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METAL VAPOR LAMP

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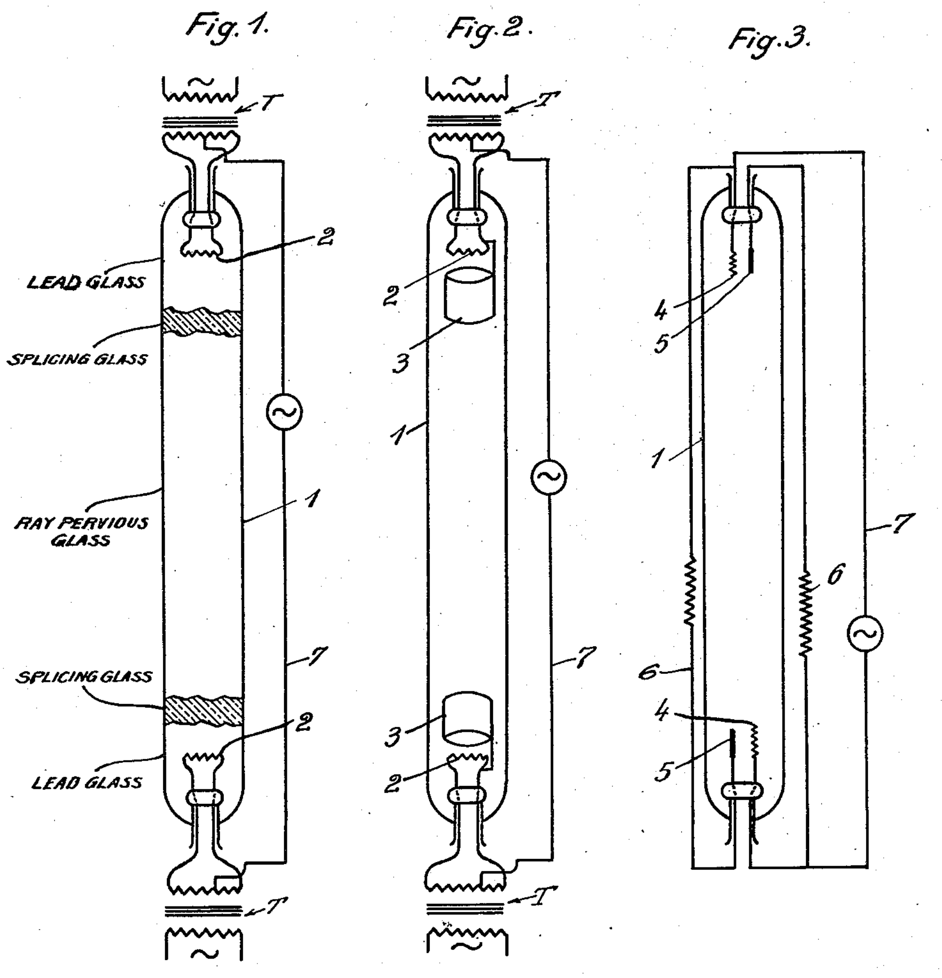

Inventors:
FRIEDRICH MEYER
HANS J. SPANNER
EDMUND GERMER

BY [signature]

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METAL VAPOR LAMP

Friedrich Meyer, Berlin-Halensee, and Hans-Joachim Spanner, Berlin, Germany, and Edmund Germer, Stockholm, Sweden, assignors, by mesne assignments, to General Electric Company, a corporation of New York

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Our invention relates to the production of chemically active spectral rays and more especially to means whereby chemically active rays such as ultra-violet rays can be produced and utilized in a particularly simple, efficient and economical manner.

The favorable effects exerted by ultra-violet rays such as are contained in sunlight in the treatment of certain diseases and also their high bactericidal power are well known and it has therefore been tried for years to provide simple and efficient means for the artificial production of such rays. The only practically useful source of ultra-violet rays which has hitherto become known is the so-called quartz lamp, which comprises an electric arc formed in mercury vapor filling a vacuum tube whose walls preferably consist of quartz. Now these quartz lamps, although being capable of producing all desirable quantities of ultra-violet light, involve the grave disadvantage of requiring direct current for their operation, being operable with alternating current only by way of complicated connections and specially devised apparatus, so that they cannot be operated directly from the house lighting system. The ignition of quartz lamps requires the provision of special igniting arrangements. It is further impossible to operate a quartz lamp in such manner as to produce only small quantities of ultra-violet rays, as the lamp is liable to be extinguished below a certain current; in other words, it is difficult to construct a quartz lamp for low capacity. Another disadvantage is sometimes felt in connection with quartz lamps, in that apart from the ultra-violet light they also emit considerable quantities of light rays of the visible range. The great intensity of ultra-violet ray emission forbids the handling of these lamps except by experts. On the other hand it is very desirable indeed to provide a source of ultra-violet rays which can be handled and installed anywhere without any danger and which can be operated direct with alternating current from the house lighting system without requiring any special igniting means.

