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ARC SCREEN PROTECTION SYSTEM

Filed June 2, 1931

FIG. 1

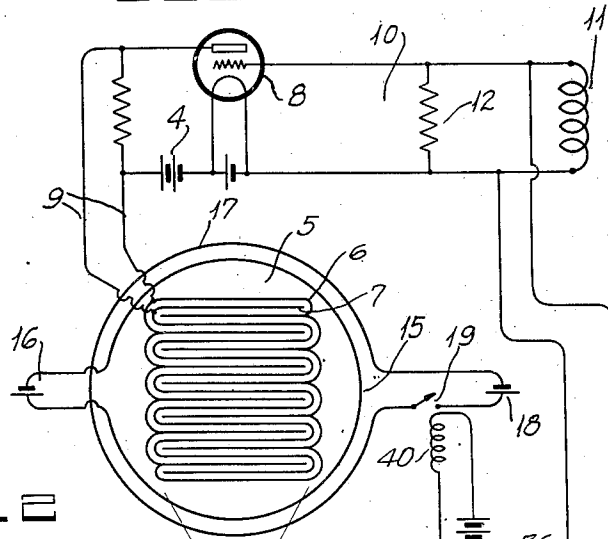


FIG. 2

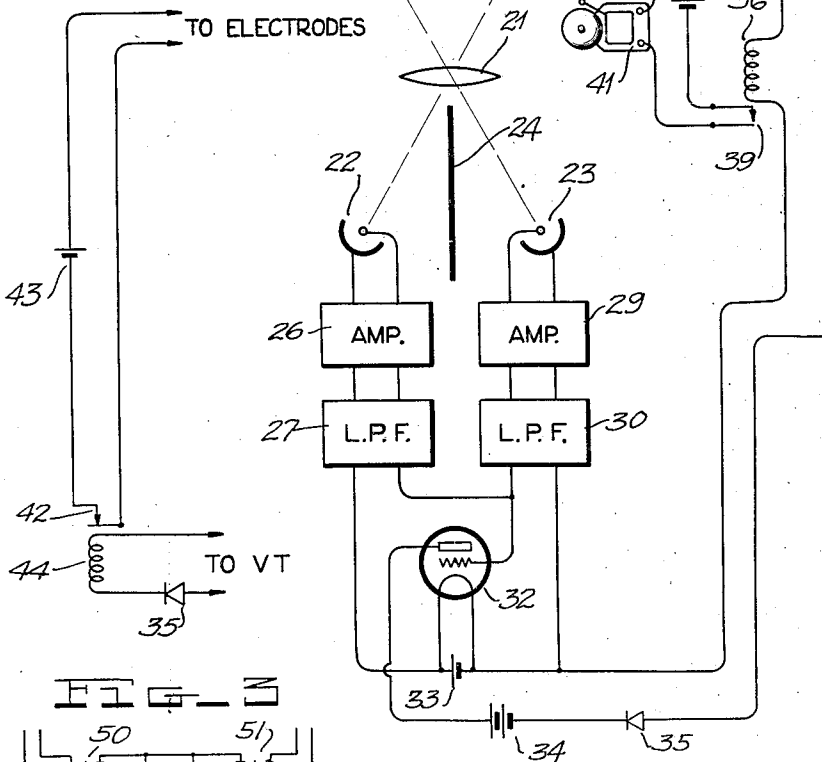
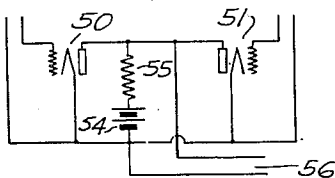


FIG. 3



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ARC SCREEN PROTECTION SYSTEM

Application filed June 2, 1931. Serial No. 541,572.

This invention relates to automatic protection devices, and particularly to such devices applied to arc screens used in television transmitters and receivers.

5 A source of light for a television transmitting system may consist of an arc formed between electrodes having adjacent paths extending over a considerable area and located behind a pinhole or lens camera. The arc is
10 propagated along the electrodes by a magnetic field surrounding the electrodes, and projects light in unit areas over an object to be scanned. The reflected light is transformed into electrical currents by a photo-
15 electric cell or similar device, and the currents transmitted to a receiving arc screen of similar type, which is modulated with the incoming currents in accordance with the light and shade densities of the object scanned.
20 Such television systems have been disclosed in several of my copending applications, namely, Serial Number 397,826, filed October 7, 1929, and Serial Number 450,025, filed May 5, 1930.

