Oct. 1, 1963 E. R. GILL, JR 3,105,954

TRAFFIC CONTROLLERS

Filed Dec. 27, 1960

FIG. 1.

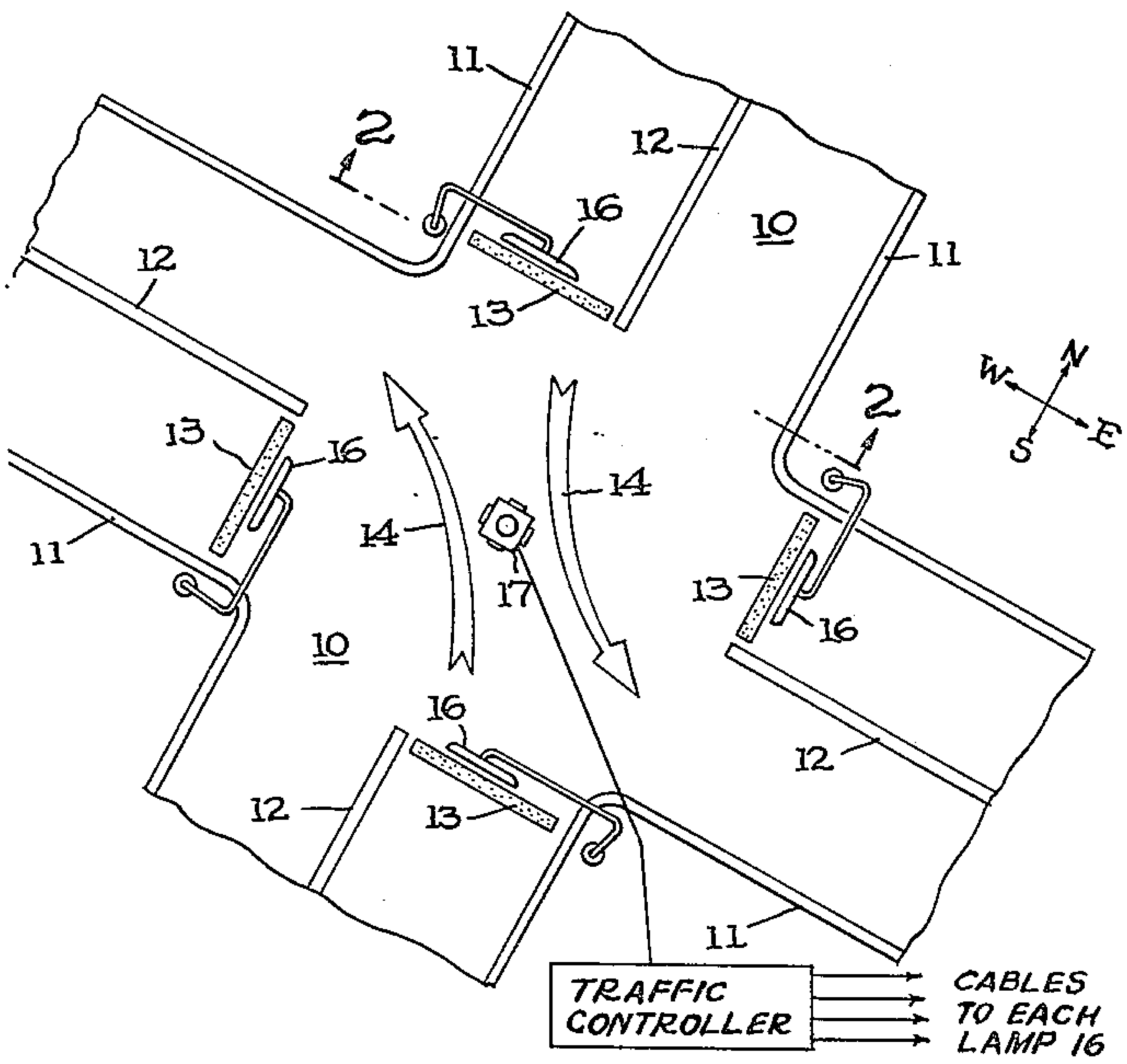



FIG. 3.