We have found that a source of chemically active rays is presented in the combination of a gas-filled tube, for instance an argon or neon filled tube, such as is in general use for the purposes of advertising, with an admixture of metal vapor, for instance mercury vapor, to the gas in the tube, the tube itself being preferably made of a material highly pervious to ultra-violet rays, such as quartz, or uviol glass, or being provided with an opening closed by such material.

If a voltage is connected with the electrodes forming part of such a tube, a glow current will pass between the electrodes which will also ionize the mercury molecules which will now emit great quantities of ultra-violet rays. Owing to the presence, in the tube, of a gas, for instance a rare gas, besides the metal vapor, such lamp can be operated with alternating current and can therefore be connected directly with any house lighting system.

We have further found that combined gas and metal vapor lamps for high capacity can be ignited easily without requiring a high voltage, if the ordinary (cold) electrodes are replaced by or combined with hot (incandescent or glow) cathodes. We may for instance use tungsten cathodes, but we have found it particularly convenient to use the kind of glow cathodes known under the name of Wehnelt cathodes, which do not require any heating current, it being possible to cause the cathodes to be heated by the ion current itself upon the glow discharge having been started by means of one of the well known auxiliary connections. This latter mode of operation is particularly recommendable if it is desired to operate with direct current.

The glow cathodes may be associated with auxiliary electrodes, each auxiliary electrode being connected across a suitable resistance with the glow cathode facing it. For instance in the case of single phase alternating current two glow electrodes and two auxiliary electrodes will be provided. Upon the circuit being closed, a glow current will pass between the auxiliary electrodes and the glow cathodes, whereby these latter will be heated and the lamp will be set operating. Inasmuch, however, as now the inner resistance of the lamp is very low as compared with the resistance inserted between the electrodes, the main current will flow merely between the glow cathodes, and the auxiliary ignition electrodes will be thrown out automatically. If current of higher voltage is used, the current impulse arising when the circuit is closed will as a rule suffice to set the glow cathodes operating.

Glow cathodes comprising an activated metal, such as combinations of molybdenum or tungsten with thorium will also be found useful in some cases.

Obviously a lamp as above described can also be enclosed in or formed of a material (quartz, uviol glass or the like), which, while being pervious to ultra-violet rays, is partly or altogether impervious to rays of the visible range. The lamp may also be combined with suitable filters of a well known kind to adapt it to all kinds of uses. It can be installed with particular advantages in lodgings, meeting rooms, theatres and the like, to purify the air without emitting visible light. The series resistance required in such cases can be accommodated in the lamp socket. In all these cases the quantity of ultra-violet rays emitted can be regulated with great nicety and low voltages can be applied without any danger of the lamp being extinguished.

If the envelope, tube or bulb forming part of the lamp is made of or formed with coatings or jackets of partly or entirely fluorescent material, the lamp can also be used with advantage for advertising purposes.

In the drawing affixed to this specification and forming part thereof, some forms of tubes or lamps embodying our invention are illustrated diagrammatically by way of example.

In the drawing—

Fig. 1 shows a tubular lamp 1, filled with a rare gas or gases, to which is admixed a metal vapor such as mercury vapor, 2,2 are glow cathodes supplied with alternating current.

Fig. 2 illustrates a similar arrangement in which auxiliary electrodes 3,3 are associated with the glow cathodes 2, the auxiliary electrodes being arranged in close juxtaposition to the glow cathodes, so as to heat them up when heated by the current.

In the modification illustrated in Fig. 3, 4,4 are glow cathodes of a different kind, and 5,5 are the auxiliary or ignition electrodes associated with them. A suitable resistance 6 is inserted in the circuit including the auxiliary electrodes. The fluorescent material may be enclosed in said envelope.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

We claim:

1. A spectral ray lamp comprising an evacuated envelope forming an enclosed elongated discharge path, two fixed electrodes therein, one of which is a Wehnelt type cathode, and a low pressure gaseous atmosphere comprising a rare gas adapted to support a heavy current discharge, and a source of metallic vapor normally incapable of supporting a low voltage discharge in the envelope, the said discharge through the rare gas being adapted to raise the vapor pressure of the metallic vapor and the ionization of the same sufficiently to cause the metallic vapor to carry and maintain the discharge and become the main source of the emitted spectral rays.