25 In these television systems, the electrode rails have comparatively small cross-sectional dimensions and are composed of highly refractory materials such as platinum and tungsten or platinum coated metals such as
30 copper. Small cross-sectional dimensions of the electrodes are necessary to reduce the dark area taken up by the electrodes between the arc paths. With such a construction it is necessary to prevent the stopping of the arc at
35 any position on the electrodes because of heating and ionization of the material of the electrodes at the stopping point. A temperature rise beyond a definite value causes parasitic ionization resulting in a warping and deterioration of the electrodes. It is extremely
40 desirable, therefore, to protect the screen rails in case the arc should stop, caused by a failure of the field or other reasons. The present invention contemplates a device which, upon
45 the retardation of the arc speed beyond a certain point, or the actual stopping of the arc, will eliminate the potential across the electrodes and extinguish the arc, or automatically restore the field.

50 The chief object of the invention, there-

fore, is to protect the electrodes of an arc illuminating screen.

Another object of the invention is to maintain a moving arc at a safe speed over a system of electrodes.

A further object of the invention is to produce an automatic arc extinguishing system and alarm when a dangerous condition is approached.

The invention, in brief, contemplates apparatus which creates from the light of the arc when travelling at its proper speed, an alternating current of definite frequency in a photocell. The current at this frequency, however, is prevented from effecting operation of the potential supply system by filters in the connecting circuits. However, at lower speeds, the current, at the generated lower frequencies will pass through to apparatus which causes the elimination of the electrode potential or energizes an auxiliary field. The system is substantially instantaneous in its action as the correcting device consists of vacuum tubes having practically no inertia. When the system has been set to operate considerably below the danger temperature, a mechanical relay system will be sufficiently rapid to operate the potential control circuit and operate the auxiliary field supply circuit.

The invention will be more fully understood by reference to the following description in conjunction with the accompanying drawing, in which:

Fig. 1 is a schematic circuit of one embodiment of the arc protective circuit;

Fig. 2 is a modification of a portion of the system of Fig. 1; and

Fig. 3 is a modification of the vacuum tube detector circuit for the system in Fig. 1.

In Fig. 1 an arc rail system 5 comprising electrode rails 6 and 7 is supplied with arc initiating potentials from a vacuum tube 8 over conductors 9. The input to the vacuum tube 8 may be through an input circuit 10 with inductance 11 which may comprise the secondary of an input transformer and a control resistance 12. A field winding illustrated by a single turn 15 is supplied from a direct current source 16. An auxiliary field winding represented by a single turn 17 is

supplied from a source 18 through a relay contact 19. The field winding 17 may be either inside or outside of the principal field winding 15 or may be interleaved therewith.

5 Located within projecting distance of the arc and so as not to interfere with the function of the screen whether scanning or reproducing transmitted images, is a concentrating lens 21, which may be replaced by a
10 pinhole camera, and photoelectric cells 22 and 23 separated by an opaque partition 24. Light is projected on photoelectric cell 23 when the arc is in the left-hand portion of the screen, and light is projected on photo-
15 electric cell 22 when the arc is in the right-hand portion of the screen. The effect of the light falling in the photoelectric cell is, therefore, to produce an impulse current of equal duration. It is to be understood, how-
20 ever, that a plural pinhole camera may be used before the cells, to permit of impulse currents being generated at various frequencies.

The output of photoelectric cell 22 is fed
25 into an amplifier 26 of the usual vacuum tube type, and then into a low pass filter 27. Similarly the output of photoelectric cell 23 is amplified in amplifier 29 and passed into a low pass filter 30. The amplifiers 26 and
30 29 have identical characteristics, and the filters 27 and 30 have identical cut-offs. The output of both filters is fed into a vacuum tube 32 having filament supply 33 and plate supply 34. The output circuit of the tube 32
35 includes a rectifier 35, a relay winding 36 and the input winding 11 shunted by the resistance 12 of the vacuum tube 8. Any change in current flow in this output circuit produces corresponding changes in the voltage drop
40 across the winding 11 and resistance 12, varying the bias on the arc supply tube 8. Also, the current in this circuit operates the contact 39 of relay 36 energizing the relay winding 40 to close the contact 19 and operate
45 alarm bell 41. The closing of contact 19 energizes the winding 17 from the battery 18.

