

Sept. 27, 1932.

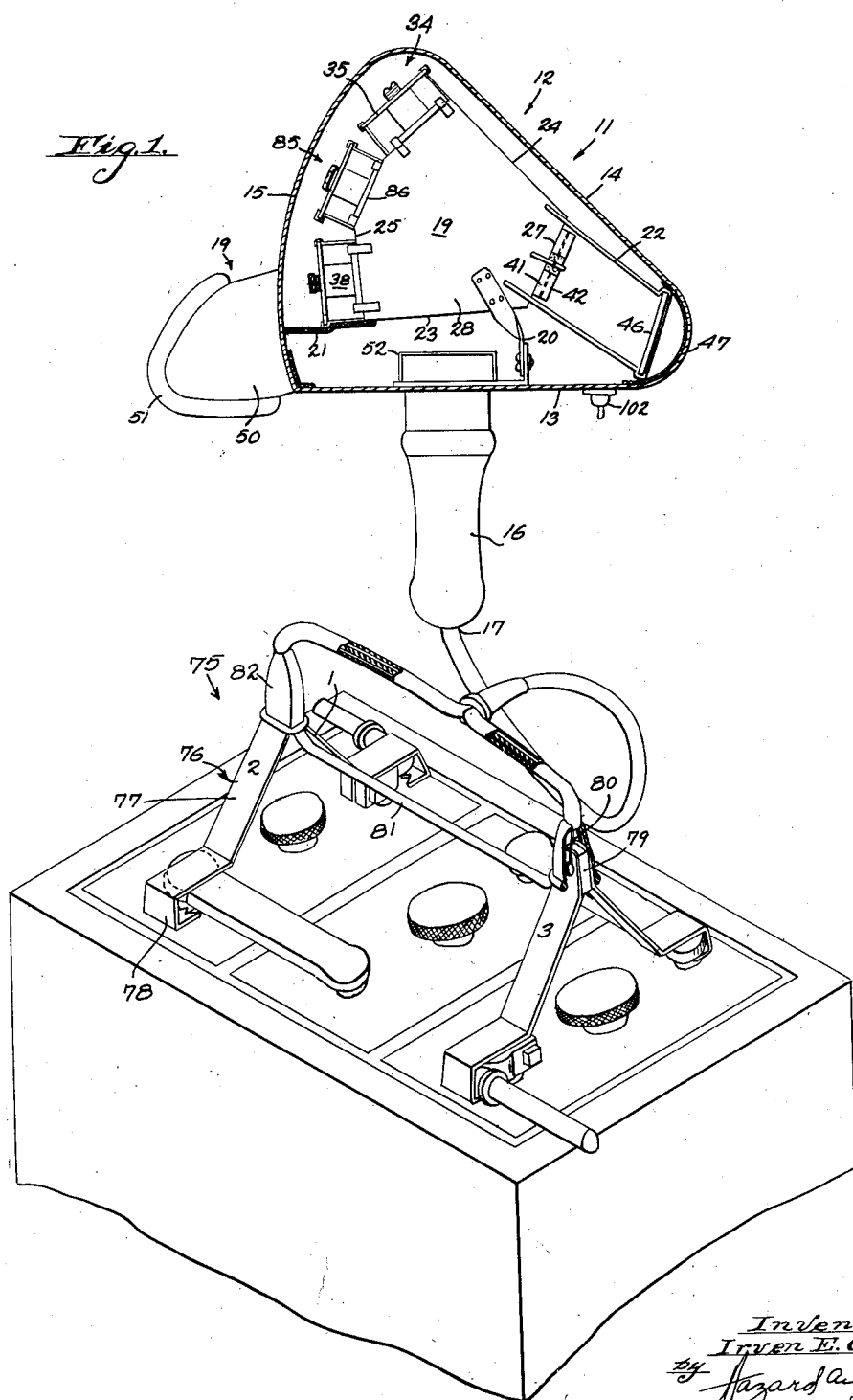
I. E. COFFEY

1,879,098

LUMINOUS INDICATOR FOR ELECTRICAL APPARATUS

Filed Feb. 13, 1931

5 Sheets-Sheet 1



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LUMINOUS INDICATOR FOR ELECTRICAL APPARATUS

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5 Sheets-Sheet 3

