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UNDERWATER COLOR LIGHTING METHOD AND DEVICE

Filed March 23, 1964 2 Sheets-Sheet 1

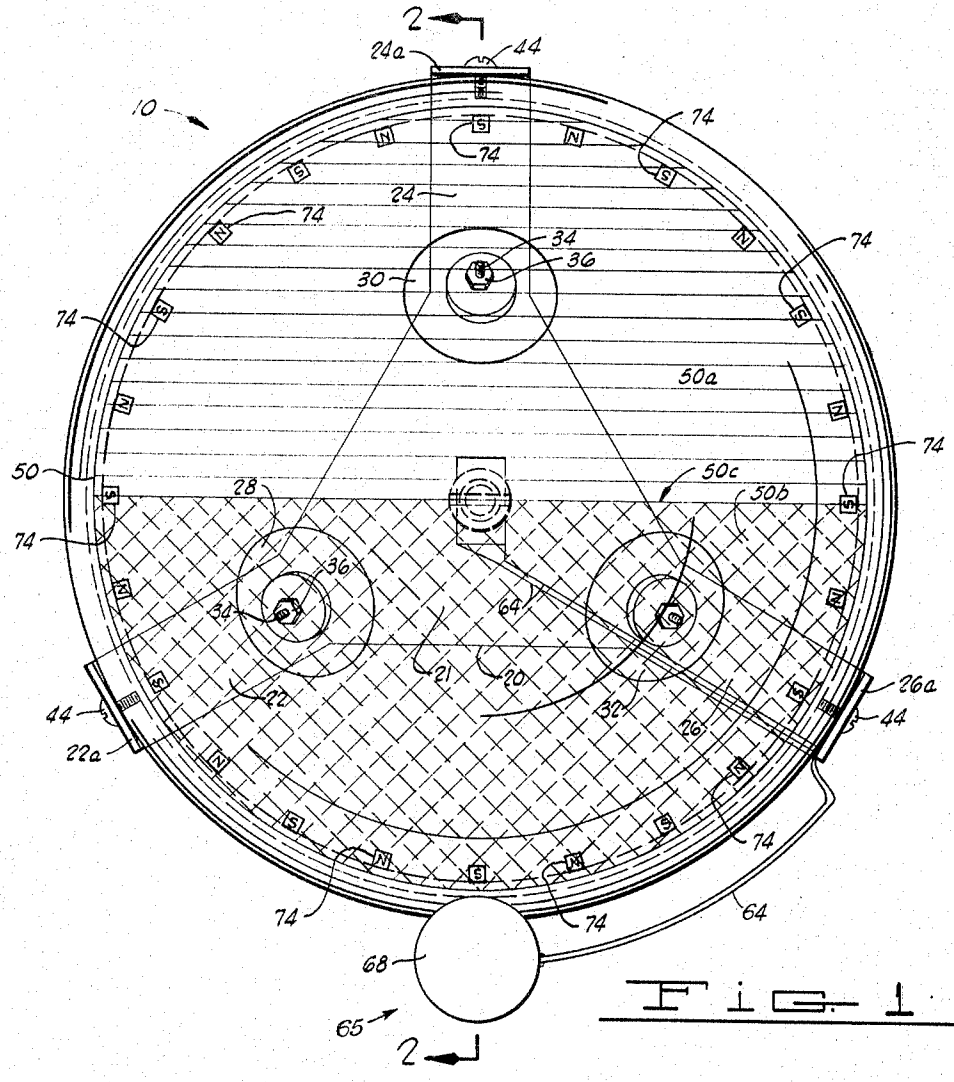

Fig. 1

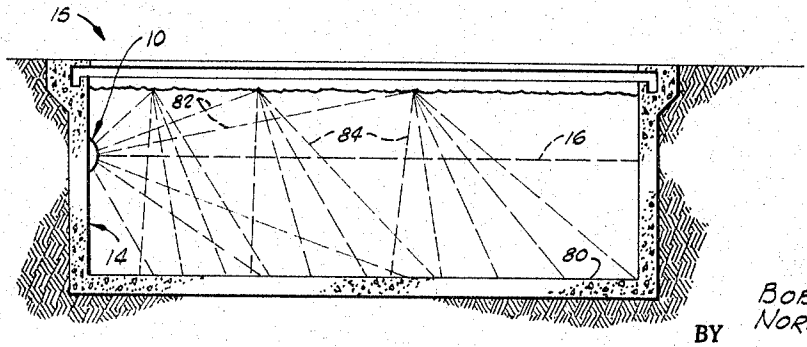

Fig. 3

INVENTORS
BOBBY G. MOORE &
NORMAN D. OSWALD

BY E. Mickey Hubbard
ATTORNEY

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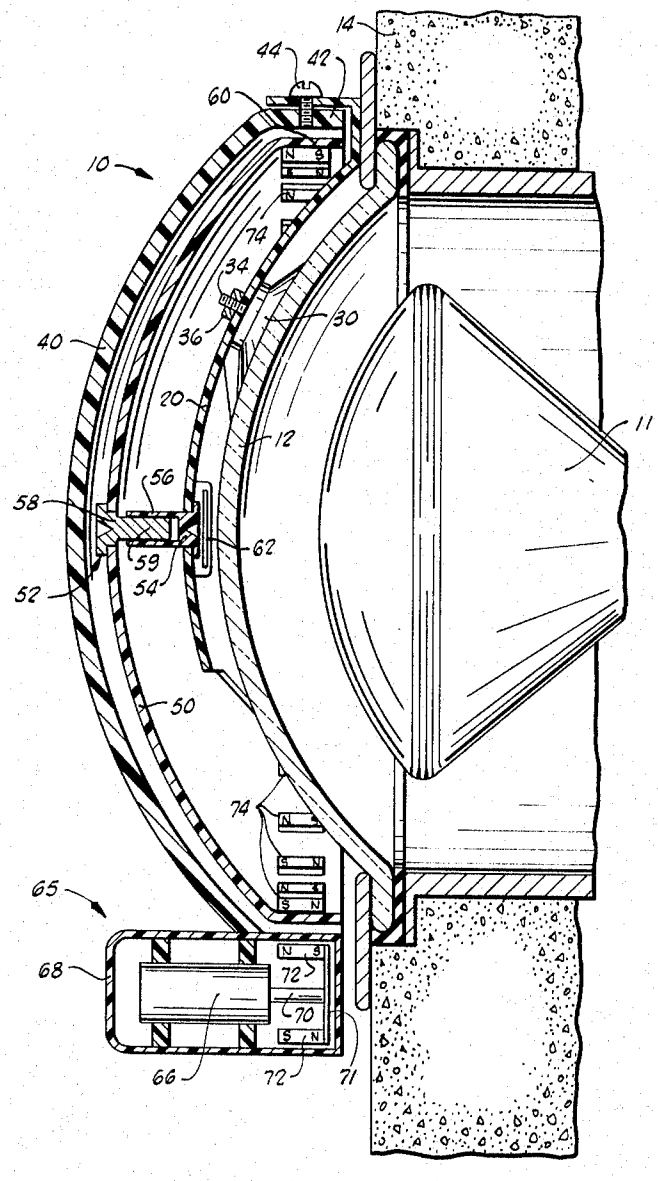

Fig. 2

INVENTORS.
BOBBY G. MOORE &
NORMAN D. OSWALD
BY
E. Mickey Hubbard
ATTORNEY

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UNDERWATER COLOR LIGHTING METHOD AND DEVICE

Bobby G. Moore, 6609 Del Norte, Dallas, Tex. 75225, and Norman D. Oswald, Dallas, Tex.; said Oswald assignor to said Moore

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The present invention relates to decorative lighting systems, and more particularly, but not by way of limitation, relates to a method and apparatus for lighting a swimming pool or other relatively clear body of liquid.

Various devices have been proposed for projecting changing color patterns upon water fountains and into swimming pools. In general, these devices employ very elaborate structures including separate light sources and various colored lens mechanisms which are moved in front of the light source to project the desired colors. The most common type of device for this purpose has a plurality of color segments mounted on a wheel or disc such that when the wheel is rotated, the various colors are successively moved over the light source. A great majority of these devices utilize an electrical drive system for rotating the color wheel or operating the other color changing mechanisms which may be employed. Further, these devices are all relatively complicated and have a high initial cost and most must be installed at the time the pool is constructed.

