April 20, 1937. R. S. S. JONES 2,078,142

ILLUMINATED DISPLAY

Filed May 13, 1935 3 Sheets-Sheet 1

FIG. 1.

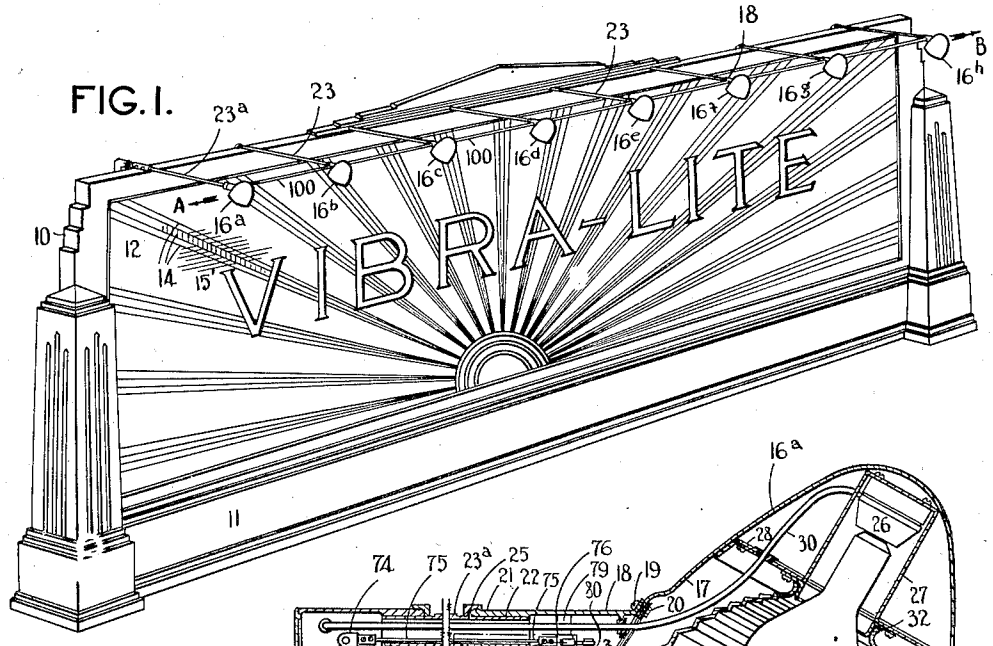


FIG. 2.

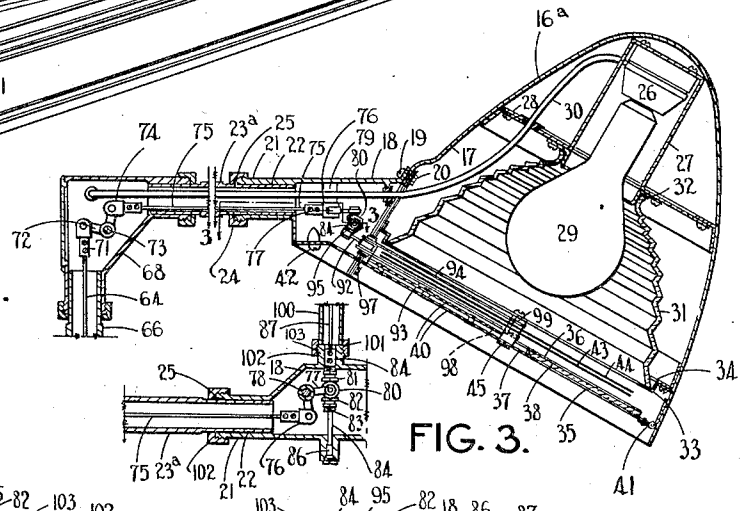


FIG. 3.

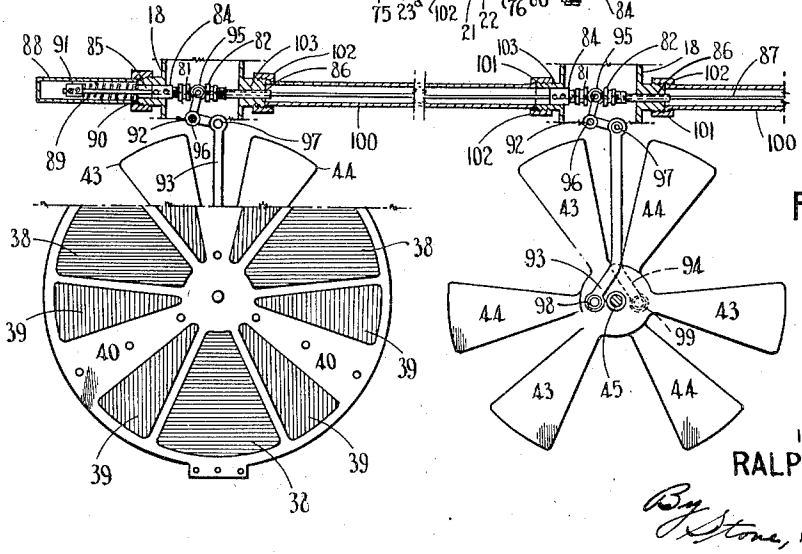


FIG. 4.

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ILLUMINATED DISPLAY

Filed May 13, 1935 3 Sheets-Sheet 2

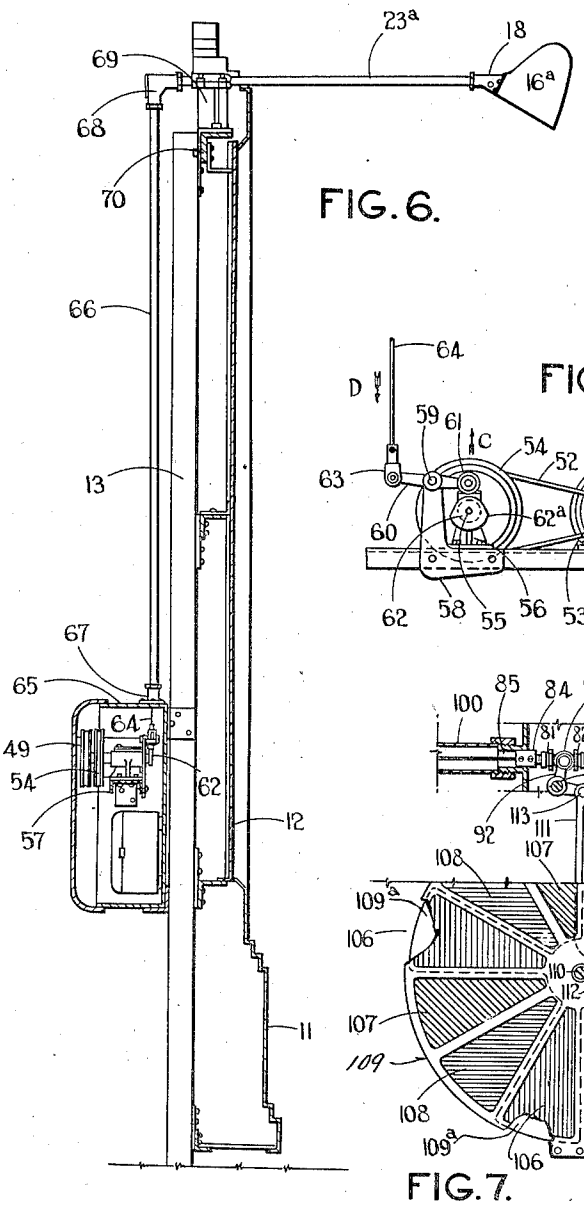


FIG. 6.

