Aug. 20, 1935. S. C. WHITMAN 2,011,743

RECORDING LAMP

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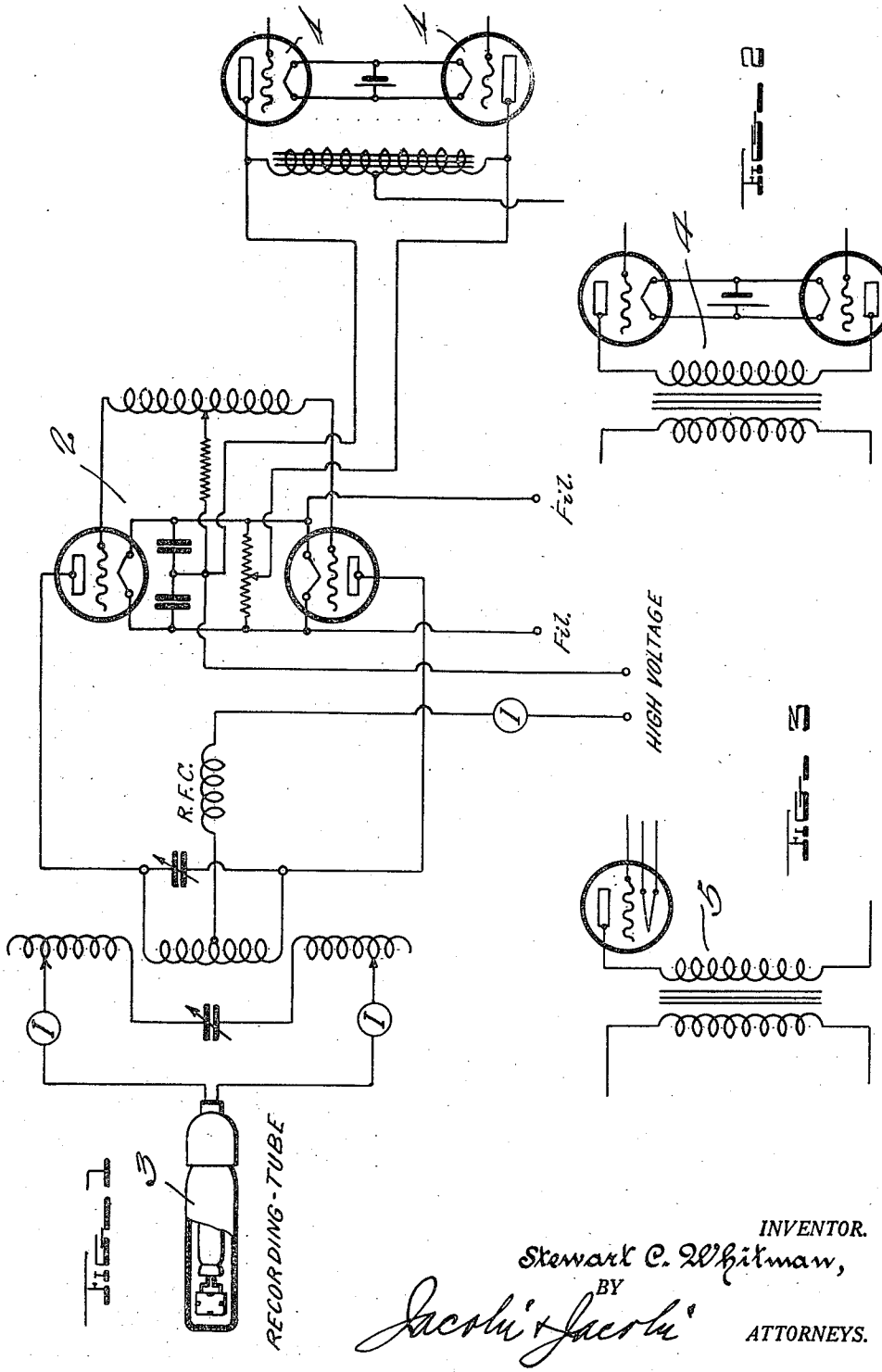

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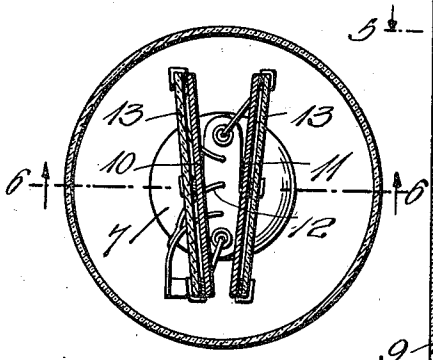
FIG. 4