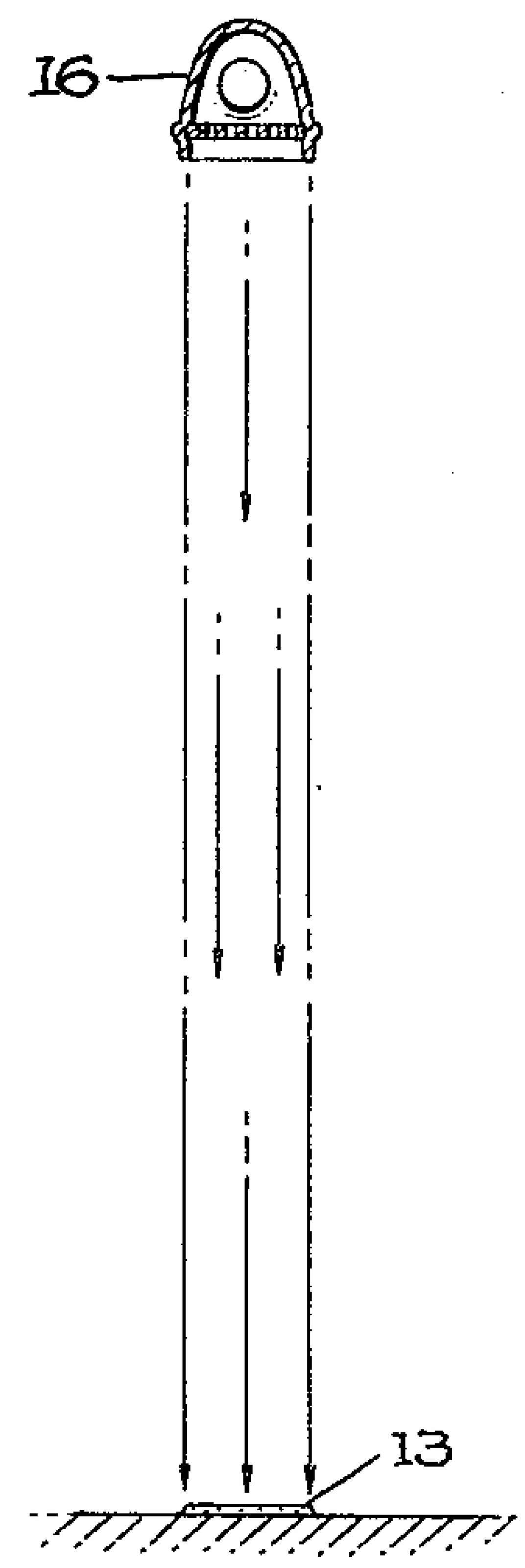
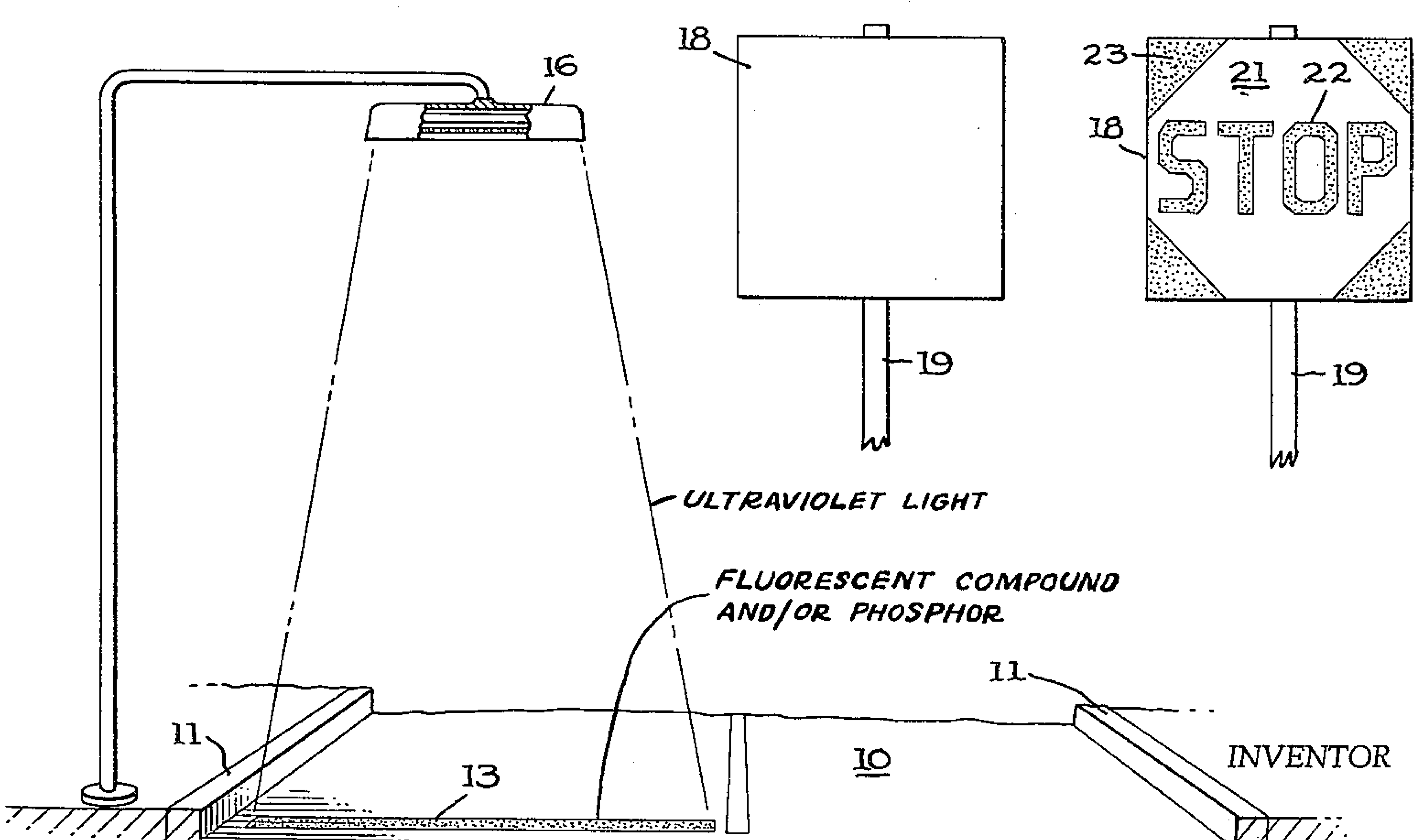