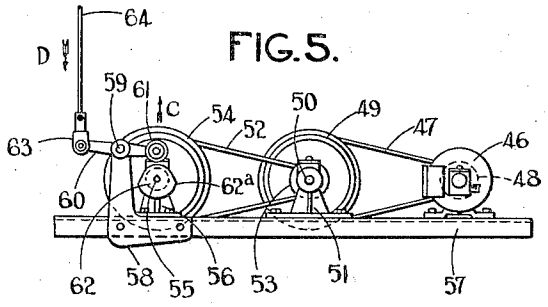


FIG. 5.

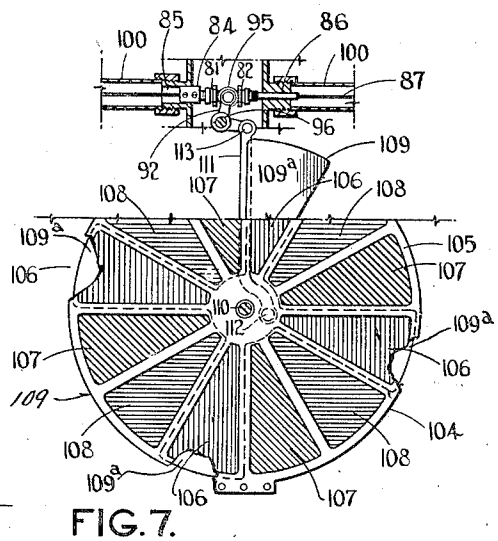


FIG. 7.

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ILLUMINATED DISPLAY

Filed May 13, 1935 3 Sheets-Sheet 3

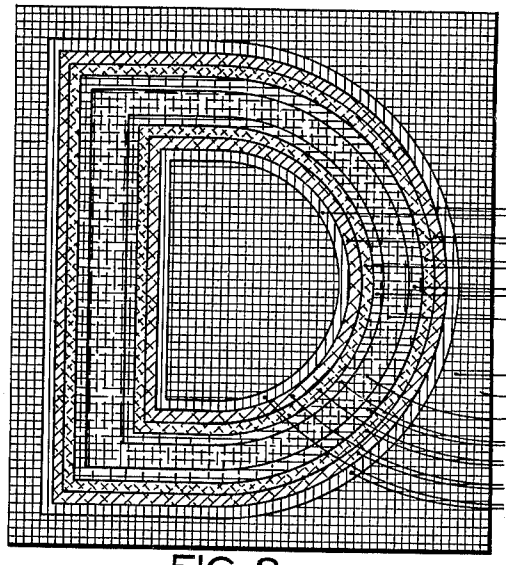


FIG. 8.

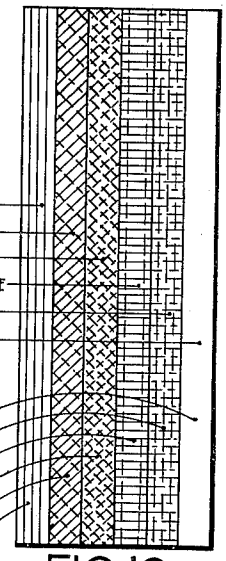


FIG. 10.

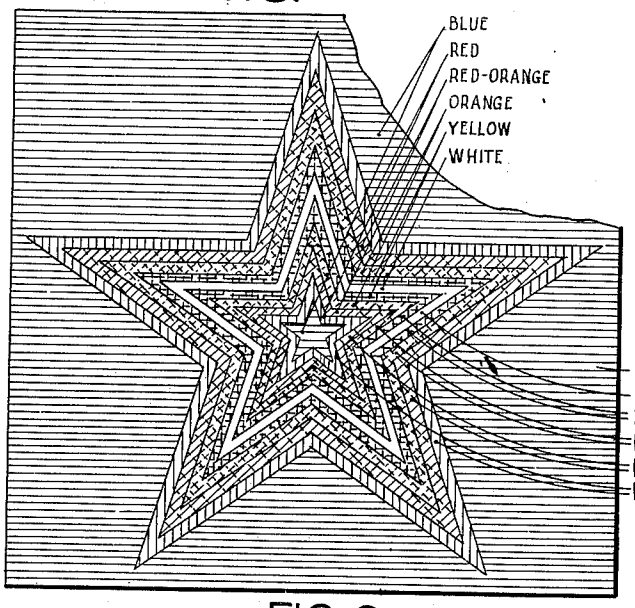


FIG. 9.

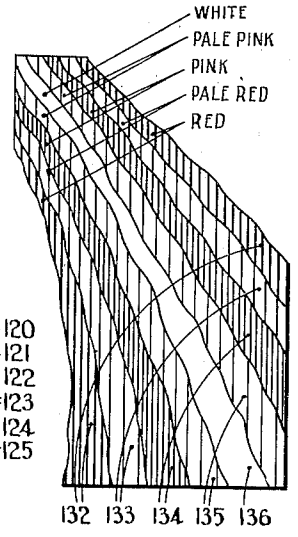


FIG. 11.

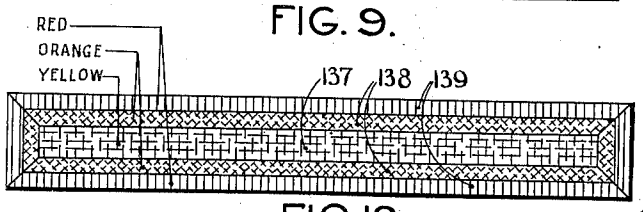


FIG. 12.

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UNITED STATES PATENT OFFICE

2,078,142

ILLUMINATED DISPLAY

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Application May 13, 1935, Serial No. 21,252

15 Claims. (Cl. 40—130)

This invention has to do with the art of illuminated displays intended to be used for advertising, educational, amusement or other purposes.

