July 14, 1936. C. H. BRASELTON 2,047,175

ELECTRIC LAMP FOR PRODUCING MODULATED LIGHTS

Filed Aug. 25, 1932 3 Sheets-Sheet 1

Fig. 1.

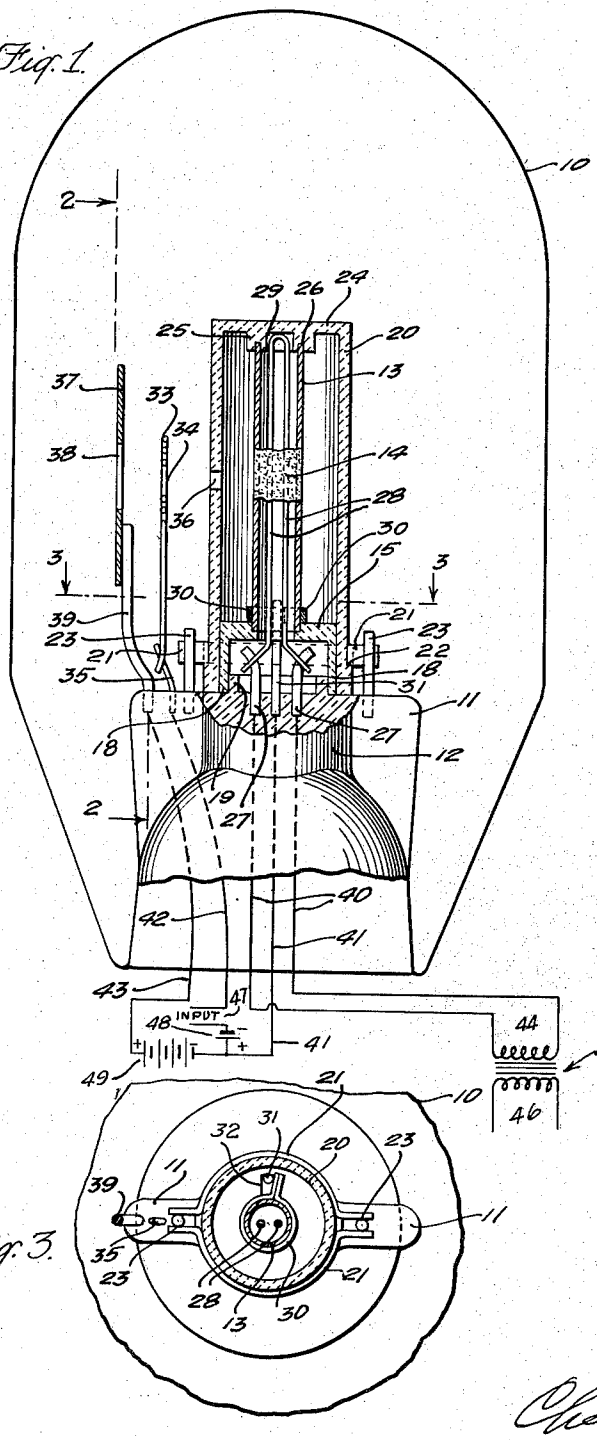


Fig. 3.

Fig. 2.

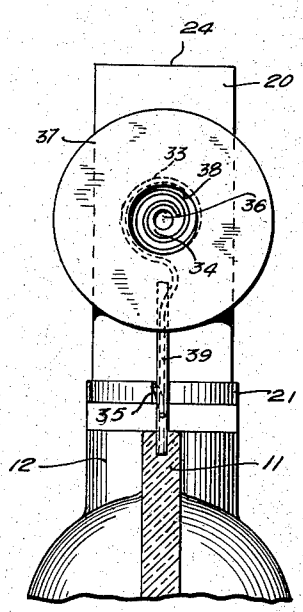
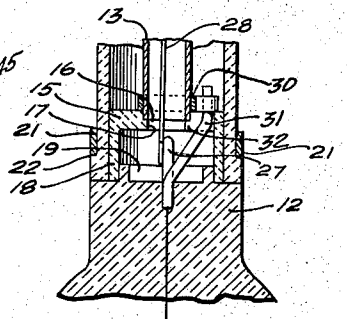


Fig. 4.