FIG. 5



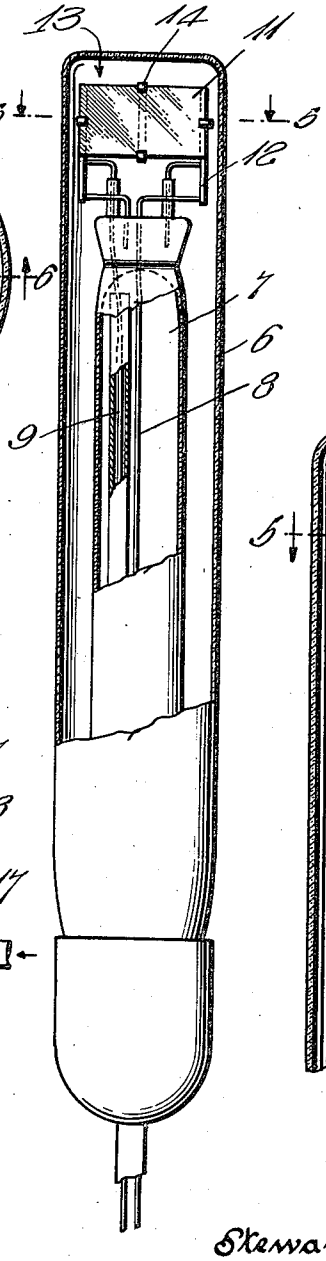
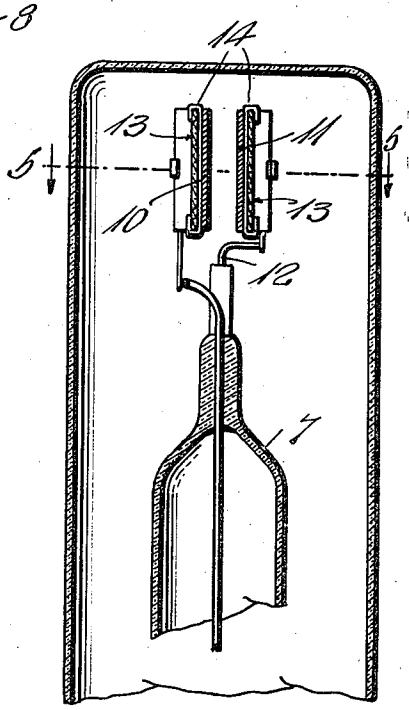


FIG. 6



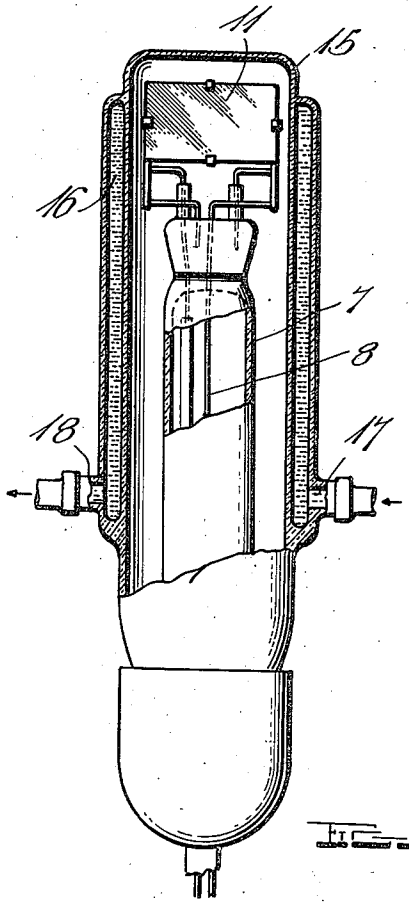


FIG. 7

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FIG. 8

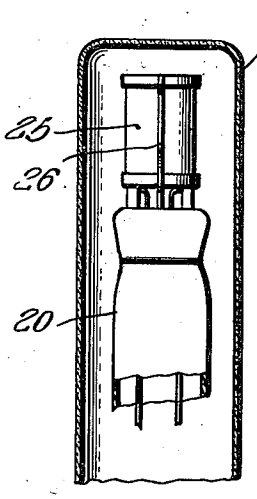


FIG. 9

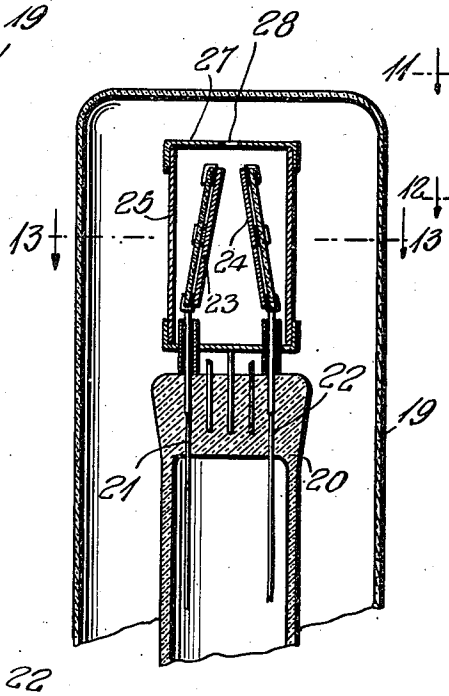


FIG. 10

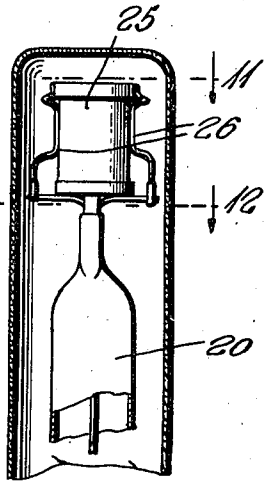


FIG. 12

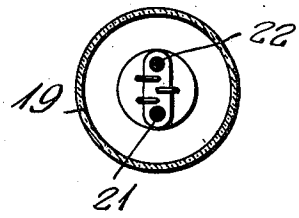
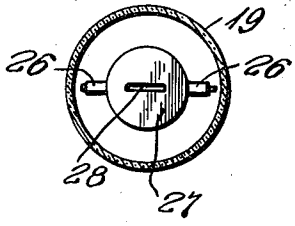