Referring to the operation of the protective system, there is an arc produced across the electrodes 6 and 7 by the direct current
50 component of the output energy in the vacuum tube 8 from the battery 4. This direct current potential is sufficient to maintain the arc, but may have superposed thereon an alternating current component from the input winding 11 to initiate the arc and/or
55 synchronize it with other arcs and/or maintain it at a uniform speed described in the above mentioned copending applications. The incoming picture components, in the case
60 of a receiving arc, may be transmitted through the tube 8. The field battery 16 supplies the field energy to propagate the arc along the electrode rails in a well known manner. As the arc crosses from side to side,
65 impulses are produced in the photocells 22

and 23, the duration of the impulse being made equal to the time when no impulse is received on either tube, so that the grid of tube 32 is made positive by cell 23 and then
70 returns to its normal position before the impulse in tube 22 again throws the grid positive. When the position of the photocells and partition 24 are arranged in this manner, the impulses are amplified in amplifiers
75 26 and 29 but are of such a value that they do not pass through the low pass filters 27 and 30, and therefore do not reach the grid of tube 32. Any retardation of the arc generating lower frequency currents, causes the
80 operation of tube 32, the frequency being below the cut-off point of the filters 27 and 30. Should the arc eventually stop at any point of the screen, the grid of tube 32 will be maintained positive and the plate current
85 increased in the tube 32 to a value sufficient to operate the protective devices. The action of the rectifier 35 is in the proper direction for this operation.

However, should the light be upon the cell
90 23 during the entire one-half of its travel across the electrodes and on cell 22 during the remaining one-half of its travel, then in either of the amplifying circuits 26 or 29 a phase shift of 180° is necessary so that the impulse of one of the tubes throws the grid of
95 tube 32 positive, while the other impulse throws the grid negative. A phase shift may be obtained in any suitable manner such as by employing an additional transformer. This method creates a current of one-half
100 the frequency value of the method first described, but is equally as effective. Under this latter arrangement the low-pass filters 27 and 30 will have a lower cut-off value than the previous system, but the system operates in
105 a manner such that should the arc be retarded to a point where the impulses created have a frequency below the cut-off value of the filter, then the grid 32 will receive current. This current, after rectification by the rectifier 35
110 in the output circuit of tube 32, will bias the tube 8 to such a value that the potential created across the electrodes 6 and 7 will consequently be eliminated. Immediately there-
115 after, the auxiliary field winding 17 will be energized by closing of contact 19 and the auxiliary field will be substituted for the main field, producing a driving force for the arc and creating a speed sufficient to bring the
120 frequency of the generated impulses in the photocells 22 and 23 above the cut-off value of the filters 27 and 30 and the system returns to normal. Should a retardation of the arc be caused by other factors besides the loss of
125 field, the increase in field strength caused by both fields will create sufficient force to start the arc and overcome the stopping factors.

The circuit shown in Fig. 2 is a mechanical arrangement in which the rectifier 35 of the
130 output circuit of tube 32 is shown in series

with a relay winding 44 having its contact 42 normally closed. In this system, a direct current source 43 supplies the potentials for the electrodes. Whenever the arc's speed is decreased to such a value that a current flows through the rectifier 35, the relay 44 opens its contact and breaks the potential supply circuit to the electrodes. This system, however, has the disadvantage of being slower acting than the system shown in Fig. 1, but with a factor of safety sufficiently high, may be employed satisfactorily.

Referring to the circuit in Fig. 3 which may be substituted for the tube 32, two tubes 50 and 51 are employed, one of which has its input circuit connected to the low pass filter 27 and the other to the low pass filter 30. A common plate supply 54 supplies polarizing potential to the plates of the tubes 50 and 51 through a resistance 55, the output circuit 56 being the same as the output circuit for the tube 32. This is an arrangement which may be desirable when considerable energy is required in the output circuit of tube 32 to operate heavy duty relays or furnish a plurality of tubes with a biasing potential.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a moving arc television system, a plurality of electrodes, means for supplying a potential thereto, a field winding for producing a field in which said electrodes are disposed, means for detecting light from said electrodes, and means in combination with said detecting means for eliminating said electrode potential when the speed of said arc is below a predetermined value.

