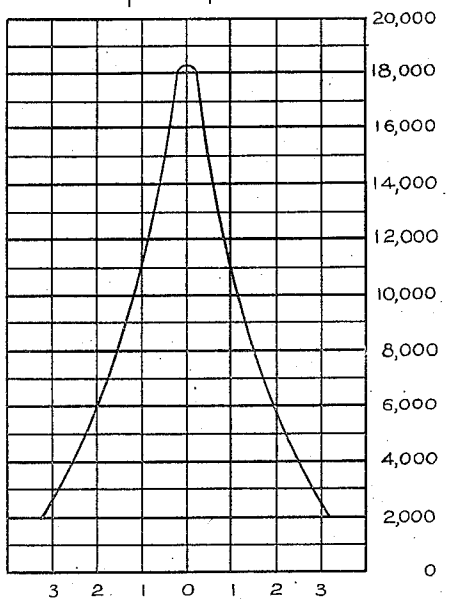
Jan. 4, 1949. E. W. PENTON 2,458,414

NAVIGATION SIGNAL SYSTEM

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Fig. 1.



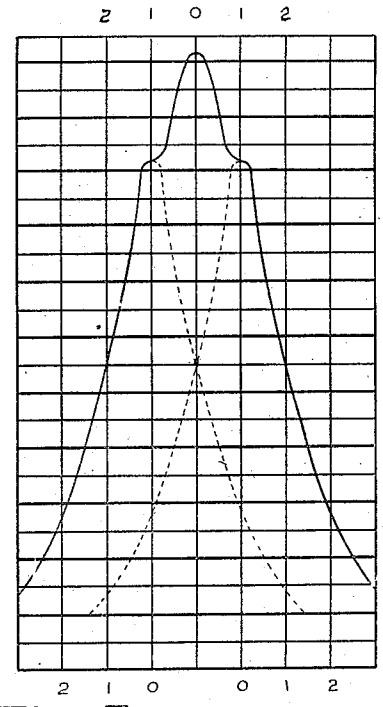


Fig. 2.

Fig. 5.

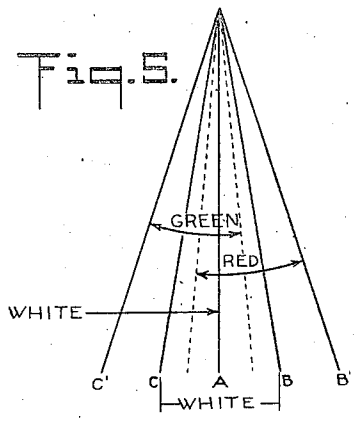
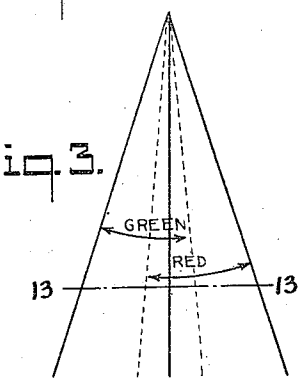


Fig. 3.



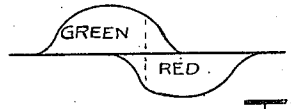


Fig. 6.

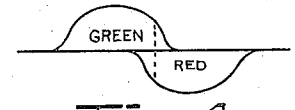
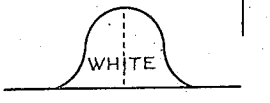


Fig. 4.



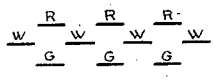


Fig. 7.

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Fig. 14.

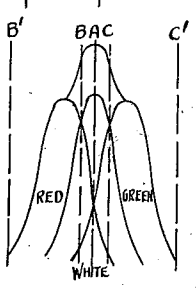


Fig. 8.

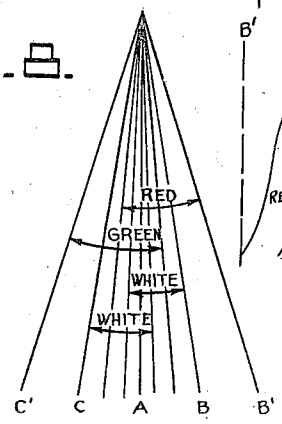
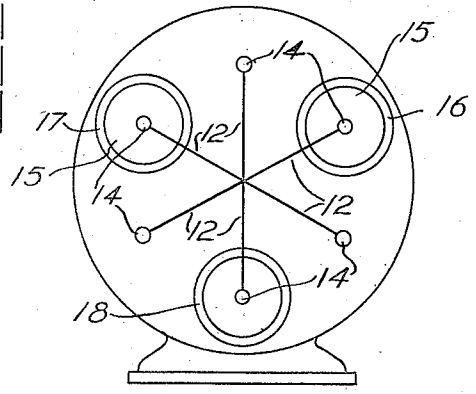


Fig. 11.



