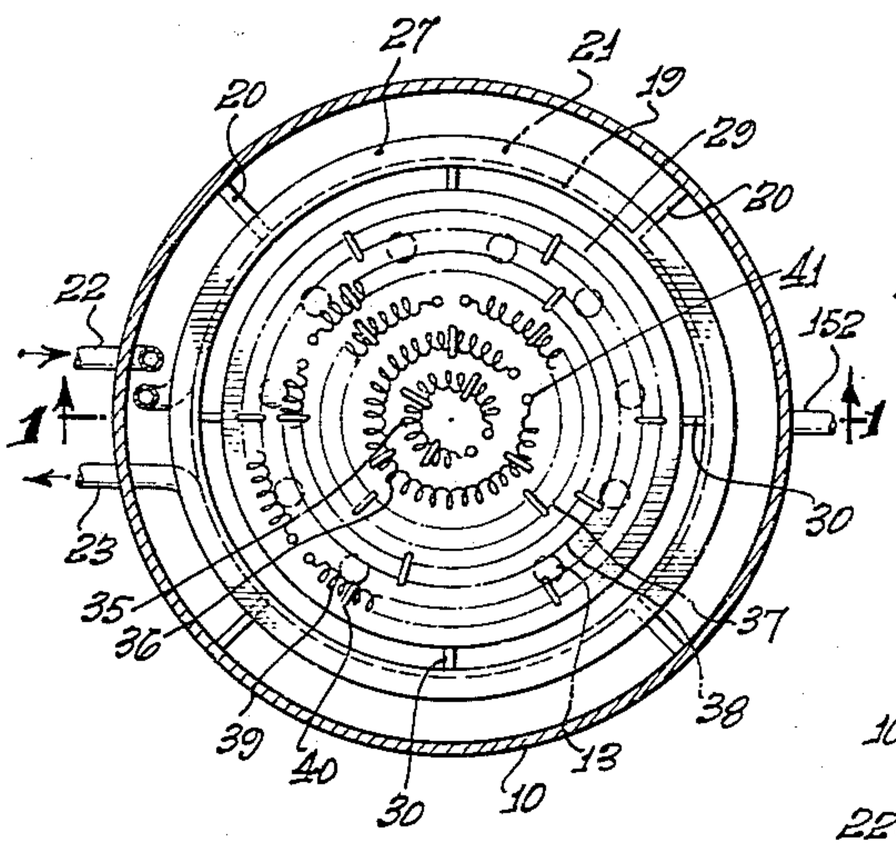


FIG. 1.