FIG. 11



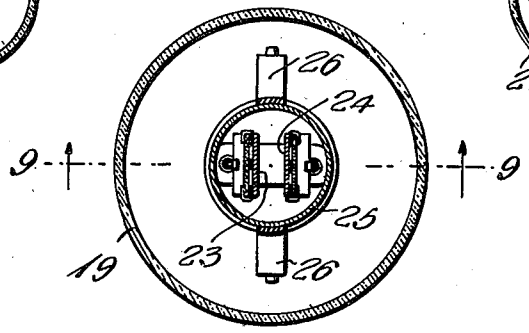


FIG. 13

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FIG. 14

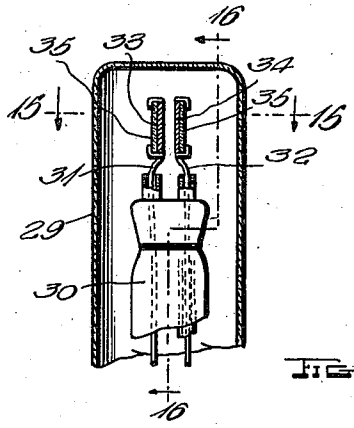


FIG. 15

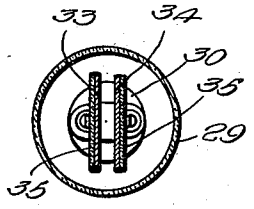


FIG. 16

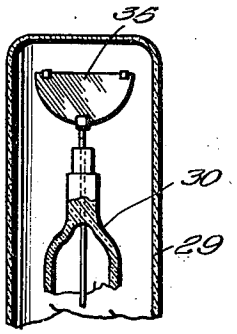


FIG. 17

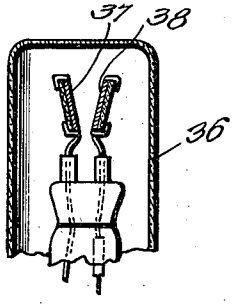


FIG. 18

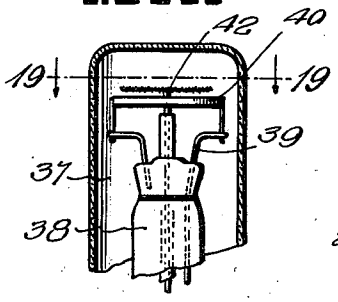


FIG. 19

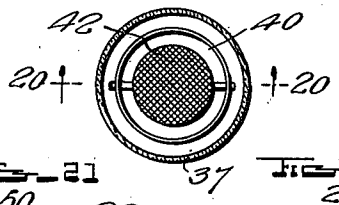


FIG. 20

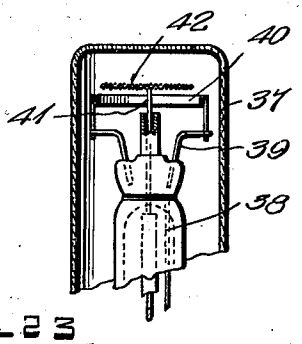


FIG. 21

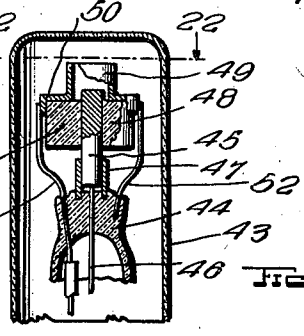


FIG. 22

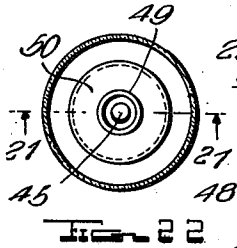


FIG. 23

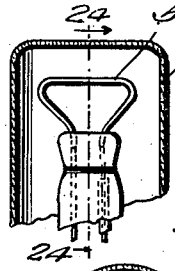


FIG. 24

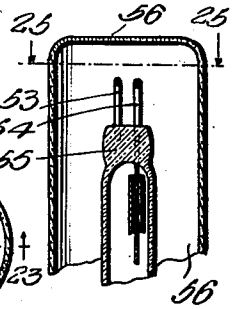


FIG. 25

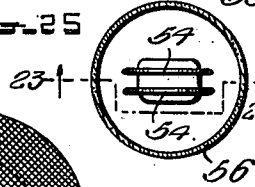


FIG. 26

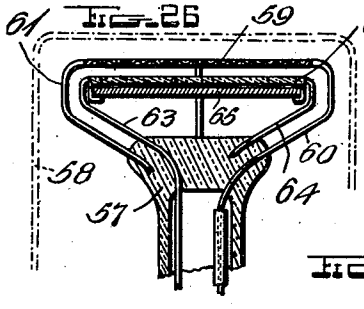
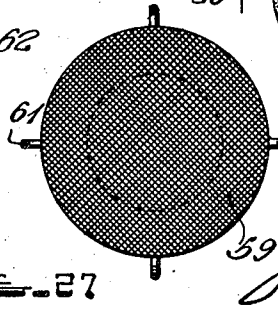