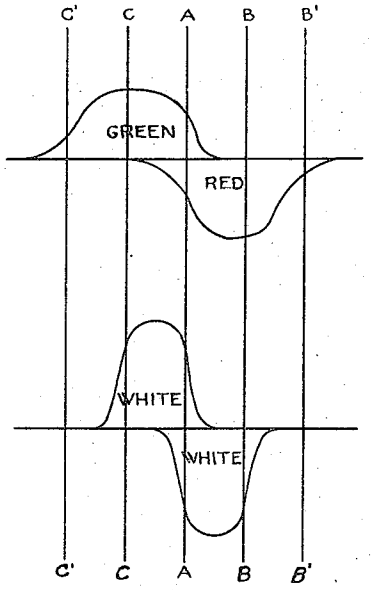


Fig. 9.

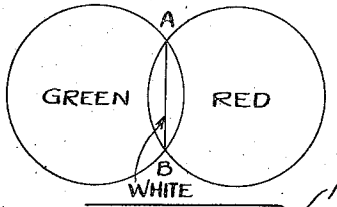


Fig. 13.

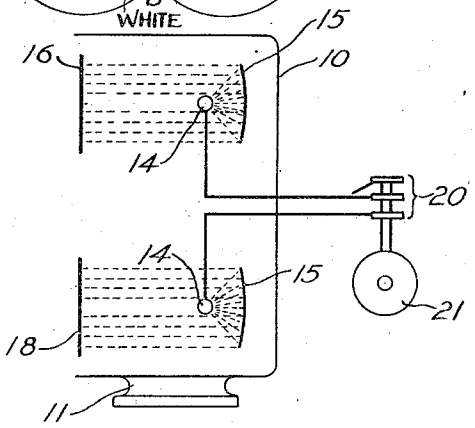


Fig. 12.



Fig. 10.

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Patented Jan. 4, 1949

2,458,414

UNITED STATES PATENT OFFICE

2,458,414

NAVIGATION SIGNAL SYSTEM

Edgar W. Penton, Fairfax County, Va.

Application May 19, 1944, Serial No. 536,397

5 Claims. (Cl. 177—352)

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This present invention relates to a system of signalling and more particularly to direction control lights for indicating to a navigator any predetermined course.

In control lights heretofore in use, such for example as range lights for directing a vessel on a proper course, it has been the practice to provide two lights in alinement and coincident with the course or channel which the vessel is to follow, so that when the navigator has these two lights in line he knows the vessel is in the proper channel or on the course. With two such lights necessity requires the finding of two sites for lamp installation at the proper points for true bearing with the incident expense of erection. Furthermore, the lights and structures have to be maintained in operation with the attendant labor and service costs.

Some of the objects of the present invention are: to provide an improved light system for marine or aerial navigation; to provide a light system wherein control is established by using a single unit for establishment of the true course; to provide a light system wherein lights at two spaced sites are unnecessary; to provide a light system wherein a plurality of different colored lights operate from a common site for direction indication; to provide a novel system of direction control lights wherein a beam of light visibly different from other beams indicates a true course while the other beams indicate variation from the true course; to provide a unidirectional beam of light which when viewed from a specific angle and within a very narrow range presents one peculiar appearance, while viewed from other angles it presents a different appearance; to provide a signalling system as a ground installation as an aid to navigators for guiding ships or airplanes on a true course, or as an installation on ships or airplanes for indicating to observers the course or altitude of the ship or airplane; to provide a novel flashing signal as a means for indicating a true course and any variation from such course; to utilize the phenomenon of addition of mutually complemental colors to establish by overlapping beams a substantial line of a visual effect contrasted with the visual effects of either of said colored beams; to indicate a course and deviations from the course; to provide a flashing course signal which gives a succession of spaced or overlapping substantially white signals when directly on a course, which gives a flashing alternation of white and one color or white and another color complemental of the first, when slightly off the course, and which gives

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a succession of flashes of one color or its complement when appreciably off the course; and to provide other improvements as will hereinafter appear.

Applicant has discovered that by taking two sharply defined beams of light similar to search light beams, which emanate from light sources located close together or in the same housing and which are respectively colored with complemental colors such, illustratively, as red and green, for instance, and by bringing these beams to bear at such angles that the edge of one beam just slightly overlaps the edge of the other beam, there will be established a combined beam having certain unique and important characteristics.