Fig. 3

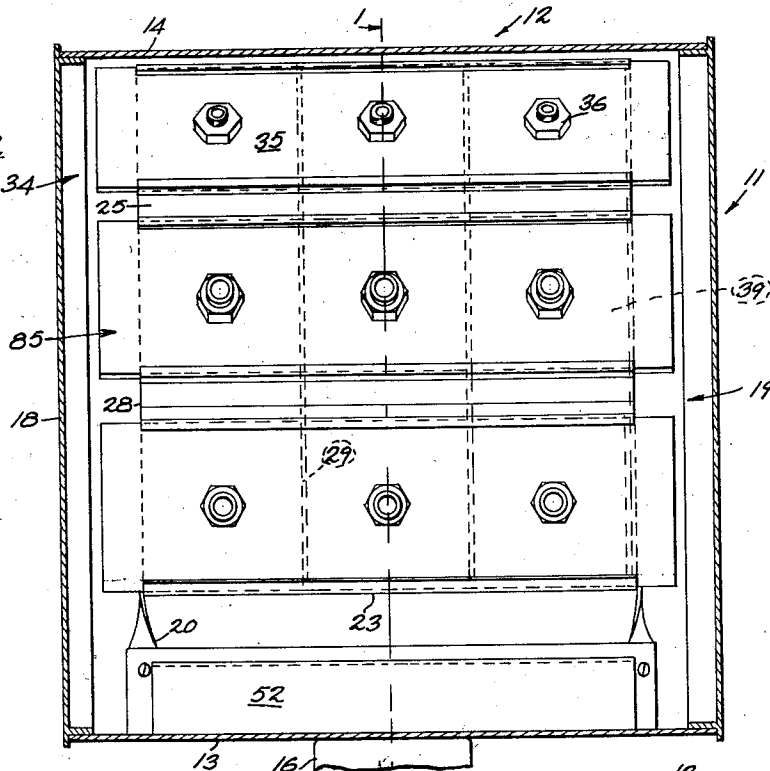
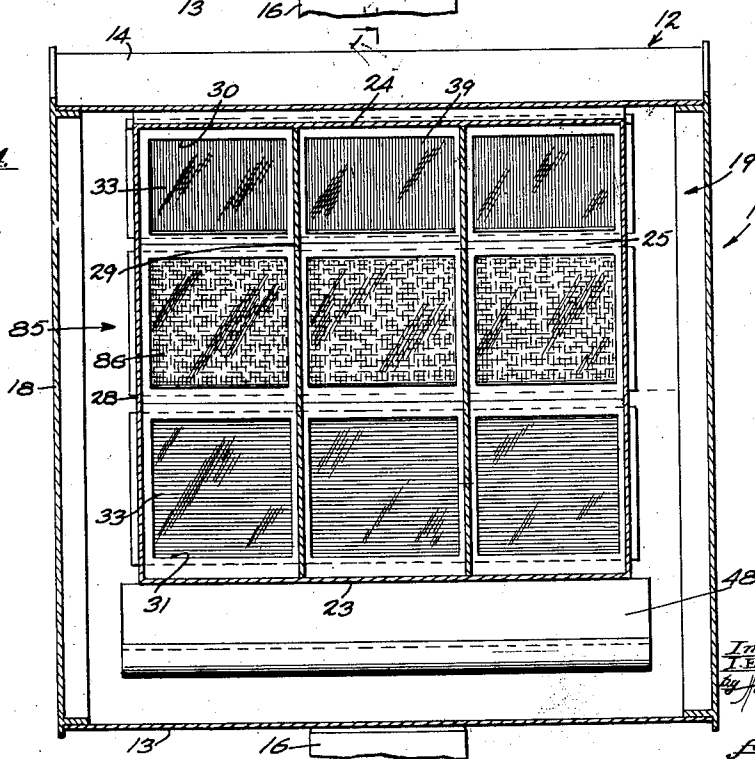


Fig. 4



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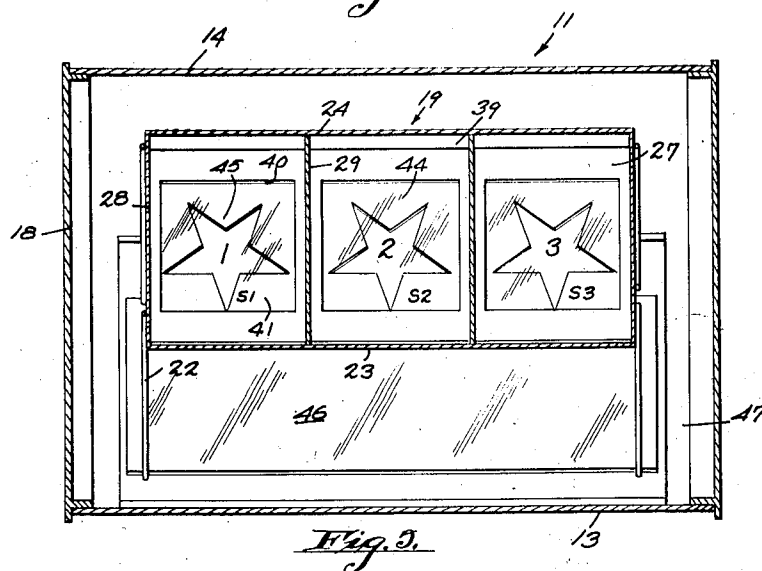
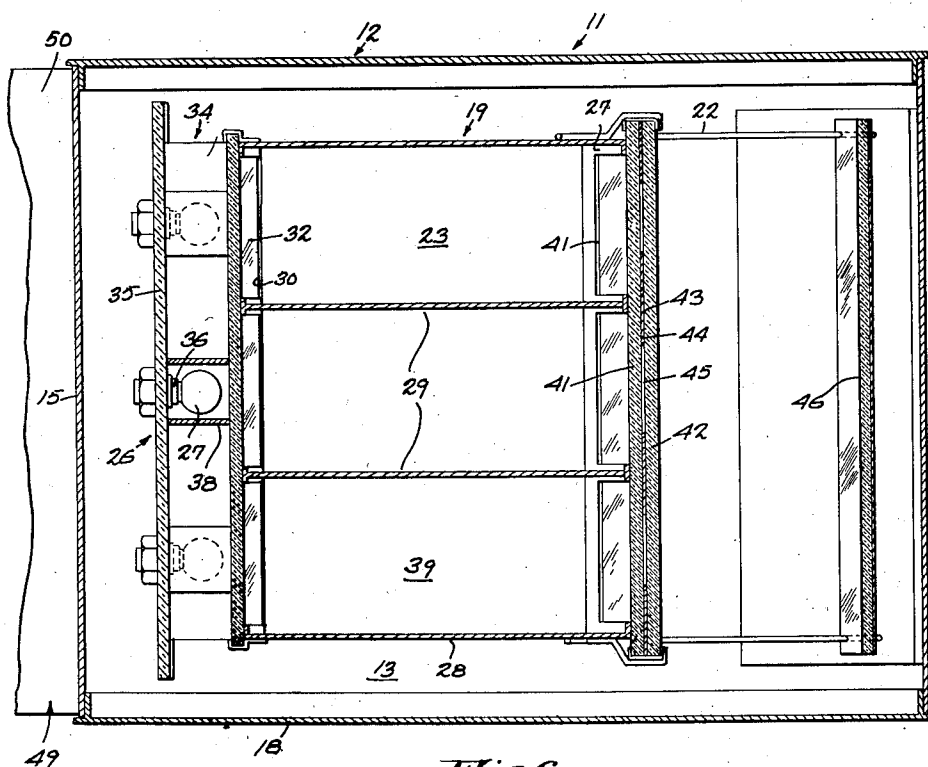
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5 Sheets-Sheet 4