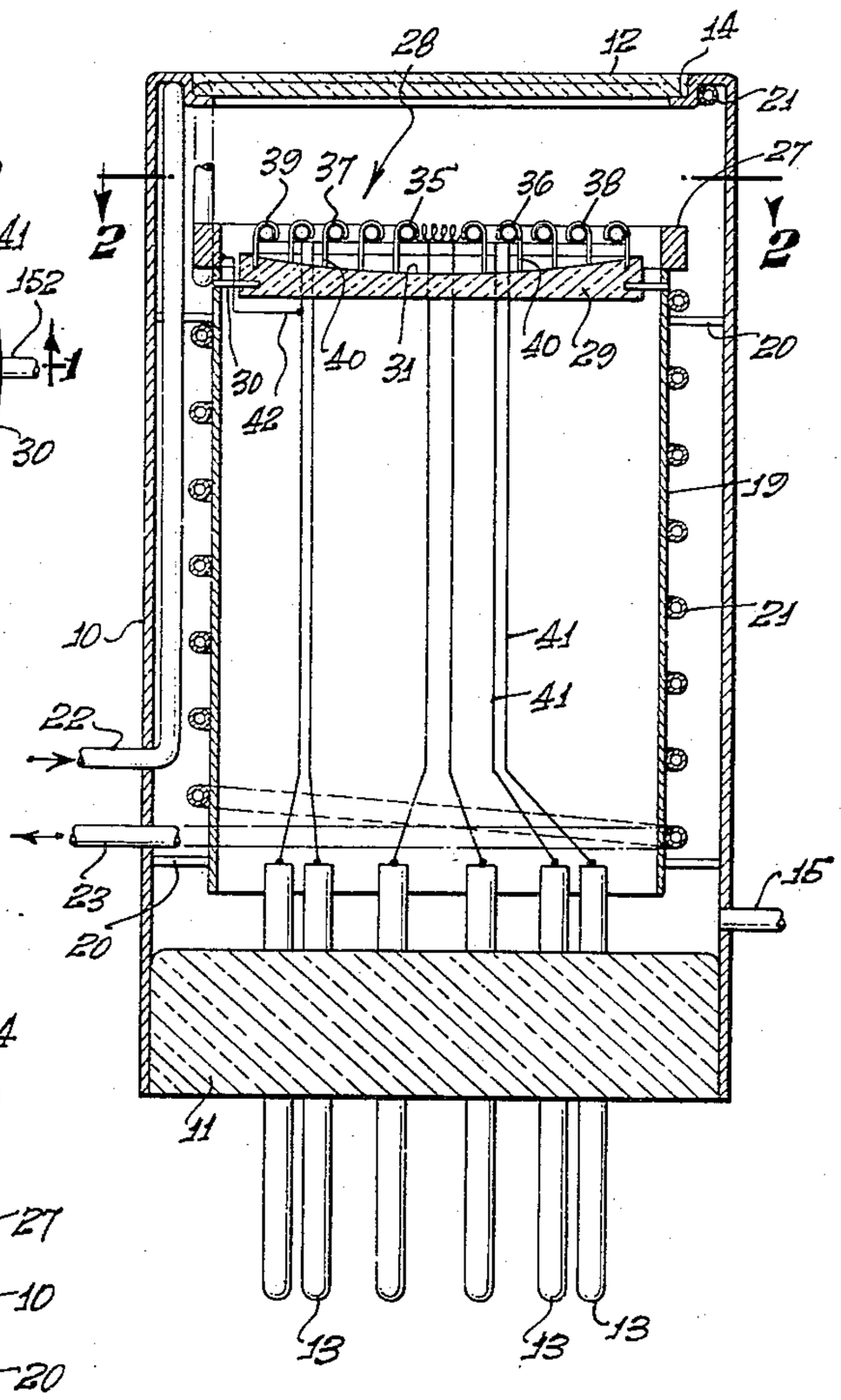
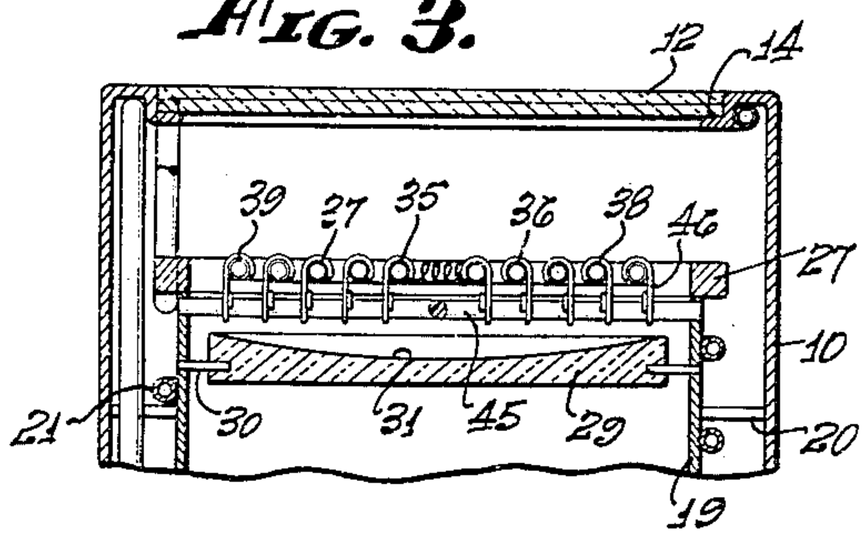


FIG. 3.



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This invention relates to electrically energized lamps for the production of high intensity illumination in visible spectrum.

It is an object of the invention to produce a lamp which is small in size and one which produces intense illumination without operating at excessive temperatures, thereby providing a long operative life. Another object of the invention is to provide such a lamp which may be operated from the conventional 110 and 220 volt, 50 and 60 cycle per second supplies without requiring step-up transformers or rectifiers.

It is another object of the invention to provide a lamp in which the illumination is produced by a combination of incandescent filaments and gases or vapors excited by electric discharge. Another object of the invention is to provide such a lamp which utilizes a plurality of incandescent filaments in conjunction with the electric discharge gas excitation.

It is a further object of the invention to provide a lamp which may be manufactured and operated without requiring the creation or maintenance of a high vacuum condition within the lamp. Another object of the invention is to provide such a lamp which may be produced and operated with an internal pressure in the range of zero to two-thirds of an atmosphere absolute.

