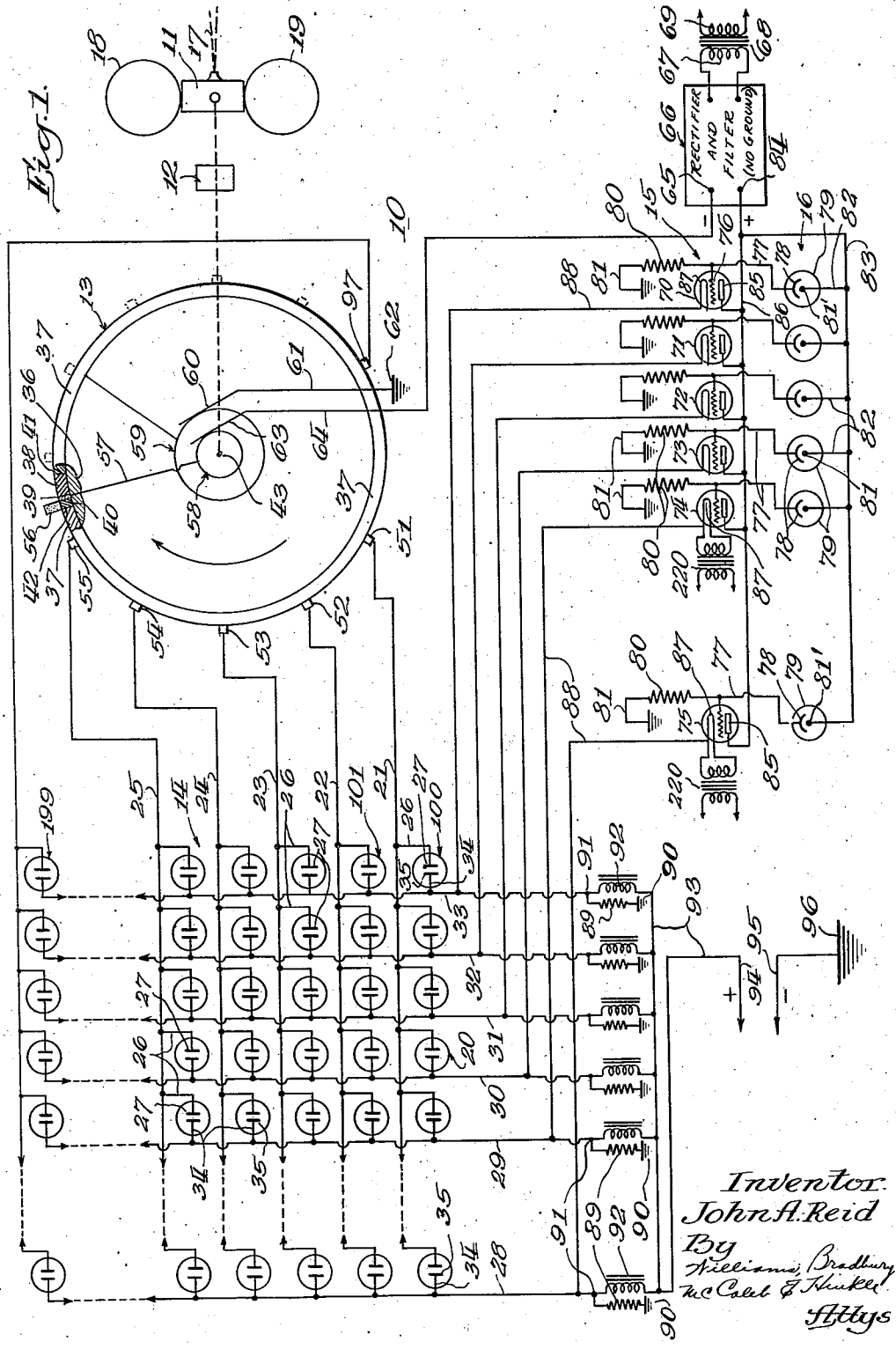
Nov. 12, 1940. J. A. REID 2,221,109

ELECTRIC SIGN SYSTEM

Filed Feb. 23, 1938 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

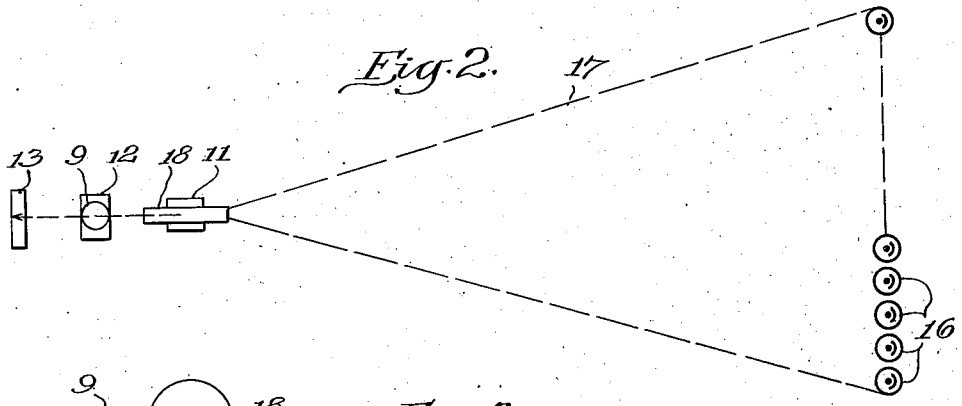