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LUMINOUS INDICATOR FOR ELECTRICAL APPARATUS

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5 Sheets-Sheet 5

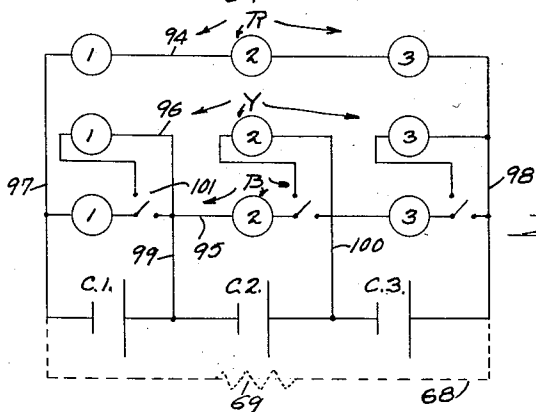
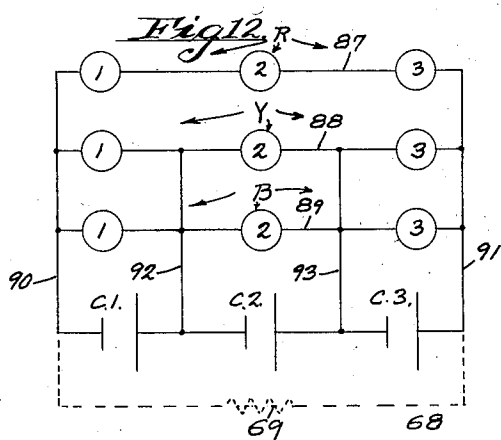
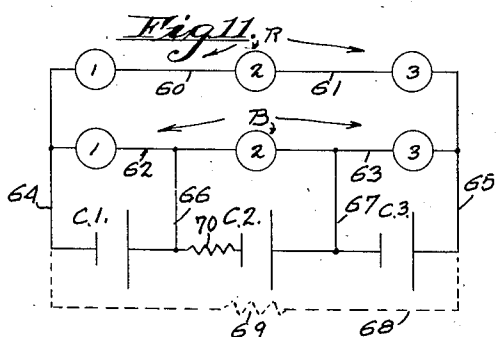
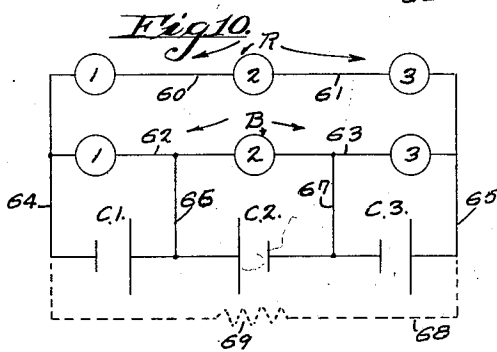
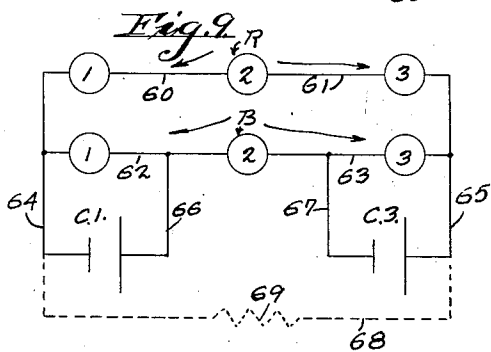
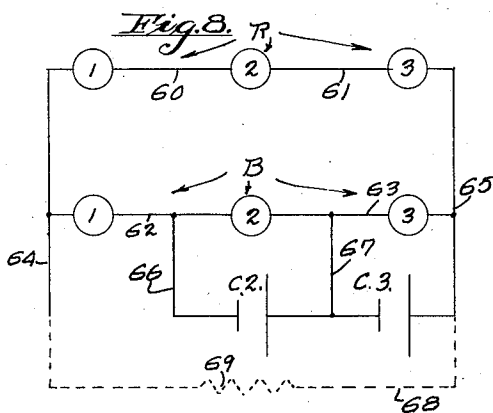
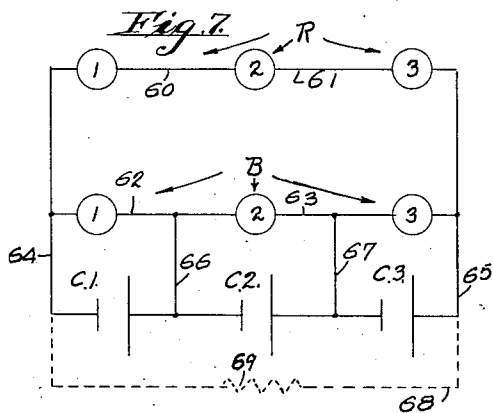