FIG. 2.

FIG. 4.

FIG. 5.

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TRAFFIC CONTROLLERS
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The present invention relates to the control of the movement of vehicular traffic, and has particular reference to the use of the properties of fluorescent materials in a traffic control system.

A great many substances, both organic and inorganic, become brilliantly luminous when excited by ultraviolet light. The fluorescence thus produced is in many instances a bright intense red, yellow, green or other color. These substances may be mixed or combined with white pigments, such as titanium dioxide or chalk, so that when the mixture is illuminated with visible light, as for instance from the headlamps of an automobile, it appears to be white, but changes to a bright color when also illuminated by ultraviolet energy.

Accordingly, the present invention is directed to the use of fluorescent materials to create a chameleonic action or illusion to attract attention and convey information at a proper time and place, or in a cyclic manner, for the control of vehicular traffic.

The invention also seeks to provide a novel means to utilize fluorescent materials arranged as a traffic control system and responding differently to white and black light.

Basically, the present invention provides a novel and improved means of traffic control comprising an ultraviolet light focused on fluorescent material contained in a road sign or marker.

Therefore, it is an object of this invention to provide a change of color in a traffic control system marker so as to convey one meaning at a certain time and another meaning at another time. In other words, a sign or marker can be made to appear one way when illuminated only by natural, or "white" light, and something different in response to invisible, or "black" light excitation.

It is another object of this invention to make use of the psychological aspect that the operator of a motor vehicle is most of all, and most continuously, aware of the highway itself and therefore any message on the surface thereof will be more quickly and more readily seen and understood.