It is another object of the invention to provide a lamp which is cooled by a target adjacent the filaments thereof, the target being constructed of a metal which absorbs oxygen on heating and gives off oxygen on cooling. A further object of the invention is to provide such a lamp which is also cooled by a heat sink comprising a metal jacket surrounding the electrical conductors therein. Another object of the invention is to provide such a lamp having a cooling fluid conductor positioned within the lamp and surrounding the jacket.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. The drawing merely shows and the description merely describes preferred embodiments of the present invention which are given by way of illustration or example.

In the drawing:

Fig. 1 is a sectional view of a preferred embodiment of the invention, taken along the line 1—1 of Fig. 2;

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1; and

Fig. 3 is a partial sectional view of an alternative embodiment of the invention shown in Fig. 1.

There are two sources of illumination in the lamp of the invention, namely, one or more resistance type filaments which are heated to incandescence by electric currents therein and a gas or vapor which is excited by an electric discharged therethrough. The elements of the lamp are contained within a housing or case 10 which may be a cylindrical shell having a base 11 at one end and a transparent plate 12 at the other end. The base 11 may be of glass or other suitable insulating material

and has a plurality of electrical feed-through conductors 13 mounted therein and extending from both sides for making electrical connections between the elements within the lamp and the surrounding equipment. The transparent plate 12 may be made of quartz, pyrex or other high temperature resistant transparent material and is mounted in a recessed section 14 of the case 10. The base 11 and the plate 12 are sealed in place in the case 10 so that the interior thereof may be evacuated. A length of tubing 15 is positioned in the wall of the case 10 providing for evacuation or injection of gas into the interior of the lamp.

A jacket 19 is positioned within the case 10, being supported by eight brackets 20 which extend inward from the inner wall of the case 10. The jacket is open at each end thereof and extends nearly the entire length of the case from adjacent the base 11 to adjacent the plate 12, preferably being of the same configuration but smaller than the case, permitting uniform spacing from the case and creating a minimum of waste space. It is understood that the case could take any form, the cylindrical shape producing a more uniform distribution of light and heat. The primary function of the jacket 19 is to serve as a heat sink to conduct heat away from the heat producing elements of the lamp. Therefore, the jacket should be made of a good heat conducting material, preferably a metal, such as stainless steel, copper or nickel. A length of tubing is formed into a plurality of turns 21 which are positioned around the jacket 19 and the recessed section 14 of the case 10, preferably being in intimate contact therewith. Ends 22 and 23 of the length of tubing are positioned in the wall of the case 10 and pass therethrough, permitting continuous flow of fluid through the turns of tubing 21 for conducting heat from the interior of the lamp.

The jacket 19 also provides support for a target 27 and a filament structure 28, both positioned near the transparent end of the lamp. A block 29, forming a part of the filament structure 28 of Fig. 1, is positioned within the jacket 19 adjacent one end thereof by four brackets 30 extending inward of the inner wall of the jacket. The block 29 is preferably a mirror having a concave upper surface 31 which directs illumination outward through the transparent plate 12 and reduces the radiation of heat towards the base 11.

A plurality of filaments 35, 36, 37, 38, 39 are supported on hangers 40 which are mounted in and extend upward from the block 29, the filaments preferably being disposed in concentric circles and in a single plane, thereby providing a uniform illumination intensity. Each of the filaments 35 through 39 may be similar to the filaments used in conventional incandescent lamps and is preferably made from a high temperature resistant material such as tungsten or the like. The outermost filament 39, being the longest, is preferably proportioned so that it may be connected directly across the supply source, such as a 110 or 220 volt line. The remaining filaments are made from the same type and size of wire and have the same turn diameter and spacing so that, with equal currents therein, equal intensities of illumination will be produced. Equal currents may be provided for each filament by connecting each to a supply having a different voltage or by connecting a resistor in series with each to make the resistance of all of the series combinations equal so that all the series combinations may be connected to the same supply.

Each end of each of the filaments is connected to one of the feed-through conductors 13 by respective individual conductors 41 which pass through the block 29 and are positioned within the jacket 19. The target 27 is connected to one of the conductors 41 by a conductor 42. If desired when dropping resistors are connected in series

with each of the filaments, the resistors could be positioned within the case of the lamp, thereby requiring only two feed-through conductors **13**. However, it is advantageous in the operation of the lamp of the invention to provide two conductors **41** and two feed-through conductors **13** for each filament so that greater heat transfer from the filament area is achieved, thereby contributing to a lower operating temperature and a longer operating life.