Fig. 13.

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UNITED STATES PATENT OFFICE

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LUMINOUS INDICATOR FOR ELECTRICAL APPARATUS

Application filed February 13, 1931. Serial No. 515,550.

My invention relates to a luminous indicator for electrical apparatus.

In different types of electrical apparatus lights of different colors may be utilized in certain circuits and in certain combinations in which in various electrical conditions of parts of these apparatus such as, for instance, an increased resistance, a reversal of polarity, or an open circuit, the colors of the lights will change and, therefore, to an observer who knows the various combinations of colors resulting from certain changes, he may readily and quickly determine approximately what the particular trouble is from a normal operation of the apparatus or device.

An object of my invention is the design and construction of a device using lights of different colors with suitable electrical connection to operate these lights so that under different electrical conditions such as may arise from changes of resistance, changes of polarity, or open circuits, the illumination value of one or more of the series of lights will be changed and thus an observer, by noting the various colors, may determine approximately where the source of trouble is from the normal operation of any particular electric circuit and then be in a position, if desired, to make more complete electrical tests and to rectify the trouble.

I have found that different colors may be caused to merge together, such colors being developed by either single lamps for each color or a plurality of lamps for each color, and, therefore, instead of the observer being required to note a number of individual changes in color he can judge by the merged or resulting colors and, therefore, determine approximately a normal condition of operation of an electrical apparatus or conditions in which such apparatus or parts thereof are not operating in a normal manner.

In the use of various colors I find it of advantage to make use of the phenomena by which an electric lamp bulb when lit by a current of low value emits light which principally has the long wave lengths, such as the deep red, and in which very little of the short wave lengths of light, such as the blue and violet, are emitted, but when the illu-

minating current through the lamp filament is increased this filament becomes a brighter color, and as the intensity of illumination increases, the value of the shorter wave lengths increases much more rapidly in proportion than those of the longer wave lengths, thus causing the blues and the violets to have a greater illuminating factor. Hence, if an incandescent filament is viewed directly under a low condition of illumination the filament will have a red glow and on increasing this the red color will increase in brightness; this will then change to a white glow, and at full illumination the filament will be a brilliant incandescent white, which color, if analyzed, by a spectroscope will show a large relative proportion of the blues and violets.

I also make use of the phenomena of the absorption and transmission of colors by glasses of different colors. For instance, if an electric lamp filament is enclosed in a clear glass bulb and a red glass is placed between the filament and the observer the red glass absorbs the yellows, blues, and violets, and will transmit only the red colors, these being of different intensities in accordance with the intensity of the illumination of the filament. Again, I make use of the same type of lamp; that is: the filament enclosed in a clear bulb and with a blue glass between this bulb and the observer. Then, in this case, as the blue glass only transmits blue light and absorbs the orange and red colors, therefore, at low conditions of illumination through the blue glass substantially no light is transmitted, but as the intensity of illumination increases the blues and violets materially increase and the blue colors will be transmitted through the blue glass, and at the full or very intense illumination a brilliant blue will be transmitted. It is obvious that, if desired, the glass or the bulbs may be made of these different colors. It is to be understood that I choose red and blue for the sake of convenience and for the contrast.

I have also ascertained that the red and the blue lights may be merged together and the resultant light may be viewed by an observer. Then, under conditions in which

there is a low illumination of the filament the red light will be a deep red and will be practically only transmitted from the red source, the blue source having substantially no red and there being no blue emitted. This will give a deep red color to the observer. As the intensity of the illumination is increased the intensity of the red changes from a dull to a brighter red and the blue will show. Thus the combination of the more brilliant red and the equal blue will give a pinkish color. As the intensity of the light is still further increased the red will become more brilliant and the blues will transmit an intense blue. Therefore, the combination of the blue and the red will produce a still different shade depending on the relative illumination. In different conditions of the electric circuits the red light may have a low degree of illumination and the blues have an intense illumination, causing a predominance of the blues, giving a mauve or so-called violet color.

It will thus be seen that if the relative illuminations of the blues and the reds are changed very many changes of resultant colors may be obtained, and by an observer's learning these different combinations of color, he may determine the normal operation of certain electrical devices, or when certain elements in the electrical circuits are operating out of the normal conditions.