It is, therefore, still another object of the invention to combine traffic control lights with stop guide lines on the road illuminated by black lamps so as to glow brilliantly red when the stop light is red and to show white when the stop light is green and the black lamp has been turned off.

Other objects and advantages will be apparent from a detailed description of the invention and from the appended drawings and claims.

In the drawing:

FIG. 1 shows a possible arrangement of an intersection in the present invention;

FIG. 2 shows a partial vertical cross sectional view of the marking as on line 2—2 of FIG. 1;

FIG. 3 shows a side elevational vertical cross section on line 2—2 of FIG. 1;

FIG. 4 shows a signpost as it would appear under natural lighting conditions; and

FIG. 5 shows the signpost of FIG. 4 as it would appear under lamps described in the present invention.

Referring first to FIG. 1, this shows an intersection of two highways wherein paved area **10** is bounded by curbing or edges **11** and center lines **12** and stop lines **13**

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painted on the surface **10** with special pigments discussed in the specification. FIG. 2 shows the same intersection of FIG. 1 as seen along a cross-sectional view along line 2—2. Again the edge of the road **11** is shown with stop line **13** and center line **12**. In FIG. 3 this point of the intersection is shown in side elvational view with a special lamp **16** suspended over stop line **13** which causes stop line **13** to change color under its effect. A similar lamp **16** is suspended over each of the stop lines **13** designated in FIG. 1.

The operation of the control system in an intersection illustrated in FIG. 1 would be as follows.

Assuming the traffic is stopped in an east-west direction and moving in a north-south direction, the traffic stop and go light **17**, which would be located at a center point in the intersection, will show red in the first and green in the last direction. At the same time the east and west stop guide lines are illuminated by their respective lamps thus glowing brilliantly red while the north and south stop guide lines show white, their respective lamps not operating. When the direction of traffic is changed, the traffic light **17**, as well as north and south stop guide lines, show red in that direction; while in the east-west direction the traffic light shows green and the stop guide lines appear to be white, since the lamps over them are now not operating. The electric circuit of the lamps over the stop guide line **13** may be connected to the same timer as traffic light **17**, the simplest hook-up being a multiple circuit with the proper red cycle.

Also illustrated in this intersection are the use of left turn arrows **14**. In this case traffic light **17** will carry below it another projector consisting of the type of lamp used in connection with this invention. The light from this lamp will be focused on the arrows in the intersection and cycled by the same timer that operates traffic light **17**.

Various other color changes and combinations are possible. As an illustration, a subtractive coloring matter may be added to the paint combination used in the stop lines. In this event the lines will appear the color of such pigments in normal natural light conditions or other white light. In the light of automobile headlamps, for instance, the lines may appear a yellow or even a green color, but when the energizing lamp **16** is switched on, the same lines will appear red. The principal of this chameleonic illusion is the combined use of a subtractive pigment and a fluorescent substance in the same composition. The fluorescent material will not show in white light so that the subtractive color alone is visible, while under the special lamp **16**, the color of the fluorescent factor will predominate.

This arrangement allows modifications of the present invention wherein operation takes place in a cycle opposite to that discussed above. Assuming that traffic is stopped in an east-west direction and flowing in a north-south direction, the traffic light **17** will show red in the first and green in the latter direction. At the same time the north-south stop guide lines **13** are illuminated by their respective lamps **16**, thus glowing brilliantly green, while the east-west stop lines **13** show white, their respective lamps **16** being out. When the direction of traffic changes, the alternate lamps **16** will be lit thus making the east-west stop lines **13** green and the north-south stop lines **16** white.

With a subtractive pigment added to the filler, the stop lines **16** may be made to appear red on the stop portion of the cycle when they would otherwise appear white in the above modification.

For these arrangements the circuits of lamps **16** may be connected in multiple circuit with the green cycle in the timer of traffic light **17**. Glass spheres or refractive elements may also be used with the above type of structures.