FIG. 27



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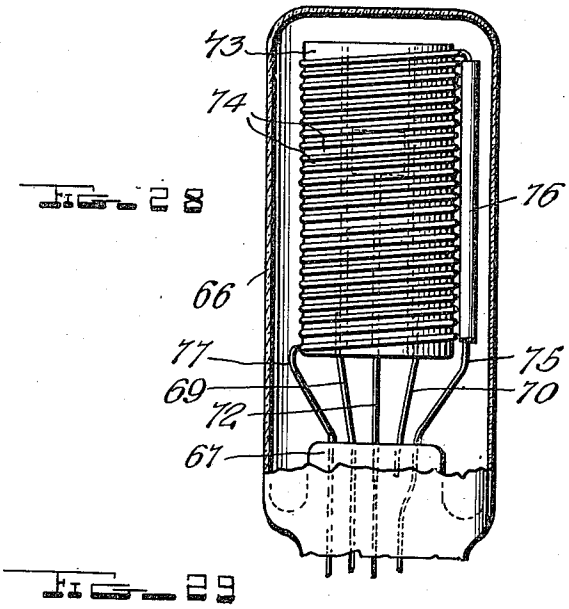


FIG. 28

FIG. 29

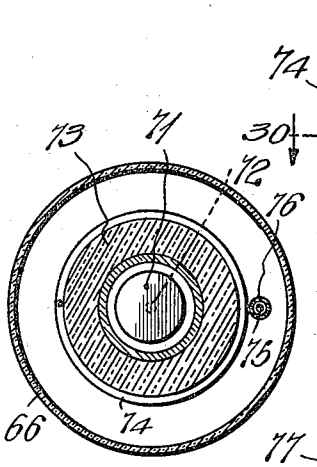


FIG. 30

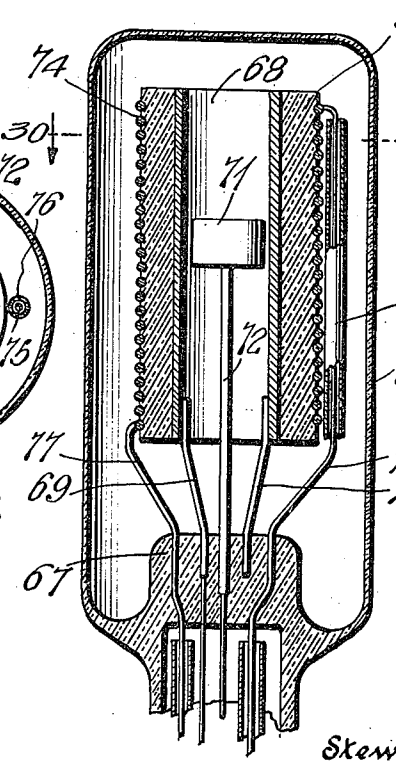
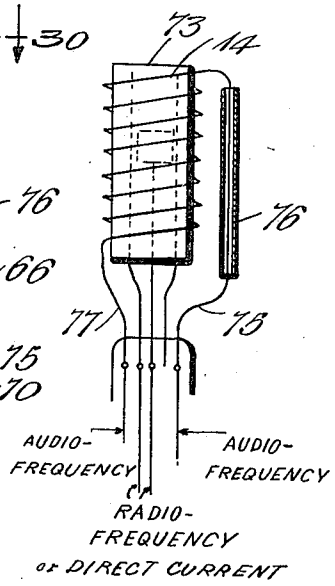


FIG. 31



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Patented Aug. 20, 1935

2,011,743

UNITED STATES PATENT OFFICE

2,011,743

RECORDING LAMP

Stewart C. Whitman, New York, N. Y.

Application January 7, 1931, Serial No. 507,220

11 Claims. (Cl. 176—122)

This invention relates to new and useful improvements in the art of recording sound on film and more particularly to a lamp operated by radio frequency energy to accomplish the result, the primary object of the invention being to provide a lamp of the character mentioned operated through a process which will result in materially improved recording.

A further object of the invention resides in the utilization of a process wherein modulated radio frequency energy is impressed on a recording lamp for the purpose of recording sound at a higher cyclage than its input.

Still another object of the invention resides in the provision of a recording lamp eliminating the use of a filament but using two elements for concentrating the light rays.

A still further object of the invention resides in the provision of a lamp which will give longer life and be capable of greater abuse than is true of the present known glow lamp.

With these and numerous other objects in view my invention consists in the novel features of construction, combination and arrangement of parts as will be hereinafter referred to and more particularly pointed out in the specification and claims.