Fig. 3.

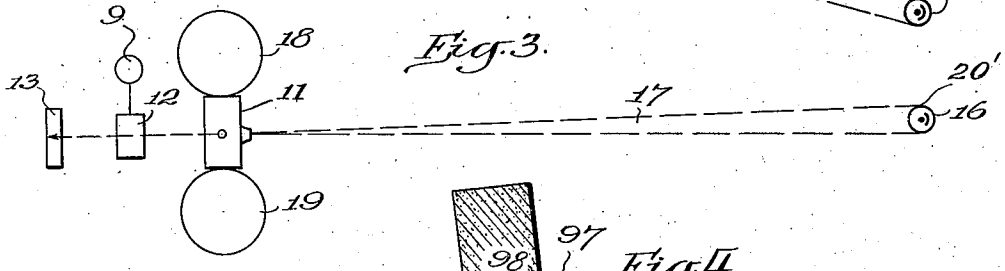


Fig. 4.

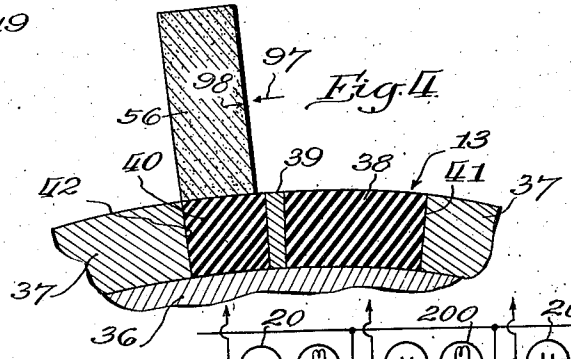


Fig. 5.

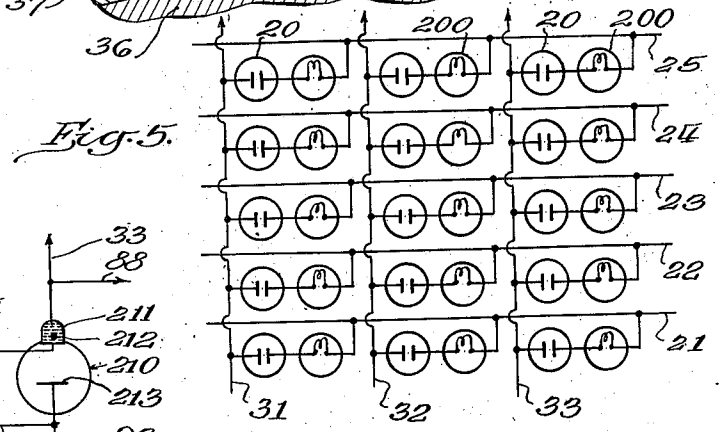
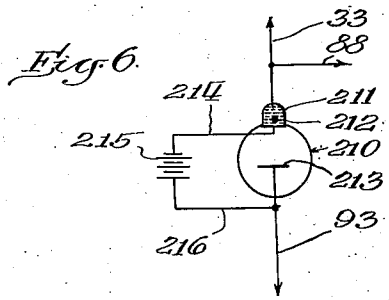


Fig. 6.