In more recent times, pool lighting devices have been devised which can be placed over various standard light sources disposed in the walls of the pool and driven by fluid pressure from the pump of the pool filtering and purifying system. This system requires rather extensive plumbing for installation. Further, these devices are relatively large because the color wheel must be over twice the diameter of the lens of the pool light fixture in order to successively move the various colored segments into register with the light source. This type of color wheel results merely in successive changes in colors with some co-mingling as the colors change.

The present invention contemplates a method and system for lighting a swimming pool or the like which produce a unique and highly pleasing color pattern. This is accomplished by projecting a first color generally toward the bottom wall of the pool and projecting a second color generally toward the surface of the water in the pool. Portions of the second color are then reflected or refracted by the surface ripples in the pool onto the bottom of the pool where the second color appears as a dancing ripple pattern superimposed on the first color, as well as producing various superimposed patterns on the walls of the pool.

More specifically, the unique color pattern can be accomplished by positioning a colored lens-disc over the lens of a standard light fixture forming a portion of the wall of the swimming pool. The lower half of the lens-disc is the first color, such as a dark blue, and the upper half is the second color, such as light blue or green. Light is projected through both the upper and lower halves so that the first color will then be projected generally onto the bottom and the second color will be projected generally upwardly to the surface and be reflected back to the bottom and superimposed as a dancing ripple pattern on the first color. The configuration of the particular pool will vary the resulting color pattern to some extent, and the water tends to refract the light downwardly toward the bottom so that some portions of the bottom will sometimes be partially lighted with the second color.

In accordance with another important aspect of the invention, the colored lens-disc may be rotated about an axis substantially centered over the standard lens of the light fixture. Then when the first color of the disc is positioned at the bottom, the first color will be projected generally onto the bottom wall of the pool and the second color will be projected generally upwardly to the surface of the water. This results in reflected ripples of the second color dancing on the bottom which is predominantly the first color. As the lens-disc rotates, the pool progressively becomes bisected by the two colors and finally the bottom wall becomes predominantly the second color with ripple reflections of the first color.

In accordance with another very important aspect of the present invention, energy generated by changing the light source is used to drive a device such as the color changing mechanism. In the preferred embodiment, a photovoltaic cell is so positioned as to receive the light emanating from the pool fixture over which the disc is positioned, and the current generated by the cell is used to drive an electric motor which in turn is connected to rotate the lens-disc. The voltage generated in this manner is quite small so that no safety hazard is involved and all external wiring is eliminated.

The invention further contemplates a novel means for securing the device to the lens of the light fixture, a novel drive system, a novel bearing support for the color disc and a novel overall construction, and the preferred embodiments of each will hereafter be described in detail.

Therefore, an important object of the present invention is to provide a lighting system for coloring a swimming pool or the like in a unique and very aesthetic manner.

Another object of the present invention is to provide a method for lighting a swimming pool or the like in a unique and very aesthetic manner.

Still another object of the present invention is to provide a drive system for operating the color changing mechanism or system associated with a light source which requires no connection to an external power source.

Yet another object of the present invention is to provide a device of the type described which may be very quickly and easily installed over substantially any standard underwater swimming pool light fixture.

A still further object of the present invention is to provide a device of the type described which may be very economically manufactured and which will have a long service life.

Yet another object of this invention is to provide a device of the type described which is safe in that no dangerously high voltage electricity is required.

Another object of the present invention is to provide a very low friction bearing support which is simple and may be economically manufactured and assembled.

A further object of the present invention is to provide a drive system which may be operated under water, yet which does not require any water-tight seals between a rotating shaft and a casing.

Many additional objects and advantages of the present invention will be evident to those skilled in the art from the following detailed description and drawings, wherein:

FIGURE 1 is a side view of a device constructed in accordance with the present invention;

FIGURE 2 is a sectional view taken substantially on lines 2—2 of FIGURE 1; and

FIGURE 3 is a schematic drawing illustrating the method of the present invention.

Referring now to the drawings, a color lighting device constructed in accordance with the present invention is indicated generally by the reference numeral **10**. As can best be seen in the sectional view of FIGURE 2, the device is positioned over a standard light fitting having a light source **11** and a clear convex lens **12** which forms a portion of a wall **14** of a swimming pool **15** or the like. The convex lens **12** is adapted to project light from what

may be considered as a point source generally along an axis of radiation 16 into a substantially complete hemisphere bounded by the wall 14 of the pool.