In its preferred embodiment the invention resides in the co-relation of a multi-coloured stationary display object with apparatus arranged to illuminate the said display object, the said display object being gradationally formed in shades of pigment colour which when viewed from one part to another part appear to reflect light in increasing or decreasing wave length, in increasing or decreasing chroma, or in increasing or decreasing value, either in indistinguishable steps or by small increment and the said illuminating apparatus being arranged to effect flooding thereof with cyclically varying shades of coloured light of such spectral character and in such manner that a very pronounced appearance of pulsation of the display object is effected.

According to the preferred embodiment of my present invention, the display object which may, for example, be letters, figures, arbitrary designs, action denoting lines or action delineations, representations of objects or representations of parts of objects, or objects or parts of objects, and such like, arranged alone or in groups or combinations of object representations, with or without background portions, are individually formed in a plurality of shades of colour of regularly increasing wave length, or a plurality of colour hues, for example, in adjoining or overlapping bands of shades of colours which may include, combinatively, a plurality of spectral colours, such as yellow, yellow orange, orange, red orange and red in gradually changing areas or strips, and in order of sequence set forth. In certain applications of the invention, to illustrate, letters, figures, action delineations and such like, opposite external or bordering portions may be formed in narrow red bands, adjoined by or merging into narrow red-orange bands, which in turn are adjoined by or merge into orange bands. The orange bands adjoin or merge into yellow-orange bands, which in turn adjoin or merge into a yellow band, which may constitute substantially central or intermediate portions or areas of display objects. From the above it is obvious that a display object, for example, the letter D, may have an internal and external red outline, and a plurality of colour line or band graduations extending from both of the red outlines, inwardly towards the central portion of the letter band formation, from red through red-orange, orange, yellow-orange to yellow, which yellow band may constitute the central portion of the letter band formation. The aforesaid letter D may be arranged on or immediately forward of a background of contrastingly different colour, for example black, so that the external and internal portions of the said letter appear to have a black background.

An object representation of the above exemplified spectral character may be brilliantly flooded in intermittent recurring cycles with light of such shades of colour or hues, and in such manner that, at one point in an illuminating cycle, portions of the display object, for example, the central and immediately adjoining yellow and yellow-orange band portions of the letter D exemplified above, appear to be brilliantly illuminated and appear substantially the same as if illuminated by mid-day sunlight. At another point in the same illuminating cycle the display object appears to be brilliantly illuminated over larger or different portions of its surface, which portions may include the aforesaid portions. These two points in the illuminating cycle may effect illumination of the display object in such manner that it appears, at different time intervals, to be of distinctly different colour hues, or on the other hand, of different tints or shades of one or more colours.

Exemplifying the foregoing by further reference to the character D, at one point in the illuminating cycle, the yellow and yellow-orange bands of the letter may be caused to appear brilliantly illuminated and therefore predominant, and at another point in the iluminating cycle the red, red-orange and orange bands appear to expand and the yellow and orange-yellow bands appear to fade so that the object representations appear to be substantially entirely of red and substantially red-orange hue. The apparent change in colour of portions of the display object provides a very pronounced illusion of movement thereof. In the case of letters and figures and certain object representations, they appear to alternately expand and contract, and appear to move towards the observer and then recede to their former position.

An important characteristic of the invention resides in the extent of the commercially practical speed range of recurrent cycles of illumination of display objects, which speed range extends from practically zero to the point at which the repeated images of the display objects appear to merge and become continuous, due to the persistence of vision, and that throughout the entire speed range portions of the display objects appear to be continuously brilliantly illuminated.

The invention includes the features and combi-

nations of features as hereinbefore and hereinafter described and/or illustrated in the accompanying drawings together with all such equivalents therefor and modifications thereof as lie within the scope of the appended claims.

In the accompanying drawings which illustrate one of many possible embodiments of the invention, but to the details of which the invention is not confined:—

Figs. 1 to 7 inclusive illustrate illuminated display apparatus of the character adapted for reduction of my present invention to commercial practice, and said views depict, respectively, a display bulletin embodying a display and apparatus for illuminating the said display; a vertical sectional view of the said display bulletin; a sectional detail view of one of the display bulletin luminaires; a detail, partly in section and partly in elevation, of the light colouring and recurrent cycle producing means; an elevation of the recurrent light cycle producing means powering apparatus; a sectional view of the bulletin structure shown in Fig. 1 illustrating the co-relation therewith of a luminaire and shutter actuating means; and a modified form of luminaire colour filter and shutter.

Figs. 8 to 12 inclusive are symbolic representations, depicting various forms of display objects which exemplify certain applications of novel aspects of my present invention.

In the description which follows and in appended claims reference is made to the term "display" and such term is intended to include any form of display or display surface of any character upon or associated with which there is represented matter to be displayed and regardless of the character of the matter.

By the terms "display object" and "object representation" I mean letters, figures, arbitrary designs, marks indicating movement, representations of objects or parts of objects, or even objects themselves, affixed to or standing in front of a background area to which the attention of an observer is to be particularly directed or which serve to direct attention to the whole or some part of the remainder or background of the display, for the purpose of conveying or emphasizing the massage which the display is designed to give. The object or object representation, or objects or object representations may be arranged at a single location or at a plurality of spaced locations in or on the display surface, and may constitute one or more portions of the display, the other portion or portions being background.

The term "background" is to be understood as including primarily those portions of the display immediately in contact or appearing to be in contiguous relation with the edges of the indicia and may extend to as much else of the display, other than the indicia, as desired.

The term "light" means, according to context, the light as it emanates from a source, or as it is modified by passage through a colour screen or filter, or by reflection or refraction.

"Neutral colours" refer to such colours as do not materially change under the spectral colours by which the display objects or object representations are displayed, or in other words, those which display no decided colour characteristic such as relate to primary or non-neutral colours, and remain of the same apparent density under complementary or primary colour light rays.

The term "gradated" as herein used is intended to mean the visual impression upon the retina of an observer of a chromatically variegated surface, which when viewed from one part to another part appears to reflect light in increasing or decreasing wave length, in increasing or decreasing chroma, or in increasing or decreasing value, either in indistinguishable steps or by small increment.

The expression "chromatically variegated" is to be taken as meaning, coloured in a variety of spectral hues, in the arrangement of which, irregularity is not essential.

By the definition "light source" I mean medium from which light is emitted and regardless of the character of the medium, where context so permits. As an indication of the various types of light sources which may be used in the commercial adaptation of my invention, reference is made to incandescent lamps; gaseous electrical discharge tubes; electric arc devices and such like.