One of the main objects, therefore, of my invention is the development of a simple construction by which the resultant combination of colors may be observed, and as a practical application of my invention I have developed a device particularly adapted for testing storage batteries without and with a load to determine the characteristics of such batteries. Presuming the device is made for testing three cell batteries, I utilize three red lights and three blue lights, there being a blue and a red for each cell. The lights for each cell are directed in certain paths and the lights from the different cells are prevented from mingling by the use of opaque partitions and the red and the blue lights for each cell are caused to merge and the merged or combination color for each cell observable by the observer. Thus the observer for a three cell battery will see three different spots of light.

The circuits are preferably arranged so that the three red and the three blue lights are each set in series and the two sets are in parallel between the positive and negative terminals of the battery. In addition, there are connecting leads between the blue lamps and the terminals of the center cell, thus placing a blue lamp in a direct circuit with each of the individual cells of the battery.

In order to afford a simple manner of making a connection, I have a special connecting device which for a three cell battery only requires four wires carried to the observing in-

strument and by the use of my device the condition of the battery may be observed when it is normal without a load and normal with a load, and various other functions indicating some irregularities in either the individual cells or in the connections.

My invention in one of its forms is illustrated in the accompanying drawings, in which:

Fig. 1 depicts a side elevation of my luminous indicator with one side removed to expose the interior and, in addition, showing a suitable type of connector for use with a storage battery;

Fig. 2 is a longitudinal section of the instrument taken on the line 1—1 of Fig. 3 in the direction of the arrows;

Fig. 3 is a section on the line 3—3 of Fig. 2 in the direction of the arrows;

Fig. 4 is a section on the line 4—4 of Fig. 2 in the direction of the arrows;

Fig. 5 is a section on the line 5—5 of Fig. 2 in the direction of the arrows;

Fig. 6 is a longitudinal section on the line 6—6 of Fig. 2 in the direction of the arrows;

Figs. 7, 8, 9, 10, and 11 are various diagrams illustrating the electrical connections from a storage battery to my luminous indicator and also indicating various changes from the normal condition of the battery, or of the battery with the applied load.

Figs. 12 and 13 are diagrams showing a three color lamp system.

Referring to the construction of the luminous indicator 11 in detail to obtain a compact arrangement I employ a casing or housing 12 which is preferably made somewhat triangular in cross section, having a base 13, a top wall 14, a curved end wall 15, these being joined at the corners; and on the base there is secured a handle 16 which has an opening therethrough for the passage of an electric cable 17. This housing or casing has removable end walls 18 to allow access to the interior of the device.

Mounted in this housing there is a lamp box 19. This is indicated as being supported by brackets 20 and 21 and a frame 22 from the inside wall of the housing. This lamp box has a bottom wall 23, a top wall 24, a wide end wall 25 with lamps 26 mounted thereon, and a narrow end wall 27, with side walls 28, and is provided for three lamp construction with interior partitions 29. The large end walls 25 are provided with openings 30 and 31 in which are fitted the colored glasses 32 and 33. Outside of these glasses there is a cage construction 34 having an insulating plate 35 thereon and a plurality of lamp bulb holders 36. Each of these holders supports an electric lamp 37, the lamps being enclosed in a tubular cover 38, this tubular cover extending from the insulating plate 35 to the glasses 32 or 33 and confining the light of the lamps so that it can only be projected through the

glass plates. It is obvious that, if desired, the lamp bulbs themselves can be colored the desired color, for instance, the red and the blue, but it is desirable to use colored glass plates as these will then be uniform and replacements of burnt out bulbs will not affect the quality of the light.

Either of the glasses 32 or 33 may be red or blue but for convenience, the blue glass is indicated at 32 and the red at 33, this simplifying the wiring, and thus it will be seen that there is one blue and one red bulb shining in each of the light compartments 39. These compartments have walls which are light absorbing and may be covered with velvet or a dull black paint or any suitable material to absorb light. The light from each of the bulbs shines toward the small end 27 of the lamp box and this end has an opening 40 in which there is placed, preferably, a milky colored opalescent glass 41, and outside of this ground glass 42 with the ground side 43 inwardly, and between these two glasses and against the ground glass face there is an opaque covering 44 preferably made of paper, and this paper has an opening for each pair of lamps, such openings being designated at 45 and indicated of a star shape. It will thus be seen that the light from two lamp bulbs is projected on the opalescent glass 41, strikes the opaque cover 44, and may shine through the opening 45, and to give a further diffusion of light the ground glass is preferably employed.

For conveniences of observation and to prevent exterior light from entering the dark compartments of the light box and thus to prevent absorption of the faint colored lights and changes of such lights, I preferably employ a reflector 46 which is illustrated as a mirror and is mounted at the end of the frame 22, preferably adjacent the curved end 47 of the housing. The light from this reflector passes through an observation opening 48 in the end 15 of the casing and to further darken the construction I employ an eye piece 49 having walls 50 and a rubber padding rim 51, this being shaped somewhat to accommodate the contour of a person's forehead and the part of the face below the eyes and nose and thus, to a greater extent, obscure the external light from entering the device.