The device 10 is comprised of a mounting fixture member 20 which may be molded from transparent plastic material and which preferably has a triangularly-shaped body portion 21 as best seen in FIGURE 1 with three elongated brackets 22, 24 and 26 extending from the apexes of the body portion 21. The body portion 21 is preferably concavo-convex so as to conform to the convex lens 12. The extension brackets 22, 24 and 26 have a cross-sectional configuration as best seen in FIGURE 2 so as to provide tab portions 22*a*, 24*a* and 26*a* extending perpendicularly from the wall 14 of the swimming pool and generally parallel to the axis 16 of light radiation for purposes which will presently be described. Three differential pressure cups 28, 30 and 32 are connected to the apexes of the body portion 21 by any suitable means such as the threaded studs 34 which extend through the mounting fixture 20 and receive nuts 36. The differential pressure fastening devices are merely what is commonly referred to as "vacuum cups." When pressed against the lens 12 of the light fixture, the pressure of the water acting on the back side of each cup presses the cup against the lens and securely holds the mounting fiixture member 20 in place over the lens.

An outer case 40 may also be molded from clear plastic material to form a circular, concavo-convex member having a cylindrical peripheral portion 42 which is received within the tab portions 22*a*, 24*a* and 26*a* of the extension brackets 22, 24 and 26. Suitable screws 44 extend through the tab portions and are threaded into the cylindrical portion 42 to secure the outer case 40 in place.

A colored lens member 50 is disposed between the mounting fixture 20 and the outer case 40 and is rotatably connected to the mounting fixture member 20 by a centrally-located bearing assembly 52. The bearing assembly 52 is preferably aligned with the axis of light propagation 16 and is comprised of a Delrin, or similar low friction plastic, journal member 54 which is press-fitted into an aperture in the center of the mounting fixture member 20. The journal member 54 has an outwardly-extending sleeve portion 56 which forms a generally fluid-tight, cylindrical well. An axle member 58, which may also be fabricated from a low friction plastic as described above, is press-fitted in an aperture in the center of the rotating colored lens member 50 and has an inwardly-extending axle portion 59 which extends into the sleeve 56 with a relatively close fit. The contacting surfaces of the low friction plastics provide a very low friction bearing. Further, once the cylindrical axle portion 59 is pressed into the sleeve portion 56, the close fit between the parts will provide a partial fluid seal and the pressure of the water on the axle member tends to retains the axle portion 59 within the sleeve 56.

The colored lens member 50 is transparent and the upper and lower halves 50*a* and 50*b* on opposite sides of the dotted diametrical line 50*c* are different colors, such as blue and amber, respectively. The two transparent colors may be applied to the lens member 50 by any suitable means, such as by initially impregnating the plastic material before it is molded, by bonding a transparent colored plastic film to a clear plastic back-up member, or by applying a liquid coloring agent to a clear plastic material. The colored lens member 50 is also concavo-convex to conform to the light fixture lens 12 and has a cylindrical skirt portion 60 which is received within the cylindrical portion 42 of the outer case 40.

Within the broader aspects of the present invention, the colored lens member 50 may be rotated by any suitable drive means. However, in accordance with an important aspect of the present invention, the colored lens member is driven by energy derived from the standard light source covered by the lens 12. This is preferably accomplished by one or more photovoltaic cells 62 which are so disposed as to be illuminated by the light radiated from the light fixture, and may be conveniently connected to the inner face of the mounting fixture 20, substantially as illustrated. One cell may be sufficient to rotate the colored lens 50 at the desired speed, which will usually be, at most, only a few revolutions per minute, if the proper gear-reducing drive is utilized. If a greater current is desired, a number of cells may be connected in parallel or if a greater voltage is desired, a number of cells may be connected in series.