Lamp **16**, illustrated in FIGS. 1, 2 and 3, may be any one of several types of ultraviolet lamps available as sources of black light. Some of the lamps which have been found practical in connection with this invention have been the Cooper-Hewitt mercury lamp, two classes of high pressure mercury lamps, and gas filled incandescent lamps. The Cooper-Hewitt mercury lamp is a quartz or glass tube usually about 50 inches long and is highly evacuated. Pressures are the order of 0.025 millimeter. These low pressure type tubes are rich in utltraviolet rays and highly efficient. The high pressure mercury lamps may be classed according to pressures used in the envelopes. One class operates with pressures ranging from ½ to 8 atmospheres and another class uses the very high pressure of from 75 to 80 atmospheres, which is as high as 1,200 lbs. per square inch. The high pressure mercury lamps have an intense light rich in ultraviolet with good efficiency. They are commonly about a foot long and double-walled. The third type of lamp, the incandescent lamp, is of a gas filled, hot filament type. The incandescent lamps, of course, are self-starting, but the mercury discharge tubes are not so easily handled. Like all gas discharge lamps, the mercury tubes require a ballast coil in series to prevent "run away," as the arc has a negative resistance characteristic. However, in this connection and with regard to this invention, the major consideration is not the ballast coil but the starting problem inherent in discharge tubes or arcs. One solution is simply that a radio active isotope be used in discharge tubes in order to keep the gas and vapor ionized at all times, thus making any auxiliary starting means unnecessary. Mercury discharge tubes of various types have some advantages over incandescent lamps in connection with this invention. There are other lamps which are presently being developed which may be used with this invention, and which have not been mentioned in the above discussion.

In addition to the use of this invention with markings on the pavement, the same pigments and lamps may be used with signs posted on the edge of the road. FIGS. 4 and 5 illustrate a typical application of this invention to signposts. As illustrated in FIG. 4, signboard **18** on its supporting post **19** appears in white light or natural light with no legend on the board, merely an unrelieved white. FIG. 5 shows the same sign when illuminated by special lamps of the type discussed above. Here signboard **18** on its supporting post **19** has a colored background, as, for example, red area **21** with legend **22** in white or some color, such as yellow, which will stand out against the red background, and non-significant corner portions **23** which may or may not be colored. This type of sign could be used at those intersections where a traffic light is normally in operation, but where it is desirable to dispense with a traffic light after certain hours of the night, but where, nevertheless, it is required in the interest of safety to bring cars from a secondary road to a full stop before entering upon or crossing a primary road.

Since the object of this invention is to change the color so as to convey one meaning at a certain time and another meaning at another time, a sign or marker can be made to appear one way when illuminated by a natural or "white" light and something different in response to invisible or "black" light excitation. Ordinarily two different pigments are used to achieve this result and are herein identified as agent V responsive to ultraviolet excitation and agent W with reflective functions operative in white light. Agent V may be either (1) a fluorescent material, usually organic, (2) a phosphor, usually an inorganic crystal aggregate, or (3) both. Agent W may be either (1) a reflective pigment, usually white or colorless, (2) a subtractive pigment, usually colored green or yellow, or (3) both. Generally, agent W will be greatly in excess of agent V, possibly the latter constituting one percent of the pigment volume and in some cases even less. It is anticipated that agent W(1) will be used in most cases. The following are examples of possible combinations with the indication of the part of the grouping under which it falls:

V–1, Rhodamine B; W–1, Titanium White. This combination to fluoresce Red but reflect White.

V–2, Activated Cadmium Sulphide; W–1, Titanium White. Fluoresces Red—reflects White.

V–1, Rhodamine B; W–3, Titanium White plus a ceramic green. Fluoresces Red—reflects Green.

V–2, Activated Cadmium Sulphide; W–3, Titanium White plus a ceramic green. Fluoresces Red—reflects Green.

Among the innumerable color arrangements possible, using two pigments, a combination can be found to meet nearly all problems.

However, it is also possible to accomplish comparable results using only one responsive agent. This is so because, (1) Phosphors usually appear white in normal light, and (2) there are many fluorescent cyclic compounds which act like subtractive pigments in ordinary, or "white" light but fluoresce an entirely different color when excited by ultraviolet, or "black" light.