In order to accommodate the wiring a conduit structure 52 is built on the inner wall 13 of the casing and prevents wires from getting into the path of light. This path of light is indicated as being from the red lights on the axial line 53 and from the blue lights on the axial line 54. As both of these lights shine on the opalescent glass and on the ground glass cover 42 they merge and form a composite color which is observable through the opening. The light, after passing these glasses, may be considered as following the

axial line 55 to the reflecting mirror 46 and the axial line 56 to the eyes of the observer.

The wiring diagram of Fig. 7 shows the attachment and condition for a normal battery. In this case the bank of red lamps are indicated by the letter R and numbered 1, 2, and 3, and the bank of blue lamps by the letter B also numbered 1, 2, and 3. (These lamps are designated respectively red and blue, although they are preferably clear bulbs, because the lights transmitted are red and blue respectively.) There are electric leads 60 and 61 between each of the red lamps 1, 2, and 3, and leads 62 and 63 between each of the blue lamps 1, 2, and 3. The battery cells are designated by the letter C 1, 2, 3. There is a lead 64 from one of the battery terminals and connecting to the red and the blue series of lamps, and another lead 65 from the opposite terminal or pole of the battery to the same series. This places the red and the blue lamps each set in series and the two sets in parallel with the battery as a whole. There are two additional leads from the battery, 66 and 67, and these are connected between the first and the second cells, and the second and third cells, and form a connection with the leads 62 and 63 between the blue lamps 1 and 2, and 2 and 3.

Presuming a battery is operating normally and each cell develops two volts, there will be six volts between the poles of the battery. The bulbs are preferably chosen so that with the cell operating normally these are not receiving their full illuminating voltage and, therefore, do not glow with their maximum brilliance. There is, however, with the battery operating normally, sufficient energy applied to each of the bulbs to produce a distinct red color from the red bulbs and a distinct blue color from the blue bulbs, and the resultant of these colors gives a pinkish color and, therefore, the observer notes the three stars all of a pinkish color and of the same intensity.

A load on the battery is indicated by the leads 68 with a resistance 69 indicated therein and connected between the opposite poles of the battery. In this condition, if the battery is normal and the external circuit is normal the lights still retain the pinkish color. The observer soon learns the normal color for a correctly operating battery.

If, for any reason, the battery or any one of the cells, either with or without a load, is not working properly the amount of current will be decreased and, hence, the illumination of all the lamps is decreased in intensity, causing the red lamps to take on a deeper, redder tone and the filaments of the blue bulbs also to be decreased in their incandescence and lessening the blue rays emitted. These blue rays may be lowered to such an intensity that no blue light at all will pass through the blue glass and only the light of the red bulbs will

be observable. This gives a red color to the stars and shows the operator that there is something wrong with the battery as a whole or with any individual cell which may show a particularly deep red color. It is to be borne in mind that the different shades of color are developed through the relative intensity of illumination of the different lamp bulbs and to the factor of the absorption and transmission of light of different wave lengths through the red and the blue glasses respectively.

Some of the instances and conditions which may affect a battery and be noted with my luminous indicator is indicated in Figs. 8, 9, 10, and 11. For instance: in Fig. 8 it is presumed that cell 1 is inoperative and, hence, only cells 2 and 3, which are presumed to be of two volts each, supply the energy for illuminating all of the lamps. For convenience, the stars 45 are designated S1, 2, and 3, corresponding to the pairs of bulbs red 1 and blue 1, red 2 and blue 2, red 3 and blue 3, and the star 1 in this case without a load will indicate a dark color with a reddish tinge, and with a load a bright blue color.

In Fig. 9 it is presumed that the center cell is inoperative and, hence, the energy of the battery is being supplied by cell 1 and cell 3. In this case star 2 receiving its light from red 2 and blue 2 has a bright blue color with a load and a dark color with a red tinge with no load.

In Fig. 10 it is presumed that cell 2 has been wrongly assembled so that its polarity is incorrect and in this case the cells may be considered as operating one against the other, one cell neutralizing the other. This gives the effect of a blue tone from each of the stars with or without a load.

Fig. 11 indicates another condition in which there is an abnormal internal resistance indicated at 70 in cell 2 which may be considered as reducing this to an output of one volt. It will, therefore, be seen that there is a total change of voltage for the whole battery which is indicated by a change in the color of the resultant lights of the different stars.

These diagrams are only illustrative of a few of many conditions which may occur in a battery and which can be indicated by different color changes in my luminous indicator. An operator may soon become accustomed to the particular characteristic colors and be able to determine approximately what is wrong either with the battery or with the external circuits. It is advisable to place the connectors of a preferred type, as hereinunder detailed, across the poles of the battery and then make another test across the connectors, as, frequently, high resistance is set up by corrosion between the battery posts and the connector. Then by employing an external cable connections may be made to the starter switch

of an automobile or to other devices operated by the battery.

In order that a battery service man may become readily informed of the different changes of color of the different stars for different conditions of the battery, I distribute descriptive literature giving approximate colors with a written statement of conditions which show. In addition, for the purposes of showing customers some of the main characteristics, I place a chart on the end 15 of the casing and thus indicate to them some of the main characteristics observable with my luminous indicator.