Suitable leads 64 extend from the photovoltaic cell along one of the bracket extensions, such as extension 26, and is connected to a novel drive system indicated generally by the reference numeral 65. The drive system 65 is comprised of an electric motor and gear train assembly 66 which is located within a hermetically sealed or other water-tight housing 68. The housing 68 should be fabricated of plastic or other non-magnetic material so as not to interfere with magnetic flux. The electric motor and gear train assembly 66 has an output shaft 70 which carries a crosspiece 71. A pair of oppositely oriented bar magnets 72 having north and south poles are connected to the ends of the crosspiece 71 and are rotated by the shaft 70 in close proximity to and generally in the same plane as the colored lens member 50. A plurality of small permanent bar magnets 74 are secured at spaced intervals around the periphery of the cylindrical portion 60 of the lens member and are magnetically coupled to the rotating bar magnets 72. Adjacent magnets 74 are oppositely oriented so that as the bar magnets 72 are rotated, the magnets 72 attract every other one of magnets 74 and repel the other magnets 74, and the magnetically coupled magnets function in much the same manner as intermeshing gears and thereby rotate the colored lens member 50.

It will be appreciated by those skilled in the art that the device 10 can be economically manufactured and assembled. The mounting fixture 20, the outer case 40, the colored lens member 50, and the housing 68 may all be molded from plastic. The plastic bearing member 54 and axle member 58 may be molded or machined. The magnets 74 may be connected to the colored lens member 50 by a suitable waterproof cement. The journal member 54 may be pressed into an aperture in the mounting fixture member 20 and the member 58 pressed into an aperture in the colored lens member 50. The axle member 58 is then merely pressed into the sleeve member 56. The photovoltaic cell 62 may be cemented or otherwise secured to the mounting fixture 20 and the differential pressure cups 28, 30 and 32 secured in place by the nuts 36. The electrical leads 64 preferably include a quick-connect coupling for connection to the electric motor. The electric motor and gear train assembly 66 including the rotating magnets 72 may be sealed in the plastic housing 68 by cementing a cover (not shown) in place. The plastic case may then be connected to the outer case 40 by screws, cementing, or other suitable means. The outer case 40 may then be secured to the mounting fixture 20 by the three screws 44 and assembly of the device is completed.

The device 10 can be installed merely by positioning the differential pressure cups in position over the lens 12 of the light fixture and pressing on the outer case 40 until the differential pressure cups 30 are securely engaged. No electrical connection of any kind is required. When the light is switched on, light impinging on the photovoltaic cell 62 will generate a current in the cell and drive the electric motor 66 and thereby rotate the bar magnets 72. The magnetic coupling between the bar magnets 72 and the peripheral bar magnets 74 secured to the colored lens member 50 will slowly rotate the colored lens member. Of course it will be appreciated that other forms of magnets may be employed without departing from the broader aspects of the invention.

The curvature of the pool, particularly the curvature

of the bottom of the pool, will vary the overall lighting effect of the device **10**. However, when the colored lens member **50** is in the position illustrated in FIGURE 1 with the line **50***c* extending generally horizontally, the color of the lower half **50***b* will be projected generally downwardly toward the bottom **80** of the pool, as represented by the lines **82** in FIGURE 3, and the color of the upper half **50***a* will be projected generally outwardly and upwardly toward the surface of the water, as represented by the lines **84**. The surface ripples and waves will then reflect a portion of the light downwardly and the curvature of the ripples will cause areas of concentrated light of the color from the upper half to be superimposed on the color from the bottom half of the colored lens member in a constantly changing ripple pattern, depending upon the degree of agitation of the surface of the pool. As the colored lens member **50** continues to rotate, the color pattern progressively changes. When the dividing line **50***c* between the color halves is disposed vertically, the pool will be divided generally into two colors generally along a vertical plane extending from line **50***a*. As the colored lens member **50** continues to rotate, the color scheme will progressively change until the junction line **50***c* is again horizontal, at which time the other color will be projected generally onto the bottom of the pool and the first color will be superimposed as the dancing ripple pattern. The overall lighting effect is unique and strikingly beautiful, and has a very pleasing aesthetic effect.

Although a magnetic drive system that is particularly suited for use under water has been described, it will be appreciated that within the broader aspects of the invention, any suitable electric drive mechanism may be used to rotate the lens member. It will also be appreciated that although the photovoltaic cell energy system is particularly suited for driving an underwater lighting device such as described, the system may also be used to drive any mechanism associated with a light source.