While I have illustrated the application of my invention to a display bulletin, it is to be understood that the disclosure is for purposes of exemplification only and that novel aspects of my invention may be incorporated in a wide range of display designs. For this reason, a very brief description of the bulletin structure will suffice. The bulletin structure illustrated includes a front or frame face **11**, a display surface **12**, and the frame structure generally designated at **13**, the latter being located at the rear of the display surface **12**, and is employed to support it and the frame face **11**.

The display surface **12** which has been illustrated for explanatory purposes is an advertising sign including objects or object representations **14** contrastingly coloured with respect to the background **15**, the former being formed substantially according to the exemplary detail depicted in Figs. 8 to 12 inclusive and referred to in greater detail following a description of illuminating apparatus adapted to effect cyclic illumination thereof.

Apparatus particularly well adapted for the purposes above stated is of the type illustrated and described in the application for Letters Patent filed February 7th, 1935 under Serial Number 5,465, also exemplified in the annexed drawings and the description which follows, it being understood however that no limitations are intended to be imposed by such specific co-relation, and that cyclic variation in the spectral characteristics of display illumination may be obtained with apparatus other than the particular form herein referred to. In other words, my invention consists essentially of a display embodying an object or an object representation formed in shades of colour in such wise and so co-related with illuminating apparatus arranged to display such object or object representation in the presence of cyclically varying beams of light of such spectral character and in such manner that novel display animation effects such as herein exemplified are attained.

Referring now to the said illuminating apparatus in greater detail, a plurality of luminaires designated by the reference characters **16***a*, **16***b*, **16***c*, **16***d*, **16***e*, **16***f*, **16***g* and **16***h* are arranged forward of the front of the bulletin structure, and in a horizontal plane at a slightly higher elevation than the top of the display surface **12**. The said units are arranged in equidistant horizontal spaced relation so as to effect substantially uniform illumination of the said display surface.

Each said luminaire comprises a housing **17**,

preferably in the form of a deep drawn metal shell, to which is tightly secured a casting 18, by screws 19 and nuts 20. The said casting includes a sleeve 21 which is internally machined to receive the machined end 22 of the supporting pipe 23. The casting 18 is secured to the said pipe by the draw nut 24 and compression ring 25. Within the housing is mounted the lamp socket 26 on the frame 27, which in turn is fastened to the ring member 28, the latter being spot welded to the housing 17. A lamp 29 is supported by the said socket, and 30 designates electric circuit wires leading to the latter from circuit mains, not shown. A reflector 31 is arranged circumjacent to the lamp 29 and is supported by the member 32, which is fastened to the member 28, the latter being welded to the housing 17, and the member 33 which is fastened to the brackets 34, one only of which is shown, the same being welded to the housing 17. The reflector illustrated is preferably formed of glass and is surfaced externally with silver. Its function is to reflect light emitted from the lamps 29 against the colour filter generally designated by the numeral 35.

The colour filter of each said luminaire includes metal frame sections 36 and 37, between which are secured sections of colouring media, for example glass. According to the present adaptation of the invention, each said luminaire is designed to flood the display surface 12 continuously with light of a colour deficient in the distinguishing hue of the indicia, for example with blue light, and intermittently with light of a colour deficient in the distinguishing hue of the background and preferably corresponding in colour with the colour of the indicia, for example red. Accordingly, a plurality of sections 38 of the colour filter 35 are blue and of such hue as to transmit blue light, and sections 39, one arranged at each side of each section 38, are red and of such hue as to transmit red light. Between each two immediately adjacent sections of red media 39 is arranged a portion of opaque material 40, herein shown as part of the metal frame sections 36 and 37. The contrastingly coloured filter sections 38 and 39 are arranged as illustrated to effect substantially uniform distribution of coloured light over the entire display surface 12 of the bulletin structure 10. The colour filter 35 in its entirety is articulated by the hinge 41, fastened thereto and to the housing 17, and is secured at the opposite side thereof to the casting 18 by screws, one of which is shown at 42. Upon removal of the said screws, the colour filter may be swung downwardly, about the hinge pintle, to gain access to the lamp 29, for replacement purposes.

Between the lamp 29 and the colour filter 35 is arranged light transmission control means, adapted to govern passage of light emitted from the lamp 29 through the colour filter sections 39. The said means are preferably in the form of two movable shutters, indicated generally by the numerals 43 and 44. The said shutters are pivoted, close to one another, on the pivot pin 45 which is secured to the frame section 37 of the colour filter 35, substantially centrally thereof. Each shutter referred to includes three blades, adapted when positioned as shown in Fig. 4, to cover three of the six colour filter sections 39, so that the both shutters, in the position shown, cover all of the colour filter sections 39 and prevent transmission of light, emitted from the lamp 29, therethrough. In such position, light emitted from the lamp 29 will filter through the blue sections 38 only.

As before premised, the shutters 43 and 44 function to govern transmission of red light from the colour filter in such wise that passage of red light is intermittently impeded. In the position shown in Fig. 4, passage of light through the filter sections 39 is impeded by the said shutters. To permit passage of light, shutters 43 shift in a clockwise direction and shutters 44 shift in counterwise direction, whereby the blades thereof are positioned behind the opaque sections 40 of the colour filter frame, in which position they do not overlap the red colour filter sections 39.

Shifting of the shutters 43 and 44 to alternately cover and clear the sections 39 of the colour filter 35 is effected mechanically. The source of motive force for actuating the said shutters may be in the form of an electric motor, indicated at 46 in Fig. 5. A belt 47 is trained over the motor shaft pulley 48 and the pulley 49 mounted on the intermediate shaft 50, which in turn is journaled in the bearing unit 51. A second belt, indicated at 52, is trained over the pulley 53 mounted on the shaft 50 and the pulley 54 mounted on the cam shaft 55, the latter being journaled in the bearing unit 56. The said bearing units and the motor are mounted on the base channel 57, to which is attached the bracket 58. A pivot pin 59 is supported by the said bracket and a rocker arm 60 is mounted on the said pivot pin. A roller 61 is carried by one end of the said rocker arm, and bears against the periphery of the cam 62 mounted on the shaft 55. The contour of the said cam embodying the ridge 62*a*, is such that upon rotation thereof, oscillating or rocking motion is imparted to the said rocker arm. A connecting yoke 63 is articulated to the rocker arm 60 and a motion transmitting flexible wire 64 is attached at one end thereof to the said connecting yoke.

The mechanism illustrated in Fig. 5 is arranged at the rear of the bulletin structure and is housed by the control box 65, the latter being supported upon the bulletin frame structure 13. The wire 64 extends from the connecting yoke 63 upwardly through the tubular member 66, which is secured at its lower end to the coupling 67 attached to the control box 65, and at its upper end to the casting 68 secured to the rear end of the pipe which supports the luminaire 16*a* located near the left end of the bulletin structure. In order to identify the said pipe from the other pipes designated at 23, it is indicated by the reference character 23*a*. Pipe 23*a* is supported by the bracket 69 mounted upon the upper stringer 70 of the bulletin frame structure 13.