In the accompanying drawings, Fig. 1 is a graph of light beam candle power with reference to the angle of dispersion; Fig. 2 is a graph of candle power of two light beams illustrating the resultant effect of overlap of the two beams to establish an axis of symmetry coincident with a course to be followed; Fig. 3 is a diagram of two light beams functioning in accordance with one form of the present invention; Fig. 4 is a graph representation for visualizing the light intensities of Fig. 3 from several planes of observation; Fig. 5 is a diagram of three light beams functioning in accordance with the invention; Fig. 6 is a graph representation for visualizing the light intensities of Fig. 5 from several planes of observation; Fig. 7 is a chart illustrative of one form of timing of the light system of Fig. 5; Fig. 8 is a diagram of four light beams functioning in accordance with the invention; Fig. 9 is a graph representation for visualizing the light intensities of Fig. 8 from several planes of observation; Fig. 10 is a chart illustrative of one form of timing of the light system of Fig. 8; Fig. 11 represents diagrammatically a front elevation of a light projecting unit; Fig. 12 represents a diagrammatic side elevation of the unit of Fig. 11; Fig. 13 is a graph illustrating more clearly the cross section relation of the combined beams of Fig. 4, the section being taken on line 13—13 of Fig. 3; and Fig. 14 is a graph of the illumination curves of the three light beams of Fig. 5.

In Figure 1 is shown an illumination curve of a sharply defined beam showing beam candle power at various degrees of divergence from the axis of the beam.

In Figure 2 is shown the resultant candle power curve if two identical beams of this character are trained so that their axes diverge by a very few degrees. A new common axis is formed mid-way and symmetrically between the original axes of

the two beams, and with a peak candle power greater than either beam above. The common axis is a substantial line partaking of equal amounts of energy from both beams. In the vertical cross section of the combined beams shown in Fig. 13 the line A—B represents the plane of equal visual values derived from the two beams.

If now one of these beams is of a distinctive color such as red, and the other beam is of another color such as green, the combined beams will have a different and distinctive appearance when viewed from different angles.

When viewed from a point directly along the common axis, the appearance will be practically white if the colors used are mutually complemental railway signal red and railway signal green. If viewed from a point very slightly to the right (in approaching the lights), the color will be immediately red while a slight deviation to the left will give a green indication. The reason for this is that although the light seen is still a combination of the two colors, when the angularity changes to the right the candle power of the red beam increases so rapidly while the candle power of the green decreases so rapidly, so the red energy is so preponderant over the green energy that a very slight deviation serves to convince the eye that it sees only red. Similar effects in the green dominance follow a slight deviation to the left from the symmetrical common axis.

If, therefore, the common symmetrical axis is caused to be substantially coincident with a desired course, such course can be followed accurately even though several miles may intervene between the observer and the light sources.

An addition to this ranging system can be made by combining additional beams both for the purpose of delineating intermediate angularities of deviation from the course or for distinguishing these lights from other competing or background lights.

For instance, if a white beam is added to the assembly and trained with its axis along the common axis of the two colored beams substantially coincident with the course as in Fig. 5, and then this white beam is flashed alternately with the two colored beams, the result will be that when the observer is approaching the lights exactly on course as at A, a steady substantially white light or a succession of pulses of substantially white light, depending on the timed rate, will be seen. When the observer is in the area A—B, slightly off of the course A, an alternate red and white light or flashes of alternate red and white light will be seen, while in the area B—B', appreciably off of course A, a flashing red light with dark intervals will be seen by the observer. Similarly, on the green side the observer will see alternate green and white light or flashes of light in the area A—C, close to course A, with flashes of green spaced by dark intervals in the area C—C', appreciably off of course A. Fig. 14 is an illumination curve diagram showing appropriate values of the white beam in relation to the values of the two colored beams. From this it will be seen that it is unnecessary to flash the colored beams in order to obtain the desired result because in the area A—B the red cannot be seen when the white is on due to the higher intensity of the white, and in the area B—B' the white cannot be seen, even when on, because of the higher intensity of the red. The same condition exists for the respective areas A—C and C—C' when considering the white and green beams.

If four beams are used in the ranging unit, as shown in Fig. 8, they might be comprised of two whites instead of the one white in Fig 5 in addition to the basic double beam of contrasting colors. In this case a variety of timing arrangements are possible. For instance, if the two colors are "on" together, then one white only of the two, then the two colors "on" together again, followed by the other of the two white only, and repeat, and with the white beams trained so as to overlap and be directed along the course, the result will be as follows: On the course at A the observer will see a continuous substantially white or succession of whites. In the area A—B he will see red—white—red—dark, and repeat. In the area A—C he will see green—white—green—dark, and repeat. In the area B—B' he will see red flashes with dark intervals and similarly he will see green flashes with dark intervals in the area C—C'.