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UNITED STATES PATENT OFFICE

2,221,109

ELECTRIC SIGN SYSTEM

John A. Reid, Oak Park, Ill.

Application February 23, 1938, Serial No. 191,890

5 Claims. (Cl. 178—6)

The present invention relates to electric sign systems, and is particularly concerned with electric signs of the type including a multiplicity of electric bulbs or glow tubes arranged in a bank for the purpose of producing or reproducing by means of light and dark glow tubes or bulbs, images, printed matter, motion pictures, or intelligent characters of any kind.

One of the objects of the invention is the provision of an improved electric system by means of which the impressions on a moving picture film may be reproduced in a bank of glow tubes, such as neon tubes, or by means of incandescent electric right bulbs.

Another object is the provision of an improved system of the class described, in which the number of electric conductors which are required for controlling the glow tubes or incandescent bulbs is greatly reduced, so that the conductor cable is relatively small and the difficulties of support and expense of such a cable are greatly simplified.

Another object of the invention is the provision of an improved system of the class described, which is adapted to reproduce the impressions of a moving picture film in a bank of glow tubes or incandescent bulbs, but which requires only a fraction of the controlling devices and conductors which are utilized in the devices of the prior art.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings:

Fig. 1 is a schematic illustration including a wiring diagram of a system constructed according to the present invention;

Fig. 2 is another schematic diagram showing the arrangement of the controlling photocells with respect to the motion picture projector, the view being taken in plan;

Fig. 3 is a diagrammatic elevational view of the same arrangement shown in plan in Fig. 2;

Fig. 4 is a fragmentary sectional view through a part of the distributor or commutator shown in diagrammatic form in Fig. 1;

Fig. 5 is a fragmentary view of a portion of a modified wiring diagram employing incandescent electric light bulbs in addition to glow tubes;

Fig. 6 is another fragmentary illustration of a portion of a diagram which may be substituted for a part of Fig. 1, illustrating a modified form of controlling device.

The present system contemplates the use of glow tubes arranged in a bank for reproducing the impressions of a motion picture film or glow tubes may be used in connection with incandescent bulbs according to the circuit of Fig. 5.

The bank of glow tubes is controlled by a series of grid controlled gaseous rectifier tubes, such as "Thyratrons," which are in turn controlled by photo-cells. The rectifier tubes are so biased that they break down and pass current at a certain intensity of light, and they are biased by means of the photo-cells, the voltages of which are impressed upon the grids of the rectifier tubes.

Such glow tubes require a higher voltage for starting the glow tube, called the "flash voltage," and thereafter for steady operation the glow tubes require a lower voltage, and the present system makes provision for the starting and operation of the glow tubes.

Referring to Fig. 1, 10 indicates in its entirety the complete system, which includes the motion picture projector 11, suitable speed reducing gearing 12, and the distributor or commutator 13, which is driven by the speed reducing gearing in synchronism with the motion picture projector.

Referring to Fig. 3, the electric motor 9 drives the motion picture projector 11 through the speed reduction gearing 12 at a much slower speed than the speed of rotation of the distributor 13, as the distributor 13 rotates once for each frame of the motion picture film in the projector, and the motion picture film passes at a continuous rate past the lenses of the projector.

It also includes the bank of glow tubes, such as neon tubes, the complete bank being indicated at 14, the series of controlling "Thyratrons" indicated as a series by 15, and the series 16 of photocells, together with suitable energizing circuits and devices will be described in detail hereinafter.

Referring to the motion picture projector 11, this projector differs from the projectors of the usual type in that the film is not moved step by step, but is moved constantly at a uniform rate of speed past the lenses. The size of the projection in the example selected must correspond in width to the length of the row of photo-cells. The height would be equal to the width in this example, and therefore the light falling on the row of photo-cells is one-hundredth of the height of the projection. The picture will constantly move in one direction, such as, for example, downward if the film is fed from the

reel 18 through the projector 11 through the reel 19.

