Feb. 24, 1953 W. B. GREENLEE 2,629,839

CAPACITIVE LIGHTING SYSTEM

Filed May 10, 1948 2 SHEETS—SHEET 1

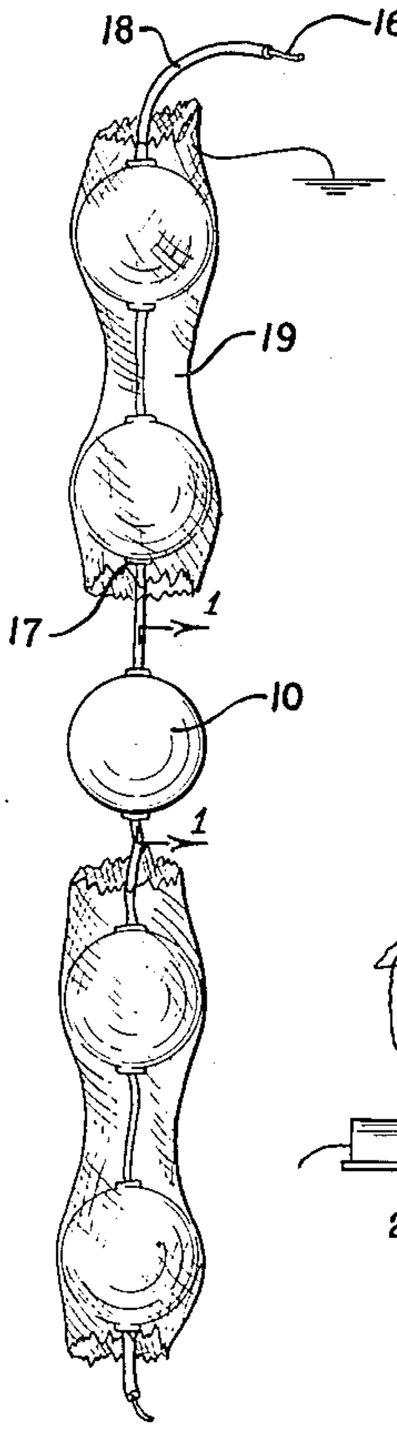