For illustration, the following examples may be mentioned:

(1) *Phosphors*

In the interest of simplicity one typical set only of these materials is given here. As there are between 500 and 1000 synthetic phosphors alone about which some information is extant, a simple illustration would seem to be ample for one skilled in the art.

In the table below are listed a related series of Class I phosphors, singly microactivated by silver. They all appear white, or nearly so, in normal light and fluoresce the color shown.

| | |
|---|---|
| ZnS (100):Ag (0.008) | Light Blue. |
| ZnS (80) CdS (20):Ag (0.01) | Pale Blue Green. |
| ZnS (60) CdS (40):Ag (0.01) | Green. |
| ZnS (50) CdS (50):Ag (0.01) | Green-Yellow. |
| ZnS (40) CdS (60):Ag (0.01) | Yellow-Orange. |
| ZnS (20) CdS (80):Ag (0.01) | Pale Red. |
| CdS (100):Ag (0.02) | Red. |

(2) *Aromatics*

Many dyestuffs of the Xanthene Class show a reflective (or subtractive) color which is different from the fluorescence. For example, mention is made of the following types of dyes:

C.I. 743—Rhodamine S—color, Red; fluorescence, Yellow

C.I. 755—Rhodine 2G—color, Scarlet; fluorescence, Green

Among the Acridine Class may be mentioned:

C.I. 785—Acridine Yellow G—color, Yellow; fluorescence, Bright Green

C.I. 786—Aurazine G—same as 785

C.I. 787—Coriphosphin O—color, Orange; fluorescence, intense Yellow Green

Among the Azine Class:

C.I. 848—Brilliant Rhodulin Red B—color, Bluish-Red; fluorescence, Orange

Among the dyes of the Mordant Class:

C.I. 1050—Alizarin-Cyanine A.C.—color, Blue, fluorescence, Red.

These materials may all be made up as paints, enamels or silk screen paste, or may be incorporated in plastics so as to form panels, buttons, beads, or other chameleonic devices.

Furthermore, they may be fabricated into sheet form as a semi-finished component for sign manufacture.

Subtractive pigments, when used to carry out a modification of this invention should be of such a nature as not to react chemically with the fluorescent components. As the latter can be either organic or inorganic, for example, an aromatic dye or a crystalline phosphor, the selection of subtractive pigment will depend on the fluorescent material present.

From a traffic standpoint, the important colors would seem to be, red, yellow and green.

As regards the fluorescent color, red is doubtless the most important, with yellow the runnerup, and many luminescent materials of both classes fluoresce these colors.

In the case or inorganic fluorescent components, the nature of the subtractive pigments is not a critical consideration because these mineral substances are relatively inactive.

In the case of organic fluorescent agents which are relatively delicate, care should be used to select subtractive pigments which are stable, such as the Cadmium Lithopones or Chrome Oxide. The last is one of the most permanent pigments known, not being affected by heat, light, alkali, chlorine, or other reagents. "Green Earth" may be useful, perhaps as an extender. It is a natural product, very permanent, but somewhat deficient in color. It is inert, being a complex Alkali-Aluminum-Magnesium-ferrous silicate of variable composition.

Another class of suitable inert color substances are ceramics, which may be obtained in a wide variety of colors and shades. These are furnace products and their color being due to metallic silicates, or a solid solution of oxides in glass, are perfectly inert and compatible with any type of fluorescent agent.

These ceramic colors may be used in powder form as a pigment, or they may be crushed and dropped into, or onto, the highway line similarly to glass beads. In the last case the particles may range in size up to 25 mils, or beyond.

There are many other uses in which this invention may be of value. All these uses depend upon the necessity of two different situations existing at two different times, such as situations where night usage differs from daytime regulations.

Also, almost innumerable instances of utility and adaptability of this invention for both pavement and signs may be found. A few such suggestions are in the case of bad weather, signs such as "curve slippery" or "road icy" and speed control signs stating "temporary speed limit 25 miles per hour" or electronic control signs such as "too fast" or "slow down" or "lower beam" and many other instances.