INVENTOR

Chester H. Braselton

July 14, 1936. C. H. BRASELTON 2,047,175

ELECTRIC LAMP FOR PRODUCING MODULATED LIGHTS

Filed Aug. 25, 1932 3 Sheets-Sheet 2

Fig. 5.

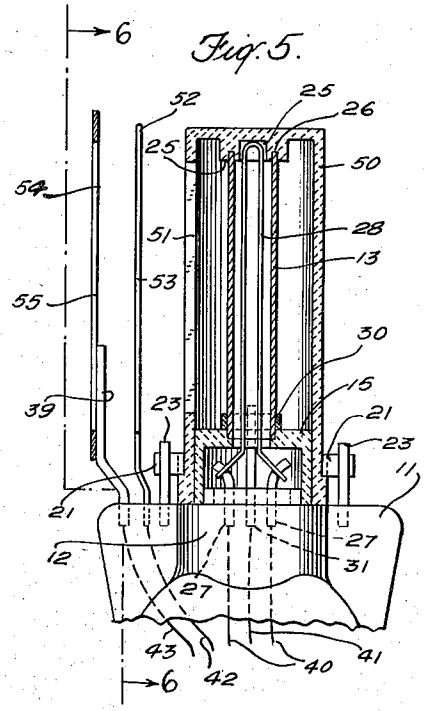


Fig. 7.

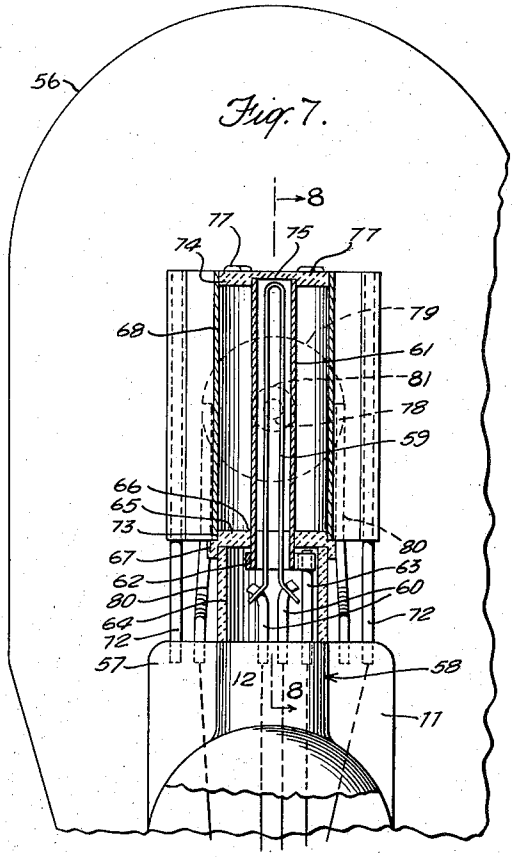


Fig. 6.