Referring to Fig. 3, the projected beam 17 is shown in vertical elevation, and the depth of the beam at the point 20 need only be sufficient to cover the light responsive part of the photo-cell 16.

It should be understood that in Fig. 3, 16 indicates a series of photo-cells which are arranged one behind the other in that figure, as indicated in Fig. 1.

Referring to Fig. 2, the projection system is there shown in plan, and it will be noted that there are a multiplicity of photo-cells 16 arranged in a row and embraced by the projector beam 17 from the motion picture projector 11.

For example, in a system employing 10,000 glow tubes in the bank 14, the series of photo-cells 16 may include 100 photo-tubes in a row, as shown in Fig. 2. The disclosure of Fig. 2 with one photo-tube in one end and a plurality at the other end, is supposed to indicate an arrangement in which a multiplicity of photo-tubes are arranged in a row, such as, for example, 100.

Referring now to Fig. 1, the bank 14 of glow tubes may consist of 100 horizontal rows of glow tubes, each row having 100 tubes. For example, the lowermost horizontal row is indicated by the numeral 100, the next by the numeral 101, and so on up to 199. The individual glow tubes being identical, any one of them may be indicated by the numeral 20' and there may be any predetermined number of glow tubes in one of the rows 100, such as, for example, 100 glow tubes in the example described.

It should be understood that any number of rows may be utilized and any number of glow tubes in a row. The bank of glow tubes, including suitable sockets and circuits, are all mounted upon suitable framework and may be located in any desirable place where an electric sign would be located.

In order to secure uniform light distribution the 10,000 glow tube bank described would be arranged with equal spacing forming a square bank, to be used with a film having a square frame. For a rectangular frame in which the horizontal dimension is longest, as is usual in motion picture films, the shape of the bank would be similar to the film frame, and the number of lamps in any row proportional to the corresponding dimension of the frame.

It will be observed that there are a number of conductors 21—25 extending horizontally in the diagram, comprising one conductor for each row of glow tubes, and these conductors each have leads 26 extending downward in the diagram and connected to one of the electrodes 27 of the glow tubes in the corresponding row.

The diagram also has a number of additional conductors 28—33, etc. (100 conductors in all) extending vertically on the diagram, and each conductor having a multiplicity of leads 34, which extend horizontally on the diagram and are connected to the other electrode 35 of the corresponding glow tubes in the vertical row. Thus the glow tubes may all be energized by the energization of appropriate conductors, such as, for example, the glow tube 100 is energized through the conductors 33 and 21.

The distributor 13 may comprise a cylindrical member which is provided with a cylindrical body 36, carrying a cylindrical strip contact 37 that covers the major portion of the periphery of the cylinder 36. The short strip 38 is of insulation, and the member 39 is a very short contact. The relatively short strip 40 is another strip of insulation, and the contact 37 extends from the point 41 around to the point 42.

The cylinder 36 is mounted for rotation about the axis 43, and it is actuated by the same electric motor which drives the motion picture projector 11, but it is driven through the speed changing gears 12 in such manner that it is synchronized with the film. For example, when the film moves at a rate of twenty frames per second, the distributor may rotate clockwise at 20 revolutions per second; that is, the distributor will make one revolution in 0.05 second.

The distributor is provided with a plurality of brushes 51—56, etc. (100 brushes in all for 100 rows of lights), and each of the brushes is connected to one of the horizontal conductors 21—25, which leads to the electrodes of one of the horizontal rows of glow tubes.

Referring to Fig. 4, this is a diagrammatic fragmentary illustration of part of the distributor, shown in section with one brush 56, for example, engaging the insulating segment 40.

The contact member 39 is connected by a conductor 57 to the inner slip-ring 58, and the contact member 37 is connected to the outer slip-ring 59. A brush 60, engaging the outer slip-ring 59, is connected by conductor 61 to ground at 62 and brush 63, engaging the inner slip-ring, is connected by conductor 64, to the negative side of the negative terminal 65 of a direct current source of supply 66, such as a rectifier and filter without a ground, which is energized by the secondary 67 of the transformer 68, the primary being indicated by the numeral 69.