Pipes 23 supporting the said luminaires, other than the pipe immediately heretofore referred to, are supported by brackets, not shown, mounted upon the stringer 70, which brackets are equivalent from a functional viewpoint to the bracket 69, illustrated in Fig. 6.

Referring now to Figs. 2 and 3, the upper end of the wire 64 is connected to the connecting yoke 71, which in turn is articulated to one arm of the bellcrank 72 pivoted on the pin 73. The other arm of the bellcrank 72 is articulated to the connecting yoke 74, which is attached to one end of the motion transmitting flexible wire 75 which extends through the pipe 23*a* and is connected to the connecting yoke 76. The latter is articulated to one arm of the bellcrank 77 pivoted on the pin 78 extending from the boss 79 integral with the casting 18. The other arm of the bellcrank 77

carries a small roller 80 which is positioned between the adjustable nuts 81 and 82 engaging the threaded shank 83 of the guide pin 84, clearly shown in Fig. 3. The said guide pin is slidably supported in reamed apertures 85 and 86 in the casting 18 mounted on the pipe 23a, shown in Fig. 2.

Casting 18 of each said luminaire is formed similar to the aforementioned casting 18 mounted on pipe 23a, and a guide pin 84, similar to that previously described, is slidably supported in each casting 18, in the manner described, and as shown in Fig. 4. A motion transmitting flexible wire 87 is connected at one end of the guide pin 84 shown in Figs. 2 and 3, extends from luminaire to luminaire, passes longitudinally through and is fastened to the guide pin 84 of each said luminaire. The casting 18 of the luminaire 16h located near the right end of the bulletin structure shown in Fig. 1 is connected with a tubular enclosure 88, within which is positioned a coil spring 89, one end of which bears against the retaining washer 90. The other end of the said coil spring abuts a collar 91 mounted near the end of the wire 87. The function of the said coil spring is to urge the said wire 87 in the direction of arrow A, appearing in Figs. 1 and 4, and the function of the mechanism including bellcrank 77, wire 75, bellcrank 72, wire 64, rocker arm 60, cam 62, and rotating means for the latter, is to alternately pull the wire 87 in the direction of arrow B, appearing in Figs. 1 and 4, thereby effecting compression of the said spring intermittently.

Motion is transmitted from the guide pin 84 to the shutters 43 and 44 of each luminaire by the bellcrank 92 and the links 93 and 94. A roller 95 is mounted on one arm of the said bellcrank and fits between the nuts 81 and 82 on the guide pin 84. The said bellcrank is pivoted on the pin 96 secured to the filter frame section 37, clearly shown in Fig. 4, and one arm of the said bellcrank is articulated to the links 93 and 94 by the pin 97. Link 93 is articulated to the shutter 43 by the pin 98, and the link 94 is articulated to the shutter 44 by the pin 99.

The luminaires designated by the reference characters 16a to 16h inclusive, are retained in spaced relation by the tubular members 100. The ends 101 of the latter are flared outwardly and are engaged by the draw nuts 102 threaded onto the bosses 103 integral with the castings 18. The tubular members also serve as enclosures for the shutter actuating wire 87 which extends longitudinally therethrough as clearly shown in Fig. 4.

In Fig. 4 I have illustrated the shutter mechanism of the two luminaires designated by the reference characters 16g and 16h, in order to clearly depict the co-relation of the wire 87 and associated shutter actuating means with respect to a plurality of luminaires. In Fig. 4 the shutters 43 and 44 are shown in light impeding position, with the wire 87 retracted in the drection of arrow B, and the coil spring 89 under compression. For purposes of comparison, the associated shutter actuating mechanism is shown in Figs. 2, 3 and 5 in the position occupied thereby when the shutters 43 and 44 do not overlap the sections 39 of the colour filters 35.

It is to be understod that the lamps 29 of the respective luminaires and the electric motor 46 may be arranged according to standard wiring practice in circuits connected to a source of current supply, and that the same may be governed by a time clock and other control instrumentalities according to established practice.

Modified form of shutter mechanism

In Fig. 7 I have shown a modified form of shutter mechanism for controlling passage of coloured light to the display surface 12. The numeral 104 designates a colour filter in its entirety, the same comprising a frame 105 arranged to support sections of colouring media 106, 107 and 108. In this form of the invention, the filter sections 106 are preferably red, the filter sections 107 are preferably green, and the filter sections 108 are preferably blue, depending upon the subject matter of the display, so that light emitted from the said sections of colouring media is red, green and blue, respectively. The shutter 109 consists of four blades 109a which are of suitable proportion to cover all of either of the said green or red groups of colouring media sections. The said shutter is pivoted on pivot pin 110 supported by the frame 105, in such wise that the said shutter may be oscillated to and fro, from the said red group of colouring media sections to the said green group of colouring media sections.

The means for actuating each shutter 109 is herein shown as the equivalent of the mechanism illustrated best in Fig. 4, except that a single link designated at 111 is articulated to each shutter as at 112 and to a bellcrank 92 as at 113. Since means for actuating the bellcranks 92 has been clearly described, further elucidation of such mechanism in conjunction with this modification appears to be unnecessary. It is to be understood however, that each of the illuminating units designated by the reference characters 16a to 16h inclusive may be equipped with the modified form of shutter mechanism described and actuated by the drive mechanism hereinbefore explained in detail, and as hereinafter more explicitly pointed out in the description of operation.

Formation of display objects

In Fig. 1 I have shown the co-relation of indicia objects and a background, the indicia objects, also herein referred to as display objects and object representations, being in the form of wording and action delineations. It is to be understood, however, that the representation is for explanatory purposes and is not intended to be limitary.

As detailed examples of the formation of object representations and backgrounds such as depicted in Fig. 1, reference is now made to Figs. 8 to 12 inclusive, wherein I have shown a series of detailed characters and in particular the formation detail of a character and various modifications of the selected exemplary representation. In all of the aforesaid figures, each object or area representation includes a display formed of colour gradations, or in more specific terminology, associated colour bands, stripes or areas of relatively different spectral character, and arranged to reflect light in gradually decreasing spectral wave lengths from one portion thereof to another associated portion.

In greater detail, an object representation or background area is so formed that it appears to be coloured in increasing colour strength from one part to another part, for example it may include a plurality of adjoining or overlapping bands, stripes or areas, including a plurality of shades of spectral colours or hues, for example, red, red-orange, orange, yellow-orange and yellow, arranged in the order specified. In certain specific applications of the invention an object representation may include a medial white or

yellow colour band adjoined by yellow-orange colour bands which in turn adjoin orange band formations. The latter may be associated in contiguous relation with red-orange colour bands bordered with red stripes. The adjoining bands or stripes may be formed in clearly defined contrast as regards colour hue, or may merge into one another to afford the appearance of gradual colour hue change.