Fig. 2

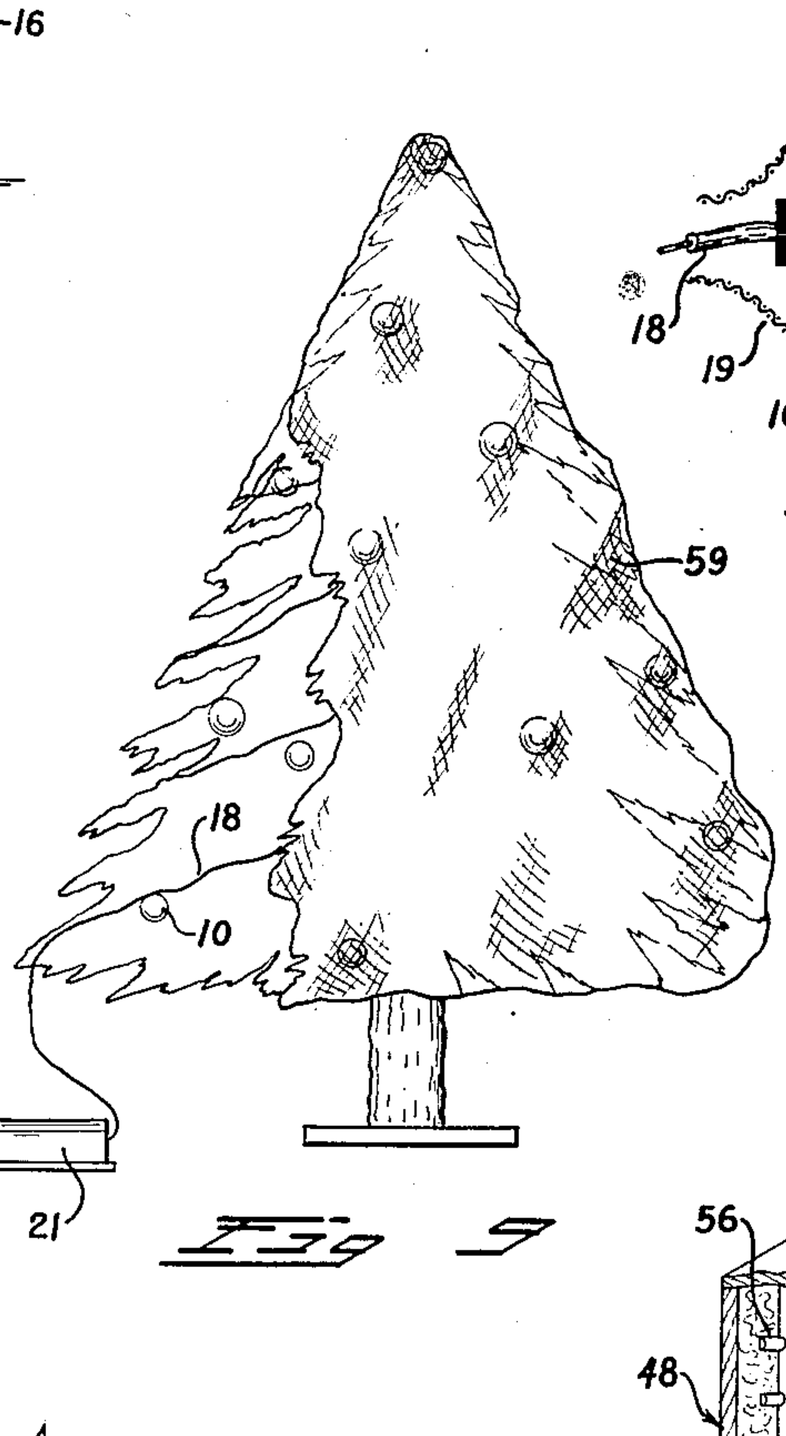


Fig. 3

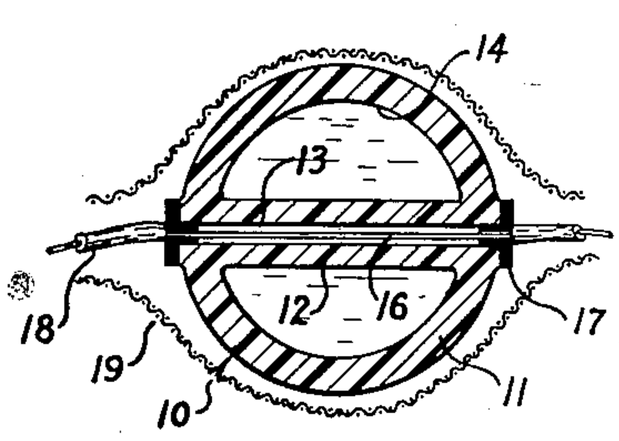


Fig. 1

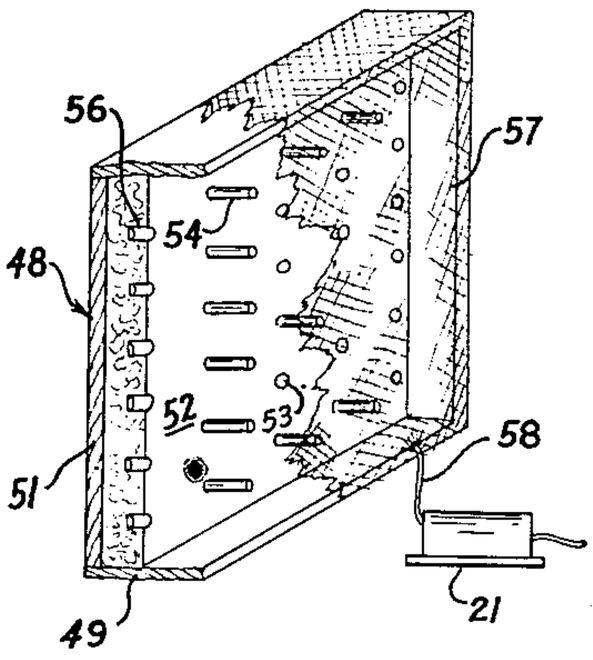