In general, it may be said that in common with all fluorescent devices the signs and markers as discussed herein have the characteristic of high legibility and visibility. Even when energized so that the fluorescent radiation is of greater intensity, such light seems to be without glare. This quality, which does not seem to be fully appreciated, is of great value in highway applications, and it is therefore the purpose of this invention to utilize this unique feature.

From the foregoing, varied applications of the novel aspects of this invention will occur to those skilled in the art, and variations in matters of detail will be apparent. Therefore, it is appropriate that the appended claims be given a latitude of interpretation consistent with the spirit and scope of the invention.

What is claimed is:

1. A traffic control system comprising visible means of designation of instructions to the traffic, including a painted marking appearing in different colors under different lighting conditions, lighting means directed at and affecting said painted marking, a traffic control signal means and cyclic means for controlling the operation of



said lighting means in cooperation with said traffic control signal means.

2. A traffic control system comprising visible means of designation of instructions to the traffic, including a painted marking appearing in different colors under different light conditions, an ultraviolet lamp directed at and affecting said painted marking, a traffic control signal means and cyclic means for controlling the operation of said ultraviolet lamp in cooperation with said traffic control signal means.

3. The traffic control system of claim 2, further characterized by said painted marking including a fluorescent material, whereby the painted marking appears to change color under light from said ultraviolet lamp.

4. The traffic control system of claim 2, further characterized by said painted marking including a fluorescent material and a subtractive pigment, whereby the painted marking appears one color under natural lighting conditions or the lights of traffic and a different color under light from said ultraviolet lamp.

5. A traffic control system comprising visible means of designation of instructions to the traffic, including a marking appearing in different colors under different lighting conditions, lighting means directed at and affecting said marking, said lighting means comprising a discharge tube, and a radio active isotope in said discharge tube whereby auxiliary starting means are unnecessary, a traffic control signal means and means for controlling the operation of said lighting means in conjunction with the operation of said traffic control signal means.

6. A traffic control system comprising visible means of designation of instructions to the traffic, including markings appearing in different colors under different lighting conditions, ultraviolet lighting means directed at and affecting said markings, said markings comprising a plurality of pigments, one of said pigments responsive to ultraviolet excitation, another of said pigments with characteristics responsive to white light, a traffic control signal means and cyclic means for controlling the operation of said lighting means in cooperation with said traffic control signal means.

7. The traffic control system of claim 6 in which the pigment responsive to ultraviolet excitation is a fluorescent material.

8. The traffic control system of claim 6 in which the pigment responsive to ultraviolet excitation is a phosphor.

9. The traffic control system of claim 6 in which the pigment responsive to ultraviolet excitation comprises a combination of a phosphor and a fluorescent material.

10. The traffic control system of claim 6 in which the pigment with characteristics responsive to white light is a reflective pigment.

11. The traffic control system of claim 6 in which the pigment with characteristics responsive to white light is a subtractive pigment.

12. The traffic control system of claim 6 in which the pigment with characteristics responsive to white light comprises a combination of a reflective and a subtractive pigment.

13. A traffic control system comprising a traffic control signal means apparent to all directions of traffic flow, painted markings located in the paths of traffic flow, said painted markings appearing in different colors under different lighting conditions, lighting means directed at and affecting said painted markings, and cyclic means controlling the operation of said traffic control signal means and said lighting means in conjunction with each other whereby both said traffic control signal means and said lighting means cooperatively operate to control the flow of traffic.

14. The traffic control system in accordance with claim 14 in which said painted markings are in the pat-

tern of stop lines drawn transversely of the direction of traffic flow.

15. The traffic control system in accordance with claim 14 in which said painted markings include directional traffic designations for directing a change in direction of the traffic flow.

16. A traffic control system comprising a changing traffic control signal means apparent to all directions of traffic flow, a painted sign visible to one of the directions of traffic flow appearing in different colors under different lighting conditions, lighting means directed at and affecting said painted sign, and lighting control means for alternate operation of said traffic control signal means and said lighting means.




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