Specific reference to colour formation of object representations and background areas is made for explanatory purposes only and is not intended to be interpreted in a limitary sense, since it is within the purview of my invention to utilize neutral and non-neutral shades of colour and colour hues, including the shades of colour of the noon solar spectrum extending from the portion of greatest luminosity to the limits of visible light.

Referring now in detail to Fig. 8 in which view I have depicted the letter "D" on a background, the reference character **114** designates the said background and the numerals **115** to **119** inclusive designate colour bands forming the said letter. In this figure, the medial colour band **115** of the letter D is yellow, and the remainder of the colour band formation is of constantly increasing spectral wave length. In other words, the yellow band **115** is adjoined at both sides by yellow-orange bands **116**, which in turn adjoin orange bands **117**. The latter bands adjoin red-orange bands **118** which in turn are bordered by red bands **119**. For purposes of vivid colour contrast, the background **114** may be of neutral colour, for example black.

In Fig. 9 I have shown an object representation in the form of a star which includes pigment colours contrastingly different to a background **120** also of pigment colour, namely blue. The star consists of a white medial colour stripe **121** bordered internally and externally by yellow stripes **122**, which in turn are adjoined by orange stripes **123**. The said orange stripes are adjoined by red-orange stripes **124**, and the latter are bordered by red stripes **125**.

As an example of a further modification of my present invention, I have shown a gradationally coloured area in Fig. 10, which may constitute a part of or the whole of an object representation or a background area. In this figure the colour formation is of increasing spectral wave length from one portion thereof to another portion thereof, being depicted in band formation, and including a white area **126**, a yellow area **127**, an orange-yellow area **128**, an orange area **129**, a red-orange area **130**, and a red area **131**.

Fig. 11 exemplifies a further modification of display object or background colour formation, as regards formation and colour arrangement. In this view, the coloured bands, stripes, or areas are of irregular formation, and consist of shades of colour including red and white and admixtures thereof of different proportions. For example, two sides **132** of the coloured area are of red colour formation, and are adjoined by areas **133** of pale red, which in turn are adjoined by pink areas **134**. The latter areas are adjoined by pale pink areas **135** in contiguous relation with a medial white area **136**.

As a further example of display object formation, I have shown in Fig. 12 an object formed of three shades of colours, including a central yellow area **137**, an intermediate orange area **138**, and an external or bordering red area **139**. All of the three colours may be formed in vivid contrast or may merge one into the other, according to the specific application.

As before premised, the aforesaid display objects, object representations and background areas are adapted to be flooded with beams of coloured light in such manner as to afford an appearance of animation thereof, which is dealt with in detail following a description of operation of the illuminating means hereinbefore described.

Operation

Referring first to the preferred form of apparatus illustrated in Figs. 1 to 6 inclusive, let it be assumed for purposes of explanation that the lamps **29** and the electric motor **46** are electrically energized, the display surface **12** is constantly flooded with blue or green light, and is intermittently flooded with red light, by reason of actuation of the shutters **43** and **44**.

Actuation of the shutters **43** and **44** of each illuminating unit is effected upon energization of the electric motor **46**, from which torque is transmitted by the pulley **48**, the belt **47**, the pulley **49**, the shaft **50**, the pulley **53**, the belt **52**, and the pulley **54** to the shaft **55**, which effects rotation of the cam **62**, and in turn movement of the rocker arm **60**. Each time the shaft **55** revolves, the ridge **62***a* of the cam **62** forces the roller **61** on the rocker arm **60** upwardly, as indicated by the direction arrow C, and this action in turn pulls the wire **64** downwardly, as indicated by the direction arrow D. Wire **64** being interconnected with wire **87** through the components **71**, **72**, **74**, **75**, **76**, **77**, **80** and **84**, upon movement as above referred to, effects movement of the wire **87** in the direction of arrow B, and compression of the spring **89**. Since the guide pin **84** of each illuminating unit is attached to the wire **87**, all of the said guide pins are shifted simultaneously, with the result that all the bellcranks **92** are oscillated and the interconnected links **93** and **94** shift the shutters **43** and **44** of each illuminating unit so that the said shutters are positioned, when the roller **61** is in contact with the ridge **62***a* of the cam **62**, as shown in Fig. 4. In this position, the red sections **39** of the colour filter are covered by the blades of the said shutters, and transmission of light from the lamps **29** through the said colour filter sections is impeded.

Continued rotation of the cam **62** causes the roller **61** to ride off the cam ridge **62***a*, with the result that the spring **89** is permitted to expand and shift the wire **87** in the direction of the arrow A. Such movement of the wire **87** effects simultaneous movement of all the guide pins **84**, rocking of all the bellcranks **92**, and movement of all the links **93** and **94**, in such manner that the blades of the shutters are shifted into concealment behind the opaque sections **40** of the colour filters **35**, in which position they clear the sections **39** thereof and light from the lamps **29** is now transmitted through the blue or green sections **38** and the red sections **39** of the said colour filter.

From the above it is clear that upon one complete revolution of the cam **62**, the shutters **43** and **44** are shifted, respectively in clockwise and counter-clockwise directions, from the position depicted in Fig. 4 into concealment behind the opaque sections **40** of the said colour filters, and are subsequently returned by movement respectively in counter-clockwise and clockwise directions, to the position illustrated by Fig. 4.

It follows therefore that upon each revolution of the cam **62**, red light is caused to be momentarily transmitted from the section **39** of the colour filter **35** to the display surface **12** and is subsequently cut off. In other words, during each revolution of the cam **62**, there occurs a period of illumination of the display surface **12** with red light transmitted from the colour filter sections **39**, followed by a period of non-illumination with light of the aforesaid colour.

Operation of modified form of shutter mechanism

Let it be assumed that the illuminating units designated by the reference characters **16***a* to **16***h* inclusive are equipped with colour filters and shutters of the type shown in Fig. 7 and that the shutters thereof are arranged for actuation by the motion transmitting wire **87** and associated powering means. Upon reciprocation of the said wire in the manner described, the bell-cranks **92** are oscillated and motion is transmitted therefrom to the shutters **109** by the links **111**, whereby the said shutters are oscillated about the pivot pin **110** and alternately shift from sections **106** to sections **107** of the colour filters **104**, and vice versa. It follows therefore that light emanating from the lamps passes through the red sections **106** and the green sections **107** of the colour filters in alternated order and that the display surface **12** is alternately flooded with red and green light, and is constantly illuminated with blue light emanating from the colour filter sections **108**.