Fig. 4

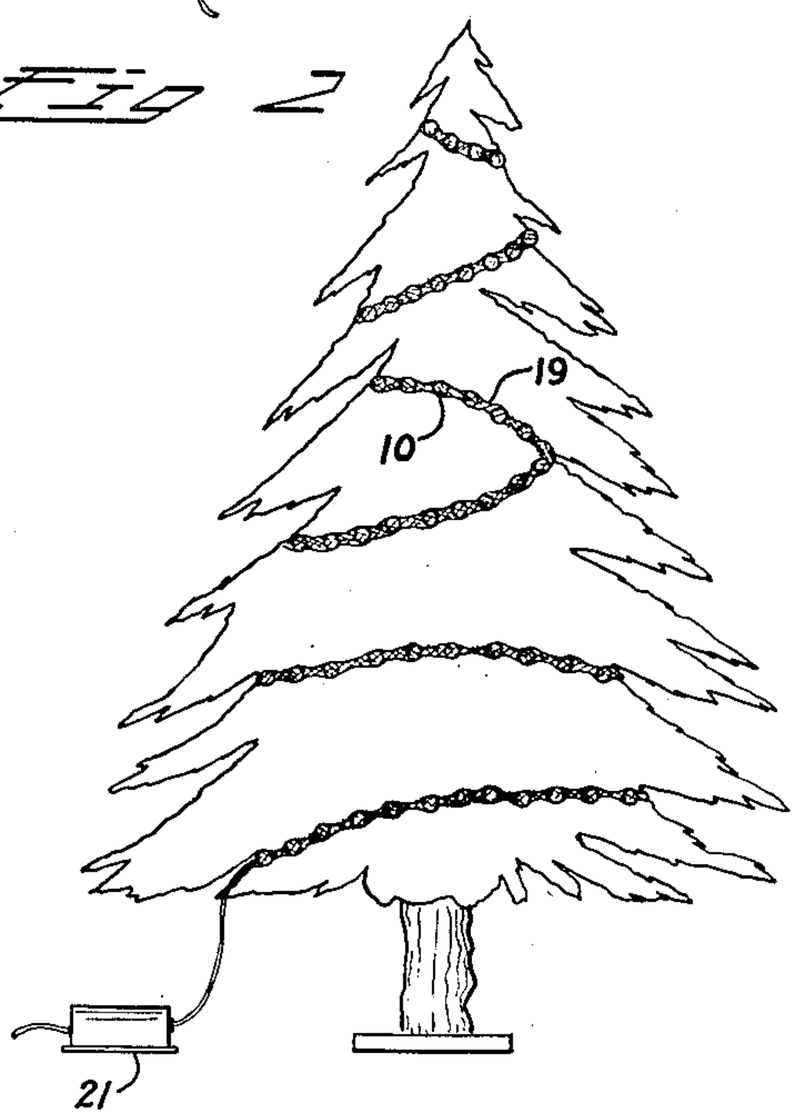


Fig. 5

INVENTOR.
William B. Greenlee
BY
H. A. McGrew
ATTORNEY

Feb. 24, 1953 W. B. GREENLEE 2,629,839