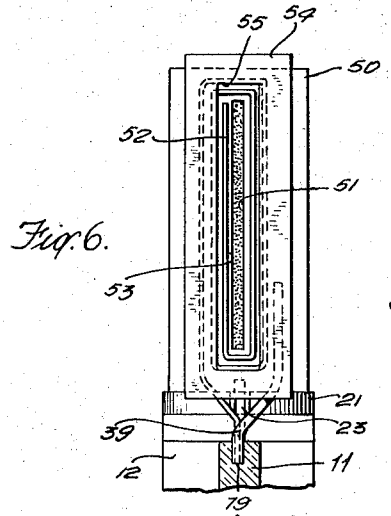


Fig. 8a

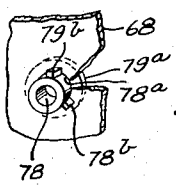


Fig. 8

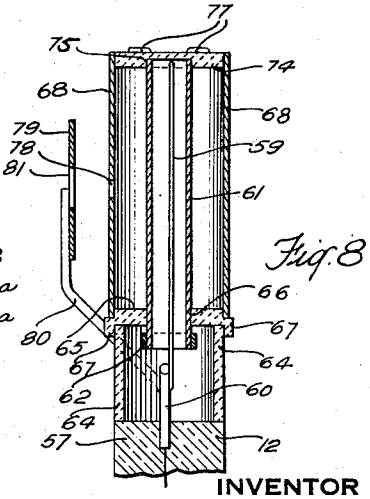
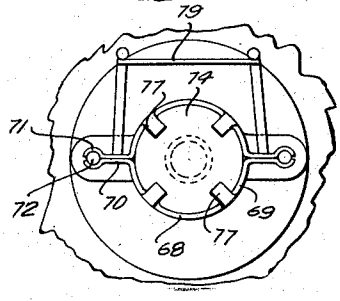


Fig. 9.



INVENTOR

Charles H. Braselton

July 14, 1936. C. H. BRASELTON 2,047,175

ELECTRIC LAMP FOR PRODUCING MODULATED LIGHTS

Filed Aug. 25, 1932 3 Sheets-Sheet 3

Fig. 10.

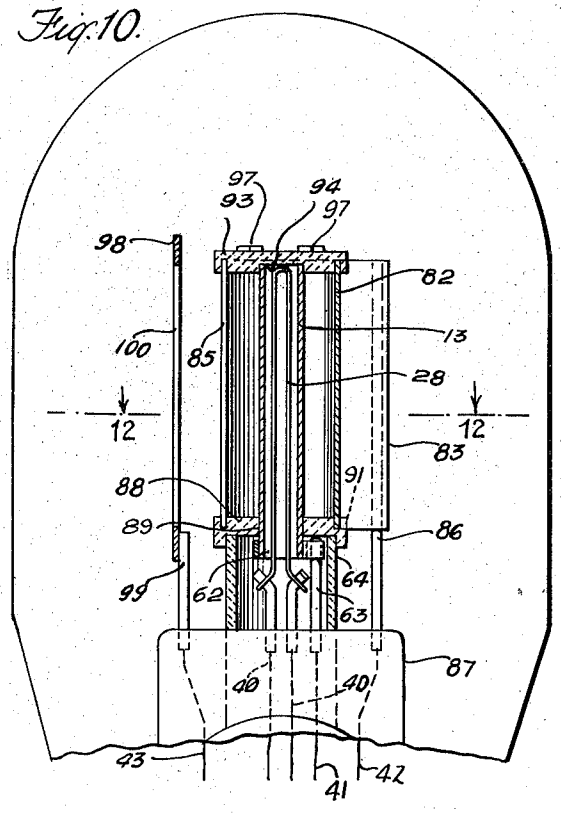


Fig. 11.

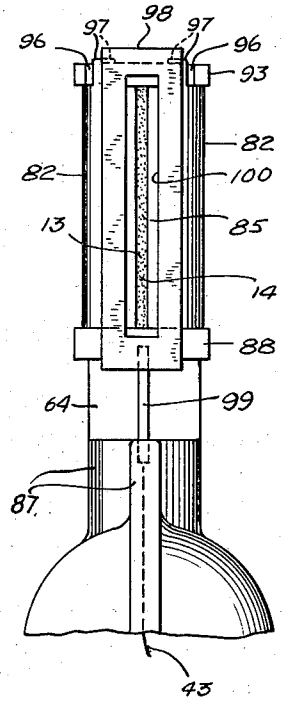
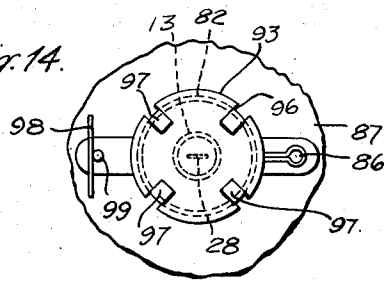


Fig. 14.