The transformer 68 may be connected to the ordinary 60 cycle 110 volt lighting power supply. The glow tubes in the bank 14 are adapted to be controlled by a plurality of "Thyratrons" 70—75, etc. (100 in all), one "Thyratron" being required for each of the 100 vertical rows of glow tubes.

The grid 76 of each "Thyratron" is connected by a conductor 77 to one electrode 78 of a photoelectric cell 79. The grid is also connected by the same conductor 77 to a bias resistor 80, which is connected by conductor 81 to ground. The other electrode 81' of the photoelectric cell 79 is conducted by conductor 82 to a common conductor 83, leading to the positive terminal 84 of the power supply 66.

The plate 85 of each "Thyratron" is connected to the positive conductor 86. The filament 87 of each "Thyratron" is provided with a suitable source of energization comprising a separate transformer 220 for each tube, only one being shown, due to lack of space. In addition, filament 87 is connected by the conductor 88 to one of the conductors 28—33. The leads 29—33 from one of the electrodes of each of the glow tubes in the bank 14 are each connected to surge resistors 89, which have their opposite ends connected to ground at 90, and the conductors 28—33 are also each connected at 91 to one terminal of a reactor 92.

The opposite terminal from each of the 100 reactors is connected to a common lead 93, which extends to the positive side of a source of direct current of suitable voltage for maintaining the glow tubes 14 in a glowing condition after they have once been started.

The negative terminal of this direct current source of supply is indicated by the lines 94, 95, connected to ground at 96.

Referring again to Fig. 1, it will be observed

that the glow tubes are adapted to be energized by direct current from the source 94, 95, and the circuit may be traced as follows: 94, 93, 92, 91, 33, 34, 35, 27, 26, 21, 51, 37, 59, 60, 61, to ground at 62, ground at 96, and negative terminal at 95. This energization takes place, however, only when the brush 51 is in contact with the contact 37, which covers the major portion of the periphery of the cylinder 36.

It should also be understood that there are 100 of the brushes like brush 51, and they are disposed much more closely together than is indicated on the diagram of the distributor. The glow tubes in the bank 14 are also adapted to be energized at a predetermined time by direct current of a higher voltage; that is, the starting or flashing voltage when the brush is in contact with the relatively narrow contact 39, and the circuit may be traced as follows: From the negative terminal 65 of the source of supply 66, through conductor 64, brush 63, slip-ring 58, conductor 57, contact 39, brush 51, conductor 21, 26, electrode 27, glow tube 100, electrode 35, conductor 34, 33, conductor 88, to filament 87 of the "Thyratron" 70 to plate 85, conductor 86, and positive terminal 84.

Referring to Fig. 4, the operation of the distributor is as follows: When, for example, the brush 56 is engaging the insulation 38, the corresponding row of glow tubes in the bank 14 are de-energized because the circuit is broken at the insulation 38. The horizontal width of the insulation segment 38, that is, the peripheral width in Fig. 4, is sufficient so that the lapse of time during which the brush 56 engages this insulation and does not engage either contacts 37 or 39, is greater than the time required for de-ionization of the particular glow tube and gaseous rectifier tube 70—75, etc. The data supplied for glow tubes usually includes the time required for de-ionization, and therefore the segment 38 of the distributor may be designed accordingly, taking into consideration the speed at which the distributor 13 rotates. The width of the brushes 56 and the contact 39 is such that there will be contact for a sufficient length of time to effect a flash-over of the corresponding row of glow tubes in order to start the glowing of the tubes.

That is, the time of contact between brush 56 and contact 39, must be equal to, and is preferably slightly more than, the time required for ionization of the glow tube.

The distributor rotates to the right in Fig. 4, and after the brush 56 engages the contact 39, the insulation segment 40 passes under the brush 56 and separates the contact 37 from the contact 39. There is a period of time which is represented by the space indicated between the arrows 97, 98, during which the glow tube is entirely disconnected from the contact 39 or the contact 37, but this period of time may be made smaller than the de-ionization period of the glow tube, so that thereafter the brush 56 will be engaged by the contact 37, while the corresponding glow tubes are still ionized. The row of glow tubes to which the brush 56 is connected will, therefore, be continuously energized by the cylindrical contact 37 until the brush again reaches the point 41 and rides over the insulation segment 38.