CAPACITIVE LIGHTING SYSTEM

Filed May 10, 1948 2 SHEETS—SHEET 2

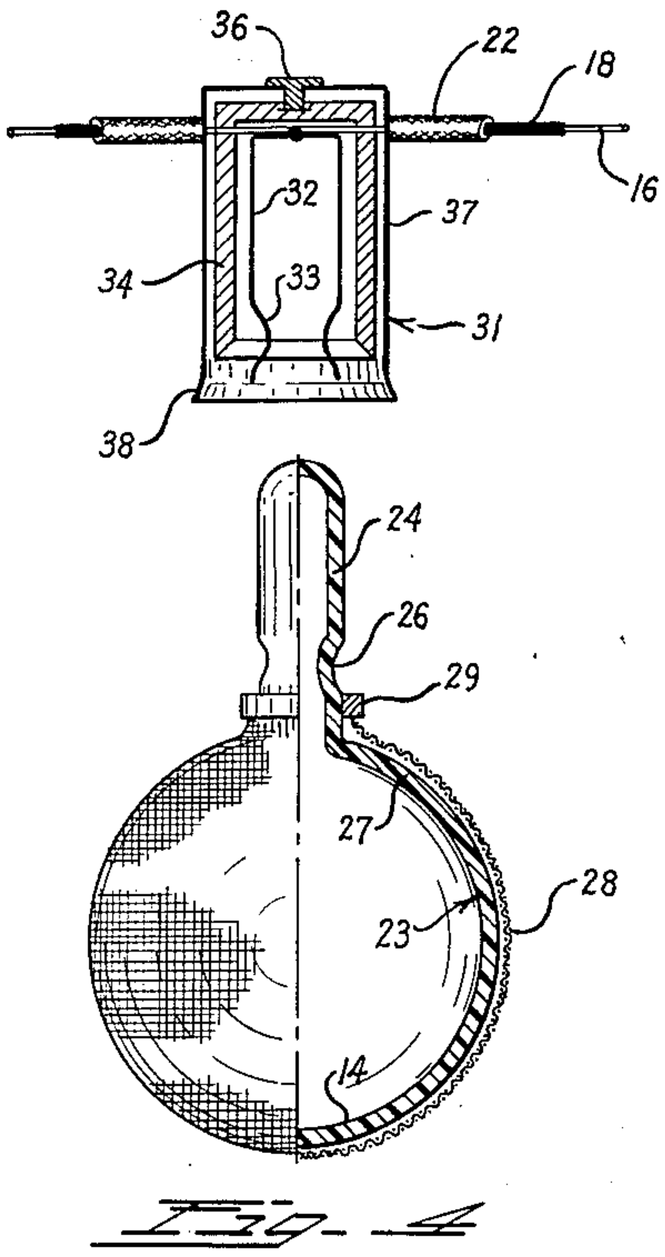
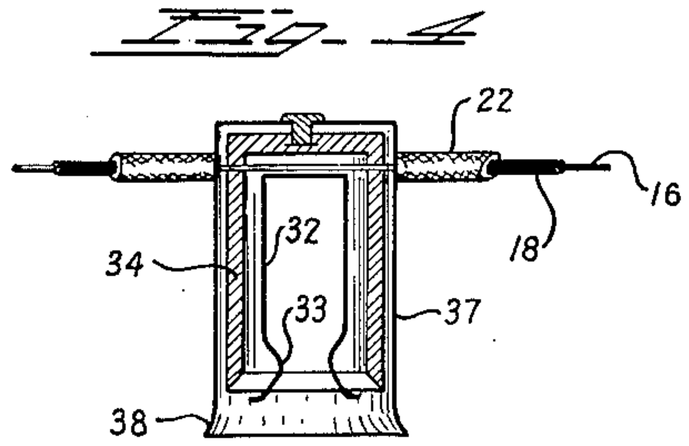