In the accompanying drawings forming a part of this application,

Figure 1 is a schematic diagram illustrating the output of an audio frequency amplifier used as the input to the oscillator-modulator circuit for delivering radio frequency energy to my improved lamp.

Figure 2 is a slight modification wherein is illustrated a transformer output of an audio frequency amplifier which may be used in connection with my lamp.

Figure 3 is a still further modification illustrating a single tube audio frequency output which may be used.

Figure 4 is a side elevation, with parts in section and parts broken away of the preferred form of my improved lamp.

Figure 5 is a horizontal section therethrough as seen on the line 5—5 of Figure 6.

Figure 6 is an enlarged vertical section through the lamp as seen on the line 6—6 of Figure 5.

Figure 7 is a side elevation partly in section, of a slight modification of the preferred form of the lamp illustrating a water jacket in connection therewith.

Figure 8 is a fragmentary vertical section through a slightly modified form of the lamp.

Figure 9 is an enlarged fragmentary vertical section therethrough.

Figure 10 is a vertical section taken at right angles to Figure 8.

Figure 11 is a horizontal section as seen on the line 11—11 of Figure 10.

Figure 12 is a similar view as seen on the line 12—12 of Figure 10 looking in the direction of the arrows.

Figure 13 is a horizontal section as seen on the line 13—13 of Figure 9.

Figure 14 is a vertical section of a still further modified form of lamp, with parts broken away.

Figure 15 is a horizontal section as seen on the line 15—15 of Figure 14.

Figure 16 is a vertical section as seen on the line 16—16 of Figure 14.

Figure 17 is a still further modified form of the lamp illustrating the plate of Figures 14 to 16, inclusive, disposed at an angle with respect to one another.

Figure 18 is a fragmentary vertical section of a further modification of the lamp.

Figure 19 is a horizontal section therethrough as seen on the line 19—19 of Figure 18.

Figure 20 is a vertical section as seen on the line 20—20 of Figure 19.

Figure 21 is a vertical section through a still further modification of the invention.

Figure 22 is a horizontal section as seen on the line 22—22 of Figure 21.

Figure 23 is a vertical section of another modified form of lamp.

Figure 24 is a vertical section therethrough as seen on the line 24—24 of Figure 23.

Figure 25 is a horizontal section as seen on the line 25—25 of Figure 24.

Figure 26 is a vertical section through a further modification of the lamp structure.

Figure 27 is a plan view thereof, with the glass envelope removed.

Figure 28 is a vertical section partly in elevation of still another modified form of lamp.

Figure 29 is an enlarged vertical section through Figure 28.

Figure 30 is a horizontal section as seen on the line 30—30 of Figure 29, and

Figure 31 is a diagrammatic view of the lamp shown in Figures 28 to 30, inclusive.

In describing the invention I shall refer to the drawings in which similar reference characters designate corresponding parts throughout the several views.

The numeral 1 designates the output of a push pull amplifier from which the impulses are con-

veyed to the oscillator-modulator system designated by the numeral 2. From this system the energy is transmitted as radio frequency to my improved recording tube, designated in Figure 1 generally by the numeral 3.

It will be seen from the schematic diagram shown in Figure 1 and referred to hereabove, that instead of the usual steady D. C. current with the modulating A. C. signal, my improved process supplies up to a 50,000 cycle steady oscillating current to the recording tube and superimposes the speech frequencies thereon. As a result of this unusual and amazing improvement, valuable and unexpected results are accomplished. For instance, the current due to this high frequency supply results in much lower light value when unmodulated. The voltage is high allowing much greater modulation. The result on the film is sharp contrast. The benefit of this contrast may be noted all the way through the reproducing schedule. The photo-electric cell is not strained, the amplification may be kept lower and ground or surface noises lessened or substantially eliminated. All these things are accomplished without impairment of quality.

It is a well known fact that in the present D. C. operating glow tube, the output is linear, due to the space charge conditions established in the tube by the high value D. C. exciting current. There is always a high abnormal cathode fall present in these tubes. The result is the same as attempting to use an amplifier tube with a positive bias. Further, it is necessary to choose the A. C. voltage impressed so that a maximum light signal will strike the film at average input. Consequently, during high peaks the glow lamp is repeatedly being varied to zero. It is a characteristic of these tubes that the glow is maintained considerably below the striking potential. In other words the voltage must rise to a high value before the glow recommences. If the input signal level is lowered the contrast is poor. If the current through the glow lamp is raised the linearity of response suffers.

With my improved system, the recording lamp may be designed to operate most successfully under the influence of the modulated high frequency discharge. The exciting current renders the recording lamp completely free from lag, impulses of all frequencies are faithfully followed, and their value maintained when translated into light. The brilliance obtained is unmatched.