Referring to the adjustable connector designated generally by the numeral 75, this comprises two clamp legs 76 formed of straps 77 having hook shaped prongs 78 at the lower end and being secured to an insulating strip 79 at the top by a rivet, this insulating one leg from the other, and from each of these legs there is an electric lead 80 enclosed in insulating material. There are two pairs of these legs and these have a flexible connecting strip 81 which fits underneath the outside insulating hood 82, and the purpose of this is to prevent an operator from twisting the ends and making wrong connections. As illustrated in Fig. 1, the legs connected to the battery terminals on the opposite poles of the battery are connected to the leads 64 and 65, designated in Fig. 7, and the legs connected to the conducting straps of the battery are connected to the leads 66 and 67 of the same figure. This device forms a convenient arrangement for attachment to the opposite poles of the battery and to the intermediate positions between two cells and also for attaching to any two desired cells. Should a battery be made with a larger number of cells the device may be arranged to hook across in three contiguous cells.

My invention is adapted to a three color system as well as a two color and for this purpose I have illustrated an additional lamp housing 85 in Fig. 2 in which if the other lamps employ blue and red light filters, this preferably has yellow, indicated at 86. Thus for each cell I have the combination of red, yellow, and blue lights. These are indicated in Fig. 12 as R1, 2, and 3 for the red; Y1, 2, and 3 for the yellow; and B1, 2, and 3 for the blue. In this instance the reds, blues, and yellows are arranged each in series having the leads 87, 88, and 89, and the three separate sets in parallel between the terminals of the battery having the leads 90, 91. The center wiring is somewhat similar to that of Fig. 7 having the leads 92 and 93 between the cells. Thus by the interconnection of the leads 88, 89, 92 and 93 the yellow and the blue lamps are connected between the individual cells.

In the arrangement and wiring of Fig. 13 the red set of lamps are in the leads 94, the

blue lamps have the leads 95, and the yellows the leads 96. The battery terminal connections are by the leads 97 and 98 and the intermediate cell connections have the leads 99 and 100. With this arrangement I preferably employ double throw switches 101 which may be conveniently arranged for the three circuits, and by this arrangement the blue lamps may be put in a series connection and in parallel with the red lamps, or the switches may be operated to connect with the yellow lamps and thus place the yellow and blue lamps for each cell in series, and this series in parallel with the red lamps. The switch mounting for this wiring is indicated at 102 in Figs. 1 and 3. Any suitable switch may be employed that will give the two way operation for the three lines.

In the construction of Fig. 12 I find it of advantage to have the resistance of the red and blue lamps substantially the same and the resistance of the yellow lamps materially higher. In fact, the resistance of the yellow may be equal to that of the reds and the blues. In the construction of Fig. 13 it is of advantage to have the yellow lamps with the least resistance, the blues of the next higher resistance, and the reds of the highest resistance so that the yellows will act as a ballast resistance for the blues and at low voltage there would be substantially no yellow light but the blue lamps would be illuminated, and at higher voltages the color of the yellow lights would be apparent. Under normal conditions of a normal battery with the lights illuminated, but not to their full brilliancy, I obtain with the three colors and the arrangement of Fig. 13 substantially a white or a yellow tinged slightly with green, and with the three color system the changes of color for any individual cell or for the lights as a whole gives a more marked difference than when only the blues and the reds are used.

In order to prevent errors in determining disorders in the batteries or circuits the stars have designating numerals such as 1, 2, and 3, and the harness for attachment to the cell also has numerals on the legs 76 to correspond. For instance, one of the legs connecting to a battery pole would be numbered 1 and the other connecting to the opposite battery pole would be 3, and the legs connecting to the intermediate cell would be numbered 2. Therefore, by noting the manner in which the harness is attached to the battery the observer may readily determine which cell is out of the proper condition.

It will be noted by my construction, and I find it convenient to designate the lights of each color as being a series of lights and the lights for each cell forming a bank of lights and, in accordance with the construction used, the lights from the individual banks are maintained separately from each other.

Various changes may be made in the details

of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A method of indicating conditions of an electric circuit, comprising illuminating a plurality of sources of light by electric current through such circuit, such illuminations having different colors, and determining by the comparison of colors a difference between a normal and an abnormal condition. 70

2. A method of indicating conditions of an electric circuit, comprising causing an illumination of different colors by current through the circuit, merging the lights of the different colors, and distinguishing by the merged light the difference between a normal and an abnormal condition in the circuit. 75

3. A method of indicating conditions of an electric circuit, comprising illuminating a plurality of sources of light by current from the circuit, filtering certain colors from such lights to give a different color from each source depending on the intensity of illumination, and distinguishing by the resultant colors the difference between a normal and an abnormal condition of the circuit. 80

4. A method of indicating conditions of an electric circuit, comprising illuminating a plurality of incandescent sources of light by current through such circuit, filtering different colors out of the light transmitted from such incandescent sources and thereby transmitting lights of different colors, merging such colors, and distinguishing by the resultant color a difference between a normal and an abnormal condition of the circuit. 85

5. A method of indicating conditions of an electric circuit, comprising energizing two sources of light to varied degrees of intensity of illumination, filtering substantially all except the red rays from one source and substantially all except the blue rays from another source, merging the resultant colors, and determining by such merged color the difference between a normal and an abnormal condition of the circuit. 90