Fig. 3

Fig. 4



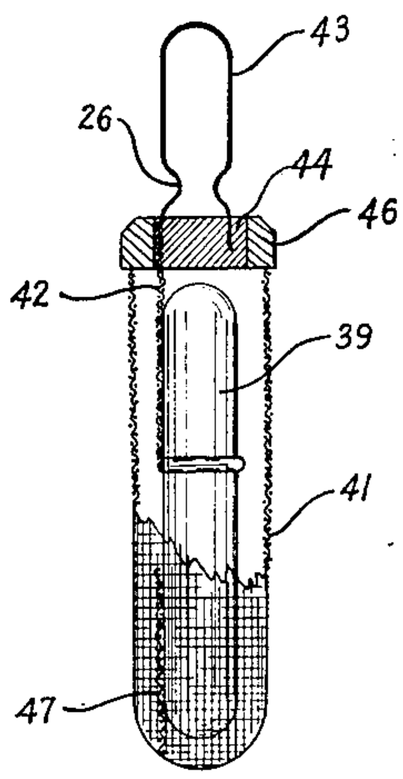


Fig. 6

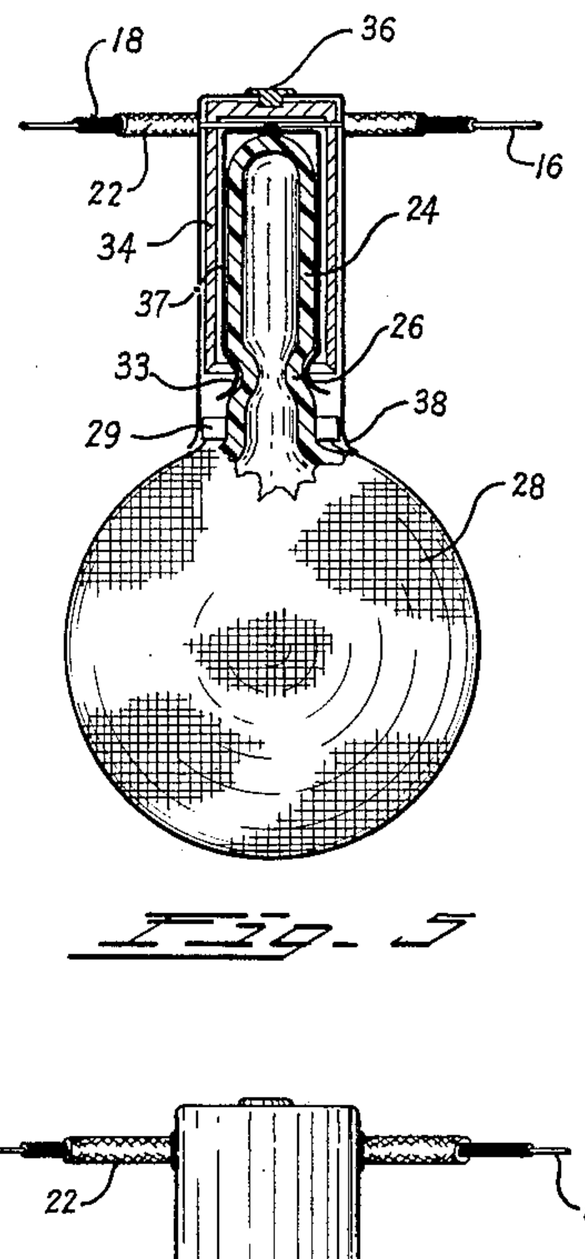


Fig. 5

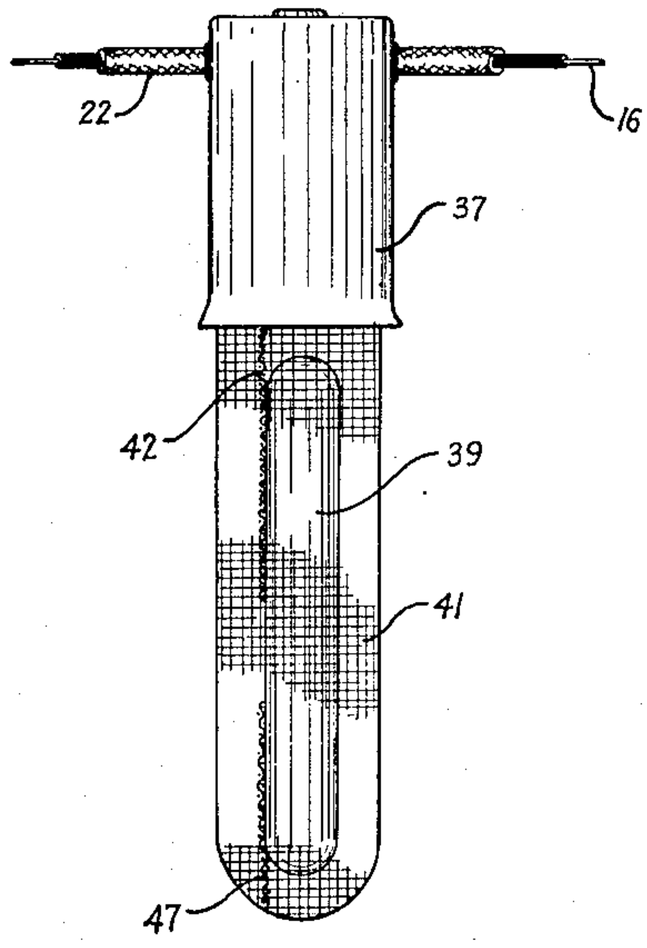


Fig. 7

INVENTOR.
William B. Greenlee
BY
W. B. Greenlee
ATTORNEY

Patented Feb. 24, 1953

2,629,839

UNITED STATES PATENT OFFICE

2,629,839

CAPACITIVE LIGHTING SYSTEM

William B. Greenlee, Peru, Ind.

Application May 10, 1948, Serial No. 26,037

4 Claims. (Cl. 313—201)

1

My invention is directed to capacitive lighting systems, particularly to those employing high frequency alternating current for illumination of gaseous discharge lamps, and has as an important object the provision of an efficient high frequency lighting system operable by relatively low voltage current, which is adapted to yield pleasing decorative effects as well as greater light intensity, and in which the high frequency radiations are effectively confined.

Other important objects include the provision of novel gaseous discharge lamps and devices for disposing such lamps in energy transmitting relation to high frequency fields, as well as devices for establishing a high field gradient for energy flowing through the lamps.