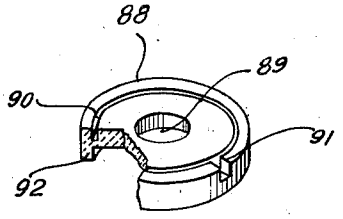
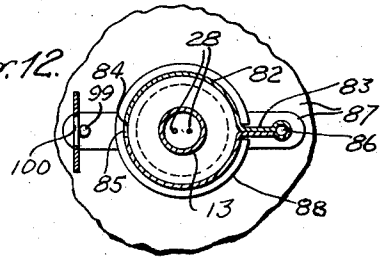


Fig. 13.

Fig. 12.



INVENTOR

Charles H. Braselton

Patented July 14, 1936

2,047,175

UNITED STATES PATENT OFFICE

2,047,175

ELECTRIC LAMP FOR PRODUCING MODULATED LIGHTS

Chester H. Braselton, New York, N. Y., assignor to Sirian Lamp Company, Newark, N. J., a corporation of Delaware

Application August 25, 1932, Serial No. 630,378

3 Claims. (Cl. 176—122)

This invention relates to electric lighting devices of the type which produces a modulated light for use especially in devices necessitating very rapid changes of intensity such as television receiving apparatuses.

One of the objects of the invention is to provide a modulated light in which the energy source for supplying the illumination is independent of the incoming wave signal.

Another object of the invention is to provide a modulating electric light in which a gaseous discharge is controlled by an electrode which is energized by the incoming signal.

A still further object of the invention is to provide a modulated electric light in which the light may be concentrated in a small spot thus increasing the intensity of the light.

Another object of the invention is to control the configuration of the light spot of a modulated electric light.

Other objects and objects relating especially to the method of constructing and assembling the various parts will be apparent as the description of the invention proceeds.

Several embodiments of the invention have been illustrated in the accompanying drawings in which:

Figure 1 is a sectional side elevational view of one form of lamp embodying the invention;

Fig. 2 is a front elevational view of the elements of Fig. 1;

Fig. 3 is a sectional plan view of the elements of Fig. 1;

Fig. 4 is a sectional rear view of the means for connecting the cathode of the structure of Fig. 1;

Fig. 5 is a sectional side elevational view of the elements of another embodiment of the invention;

Fig. 6 is a front elevational view of the elements of Fig. 5;

Fig. 7 is a sectional rear elevational view of still another modification of the invention;

Fig. 8 is a sectional side elevational view of the elements of Fig. 7;

Fig. 8a is a detail view in perspective of a slight modification of the control electrode of Fig. 8;

Fig. 9 is a plan view of the structure shown in Figs. 7 and 8;

Fig. 10 is a sectional side elevational view of still another embodiment of the invention;

Fig. 11 is a front elevational view of the elements of Fig. 10;

Fig. 12 is a sectional plan view of the construction of Fig. 10 taken on the line 12—12 of that figure;

Fig. 13 is a perspective view of one of the shields shown in Figs. 10 and 11; and—

Fig. 14 is a plan view of the elements of Figs. 10 and 11.

Referring now more specifically to the drawings the invention is shown in Fig. 1 as comprising a bulb 10 of transparent material such as glass, quartz, or the like with a press 11 formed integral with the bottom of the bulb and extending upwardly inside thereof in the usual manner of forming electric lamps. The press 11, however, is preferably provided with a circular enlargement 12 adjacent the center thereof the top of which is flush with the top of the press 11 and the purpose of which will be evident as the description proceeds.

A tubular cathode 13 formed of nickel or other suitable material and coated on its surface with electron emitting material 14 is mounted vertically adjacent the center of the bulb upon an insulating member 15 which has a hole 16 extending through it with a shoulder 17 to receive the lower end of the cathode. The electron emitting material 14 may be any of the well known materials used for that purpose such as the oxides of the alkaline earth group of metals or mixtures of such oxides held together with a suitable binder. The member 15 is preferably provided with a depending peripheral flange 18 which may rest upon the press 11 and if desired a suitable rim 19 may be provided on the press 11 at the central portion to secure the insulating member 15 in position on the top of the press and prevent horizontal displacement thereof. The member 15 may be made of any suitable insulating material such as quartz vitreous insulators, or the like, and preferably one which is opaque so as to prevent any light rays from passing through it.