Display effects

From the foregoing it is clear that the display surface **12**, including the background **15**, the indicia or object representations **14**, or alternately any display object or object representation, for example, as depicted in Figs. 8 to 12 inclusive, may be illuminated by the apparatus shown in Figs. 1 to 7 inclusive, with beams of light of cyclically varying spectral characters, to produce the desired animation effects. In greater detail, the apparatus depicted in Figs. 1 to 6 inclusive, is such that the display is constantly illuminated with a plurality of beams of substantially blue light, and intermittently with a plurality of beams of substantially red light, the intensity of the red light varying cyclically resultant of actuation of the shutters **43** and **44**, from substantially nil to the limits of capacity of the illuminating apparatus design, and vice versa. With the modified form of illuminating apparatus depicted in Fig. 7, the display is constantly flooded with beams of substantially blue light and alternately with beams of red, and beams of green light, which alternately diminish and increase in intensity by reason of actuation of the shutters **109**.

Illuminating apparatus such as illustrated and described is well adapted for illuminating displays of the character described by reason of the gradual variation in intensity of the red, and the red and green light beams, resultant of oscillation of the aforesaid light impeding shutters, particularly in such instances where the display is illuminated at a moderate frequency of light beam intensity variation, for example at frequencies of from 10 to 160 cycles per minute, depending upon the particular formation of the display. The form of apparatus illustrated in Figs. 1 to 6 inclusive is particularly well adapted for use where extensive pale areas, such as shades of pale blue, yellow, pink, or white, require illumination with substantially non-flickering effect. The modified form of apparatus shown in Fig. 7 is particularly well adapted for illumination of displays, objects, or object representations such as illustrated in Figs. 8 to 12 inclusive, where a very vivid appearance of animation is required.

Referring specifically to illumination of the display objects depicted in Figs. 8 to 12 inclusive, for general explanatory purposes and without limitation as to scope of application, at the period in an illuminating cycle when a display object is illuminated with one or more beams of blue light or beams of blue and green light, the white, yellow, yellow-orange, pale pink and pink shades of colours, for example, appear to be brilliantly and intensely illuminated. Where a display object is illuminated as aforesaid in the presence of incidental light such as obtains during the evening and night on the average city street, for example in the presence of incidental light of an intensity of from one-quarter up to one foot candle as measured by the electronic type of photometer sensorial transmission to the brain of the average observer is such that the aforesaid shades of colour appear substantially the same as when illuminated by mid-day sunlight. As the aforesaid shutters move and red beams of light impinge the display object, and increase in intensity, the shades of colour of the display object analogous to the red hue, for example red, red-orange and orange colours and hues become predominant and these shades of colours and colour hues appear to sweep across the aforesaid shades of colours and colour hues, and at the period when the red light beams are of maximum intensity, the red and red-orange shades of colour are predominant, and appear to encroach upon the aforesaid yellow-orange and yellow colour portions of the display.

In such instances where a display object is coloured gradationally from a medial portion, demedially, in colour of increasing wave length, for example from yellow, through yellow-orange, orange, red-orange to red, as exemplified in Figs. 8 and 9, at one period in an illuminating cycle, that is to say when the illuminating beams of light are deficient in red, the central and immediately adjoining areas appear to be brilliantly illuminated and are predominant, and at another period in an illuminating cycle when the red light beams are of substantially maximum intensity, the external red portions and the intermediate red-orange and orange portions of the display appear to be of analogous colour hue, namely red and red-orange. As the red light beams increase in intensity, the aforesaid intermediate red-orange and orange areas appear to change in colour from their daylight colour values to red hue, which change affords the optical illusion of distortion to the display objects. In other words, the said display objects appear to bulge forward and spread out, the latter appearance of movement being very pronounced where a display object is associated with a background, as in Figs. 8 and 9. The appearance of distortion and bulging above referred to affords the optical illusion of movement forward of the display object with respect to its background, that is to say, towards the observer. As the red light beams diminish in intensity, the central and adjoining areas of the display object are rendered predominant, with attendant appearance of recession of red hue illumination from the aforesaid intermediate areas, which affords the optical illusion of retrogression of those portions of the display object with respect to its background, or in other words, recession

from the observer. At all times the geometrical formation of a display object remains the same.

In such instances where a display surface or a portion thereof, either in the form of an object representation or a background area, is coloured gradationally from one portion thereof in coluors of decreasing spectral wave lengths such as exemplified in Fig. 10, when cyclically illuminated in the manner described, there is afforded an optical illusion of back and forth motion in a direction substantially transversely of the colour band formation, that is to say, from right to left and vice versa, of the area depicted in Fig. 10.

For best appearances of vivid animation, pulsation and alternated backward and forward movement, as exemplified above, the display object or other area under cyclically varying spectral light should include several colour bands, stripes or areas of gradually changing shades of colour, as exemplified in Figs. 8 to 11 inclusive, but nevertheless good animation effects may be obtained with display matter including a plurality of coloured areas of closely distinctive colour contrast, as exemplified in Fig. 12.

Relative intensities of coloured light beams impinging the display object are in some measure determined by the specific colour formation of the object per se and its co-relation with the sources from which the light beams emanate, and special applications of the invention must be dealt with according to all attendant factors and known principles of reflection and absorption of light. Display objects and areas of the character described appearing on conventional type outdoor display bulletins are suitable for illumination by apparatus of the character described wherein a single light source is used in each luminaire and the differently coloured sections of the colour filter are of substantially equal area.

Although I have selected, for purposes of concise explanation, certain colour treatments or formations of display objects, object representations and other display areas or surfaces, and have specified illumination thereof with beams of coloured light of predetermined characteristics, certain of which are caused to vary in intensity whereby the spectral characteristics of illumination cyclically vary, this disclosure is not to be interpreted as limited to the details exemplified, but on the other hand should be interpreted in a generic sense by those skilled in the art, as defined by the scope of the following claims.

I claim:

1. In display apparatus of the character described, in combination, a display object having a plurality of coloured areas, including substantially central areas, intermediate areas surrounding the said substantially central areas, and external areas surrounding the said intermediate areas, the shades of colour of the said areas being relatively different and including shades of colour of the noon solar spectrum extending from the portion of greatest luminosity to the limits of visible light; and apparatus arranged to flood the said display object with coloured light in recurring cycles in such wise that at one point in an illuminating cycle the substantially central areas of the said display object appear to be brilliantly illuminated and at another point in an illuminating cycle the said surrounding areas appear to be brilliantly illuminated and of substantially the same hue as the said intermediate areas, and the said substantially central areas appear to bulge forward.