It will thus be observed that the distributor is adapted to light, by means of a flash voltage, each row of glow tubes in the bank 14 at a predetermined time, and thereafter disconnect the flash voltage and apply a steady direct current voltage of lower predetermined value for maintaining the energization of the glow tubes throughout one revolution of the distributor.

The direct current source 94, 95 of voltage for maintenance of the glow tubes in the row is always available and connected in circuit, whether it is used or not, but such maintenance voltage 94, 95 is not adapted to light the glow tubes of any particular row until they have first been energized by the flash-over voltage which is provided through the contact 39. This flash-over voltage is only provided when the corresponding Thyratron 70—75, etc. breaks down and permits direct current to flow.

Each "Thyratron" is controlled by a photo-electric cell. The grids of the "Thyratrons" are connected through ground and through the grid resistors to the negative potential of the second source of direct current supply, that is, 94, 95, and therefore the grid resistors will tend to keep the grids at negative potential. The grid resistance is so designed that the "Thyratron" tubes or rectifiers will be in condition to pass current at a desired intensity of photo cell illumination, but will not pass any current below this value of illumination. The photo cell acts like a variable resistance, and light impinging upon it decreases its resistance. As the photo cell is connected to a positive source by conductor 83, grid 26 will tend to become positive as light on the photo cell increases, and the rectifier tube breaks down and passes current to the glow tubes at a certain grid potential. Thus a motion picture film which has light portions and dark portions will be treated as though the lighter portions are entirely light and of the same shade, and the darker portions are all entirely dark and of the same shade.

As previously stated, the motion picture projector projects one-hundredth the light of the frame of the film on the row 16 of photoelectric cells.

The distributor 13 moves synchronously with the motion picture projector, and each brush 51—55 or row of glow tubes 100—199 corresponds to a particular part of the film picture of one frame, and each brush and row of glow tubes is appropriately connected in circuit at the proper time, corresponding to the location of its portion of the film opposite the projection slit. For example, if the film speed is 20 frames per second, the distributor rotation may also be in a clockwise direction at 20 revolutions per second, or one revolution in 0.05 second. Since there are 100 brushes, each brush will, therefore, have a time width of not more than 0.0005 second, and this width will be decreased as the brush spacing is increased.

The glow tubes of the bank 14 each correspond to a small section of the area of the film, which section is one-hundredth as long and one-hundredth as wide as the complete frame, and each glow tube will be made light or dark, corresponding to the presence of light or dark on that relatively small section of the film which corresponds to the glow tube in question.

In brief, the picture of the motion picture film will be reproduced on the bank of lights 14, except that there will be no shading of the glow tubes, and each glow tube will be entirely light or entirely dark. The resulting picture in the bank of glow tubes corresponds to a black and white picture without any intermediate shades. The surge resistors 89 serve to absorb any inductive surges from the reactors 92 whenever there is a sudden drop of current through the re-

actors due to the extinguishment of a large number of glow tubes. The reactors 92 serve to cause each of the vertical rows of glow tubes to operate separately in so far as their control by the "Thyratrons" is concerned.

The direct current voltage supplied by the "Thyratrons" is in the form of a high frequency impulse, and since all of the conductors 28—33 are connected to a common conductor 93, one "Thyratron" would otherwise apply voltage to all of the glow tubes simultaneously through the conductor 93, were it not for the reactors 92, which prevent the direct current impulses of high frequencies from the "Thyratrons" from going down into the conductor 93 and up into other rows of glow tubes.

Referring to Fig. 6, rectifier tubes might be substituted for the reactors and surge resistors, and I prefer to use rectifier tubes of the "Ignitron" type. The leads from these "Ignitron" rectifiers correspond to the leads from the reactors 92 so that the fragmentary diagram of Fig. 6 may be substituted for a portion of Fig. 1. 210 indicates the "Ignitron" which is a mercury vapor rectifier tube, having mercury at 211, a carborundum igniter electrode 212, and another electrode 213. Lead 214 extends from 212 to copper oxide rectifier discs 215, and lead 216 extends from the latter to 93.