A housing 20 formed of similar material in the shape of a hollow cylinder having a diameter slightly larger than the insulating member 15 is placed thereover to rest upon the top of the press 11. The housing 20 may be held in position upon the press 11 by means of a pair of semi-circular clamps 21 which surround the housing at the bottom thereof, resting upon a shoulder 22 provided for that purpose in the housing, and are welded to two short support rods 23 which are sealed in the press 11. The upper end of the housing 20 is provided with a wall 24 which has an inner raised portion 25 in the center thereof with a circular groove 26 in its face to receive the

upper end of the tubular cathode. This housing holds the cathode securely down upon the insulating member 15 and the insulating member 15 down upon the press 11.

A pair of short connecting rods 27 may be mounted in the press 11 at the center thereof being short enough to terminate under the insulating member 15 and to these rods I weld or otherwise secure the ends of a hairpin filament 28 which extends up through the inside of the cathode, the loop end terminating in a cavity 29 provided for that purpose in the upper wall 24 of the housing 20. The filament 28 may be coated with a suitable insulating material so as to prevent short circuiting between the adjacent legs of the filament and between the filament and cathode.

Electrical connection may be made to the cathode 13 by means of a band 30 of metal which may be welded around the lower end thereof with its ends bent out radially from the cathode, and these ends may be welded to a rod 31 which is sealed in the center of the press 11 between the connectors 27 and which may be bent outwardly and upwardly to reach the band 30, passing through a suitable groove 32 provided in the insulating member 15 as shown in Fig. 4.

A control electrode 33 which may be formed of a spiral coil of wire, as shown in Figs. 1 and 2, or which may be formed of wire mesh or merely a flat metal plate, as desired, is provided with a hole or open space 34 and may be positioned adjacent the housing 20 being mounted on a support rod 35 which is also sealed in the press 11. The housing 20 adjacent the control electrode 33 is provided with a hole 36 which may have any configuration depending on the configuration of the light desired, the hole 36 being preferably somewhat smaller than the opening 34.

On the outside of the control electrode 33 I provide a plate 37 which may be formed of nickel if desired although highly refractory metals such as tungsten and molybdenum may be used. The plate 37 acts as the anode for the device and is provided with a hole 38 in the center thereof which is preferably larger in diameter than the opening 34 in the grid 33 as the illumination in the opening 36 in the housing 20 is to be observed through the hole 38 in the anode. The anode may be supported upon a support rod 39 also sealed in the press 11. In order to make the electrical connections to the device a pair of wires 40 may be connected to the filament connectors 27, while a wire 41 may be connected to the cathode connector 31. Similarly a wire 42 may be connected to the control electrode support rod 35 and a wire 43 may be connected to the anode support rod 39.

With the elements thus assembled the bulb may be connected in the usual manner to a vacuum pump and an oven placed over it to raise the temperature of the bulb and associated parts while the pump is exhausting the air and other gases which may be present. During this time the filament is energized by passing a current through it so as to raise its temperature and heat up the associated parts, and as much of the occluded gases and vapors are removed from the elements of the device as possible. When all of the gases have been removed a small amount of ionizable gas such as neon may be admitted at a pressure preferably under 25 mm. of mercury. Other gases may be used such as argon, helium, krypton, and zenon, or mixtures of such gases, the monatomic gases being preferred. Also metal vapors, such as the vapors of mercury, caesium, and rubidium may be added to increase the conductivity of the gas and for color effects. The lamp may then be sealed off and is ready for use.

When the lamp as described is completed it may be connected in a circuit as indicated in Fig. 1. Thus the two filament leads 40 may be connected to the secondary 44 of a transformer 45, the primary 46 of which is connected to the source of alternating current supply. The wire 42 connected to the control electrode may be connected to the input circuit 47 which carries the incoming signal, the other side of the input circuit being connected through the biasing battery 48 to the cathode connecting wire 41. A B battery 49 or other source of plate potential may have its negative side also connected to the cathode lead wire 41 while the positive side may be connected to the wire 43 which forms the anode connector of the device.