Referring to Figure 2 I have illustrated a transformer output of an audio frequency amplifier designated by the numeral 4 which may be used in substitution for the output push pull amplifier of the type shown in Figure 1. In Figure 3 is illustrated a single tube audio frequency output which may be used, the same being designated by the numeral 5. I have shown these two modifications in Figures 2 and 3 merely to illustrate certain changes which may be made in this output of the amplifier but it will be understood that I do not wish to be limited to any particular form or type such as shown herein to generate the radio frequency energy. Any form of amplifier may be used and any form of means for generating radio frequency energy may be utilized. The principal feature of the invention, as would appear obvious from the foregoing, is the utilization of audio frequency energy impressed on radio frequency energy for use in association with a recording lamp to concentrate rays on a photo-sensitized motion picture film.

In Figures 4 to 6, inclusive, I have disclosed the preferred form of my invention wherein the vacuum envelope is designated by the numeral 6. Within the envelope 6 is the glass mounting stem 7 through which the leads 8 and 9 connect respectively to the elements 10 and 11, which are respectively, the anode and cathode. These elements 10 and 11 are held in vertical supported position by means of the supporting members 12, as many of such supporting members being provided as may be found desirable and necessary. The elements 10 and 11 are of metallic plate-like formation, disclosed rectangular in the drawings, although other shapes or designs may be used and the same are covered on their outer faces with plates 13 formed of mica or other similar suitable material, the plates 13 being held to the plates 10 and 11 by means of the clamps 14. In supporting these plate-like elements 10 and 11 I prefer to dispose of same in vertical converging planes, as clearly shown in Figures 5 and 6 of the drawings. Through this medium, the radio frequency impulses traveling longitudinally back and forth between the plates will take such a course as to discharge the high frequencies across the ends of the plate at the converging ends and the low frequencies are discharged at the diverging portions of the plates. The intermediate frequencies between the highest and lowest frequencies are, obviously, discharged between the intermediate portions of the elements 10 and 11. In this manner the full band of frequencies are discharged and correspondingly recorded.

In constructing the lamp described hereabove, the air is exhausted and the lamp filled with a gas of a type such as argon, helium, neon and/or any combinations thereof or any other gases of a similar type that may be used for purposes of recording, for the best ultra violet ray results. A magnesium "getter" is used in the course of construction of the lamp and at times, when found desirable, mercury is used to assist the glow from the lamp. The lamp is bombarded and sealed in the usual or any preferred manner. As to the quantity of gas or gases used or the proportions of gas or gases used in the construction of this lamp, I may state that this will depend primarily upon the size of the tube or lamp being constructed.

In Figure 7 I have shown a slight modified form of the invention wherein the identical lamp shown in Figures 4 to 6 is used except for the vacuum envelope. In this particular form of the invention the vacuum envelope designated by the numeral 15 is provided with a cooling chamber 16 encircling the same. The inlet to this chamber 16 is designated by the numeral 17 and the outlet by the numeral 18. A cooling medium of any desired or preferred character is used in connection with this chamber, such as water, oil, air or any other medium capable of dissipating heat. Otherwise, the lamp is the same, as stated, as the construction shown and above described in connection with Figures 4 to 6, inclusive.

In Figures 8 to 13, inclusive, I have shown a still further modified form of the invention. In this form of the invention the vacuum envelope is designated by the numeral 19. The mounting stem is designated by the numeral 20, the same supporting the leads 21 and 22 which in turn connect with the elements 23 and 24, respectively, which are constructed similar to the element construction illustrated in Figures 4 to 6, inclusive and above specifically described. These ele-

ments 23 and 24 are mounted on upwardly converging planes, as clearly shown in Figure 9 of the drawings so that there is a narrow space between the upper terminal edges thereof. The purpose of this has been fully set forth in connection with the form set forth in Figures 4 to 6, inclusive. However, in these Figures 8 to 13, inclusive, the convergency of the plates is on a plane at right angles to the plane of convergency of the plate in Figures 4 to 6, inclusive.

One of the principal features of distinction between this form of the invention and that shown in Figures 4 to 6, previously described, is the use and association with the elements of a light ray concentrating means. In this form of the invention this means is disclosed by the use of a cylinder 25 which is supported above the upper end of the mounting stem 22 by any number of desirable supports, the supports being shown and designated in the drawings by the numeral 26. The upper cap of the cylinder 25 which is designated by the numeral 27 is slotted centrally as shown by the numeral 28. Through this slot 28 the light rays are directed. The elements in the position shown concentrate the light rays and this concentration is facilitated through the medium of the slot 28, so that the light rays so concentrated and directed may be passed through an optical system without the utilization of any mechanical means.

In the form of the invention shown in Figures 8 to 13, inclusive, it will be noted that the elements 23 and 24 which are of plate-like formation are of substantially equal areas. The light ray concentrating means which is in the form of a cylindrical member 25, forming an enclosure for the elements 23 and 24 is an electrode and constitutes a control means for the rays of light emitted from said elements 23 and 24.

As shown in Figs. 9 and 13, the cylinder 25 and its caps are metal. One way of using the cylinder or electrode 25 is shown in Figure 9, without an external electrode connection, and it will then accumulate a space charge during operation which will serve to control the glow.