The rectifier tubes merely serve to permit direct current to pass through them only in one direction from the positive terminal 94 to the glow tubes, but do not permit direct current impulses from the "Thyratrons" to pass in the reverse direction. Thus they serve the same purpose as the reactors 92 in causing the vertical rows of glow tubes to be controlled separately by corresponding "Thyratrons".

Referring to Fig. 5, this diagram shows a portion of a bank of glow tubes and incandescent bulbs in which the circuits are substantially the same as those of Fig. 1, except that each glow tube 20 has in the same circuit, in series with it, an incandescent bulb 200.

The glow tubes are only one-tenth as efficient, in so far as production of light is concerned, as incandescent bulbs, and the glow tubes may serve as relays for controlling the energization of incandescent bulbs.

The incandescent bulb and glow tube are balanced as to resistance and current so that the incandescent bulb is fully lighted when sufficient current passes through the glow tube to energize the glow tube. The inclusion of the incandescent bulb in series with the glow tube does not interfere with the flash-over or ionization of the glow tube because the full voltage is initially applied to the glow tube at the beginning.

In this case the bank will include not only the glow tubes, but the brighter incandescent bulbs controlled by the glow tubes, and a much brighter light and dark picture representation may be secured by the use of incandescent bulbs.

It will thus be observed that the system is adapted to scan the film and provide for the individual control of the glow tubes, each tube being light or dark in accordance with its corresponding area on the frame of the film. The space between the brushes 97 and 51 at the bottom of the distributor in Fig. 1 corresponds to the transition from one frame to the next frame. This space is made slightly larger than the other brush spaces, in the event there are spaces between the frames of the film.

It will thus be observed that only 100 photoelectric cells and 100 "Thyratrons" are required to control the lighting of 10,000 glow tubes, and instead of requiring 10,000 conductors extending from the electric sign or bank of glow tubes to the controls, it is only necessary to have 201 conductors, comprising the conductors 21—25, conductors 88 and conductor 93 extending downward from the electric sign to the control apparatus.

The present system is, therefore, adapted to simplify the connection and control of such electric signs, and systems constructed according to the present invention may be constructed at a much lower cost. Whereas the size of electric signs would probably be limited by the size or weight of the cable containing the insulated conductors leading to the glow tubes or incandescent lamps if the conductor were used for each tube or lamp. In the present invention the size of the cable is greatly reduced and does not substantially limit the number of lamps that may be used.

Only one-fiftieth as many conductors leading to the sign are required according to the present invention as would be required if a conductor were necessary for each separate tube. The reduction in the number of photo cells and "Thyratrons" also effects a substantial saving in expense of installation because such special tubes are still available only at a substantial cost.

It will thus be observed that I have invented an improved electric sign system by means of which the pictures on a photographic motion picture film or any other film may be reproduced on an electric sign, comprising glow tubes and/or incandescent bulbs.

Such electric signs are highly desirable for advertising because of the pictures or disclosure of the electric sign which may be constantly changing and may thus constantly attract the attention of observers within sight of the electric sign. Whereas ordinary motion pictures would hardly be visible, an electric sign in which the picture is reproduced in dark or light on glow tubes or incandescent bulbs is visible at a great distance and either in the night time or in the daylight.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an electric sign system, the combination of a motion picture projector adapted to move its film at a continuous and uniform speed with a distributor synchronously driven with said projector, said distributor rotating once for each frame of a film carried by said projector, a series of light responsive cells arranged in a row transversely to the direction of movement of the film to have a transverse element of the picture from said film projected on said cells, a series of grid-controlled gaseous rectifier tubes, including one grid-controlled tube for each of said cells, said cells controlling the operation of said grid-controlled tubes, a bank of glow tubes adapted to reproduce in lighted and dark tubes the light and dark parts of the subject-matter of said film, said glow tubes being arranged in primary and secondary rows of glow tubes, said primary rows