After the lamp of the invention has been assembled as described above, the interior thereof is partially evacuated through the tubing **15** and then flashed with an electric discharge lamp gas. The term "flashed" as used herein means the injection of a very small amount of gas into the interior of the case, the amount of gas involved being in the order of a few molecules, not being an amount great enough to make a significant change in the pressure within the case. An important feature of the invention is the fact that it is not necessary to evacuate the interior of the lamp to anything approaching absolute zero pressure, nor is it necessary to provide an inert gas within the lamp. Satisfactory operation is obtained when the pressure within the lamp is not more than two-thirds of an atmosphere absolute, the preferable operating point being in the order of one-half atmosphere absolute. The electric discharge lamp gas which is flashed into the lamp may be hydrogen, sodium, mercury or any of the noble gases, such as helium or argon, argon and hydrogen being preferred since they produce the maximum amount of illumination.

When the lamp is connected to a suitable source, an electric discharge is created between the target **27** and the various filaments. This discharge excites the electric discharge lamp gas within the case and provides illumination in addition to that of the incandescent filaments.

The target **27** is made of a suitable high temperature resistant electrical conducting material such as tungsten, platinum, rhodium or gold. The target is constructed to encircle the filaments and is positioned adjacent the outermost filament **39** in order to create the desired electric discharge. It is preferred that the target be made of platinum or other material having the property of absorbing oxygen as its temperature increases and giving off oxygen as its temperature decreases. The absorption of oxygen by the platinum when the platinum is heating up produces a cooling action in the surrounding atmosphere and materially reduces the operating temperature of the filaments of the lamp. It has been found that the mass of platinum provided in the target **27** must be at least one and one-half times the mass of the filaments in order to perform an adequate cooling operation. It has also been found that an increase of the mass ratio to more than two to one does not produce an improvement in the cooling operation. Therefore, it is preferred that the target **27** be made of platinum and have a mass in the range of one and one-half to two times that of the mass of the filaments.

A lamp constructed in the form of Figs. 1 and 2 with five concentric filaments, the outer filament being about two and one-half inches in diameter, and the target being spaced about one centimeter from the outer filament, with the over-all diameter of the case being about four inches, draws approximately forty amperes from a 220 volt 60 cycle per second source. In this unit, dropping resistors were provided outside the case in series with each of the filaments except the outermost to provide equal current densities in the filaments.

An alternative construction for supporting the filaments is shown in Fig. 3, wherein an insulating support member **45**, which may be in the shape of a cross, is supported by the jacket **19** across the end thereof. A plurality of hangers **46**, similar to the hangers **40**, are used to support the filaments, each having one end thereof wrapped around the support member **45** with the other end thereof projecting upward therefrom and engaging a portion of the filaments.

A lamp constructed in accordance with the teachings of this invention will operate at a considerably lower temperature than conventional incandescent lamps and yet will provide intense illumination in the visible, infrared and ultra-violet spectrum. Because of the lower operating temperature, the filaments do not become hardened and brittle, resulting in a material increase in the operating life of the lamp.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiments disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In a lamp, the combination of: a case; a plurality of incandescent lamp filaments; means for supporting said filaments within said case; means for connecting an electrical potential to the ends of said filaments; a platinum target, the mass of said target being at least one and one-half times as great as the mass of said filaments; means for supporting said target within said case adjacent said filaments; and means for electrically connecting said target in circuit with one of said filaments.

2. In a lamp, the combination of: a case which has been evacuated to about one-half atmosphere and flashed with an electric discharge lamp gas; a plurality of incandescent lamp filaments; means for supporting said filaments within said case with said filaments equally spaced and lying in a plane; means for connecting an electrical potential to the ends of said filaments; a platinum target surrounding said filaments and lying in said plane, the mass of said target being at least one and one-half times as great as the mass of said filaments; means for supporting said target within said case; and means for electrically connecting said target in circuit with one of said filaments.

3. In a lamp, the combination of: a case which has been evacuated to about one-half atmosphere and flashed with an electric discharge lamp gas, said case having a plurality of feed-through electrical connectors positioned therein; a plurality of incandescent lamp filaments, said filaments being substantially equally spaced over a zone in a plane; means for supporting said filaments within said case; conductor means for electrically connecting the ends of said filaments to said feed-through electrical connectors; a metal jacket encircling and spaced from said conductor means, said jacket extending from adjacent said feed-through connectors to adjacent said filaments, the end of said jacket adjacent said filaments terminating in a platinum target encircling said filaments with said target lying in said plane and substantially constantly spaced from the periphery of said zone, the mass of said target being at least one and one-half times as great as the mass of said filaments; means for supporting said jacket within said case; and means for electrically connecting said target in circuit with one of said filaments.

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