2. In an electrodynamic arc screen protection device, the combination of an electrode rail system, means for supplying a potential difference thereto to initiate an arc, a magnetic field for propagating said arc at a definite speed over said electrodes, means for transforming the light from said arc into electrical currents, said means creating an oscillating current, and an output circuit for said transforming means for controlling the electrode supply potential, said means eliminating the potential difference across said electrodes of said arc screen when the speed of said arc is below a predetermined value.

3. In an electrodynamic arc screen protection device, means for creating an electrodynamic arc, a pair of electrodes, a magnetic field for propagating said arc along said electrodes at a predetermined speed, an auxiliary field for said electrodes, a photoelectric device for transforming light from said arc into electrical currents, and means in combination with said photoelectric device for energizing said auxiliary field when the speed of said arc is below a predetermined value.

4. In a television scanning system, an electrode rail screen, means for supplying a po-

tential thereto from a thermionic device, said means creating an arc between said rails, means for biasing said device, means for propagating said arc along said rails, a device for transforming light from said arc into electrical currents, said device comprising a plurality of photoelectric cells and associated amplifiers, said cells having induced therein a pulsating current depending upon the speed of said arc, means for connecting the output of said thermionic device associated with said cells to the input of said thermionic device providing the potential for said electrode rail system, and means for preventing currents from said photocell amplifier from reaching said last mentioned thermionic device at the proper speed of said arc, said means passing biasing current to said last mentioned thermionic device to extinguish said arc when the speed of said arc is below a proper value.

5. In combination, an electrode screen having electrodes forming adjacent paths, means for initiating an arc across said electrodes, a magnetic field for propagating said arc along said electrodes, a photoelectric cell device for transforming light from said arc into electrical impulses when said arc is in a definite position on said electrodes, another photoelectric cell device for transforming light from said arc into electrical currents when said arc is on a different portion of said electrodes, means for combining the output of said cells, said output current operating to eliminate the potential across said electrodes, and means in the output circuits of said cells for preventing said output current from reaching said arc potential eliminating means when said arc is travelling at a predetermined speed.

6. The method of protecting the electrode rails of an arc illuminating screen when said arc speed has decreased beyond a definite value comprising generating electrical currents with the light from said arc as said arc is propagated along said electrode rails, and controlling the arc potential with said generated current.

7. The method of extinguishing a travelling arc along electrode rails when said arc has decreased in speed below a certain value, comprising transforming the light from said arc into electrical currents of a frequency depending upon the speed of the arc, and decreasing the potential of said electrode rails to the arc extinguishing point with the generated current when the frequency of said current is below a predetermined value.

8. In an electrodynamic arc television scanning system, a pair of electrode rails, means for polarizing said rails to initiate an arc therebetween, a magnetic field in which said electrode rails are disposed, means for transforming the light from said arc into electrical currents of a frequency depending

upon the speed of said arc, a filter system passing currents below a predetermined frequency, said frequency being determined by the safe speed of said arc, and means for reducing the potential of said polarizing means with the current passing through said filters.

9. In combination, an electrode screen, a magnetic field in which said screen is disposed, a thermionic device for polarizing said electrodes and creating an arc therebetween, said arc being propagated in line units over said screen, a photoelectric cell for transforming the light from a certain portion of said screen into electrical currents, a second photoelectric cell for transforming light from another portion of said screen into electrical currents, means for combining said generated currents as impulses, means for impressing said impulses upon a filter, output circuits for said filters, and means for utilizing the output current from said filters for biasing said thermionic device supplying arc potential to said electrodes.

10. In a moving arc television system, a plurality of electrodes, means for supplying a potential to said electrodes for producing an electrical discharge therebetween, a field winding for producing a field in which said electrodes are disposed, detecting means for light from said electrical discharge, said detecting means transforming light impulses into electrical currents, and means operative by said currents when said arc is travelling at a predetermined speed for varying the potential on said electrodes.

11. A moving arc television system in accordance with claim 10 in which said last mentioned means includes an alarm circuit for indicating the approximate speed of said arc and for supplying an additional field for said electrodes.

12. In a moving arc television system, a plurality of electrodes, means for supplying a potential to said electrodes for producing an electrical discharge therebetween, means for propagating said discharge along said electrodes, means for transforming light from said discharge into electrical currents, and means operative by said currents for varying the electrode potential and discharge propagating means when the speed of said discharge approaches a predetermined limit.

Witness my hand this 19th day of May, 1931, at the city of Newark, in the county of Essex, and State of New Jersey.

ALEXANDER McLEAN NICOLSON.