Other objects reside in the diverse novel shapes, combinations, and arrangements of component parts, as will more fully appear in the course of the following description and from the appended drawings in which:

Figure 1 is a vertical sectional view of a lamp and conductor;

Figure 2 is a plan view of a series of lamps similar to those illustrated in Figure 1, arranged on a conductor;

Figure 3 is an elevational view of the lamp string illustrated in Figure 2 applied to a tree;

Figure 4 is a partially sectioned vertical elevation of another form of lamp together with a suitable socket;

Figure 5 is a partially sectioned elevation illustrating the assembled position of the parts shown in Figure 4;

Figure 6 is a partially sectioned elevation through a modified form of my lamp.

Figure 7 is an elevation illustrating the assembled position of the parts shown in Figure 6;

Figure 8 is a partially sectioned perspective view of a modified form of my invention, particularly adapted for use as a sign; and

Figure 9 is a partially sectioned elevation of a modified form of my device as applied to tree decoration.

In Fig. 1 I have illustrated a lamp, generally designated 10, which may include a hollow spherical glass envelope 11, having sealed therein a glass conduit 12 provided with an internal bore, indicated at 13. The envelope 11 is filled with a suitable gas, such as neon, argon, krypton, helium, xenon, or mixtures thereof under low pressure, although other gases may be employed, if desired. Preferably, the internal surface of the envelope 11 is provided with a coating of suitable phosphor 14 of the type adapted to radiate visible light waves when acted upon by ultraviolet radiation. The surfaces of the conduit 12 preferably should not be coated with a phosphor, although in special instances such a coating may be employed.

2

A high frequency conductor 16 extends through the bore 13 of the conduit 12, the lamp 10 being held in position on the conductor 16 by a suitable resilient grommet 17, shaped to resiliently engage the conductor 16 and the internal surfaces of the bore 13. The grommet 17 should fit both the bore 13 and the conductor 16 quite closely in order to prevent the entry of water or moisture into the bore 16. The conductor 16 is normally provided with an insulating coating 18 which need not be removed from the portion of the conductor extending through the bore 13 and serves to insulate the conductor 16 from an external conductive screen or mesh covering 19.

As best seen in Figure 2, the covering 19 may extend over the conductor 16 and the lamps 10 which may suitably be spaced at intervals along the conductor. This covering 19 ordinarily comprises a metallic mesh or screen of a highly flexible nature and open weave, formed by weaving fine wire or the like. It is essential to my purposes that the weave of the covering 19 be sufficiently open to permit the substantially unobstructed passage of light, and is, for that reason, herein termed "transparent," although it will be understood that the actual metallic members of the covering 19 are not themselves transparent.

My lamp string, illustrated in Figure 2, may be applied as an assembly for decorative purposes, as to a Christmas tree, and connected to a suitable oscillator 21 which, in turn, is connected to a suitable source of alternating current and may, if desired, include an artificial ground, to which the conductive covering 19 is connected. Alternatively, the chassis of the oscillator 21 may be connected to ground, and the covering 19 connected to the chassis of the oscillator. It is, of course, not essential that the covering 19 be connected directly to ground since suitable conductive media insulated from the high frequency conductor 16 may be employed for this purpose. I have found shielded cable, comprising an internal high frequency conductor 16, an intermediate insulating coating 18, and an external flexible metallic cover 22 to be highly satisfactory for this purpose.

As a more specific example, the string of lights illustrated in Figures 2 and 3 may be approxi-

mately 12 feet in length and provided with approximately 24 lights spaced evenly along the conductor. The oscillator 21 may suitably be of an output frequency of approximately 100 kilocycles at 1,000 volts. Under these conditions, when the external covering 19 is suitably applied over the lamps 10 and grounded, as hereinbefore described, the lighting system will draw approximately 8 watts.

From the foregoing, it will be understood that as the oscillator 21 applies high frequency current to the conductor 16, a field of similar frequency is created around the conductor and the lamps 10 disposed along the conductor pick up this energy, causing an internal gaseous discharge within the lamp, the intensity of the discharge being proportionate to the field gradient through the lamp. The circuit is completed through the external conductive covering 19 to ground, it being understood that the covering 19 is at all times insulated from the high frequency conductor 16. The conductor 16, in other words, acts as one element of a capacitance, the other element being the external conductive covering 19, and the lamps 10 acting as the discharge path between the capacitive elements of the system.