When the lamp is connected in such a manner the filament is energized by current from the alternating source and heats the cathode up to electron emitting temperature. Inasmuch as there is a difference in potential between the anode and the cathode, electrons will move from the cathode to the anode but inasmuch as the housing 20 surrounds the cathode and shields it from the anode at all points, except at the opening 36 in the wall thereof, all of the electron stream will tend to pass through this opening in order to reach the anode. Inasmuch as the lamp is filled with an ionizable gas the gas is ionized by this electron stream and the result is an intense illumination appearing in the hole 36 as the ionic discharge passes through it to reach the plate. Similarly to the action of a vacuum amplifying tube the negative charge on the control electrode will tend to repel the discharge and cause it to return to the cathode, while a positive charge on the control electrode will speed the discharge on its way toward the anode, and thus variations of the potential of the control electrode caused by the incoming signal will vary the density of the discharge. Inasmuch as there is a hole 38 in the anode an observer can stand in front of the anode and look through it and through the opening 34 in the control electrode at the hole 36 which, as has been said above, will appear intensely bright as long as the control electrode is positively charged or at zero potential, and the illumination will fade out as the control electrode builds up on the negative side.

Such a lamp is especially desirable for use in television reproducing apparatus where a spot of modulated light is caused to move across the field of vision in any one of a number of different ways which are now the subject of considerable research and experimentation.

For use with certain types of television devices it may be desirable to have an elongated opening for the area of intense illumination and if so the construction of Figs. 5 and 6 may be used. Here the filament, cathode, and cathode supporting parts are identical with those already shown and described with the exception of the housing 50 which has in its front an elongated slot 51 instead of the hole as shown in the housing 20. The control electrode 52 is similar to the control electrode shown in Fig. 1 but has an opening 53 corresponding in shape to the opening 51 in the housing 50. In like manner the anode 54 comprises a plate with an elongated slot 55 therein

so that the slot 51 in the housing 50 may be seen through it.

In assembling the construction of Figs. 1 to 4 inclusive the filament is first welded to the support rod 27 and then the member 15 is placed over the filament. The cathode is placed over the filament and the cathode band 30 welded to its support rod 31. The housing 20 is then placed over the cathode and over the member 15 and the housing clamps 21 are welded to the support rods 23 to hold the whole unit in position. The control electrode and anode may then be mounted in position as indicated. The construction shown in Figs. 5 and 6 may be assembled in the same manner.

In Figs. 7, 8 and 9 I have shown another embodiment of the invention in which the insulating refractory housings 20 and 50 of Figs. 1 and 5 are eliminated and the control electrode itself becomes the housing for preventing the discharge between the cathode and anode except through a predetermined opening. This device is shown mounted in a bulb 56 having a press 57 somewhat similar to the press 11 of the preceding figures and having a similar circular extension 58 at the center thereof whose top is flush with the top of the press 11.

A heating filament 59 may be supported on a pair of support rods 60 which are sealed in the press 57 at about the center thereof and this heater may be surrounded by a cylindrical cathode 61 similar to the cathode 13 of the preceding figures and coated with electron emitting material in a similar manner. The lower end of the cathode 61 may be provided with a securing band 62 of metal which may be welded to a support rod 63 also sealed in the press 57 adjacent the filament supports 60. A sleeve 64 of insulating material having a diameter large enough to surround the cathode support rod 63 as well as the filament supports 60 is provided resting upon the surface of the enlarged portion 58 of the press 57. A disc 65 also made of insulating material may be placed on top of the sleeve 64, a suitable hole 66 being provided in the center thereof to receive the cathode while a flange 67 may also be provided in the outer periphery to fit over the upper edge of the sleeve 64.