being transverse to said secondary rows, one terminal of the glow tubes in each of said primary rows being connected to the plate circuit of one of said grid-controlled tubes to be controlled separately by said grid-controlled tubes, said glow tubes also having their other terminals connected in multiple to provide secondary rows of glow tubes, the terminals of each secondary row being connected to one of a plurality of fixed contacts engaged by said distributor, said distributor having a conducting segment extending over the major portion of its periphery for energizing said glow tubes during a corresponding part of each rotation of the distributor, a source of energization for the conducting segment adapted to maintain illumination of said glow tubes, the ends of said segment being separated by a deionizing insulating segment and energized flash-over segment connected in the plate circuit of said grid-controlled tubes, and another insulating segment of greater width than said fixed contacts, a source of energization for said flash-over segment adapted to effect initial ionization of said glow tubes, and energizing circuits for said glow tubes, grid-controlled tubes, and cells, whereby the light responsive cells effect a break-down of the plate circuits of said grid-controlled tubes selectively depending on predetermined lightness or darkness of parts of the film and the glow tubes are ignited and maintained energized or kept dark depending on the lightness or darkness of the corresponding parts of the film, the said distributor deionizing each energized glow tube once during each rotation of the distributor whereby the rows of glow tubes connected to said fixed contacts are successively energized in correspondence with transverse linear elements of the subject-matter on the film, and are maintained energized throughout the passage of one frame of the film.

2. An electric sign system according to claim 1, the said deionizing segment being of sufficient width relative to the speed of rotation of the distributor to break the circuit of the glow tubes over a period of time greater than the deionization period of the glow tubes.

3. In an electric sign system, the combination of a motion picture projector adapted to move its film at a continuous and uniform speed with a distributor synchronously driven with said projector, said distributor rotating once for each frame of a film carried by said projector, a series of light responsive cells arranged in a row transversely to the direction of movement of the film to have a transverse element of the picture from said film projected on said cells, a series of grid-controlled gaseous rectifier tubes, including one grid-controlled tube for each of said cells, said cells controlling the operation of said grid-controlled tubes, a bank of glow tubes adapted to reproduce in lighted and dark tubes the light and dark parts of the subject-matter of said film, said glow tubes being arranged in primary and secondary rows of glow tubes, said primary rows being transverse to said secondary rows, one terminal of the glow tubes in each of said primary rows being connected to the plate circuit of one of said grid-controlled tubes to be controlled separately by said grid-controlled tubes, said glow tubes also having their other terminals connected in multiple to provide secondary rows of glow tubes, the terminals of each secondary row being connected to one of a plurality of fixed contacts engaged by said distributor, said distributor having a conducting segment extending over the major portion of its periphery for energizing said glow tubes during a corresponding part of each rotation of the distributor, a source of energization for the conducting segment adapted to maintain illumination of said glow tubes, the ends of said segment being separated by a deionizing insulating segment and energized flash-over segment connected in the plate circuit of said grid-controlled tubes, and another insulating segment of greater width than said fixed contacts, a source of energization for said flash-over segment adapted to effect initial ionization of said glow tubes, and energizing circuits for said glow tubes, grid-controlled tubes, and cells, whereby the light responsive cells effect a break-down of the plate circuits of said grid-controlled tubes selectively depending on predetermined lightness or darkness of parts of the film and the glow tubes are ignited and maintained energized or kept dark depending on the lightness or darkness of the corresponding parts of the film, the said distributor deionizing each energized glow tube once during each rotation of the distributor whereby the rows of glow tubes connected to said fixed contacts are successively energized in correspondence with transverse linear elements of the subject-matter on the film, and are maintained energized throughout the passage of one frame of the film, the said deionizing segment being of sufficient width relative to the speed of rotation of the distributor to break the circuit of the glow tubes over a period of time greater than the deionization period of the glow tubes, and the said energizing circuits of said glow tubes including a reactor for each of the primary rows of said glow tubes controlled by each grid-controlled tube to cause each primary row of glow tubes to operate separately when controlled by said grid-controlled tubes, although energized from a common conductor.

4. An electric sign system according to claim 3, and a surge resistor for each of said reactors to absorb inductive surges from the reactors due to the extinguishment of a large number of glow tubes simultaneously.

5. An electric sign system according to claim 1, and an incandescent lamp connected in series with each of said glow tubes and adapted to be energized when the corresponding glow tube is ignited, the current of each glow tube corresponding substantially to that of each lamp.

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