2. A spectral ray lamp comprising an evacuated vessel forming an enclosed elongated discharge path containing a source of metallic vapor adapted when excited to emit rays within the desired range of the spectrum, two fixed electrodes, one of which is a Wehnelt type cathode, and an inert gas adapted to support a low voltage gaseous discharge to increase and maintain the vapor pressure and the density of the metallic vapor in the discharge path to cause the latter to support and maintain the main discharge at the low voltage of the lamp and thereby cause the vapor in said elongated path to emit the desired spectral rays.

3. A spectral ray lamp comprising an evacuated vessel forming an enclosed elongated discharge path containing a source of mercury vapor adapted when excited to emit ultra-violet rays within the desired range of the spectrum, two fixed electrodes, one of which is a Wehnelt type cathode, and a rare gas adapted to start, a low voltage gaseous discharge and of sufficient intensity to increase and maintain the vapor pressure and density of the mercury vapor in the discharge path sufficient to cause the latter to support the main discharge at the starting voltage of the lamp and thereby cause the said vapor to emit the desired ultra-violet rays throughout the length of the elongated discharge path

4. A metal vapor lamp of high capacity which can be started and operated directly from ordinary alternating house lighting voltages, comprising a vessel pervious to the desired spectral rays, two fixed main discharge electrodes spaced apart and forming with the walls of said vessel an elongated discharge path therein, at least one of said electrodes being of the Wehnelt type, an inert gas atmosphere, and a source of metallic vapor; the latter electrode in cooperation with the gas atmosphere being capable of starting and maintaining a heavy current low voltage gaseous discharge between said electrodes, thereby forming an enclosed luminous gas column therebetween, the said gas discharge being adapted to raise the pressure of said metallic vapor and its density throughout the elongated discharge path sufficiently to cause the vapor to support said low voltage discharge throughout a range of intensities as the desired main source of spectral radiation.

5. A metal vapor lamp of high capacity which can be started and operated directly from ordinary alternating house lighting voltages, comprising a vessel pervious to the desired spectral rays, two fixed main discharge electrodes spaced apart and forming with the walls of said vessel an elongated discharge path therein, at least one of said electrodes being a Wehnelt type cathode, an auxiliary electrode adjacent said cathode, an inert gas atmosphere, and a source of metallic vapor the pressure of which increases with rise in temperature; said cathode in cooperation with the gas atmosphere and said auxiliary electrode being capable of starting and maintaining a heavy current, low voltage gas discharge between said electrodes thereby forming an enclosed luminous gas column between the main electrodes adapted to raise the pressure of said metallic vapor and its density throughout the main discharge path sufficiently to cause it to support said low voltage discharge as the desired main source of spectral radiation.

6. A metal-vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, a Wehnelt type cathode and a cooperating electrode disposed at opposite ends of said path, and a filling of inert gas and metal vapor; the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the metal-vapor density throughout the path sufficiently to make the metal vapor the main source of emitted rays.

7. A metal-vapor lamp comprising a vessel adapted to provide an elongated discharge path defined by the walls of said vessel, said walls being transparent to the desired rays, electrodes disposed at opposite ends of said path one at least being a Wehnelt type cathode adapted to operate with substantially no cathode fall, and a filling of inert gas and metal vapor in said vessel; the normal electron emission of said cathode

and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to form a luminous column having sufficient current density to raise the metal-vapor density throughout the path sufficiently to make the metal vapor the main source of emitted rays.

8. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is a Wehnelt type cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall, said rare gas being adapted to start and support a discharge therethrough of sufficient current density to raise the density of the metallic vapor throughout the said column and to such an extent that the metallic vapor becomes the main source of the rays emitted by said lamp.

9. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is a Wehnelt type cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall.

10. A mercury vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, a Wehnelt type cathode and a cooperating electrode disposed at opposite ends of said path, and a filling of inert gas and mercury vapor; the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the mercury vapor density throughout the path sufficiently to make the mercury vapor the main source of emitted rays.