Preferably, the lamps 10 should be disposed as closely as possible to the conductor 16 and the covering 19 in order to obtain the maximum field gradient through the lamp. The lamps 10 assembled in the manner described are particularly well adapted for use out of doors, where extreme moisture conditions may be encountered. I have found that moisture has little or no effect upon this system if excluded from the bore 13 by the resilient grommets 17. Since the covering 19 is conductive, an efficient system is provided wherein substantially all of the energy consumed is utilized in illumination, and furthermore the high frequency radiations are confined to the space within the covering 19, thereby preventing local radio interference.

It is not, however, necessary that the covering 19 envelop both the conductor 16 and the lamp 10. As shown in Figures 4 and 5, I may provide a lamp, generally designated 23, having a projecting hollow stem 24 provided with indentations 26 near a hollow envelope 27. The envelope 27 contains a quantity of gas under low pressure, similar to the gas fill previously mentioned, and may also be provided with a phosphor coating 14 on its internal surface. A transparent external conductive covering 28 extends around the envelope 27 and is secured to a metal ring 29 telescoped over the stem 24 and supported by the envelope 27 below the indentations 26. The lamp 23 is adapted for reception by a socket, generally designated 31, which is provided with a centrally disposed internal metal clip 32 having lips 33 shaped to receive and engage the indentations 26 in the stem 24 of the lamp 23. A hollow cylindrical insulating member 34 is telescoped over the clip 32 and secured, as by a rivet 36, to an external cylindrical metal cover 37 having lips 38 extending downwardly and outwardly beyond the extremities of the clip 32 a distance sufficient to firmly engage the metal ring 29 when the lips 33 of the clip 32 have engaged the indentations 26 in the stem 24. The conductor 16 extends through the socket 31 into contact with the clip 32, but is insulated from the cover 37. Since shielded cable should be used for this type of insulation, the external conductive covering 22 of such cable is secured to the cover 37 of the socket 31. Therefore, as high frequency current is applied to the conductor 16, the lamp 23 will be illuminated, the current flowing through the clip 32 and the lamp 23 to the covering 28, through the ring 29 to the covering 37, and then through the external cover 22 to ground, completing the circuit and confining the high frequency field to the desired area.

It is, of course, not essential that the envelope 27 of the lamp 23 be spherical in shape, since substantially any other shape will be found suitable. If desired, the envelope may be formed as letters of the alphabet or numerals, and employed for advertising purposes. In such instances, however, the modified form of apparatus illustrated in Figures 6 and 7 are usually more efficient. In this modification I provide a tubular envelope 39 supported within a transparent external conductive covering 41 by a suitable conductor 42 secured at one end to the envelope 39 and at the other to a metal clip 43, having indentations 26 similar to those described in connection with Figure 4. The clip 43 and the conductor 42 may be embedded in a cylindrical block 44 of insulating material mounted within an annular metal ring 46 which is, in turn, secured to the external covering 41. Although the clip 43 may assume many various forms, I have illustrated my preferred form which is similar to that previously described and employs a similar socket. The envelope 39 is, as in other lamps previously described, provided with gas fill, and, if desired, an internal phosphor coating. Maximum efficiency will be obtained by securing the conductor 42 to the envelope 39 at a point somewhat less than half way along the envelope and by providing a conductive member 47 connected to the external covering 41 extending upwardly along the envelope 39 for a substantially equal distance. As the conductor 16 is energized, the energy will flow through the clip 43 and along the conductor 42, through the lamp and into the covering 41 through the conductor 47, the latter being effective to confine substantially all of the energy flowing in the circuit to a path which includes the lamp. It is, of course, essential that the conductor 47 and the external covering 41 be spaced or insulated from the conductor 42. By the use of suitable insulating material disposed between the covering 41 and the conductor 42, the covering 41 may be bent inwardly toward the lamp below the conductor 42, thereby eliminating the desirability of the conductor 47. This does not, however, constitute a preferred embodiment. The envelope 39 may, as previously mentioned, assume substantially any desired shape, as may the tubing employed in the construction of the so-called neon signs, and may, by the suitable selection of phosphors and gases, provide a wide range of color selection.