I provide a control electrode 68 preferably of a refractory metal such as tungsten or molybdenum in a tubular form to surround the cathode. Thus a pair of plates 69 may be pressed to form a semi-cylindrical portion with a flange 70 at each side thereof. The two plates are placed together with the concave sides adjacent each other and the flanges may then be welded together to form a cylindrical control electrode with radially extending side flanges. The flanges 70 may be provided at their extreme edges with grooves 71 to fit a pair of support rods 72 which may be positioned in the press 57 at opposite ends thereof. The control electrode 68 may, therefore, be supported resting upon the insulating disc 65, a suitable groove 73 being provided to receive it on the periphery of the disc 65, by means of the support rods 72 to which the flanges 70 may be welded. This holds the disc 65 and the sleeve 64 securely in place upon the top of the press. The upper end of the control electrode 68 is closed by means of an insulating disc 74 which fits down inside of the electrode 68 and is provided with a recess 75 to receive the top of the cathode, thus spacing the cathode at the top from the control element. The disc 74 is held in place by suitable lugs 77 which may be formed on the upper edge of the control element 68 and which are then bent over on top of the disc 74 as shown.

The control element 68 may have a small hole 78 in the side thereof and an anode 79 may be placed directly in front of this hole and supported upon a pair of support rods 80 which may be sealed in the press 57 at each side of the sleeve 64. The anode is provided with a hole 81 which is larger in diameter than the hole 78 in the control element so that the intense light passing through this hole will be evidenced as viewed through the hole in the anode.

In assembling the device just described the filament is first welded to the support rods 60 and the cathode is then slipped over the filament and welded to the support rod 63. Then the sleeve 64 is placed over the cathode and filament upon the top of the press and also the disc 65 is placed over the cathode to rest on top of the sleeve, and the control element 68 is slipped down over the cathode, the support rods 72 passing through the grooves 71 provided for that purpose in the flanges 70. The control element is then welded in place by welding the flanges 70 to the support rods 72. This holds the insulating sleeve and insulating disc in position and the insulating disc 74 is then positioned on top of the cathode inside of the control element 68 and the flanges 77 bent over, which holds it in position and spaces the cathode from the control element.

The device just described works similarly to the devices of Figs. 1 to 6 inclusive. As the control element itself is also the shield it will prevent any discharge from passing to the anode except through the opening in the side thereof and hence the intense illumination will appear at this opening.

In some instances it may be desired to protect the edges of the opening 78 in the control electrode against the intense heat produced by the discharge passing therethrough. In Fig. 8*a* a construction to accomplish this purpose is shown in which the hole 78*a* in the control electrode is made somewhat larger with a slot 78*b* at one side thereof. A bushing 79*a* of some highly refractory non-metallic material may be inserted in the hole 78*a*, a suitable lug 79*b* being provided on the outer end of the bushing to hold it in place when the bushing is rotated in the hole. The hole through the bushing should have the same diameter as the hole 78 in the control electrode described above but as the bushing can stand a higher temperature than the metal of the electrode there is less danger of the edges of the opening melting or otherwise being destroyed by the heat or discharge.

If it is desired to have an elongated slot for the opening the construction shown in Figs. 9 to 14 may be employed. Here the press, cathode, and filament construction are the same and the sleeve 64 is employed to surround the filament and cathode support posts as in the construction just described. The control electrode 82, however, is formed of two plates which are bent in a semi-cylindrical form but which are provided with a flange 83 at one side only so that the edges of the semi-cylindrical plates where there is no flange form the opening 85 through which the light and discharge pass. The control element is supported upon one support rod 86 only, which is positioned at the extreme end of the press 87 opposite the anode end and to which the flanges 83 are welded similarly to the manner described in connection with Fig. 7. However, the

insulating disc 88 at the bottom is provided in addition to the hole 89 for the cathode with a suitable groove 90 in which the bottom of the control element may fit. A radial groove 91 in the side of the member 88, (see Fig. 13), communicating with the groove 90 permits the flanges 83 to extend outwardly toward the support rod 86. The disc may also have a depending flange 92 for fitting over the sleeve 64. This construction holds the two sides of the control element firmly and prevents warping due to variations of heat and cold so that the slot 85 through which the discharge passes will not open or close.