6. A method of indicating conditions of an electric circuit as claimed in claim 5, illuminating a third source of light by the circuit and filtering out substantially all except the yellow color and merging the yellow with the red and the blue, and determining by the resultant color the difference between a normal and an abnormal condition of the circuit. 95

7. A luminous indicator comprising means to form an electric circuit with an electrical apparatus, a plurality of incandescent lamps in said means, a different color filter for each lamp, the colors transmitted being utilized to determine the difference between a normal and an abnormal condition of the apparatus. 100

8. A luminous indicator comprising means 105

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to form an electric circuit with an electrical apparatus, a plurality of incandescent electric lamps in the said means, a different color filter for each lamp, means to merge the colors from each lamp, and means to observe the merged colors for determining the difference between a normal and an abnormal condition of the circuit.

9. A luminous indicator for electrical apparatus, comprising an electric circuit connectible to said apparatus and having a plurality of banks of incandescent lamps, each bank having different light filters for each lamp, means to merge the resultant light from each bank, and means to observe the merged light to determine the difference between electric circuits developed in different parts of such apparatus.

10. A luminous indicator for electrical apparatus, comprising a plurality of electric lamps arranged in two sets, each set having different color filters, means to connect each set in series and the two sets in parallel with two different points of an electrical apparatus, additional electrical connections to connect the lamps of one of the series between intermediate parts of the electrical apparatus, means to confine the resulting light whereby there are a plurality of banks of light composed of a light from each of the series, means to merge the resultant colors of each bank, and means to observe such resultant colors to determine the difference between a normal and an abnormal condition of different portions of the electrical apparatus.

11. A luminous indicator for electrical apparatus as claimed in claim 10, a third set of lights, there being one for each bank and having a color filter different from the color filter of the first two sets, and an electrical connection for the third set placing this in parallel with the first and second set, and with intermediate connections for the lamps of the third set.

12. A luminous indicator for electrical apparatus, comprising a plurality of electric lamps arranged in three sets, each set having different color filters, means to connect each set in series and the three sets in parallel with two different points of an electrical apparatus, additional electrical connections to connect the lamps of at least two of the sets between intermediate parts of the electrical apparatus, the lights being arranged in banks of three different colors, means to confine the lights from each bank from the other, means to merge the lights from each of the banks, and means to observe the resulting color to determine the difference between a normal and an abnormal condition of different portions of an electrical apparatus.

13. A luminous indicator for electrical apparatus as claimed in claim 12, a variable

electrical connection whereby the two sets of lamps connected to the intermediate parts of the apparatus may be connected in series for each bank or only one of such lights of each bank energized.

14. A luminous indicator for electrical apparatus, comprising a first, second, and third set of lamps, the first set having a red filter, the second set a yellow, and the third set a blue filter, electrical connections connecting each set in series and the three sets in parallel between the two spaced portions of an electrical apparatus, electrical connections for connecting individual lamps of the second and third series between intermediate points of the electrical apparatus, the lamps thereby forming a plurality of banks each emitting a red, yellow, and blue light, means to confine the light of each bank, means to merge the light from each bank, and means to observe the resultant color to determine the difference between a normal and an abnormal condition of different portions of the electrical apparatus.

15. A luminous indicator for electrical apparatus as claimed in claim 14, a harness suitable for attachment to a storage battery comprising a plurality of clamping legs, said legs being conductors with jaws for attachment to conducting elements of a battery, and electric wiring from the legs connected to the different lights.

16. In a luminous indicator for electrical apparatus, a harness suitable for attachment to a storage battery comprising two pairs of conducting legs, the legs of each pair being insulated one from the other, each leg having a jaw to engage a conducting terminal or post of a battery or of a cell of such battery, an electric lead from each of the legs, and means to indicate a reversal of position of the said pairs of legs.

17. In a luminous indicator for electrical apparatus, a structure having a plurality of electric lamps arranged in rows, each row having a color filter, the same for each row but each row being different from the next, partitions separating said lamps into banks whereby each bank transmits a plurality of colors, means to merge the various colors of each bank together into a composite color, means to allow observation of such composite color, and means adapted for the connection of electric leads to said lamps.

18. In a luminous indicator for electrical apparatus, an enclosing casing having a box-like structure therein with a plurality of series of electric lamps, each series having a distinctive light filter, the light filters for each series being different, partitions separating the path of the projection of light whereby a plurality of banks of lights are established, each bank having a color corresponding to the light filters, a diffusing glass for merging the different colors of each

bank, an eye piece connected to the casing positioned to permit observation of the illuminated diffusing glass for each of the banks of lamps.

- 5 19. In a luminous indicator for electrical apparatus, comprising in combination an enclosing casing having a box-like structure therein, the said structure having a plurality of series of electric lamps arranged in rows,
10 each series having a distinctive light filter, the colors of the filters being different, partitions separating the path of projection of light from the lamps into banks of a plurality of lamps, a diffusing glass for each bank,
15 the lamps being positioned to project light on to said glass, a reflector, an eye piece, the eye piece and the reflector being positioned to permit observation of the merged colors from the different banks of lamps.

- 20 In testimony whereof I have signed my name to this specification.

IRVEN E. COFFEY.

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