The external covering which constitutes one of the capacitive elements of my system need not, in each instance, be employed in precisely the manner described, it being desirable, however, to dispose the covering in such a position that the lamp employed will be supported in relatively close proximity thereto. An example of this type of installation is shown in Figure 8, in which I have provided a sign comprising a generally rectangular box, generally designated 48, having sides 49 and a bottom 51. A metal plate 52 may be disposed within the box between the sides 49 and spaced from the bottom 51. The plate 52 is provided with a plurality of spaced openings 53 suitably shaped to receive tubular gaseous discharge lamps 54. If desired, spring clips 56 may be secured to the underside of the plate 52 to

limit the projection of the lamps 54 through the plate. An external transparent conductive covering 57 enveloping the box 48 is provided and connected to ground. The oscillator 21 is connected by a suitably shielded conductor 53 to the plate 52.

When properly arranged the lamps 54 should project through the plate 52 for approximately one-third to one-fourth of their length and should be sufficiently long to bring the outer ends thereof into close proximity with the external covering 57, thereby insuring that substantially all of the energy flowing between the plate 52 and the covering 57 goes through the lamps 54.

A similar arrangement may also be employed in tree decoration or the like, utilizing lamp strings of the type illustrated in Figure 2, but without the external covering 19. In such instances, as illustrated in Figure 9, the lamp strings may be draped on the tree or other support near the outer ends of the boughs, and the entire tree covered with a transparent conductive mesh cover 59 suitably connected to ground.

From the foregoing, it may be seen that in each instance the lamps employed are disposed in energy transmitting relation to both the high frequency conductor and the external conductive covering, this disposition not only insuring a high field gradient through the lamp but also confining the high frequency field to the desired area. Since no internal electrodes are employed, relatively impure or inexpensive gases may be employed, and the simplicity of construction makes possible not only inexpensive fabrication but permits a high order of durability. Because of the efficient coupling between the capacitive elements of my lighting system, substantially all of the energy consumed is utilized for illuminating purposes, resulting in a light of higher intensity than would otherwise normally be expected.

The foregoing detailed description has been made in compliance with R. S. 4888 but is not intended to limit my invention to the precise details hereinbefore described except in so far as defined by the appended claims.

I claim:

1. A gaseous discharge lamp assembly comprising a transparent envelope of dielectric material having its interior sealed from the atmosphere, a conduit extending through the envelope and sealed at each end to the envelope, a rare gas sealed within the envelope at low pressure and encompassing the conduit, a high frequency conductor extending slidably through the conduit, means between the conduit and envelope for holding the envelope in place on the conductor, and a grounded reticulated metal member around the envelope.

2. A gaseous discharge lamp assembly comprising a hollow transparent glass envelope having its interior sealed from the atmosphere, a glass tube extending through the envelope, said tube being sealed at each end to the envelope, a rare gas sealed within the envelope at low pressure and encompassing the conduit, a high frequency conductor extending slidably through the glass tube, means extending between the conductor and the glass tube for holding the envelope in position on the conductor, and a grounded reticulated metal member enveloping the conductor and the envelope.

3. A gaseous discharge lamp assembly comprising a spherical glass envelope having its interior sealed from the atmosphere, a straight glass tube extending diametrically through the envelope and sealed at its opposite ends to the envelope wall, a rare gas sealed within the envelope at low pressure and encompassing the conduit, a high frequency conductor extending slidably through the glass tube, means extending between the tube and the conductor for holding the envelope in place on the conductor, and a grounded reticulated metal member enveloping the conductor and the envelope.

4. A gaseous discharge lamp assembly comprising a transparent envelope of dielectric material having its interior sealed from the atmosphere, a tube of the same material extending through the envelope in sealed opposite ends to the envelope, a phosphor coating on the internal surfaces of the envelope, a rare gas sealed within the envelope at low pressure and encompassing the tube, a high frequency conductor extending slidably through the conduit, means extending between the tube and the conductor for holding the envelope in place along the conductor, and a reticulated grounded metal member completely enveloping said conductor and envelope.

WILLIAM B. GREENLEE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,819,105	Machlett	Aug. 18, 1931
2,004,577	Lebedenko	June 11, 1935
2,117,544	Coustal	May 17, 1938
2,268,870	Greenlee	Jan. 5, 1942
2,457,503	Singer	Dec. 28, 1948
2,484,332	Capita	Oct. 11, 1949

FOREIGN PATENTS

Number	Country	Date
324,101	Great Britain	Jan. 17, 1930
354,273	Italy	Nov. 16, 1937