A wide variety of combinations are thus available with suitable timing mechanisms for various purposes.

Referring to Figs. 11 and 12, a three light beam projecting unit is shown wherein a housing **10** is mounted on a fixed base **11** and encloses a rotatable standard having three pairs of arms **12** arranged to rotate about a common axis and each mounting a lamp **14**. Each lamp **14** has a reflector **15** shaped and positioned to project parallel light beams out of the housing, the beam from one lamp passing through a red filter **16**, the beam from the second lamp passing through a green filter **17** and the third lamp through a white filter **18**. In this arrangement three lamps are simultaneously in operative position and in a closed circuit, while the other three lamps are inoperative and in an open circuit and provide an emergency set should any lamp of the other set burn out. In that event, the standard is rotated to replace the former operative set by the second set of lamps and the replacement time thus kept to a minimum. The lamps can be timed by any suitable timing mechanism such as a commutator system **20** driven by a small motor **21**.

Having thus described my invention, I claim:

1. A signalling system comprising means for projecting a red beam, having a light distribution pattern symmetrical about an axis, along a course with the axis of the red beam angularly divergent from the line of the course so that the said red beam is asymmetrical thereof, means for projecting a green beam, having a light distribution pattern symmetrical about an axis, along the same course with the axis of the green beam angularly divergent from the said line of the course and asymmetrical thereof, said red and said green beams mutually overlapping in a path symmetrical of the line of the course, said respective beams forming a line substantially coincident with the line of the course partaking equally of the energy of both said beams so that the visual aspect of the formed line is a resultant of an even additive mixture of the two beam colors while the visual aspect even slightly to one side of the formed line is of an additive mixture of unequal energies in which the greater energy dominates and establishes the visual aspect.

2. A signalling range system comprising means for flashing simultaneously a pair of complementally colored slightly divergent and overlapping light beams of the same effective intensity and each having a light distribution pattern symmetrical about an axis, and means for flashing a substantially white beam narrower than the combined width of the overlapping colored beams

and superposed over the common axis defined symmetrically of the overlapping area of the said two simultaneously flashed beams.

3. The method of forming a unidirectional guide beam to identify a linear course from a position toward an objective, which comprises projecting a beam of light having a light distribution pattern substantially symmetrical of an axis of peak intensity and of predetermined chromatic characteristics to continuously overlap said course for substantially the full effective range of the beam and by a predetermined angle while maintaining said axis of peak intensity thereof at an angle to and on one side of such course, and projecting a second beam of light having a light distribution pattern substantially symmetrical of an axis of peak intensity and of different predetermined chromatic characteristics from the first beam to continuously overlap said course and the overlapping portion of the first beam for substantially the full effective range of said second beam and by predetermined angles while maintaining the axis of peak intensity of said second beam at an angle to and on the other side of such course from the first beam to form a single composite beam, whereby the overlapping portions of the first mentioned two beams between the respective axes thereof form a third beam having an axis coincident with such course and visually contrasting chromatically with both of said first mentioned beams, said last mentioned beam at its axis being formed of equal energies of the first two beams and its intensity comprising a function of the relative angularity of the overlapping portions of the first two mentioned beams.

4. In signalling, means forming a beam of light of predetermined chromatic characteristics and having an axis of peak intensity, said beam forming a light distribution pattern symmetrical about said axis, means forming a second beam of light of predetermined chromatic characteristics different from those of said first beam and having an axis of peak intensity, said second beam forming a light distribution pattern symmetrical about its said axis means for simultaneously projecting both of said beams together to form a composite observable guiding beam comprised of components of both of said beams, said composite guiding beam containing the axes of both of said

beams with an angular divergence between them forming spaced peaks of intensity with each peak dominated by the chromatic characteristics of the beam having the particular axis, and said composite beam having an axis symmetrically between the first two mentioned peaks composed of an additive mixture of the chromatic characteristics of both beams and being visually in contrast with both said first mentioned beams, said three beams when seen by an observer passing transversely thereof as successively a beam dominated by the chromatic distribution of the first beam, a composite beam partaking of the additive effects of both beams in a line symmetrically between the axes of the first and second beams, and a beam dominated by the chromatic characteristics of the said second beam.

5. A signalling range system comprising means for flashing simultaneously a pair of complementally colored slightly divergent and overlapping light beams of the same effective intensity and each having a light distribution pattern symmetrical about an axis, with the respective axes in acute angular divergence to form a third beam having a light distribution pattern symmetrically between said two axes, and means for flashing in alternation thereto a substantially white beam narrower than the combined width of the overlapping colored beams and superposed over the common axis defined symmetrically of the overlapped area of the said two simultaneously flashed beams.

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