11. A mercury vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, a Wehnelt type cathode and a cooperating electrode disposed at opposite ends of said path, a filling of inert gas and mercury vapor, the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the mercury vapor density throughout the path sufficiently to make the mercury vapor the main source of emitted rays and a luminescent material disposed in the path of said rays.

12. A mercury vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, a Wehnelt type cathode and a cooperating electrode disposed at opposite ends of said path, a filling of inert gas and mercury vapor, the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the mercury vapor density throughout the path sufficiently to make the mercury vapor the main source of emitted rays and a coating of luminescent material on said vessel.

13. A mercury vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, a Wehnelt type cathode and a cooperating electrode disposed at opposite ends of said path, a filling of inert gas and mercury vapor, the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the mercury vapor density throughout the path sufficiently to make the mercury vapor the main source of emitted rays and luminescent material enclosed in said vessel.

14. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall.

15. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated thermionic cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall.

16. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall and means for causing an auxiliary starting discharge in the vicinity of said cathode.

17. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall, means for causing an auxiliary starting discharge in the vicinity of said cathode and luminescent material disposed in the path of said spectral ray emission.

18. A mercury vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, an activated cathode and a cooperating electrode disposed at opposite ends of said path, and a filling of inert gas and mercury vapor; the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the mercury vapor density throughout the path sufficiently to make the mercury vapor the main source of emitted rays.

19. A mercury vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, an activated cathode and a cooperating electrode disposed at opposite ends of said path, a filling of inert gas and mercury vapor, the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the mercury vapor density throughout the path sufficiently to make the mercury vapor the main source of emitted rays and luminescent material enclosed in said vessel.

20. A metal-vapor lamp comprising a vessel

adapted to provide a discharge path defined by the walls of said vessel, an activated cathode and a cooperating electrode disposed at opposite ends of said path, a filling of inert gas and metal vapor, the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the metal-vapor density throughout the path sufficiently to make the metal vapor the main source of emitted rays and a luminescent material disposed in the path of said rays.

21. A metal-vapor lamp comprising a vessel adapted to provide a discharge path defined by the walls of said vessel, an activated cathode and a cooperating electrode disposed at opposite ends of said path, and a filling of inert gas and metal vapor; the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to raise the metal-vapor density throughout the path sufficiently to make the metal vapor the main source of emitted rays.

22. A metal-vapor lamp comprising a vessel adapted to provide an elongated discharge path defined by the walls of said vessel, said walls being transparent to the desired rays, electrodes disposed at opposite ends of said path one at least being an activated cathode adapted to operate with substantially no cathode fall, and a filling of inert gas and metal vapor in said vessel; the normal electron emission of said cathode and the pressure of inert gas being adapted to start and support a low voltage gaseous discharge in said path, the said gaseous discharge being adapted to form a luminous column having sufficient current density to raise the metal-vapor density throughout the path sufficiently to make the metal vapor the main source of emitted rays.

23. A metal vapor lamp comprising an elongated vessel, a filling of rare gas and metallic vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall, said rare gas being adapted to start and support a discharge therethrough of sufficient current density to raise the density of the metallic vapor throughout the said column and to such an extent that the metallic vapor becomes the main source of the rays emitted by said lamp.

24. A mercury vapor lamp comprising an elongated vessel, a filling of rare gas and mercury vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall, said rare gas being adapted to start and support a discharge therethrough of sufficient current density to raise the density of the mercury vapor throughout the said column and to such an extent that the mercury vapor becomes the main source of the rays emitted by said lamp.

25. A mercury vapor lamp comprising an elongated vessel, a filling of rare gas and mercury vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is a Wehnelt type cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall.

26. A mercury vapor lamp comprising an elongated vessel, a filling of rare gas and mercury vapor, the latter constituting, in operation, the main source of spectral ray emission, and two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall.

27. A mercury vapor lamp comprising an elongated vessel, a filling of rare gas and mercury vapor, the latter constituting, in operation, the main source of spectral ray emission, two fixed main discharge electrodes, at least one of which is a Wehnelt type cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall and fluorescent material disposed in the path of said spectral ray emission.

28. A mercury vapor lamp comprising an elongated vessel, a filling of rare gas and mercury vapor, the latter constituting, in operation, the main source of spectral ray emission, two fixed main discharge electrodes, at least one of which is an activated cathode, spaced apart in said vessel to form therebetween a luminous discharge column defined by the vessel wall and fluorescent material disposed in the path of said spectral ray emission.

FRIEDRICH MEYER.
HANS-JOACHIM SPANNER.
EDMUND GERMER.