The top of the control element is held in a similar way by a disc 93 which is provided with the grooves 90 and 91, shown in the disc 88, and a recess 94 in the center to receive the upper end of the cathode. The disc 93 is also provided with a plurality of notches 96 into which lugs 97 attached to the control element may pass and be bent over the top of the disc thereby holding the disc securely to the control element and spacing the cathode therefrom at the top.

The anode may comprise a plate 98 mounted upon a support rod 99 which is sealed in the press 87 opposite to the support rod 86. The plate 98 may be provided with an elongated slot 100 which is slightly larger than the slot 85 in the control element.

If desired the opening through the control electrode may be provided with refractory edges to prevent destruction by the intense heat similarly to the construction described in connection with Fig. 8*a*.

The elements of this device are assembled similarly to that shown in Figs. 7, 8, and 9 and no description of the assembly thereof is believed to be necessary.

It will be seen from the above that I have provided a lamp the lighting energy of which is obtained from a source entirely independent of the incoming modulation signal and that the light produced by the lamp will be varied in accordance with a very minute voltage modulation which is impressed upon a suitable control electrode. This is a great advantage over lighting devices where the energy for producing the light is derived from the modulating light signal inasmuch as in the present invention the intensity of the light may be enormously increased over any of these prior art devices. It is also possible to eliminate the necessity of a powerful incoming modulated signal as the control element of my device will respond to very minute changes in incoming voltage and hence it is not necessary to amplify an incoming signal as for instance a television signal to any great extent thereby producing a more true reproduction of the signal as it eliminates the inherent distortion usually accompanying large amplification.

In the several embodiments of the invention I have shown one form of the anode as comprising a plate of metal but it will be understood that any metallic electrode may be used to act as an anode such as a single wire, for instance, which is positioned in front of the opening through which the discharge passes. It is desirable, however, to make the anode large enough so that it will not overheat inasmuch as the temperature thereof is raised considerably by bombardment and a small wire, for instance, may become white hot when subject to the discharge. In like manner the control electrode of Figs. 1 to 6 inclusive may be made of wire mesh if desired or formed of a plate, the important requirements being that the control electrode be near the opening through which the discharge passes and large enough to affect the potential of the region immediately adjacent to such opening. When the filament has been shown as connected to the secondary of a transformer and perhaps preferably adapted to operate on a low voltage it will be evident that it may be designed to operate on any desired voltage as high as 110 or higher.

While the invention has been shown and described particularly in connection with a lamp used for television reproduction it is to be understood that the invention is not limited to television use but may be employed wherever it is desired to modulate a source of light as for sound-on-film recording or any type of signal work.

Many modifications of the invention may be resorted to without departing from the spirit thereof and I do not, therefore, desire to limit myself to what has been shown and described except as such limitations occur in the appended claims.

What I desire to claim and secure by Letters Patent is:

1. In a device of the class described an envelope, a press within said envelope, a cathode mounted on said press, means to heat said cathode, an anode spaced from said cathode, a control electrode positioned between said anode and cathode, and a shield between said cathode and anode, and cathode and control electrode, and having a small opening in the vicinity of said control electrode.

2. In a device of the class described an envelope, a press within said envelope, a cathode mounted on said press, means to independently heat said cathode, a shield completely surrounding said cathode only, said shield having a small opening in the side thereof, an anode positioned in front of said opening, a control electrode positioned between said anode and cathode, and an ionizable gas within said envelope.

3. In a device of the class described an envelope, a press within said envelope, a cathode mounted upon said press, independent means to heat said cathode, a shield completely surrounding said cathode, said shield having a small aperture in one side thereof, an anode positioned directly in front of said aperture, said anode having an opening therein slightly larger than the aperture in said shield and in alignment therewith, and an electrostatic control electrode positioned between said anode and cathode, and between said anode and shield, and removed slightly from the common axis of the opening in said anode and the aperture in said shield, and an ionizable gas within said envelope.

CHESTER H. BRASELTON.