2. In display apparatus of the character described, in combination, a display object of gradated colour formation including stripes arranged in substantially contiguous relation and chromatically variegated to reflect light in increasing wave length, the said stripes being arranged within the confines of stripes which define external portions of the said display object, which external portions appear to be of substantially one shade of colour and of a shade different than the shades of colour of the stripes between said external portions; and apparatus arranged to flood the said display object with varying shades of coloured light in recurring illuminating cycles, the said display object being arranged as aforesaid and in such wise and the said illuminating apparatus being arranged to flood the said display object with varying shades of coloured light in such manner that at one moment stripes within the confines of the said external portions of the said display object appear to be more conspicuous than the said external portions of the said display object and at another moment the said external portions of the said display object appear to be more conspicuous than the stripes within the confines thereof and certain of the latter appear to be of substantially the same colour hue as the colour hue of the said external portions.

3. In display apparatus of the character described, in combination, a display object of chromatically variegated spectral formation including shades of colour of increasing colour value, as viewed from one portion thereof to another portion thereof, including external portions which define the contour of the said display object, which external portions are of substantially one hue, and coloured areas within the confines of the said external portions, which coloured areas adjoining the said external portions are of relatively different shades of colour with respect to the shades of colour of the said external portions, and coloured areas forming substantially central portions of the said display object, the shades of colour of the last said areas being relatively different with respect to the shades of colour of the areas immediately surrounding the said central portions; and apparatus arranged to flood the said display object with recurrently changing shades of coloured light in recurring cycles and in such wise that portions of the said display object appear to alternately advance towards and recede from the observer of the display and the said external portions of the said display object appear to alternately encroach upon the said central portions of the said display object.

4. In display apparatus of the character described in combination, a stationary display object including areas of relatively different hues, which areas are formed of relatively different coloured stripes arranged in decreasing wave length and in order of relative attention compelling value and including shades of colour of the noon solar spectrum between the portions of greatest luminosity and the limits of visible light; and apparatus arranged to impinge the said display object with varying shades of coloured light in recurring cycles, the said display object being formed, coloured and arranged in such wise and the said illuminating apparatus being arranged to flood the said display object in such manner that the said display object appears to pulsate and portions thereof appear to alternately move towards and recede from the observer of the display object.

5. In display apparatus of the character described, in combination, a display object including relatively different shades of colours of analogous hue formed and arranged in gradually changing colour hue bands, and apparatus arranged to illuminate the said display object with shades of coloured light in recurring cycles, the said display object being formed in such wise and the said apparatus being arranged to intermittently flood the said display object with light of different colour in such manner that at different periods during an illuminating cycle different shades of colour of the said display object are rendered momentarily conspicuous and predominant, whereby the said display object appears to pulsate.

6. In combination, a display object including a plurality of narrow bands arranged side by side, the said bands being formed of relatively different shades of colour of increasing chroma of non-continuous spectral character and co-related in such wise that there is presented in the display object a gradual change of surface colour as it is viewed from one extremity thereof to another extremity thereof; and apparatus arranged to flood the said display object with shades of coloured light of such spectral character and in such wise that the said display object appears to pulsate.

7. A display of the character described including, in combination, a stationary background and a stationary object associated with the said background, the said object being formed to reflect light in contiguous bands commencing at a predetermined spectral wave length and extending decentrally in increasing spectral wave lengths; and means to flood the said display with light of different color and of such spectral character and in such manner that the said object partakes of the appearance of alternate expansion and contraction.

8. A display of the character described including, in combination, a stationary background and a stationary object associated with the said background, the said object being formed in shades of non-neutral colour arranged to reflect light in gradually decreasing spectral wave lengths from substantially its medial portion demedially; and apparatus arranged to flood the said display object with shades of coloured light in recurring cycles and in such wise that portions of the said object appear to alternately move toward and recede from the observer.

9. In the art of illuminated displays, in combination, a stationary object and a background for the said object, the said object and the said background being formed in contrastingly different shades of colour, the said object being formed in non-neutral shades of color in such manner that it reflects light in a plurality of gradually increasing spectral wave lengths; and apparatus arranged to flood the said display object and background with recurrently changing beams of coloured light and in such wise that the said background appears to remain stationary and the said object partakes of the appearance of pulsation and distortion in one plane.

10. In combination, a display area and means to flood the said area at non-coincident periods with light beams having different pigment colour characteristics, the said area including colour gradations of non-continuous wave lengths and embodying a plurality of shades of colours including at least one pigment colour and being so formed and arranged that at one period during an illuminating cycle portions of the said area are rendered predominant and at another period of the same illuminating cycle portions of the aforesaid portions appear to change in colour and the entire area appears to be brilliantly illuminated.

11. In combination, a chromatically variegated display object of gradated spectral formation, the gradations of which vary chromatically in gradually increasing wave lengths, and apparatus arranged to illuminate the said object at non-coincident periods with light beams including non-neutral shades of colour, at least one of which light colours corresponds substantially with one of said object colours, the said apparatus being arranged to effect illumination of the said object in recurrent cycles at such frequency that there is presented an appearance of bodily object movement.

12. In combination, a display surface having contrastingly coloured areas including one area formed in a plurality of shades of non-complementary colours having spectral colour difference, and means for displaying the said display surface successively in the presence of light beams having different colour characteristics, whereby the last said area partakes of the appearance of pulsation and alternate expansion and contraction.

13. In the art of illuminated displays, in combination, a chromatically variegated display embodying non-complementary coloured portions arranged to gradationally reflect light, radiation emitting means arranged to flood the said display object with beams of coloured light, and further means arranged to recurrently vary the characteristics of radiation emitted from the said radiation emitting means whereby the said display object reflects radiation in such wise that it partakes of an appearance of sustained illumination and recurrent pulsation.

14. In the art of illuminated displays, in combination, a display surface containing a gradated portion formed to reflect light in non-complementary spectrally varied wave band formation; a contrastingly different coloured portion adjoining the aforesaid gradated portion; means arranged to project beams of coloured light against the said display surface, which light beams include shades of colour contained in the said gradated portion of the display surface, and further means arranged to govern the aforesaid means to effect variation in the spectral characteristics of emitted radiation so as to produce an appearance of recurrent shifting of that portion of the gradated portion adjoining the contrastingly different coloured portion towards the latter.

15. In the art of illuminated displays, in combination, a display surface containing a coloured area the contour of which is defined in part by a contrastingly different multi-hued area arranged to gradationally reflect light of non-neutral characteristics; means arranged to flood the said display surface with coloured light including at least one wave band of colour similar to one of the shades of colour of the said multi-hued display surface area, and further means arranged to effect recurrent variation in the spectral characteristics of such light so as to produce an appearance of recurrent expansion and contraction of the first said coloured area.

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