In Figures 14 to 16, inclusive, I have shown a still further modified form of the invention. In this form of the invention the vacuum envelope is designated by the numeral 29 and therewithin is the mounting stem 30 through which projects the leads 31 and 32 supporting respectively the elements 33 and 34. These leads 31 and 32 supply energy to the plates or elements 33 and 34 as well as support the latter, as is clearly seen in Figures 14 and 16. These elements 33 and 34 are plates preferably semi-circular in plan covered by similarly designed mica plates 35. These plates 35 may be formed of any other material than mica so long as the same form an insulation for the metallic elements 33 and 34. In this form of the invention the elements are in vertical parallel planes, as clearly seen in Figures 14 and 15.

In Figure 17 I have shown a still further modified form which, however, is identical in general structure as the form shown in Figures 14 to 16, inclusive, except that these plates or elements are disposed in downwardly converging planes. In this form the envelope is designated by the numeral 36 and the elements are designated generally by the numerals 37 and 38. As stated, the construction of these elements is the same as disclosed in Figures 14 to 16, inclusive, the distinction being simply in the disposition of these elements 37 and 38 on downwardly converging planes, the purpose of which appears obvious, in view of the foregoing description.

In Figures 18 to 20, inclusive, I have shown a modified form of the invention wherein the glass envelope is designated by the numeral 37 and the mounting stem by the numeral 38. Extending from the mounting stem 38 are the supports 39 which carry an annular element 40. A lead wire 41 is supported on the stem 38 at the outer end of which is carried a screen 42. This screen 42 is of disk-like design and constitutes the second element of the lamp. The disk-like screen 42 is concentric with the annular element 40 and is in a plane slightly above the horizontal plane of said element 40, as appears obvious from Figures 18 to 20.

In Figures 21 and 22, I have shown a still further modified form of the invention wherein the glass envelope is designated by the numeral 43 in which is disposed the mounting stem 44. Projecting from the upper end of the mounting stem is the metal stem 45 which forms the cathode of the lamp. The lead wire to this cathode is designated by the numeral 46 and a collar 47 is mounted on the mounting stem 44 to support this cathode, as clearly shown in Figure 21. Surrounding the cathode 45 is a cylindrical insulator 48 and an anode in the form of a collar or sleeve 49 is mounted on the upper face of this insulator. The collar 49 has a base flange thereon which rests on the upper face of the member 48 and has an integral depending flange 50 which encircles the outer periphery of the insulator 48, as clearly shown in Figure 21. The flange 50 is engaged with the lead wire 51 which acts also as one support therefor and a support or supports 52 are also provided to sustain the collar 49 in proper position. It will be seen that in this form of lamp, the light rays are concentrated and directed through the collar-like anode 49, the advantage of which appears obvious.

In Figures 23 to 25, inclusive, I have shown a still further modification of the invention wherein the two elements of the lamp are in the form of wires respectively designated 53 and 54, the same being supported on the mounting stem 55 within the glass envelope 56. These elements 53 and 54 are looped in substantially triangular formation so that the base of the substantially triangular design thereof is facing outwardly, as clearly shown in Figures 23 and 25. The glow from these elements follows the wires 53 and 54 and form substantially a set of lights to be projected from the lamp.

In Figures 26 and 27, I have shown a further modified form of the invention wherein the numeral 57 designates the mounting stem enclosed within the glass envelope 58. The anode is in the form of a disk-like screen 59 supported uppermost and in a horizontal position by the lead wire 60 and the support 61. The cathode is of disk-like formation designated by the numeral 62, same being supported by the lead wire 63 and the support 64. This cathode is in a horizontal plane just below the anode 59, as shown in Figure 26 and the bottom face thereof is covered with a mica plate 65. Other material than mica may be used if found desirable and I do not wish to be limited to the use of a mica plate, since any form of insulation may be used for the purpose. In this form of the invention the ray of light is projected from the entire area surrounded by the circumference of the screen-like anode 59.

In Figures 28 to 31, I have shown a materially

modified form of the invention wherein the glass envelope is designated by the numeral 66, and the mounting stem by the numeral 67. A metal tube 68 is provided forming an anode the same being supported by the lead wire 69 and supporting elements 70, as clearly shown in Figure 29. Disposed centrally of this tube 68 and concentric therewith is a cathode 71 which is in the form of a short cylinder supported on the lead wire 72. Fitting tightly around the anode 68 is a tubular insulator 73 which is provided on its outer periphery with a spiral groove extending from the upper to the lower end thereof. Mounted in this spiral groove is a continuous winding of wire 74. One end of the wire connects with the lead 75 which is extended downwardly along the side of the tube 73 and insulated from the winding by the insulator tube 76. The other end of the winding 74 connects with the lead 77. As shown in the diagrammatic view, Figure 31, the leads 77 and 75 connect with audio frequency while the leads 69 and 72 connect with radio frequency impulses or may connect with direct current.

This tube is one wherein audio frequency impulses are passed through a coil around the path of a discharge actuated by radio frequency impulses or by direct current, the audio frequency passing around a coil of wire which matches the impedance outward of an amplifier. The advantage of such a construction appears obvious.

From the foregoing description of the construction of my improved lamp and the various modifications thereof, the method of assembly and application to use will be readily understood and it will be seen that I have provided a simple, comparatively inexpensive and efficient means for carrying out the objects of the invention.

While I have particularly described the elements best adapted to perform the functions set forth, it is obvious that various changes in form, proportion and in the minor details of construction and various other modifications may be made, without departing from the spirit or sacrificing any of the principles of the invention.

Having thus described the invention what is claimed is:

1. In a gaseous conduction lamp, a vacuum envelope, a mounting stem therein, a pair of mutually converging plate-like elements supported thereon, and means supported from said stem partially enclosing said elements and confining the rays of light projected therefrom.

2. In a recording lamp of the gas discharge type, including a transparent envelope and a mounting stem therein, a pair of flat electrodes of substantially equal areas mounted in diverging planes on said stem and having their outer surfaces insulated, an opaque cylindrical control element surrounding the aforesaid electrodes and coaxial with said stem.

3. In a recording lamp of the gas discharge type, including a transparent envelope and a mounting stem therein, a pair of flat electrodes of substantially equal areas mounted in diverging planes on said stem, and having their outer surfaces insulated, and a hollow cylindrical element enclosing the aforesaid electrodes and controlling the light rays emitted from the latter.

4. In a recording lamp of the gas discharge type, including a transparent envelope and a mounting stem therein, a pair of flat electrodes of substantially equal areas mounted in diverging planes on said stem and having their outer surfaces insulated, and a hollow cylindrical element provided with a narrow rectangular opening centrally disposed in its outer end face, said cylindrical element completely surrounding the first mentioned electrodes and controlling the light rays emitted from the latter and being substantially coaxial with said mounting stem.

5. In a recording lamp of the gas discharge type, including a transparent envelope and a mounting stem therein, a pair of flat electrodes of substantially equal areas mounted in upwardly converging planes on said stem and having their outer surfaces insulated, and a hollow cylindrical element provided with a narrow rectangular opening in its top face in registration with the space between the upper converging ends of said flat electrodes, said cylindrical element completely surrounding the first mentioned electrodes and controlling the light rays emitted from the latter and being substantially coaxial with said mounting stem.

6. In a recording lamp of the gas discharge type, including a transparent envelope and a mounting stem therein, a pair of flat electrodes of substantially equal areas mounted in upwardly converging planes on said stem and having their outer surfaces insulated, a hollow cylindrical element, an upper cap member and a lower cap member adapted to engage the respective ends of said cylindrical element, said lower cap member being mounted on said mounting stem and carrying said cylindrical element, said upper cap member being carried on the upper end of said cylindrical element and being centrally slotted, said flat electrodes being mounted inside said cylindrical element and being entirely surrounded thereby and said flat electrodes terminating upwardly on opposite sides of the slot in said upper cap member.

7. In a recording glow lamp, an envelope, a pair of flat spaced electrodes of substantially equal areas mounted in said envelope from one portion thereof in planes mutually converging away from said mounting portion, individual mutually insulated leads connected respectively to said electrodes and extending outside said envelope, and a hollow cylindrical metallic element closed at both ends by base members and being mounted by one of its base members from said mounting portion of said envelope so that it entirely surrounds said electrodes, the other of said base members of said cylindrical element being slotted on a line parallel to the ends of said electrodes which are closest together and in register with the space therebetween.

8. In a recording glow lamp, an envelope, a mounting stem therein, a pair of flat spaced electrodes each mounted from one end on said mounting stem to mutually converge away from their mounting ends, said electrodes being mounted symmetrically with reference to a plane substantially parallel to the axis of said mounting stem, and a hollow cylindrical metallic element having base members closing both ends thereof and mounted from said mounting stem so that it entirely surrounds said electrodes, said cylindrical element being mounted substantially coaxially with said mounting stem, and being slotted substantially in said plane parallel to said axis of said mounting stem.

9. In a recording glow lamp, an envelope, a mounting stem therein, a pair of flat spaced electrodes each mounted from one end on said mounting stem to mutually converge away from their mounting ends, said electrodes being mounted symmetrically with reference to a plane substan-

tially parallel to the axis of said mounting stem, and means for maintaining an equipotential surface entirely surrounding said electrodes, said means being symmetrical with reference to the axis of said mounting stem and being slotted substantially in said plane parallel to the axis of said mounting stem.

10. In a recording lamp of the gas discharge type, a transparent envelope, a mounting stem in said envelope, a pair of flat spaced electrodes each mounted from one end on said mounting stem to mutually converge away from their mounting ends, the outer surfaces of said electrodes being electrically insulated, and a hollow metallic element completely surrounding said electrodes and being apertured in register with the space between the ends of said electrodes which are closest together.

11. In a recording lamp of the gas discharge type, a transparent envelope, a mounting stem in said envelope, a pair of flat spaced electrodes each mounted from one end on said mounting stem to mutually converge away from their mounting ends, the outer surfaces of said electrodes being electrically insulated, and a hollow element formed of electrically conducting material completely surrounding said electrodes and being apertured in register with the space between the ends of said electrodes which are closest together.

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