From the above detailed description of a preferred embodiment of the invention, it will be evident that a device for providing a unique lighting effect has been disclosed. If desired, the colored lens member may be fixed over the light fixture, such as by replacing the light fixture lens with a multicolor lens. Or a separate colored lens member may be secured over the light fixture lens, preferably by differential pressure cups connected directly to the colored lens member for simplification. In this regard, it should be noted that the differential pressure cups will not materially interfere with the light projected through the colored lens member, probably because of the high degree of refraction and reflection inherent in the pool. If desired, the colored lens member may be rotated by a conventional electric source or by water jets, but the unique drive system employing the energy generated by the light source eliminates the need for any external wiring or plumbing. The drive system will not be operative unless the pool lights are turned on, if the photovoltaic cells are properly positioned so as not to be illuminted by day, yet will be activated as soon as the pool lights are turned on. The novel power system may also be used to operate almost any color changing mechanism.

Although a preferred embodiment of the invention has been described in detail, it is to be understood that various changes, substitutions and alterations can be made in the parts and in the combinations thereof without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. In combination with a light source disposed in a side wall of a water pool having a bottom and a free water surface, the light source being disposed below the water surface, a transparent colored lens member disposed over the light source such that light from the source will be projected through the lens member, the lower portion of the lens member over the light source being a first color and the upper portion of the lens member over the light source being a second color whereby light passing through the lower portion will be a first color and will be directed generally onto the bottom and light passing through the upper portion will be a second color and will simultaneously be projected generally upwardly to the surface where a portion of the light will be reflected downwardly to the bottom and be superimposed as a ripple pattern on the first color.

2. The combination defined in claim **1** further characterized by:

means for rotating the lens member about an axis extending generally from the center of the light source.

3. The combination defined in claim **2** wherein:

the means for rotating the lens member is energized by a first type of energy, and the device is further characterized by:

means for converting energy generated by the light source to the first type of energy whereby the lens member will be rotated by energy derived from the light source.

4. The combination defined in claim **3** wherein:

the means for rotating the lens member includes an electric motor, and

the means for converting energy generated by the light source comprises at least one photovoltaic cell so disposed as to be illuminated by light from the light source.

5. A device for projecting a changing color pattern from a light source comprising:

a multicolored transparent lens member,

support means for rotatably supporting the lens member in front of the light source such that light from the source will pass through at least a portion of the lens member,

an electric motor connected to rotate the lens member, and

at least one photovoltaic cell disposed in a position to be illuminated by light from the light source and connected to energize the motor and thereby rotate the lens member.

6. A device for projecting a multicolored pattern from a light fixture disposed in a wall of a pool and having a lens forming a portion of the wall, comprising:

a substantially transparent mounting member for disposition over the lens,

means connected to the mounting member for coupling the mounting member to the wall of the pool,

a substantially transparent case member connected at the periphery thereof to the mounting member and spaced therefrom,

a multicolored transparent lens disposed between the mounting member and the case member and adapted to substantially cover the lens of the light fixture such that substantially all light from the light source will pass through the lens,

journal means rotatably connecting the multicolored transparent lens to one of the members for rotation about an axis extending from the center of the lens of the light fixture, and

drive means for rotating the multicolored transparent lens member about the axis.

7. A device as defined in claim **6** wherein:

the lens member has at least two colors divided by a line which becomes generally horizontally disposed as the lens member is rotated such that light of one of the colors will be projected downwardly toward the bottom of the pool and light of another color will be projected upwardly toward the surface of the water in the pool.

8. A device as defined in claim **7** wherein:

the lens member has two different colors and the

dividing line between the colors extends through the axis of rotation of the lens member.

9. A device as defined in claim 8 wherein the drive means is characterized by:

an electric motor connected to rotate the lens member, and

a photovoltaic cell means disposed so as to be illuminated by light radiating from the light source and connected to energize the electric motor.

10. A device as defined in claim 9 wherein the drive means is further characterized by:

a reduction gear assembly connected to be driven by the electric motor and having a rotating output shaft,

first magnetic means connected to the output shaft,

a watertight housing encasing the electric motor, the reduction gear assembly, the output shaft and the first magnetic means, and

second magnetic means connected to the lens member and magnetically coupled to the first magnetic means such that rotation of the first magnetic means rotates the lens member.

11. A device for projecting a changing color pattern from a single light source having a clear lens, comprising:

a transparent mounting member having at least one differential pressure cup for connecting the mounting member to the lens of the light source,

a transparent outer case member connected to the mounting member and spaced therefrom,

a multicolored lens member disposed between the outer case member and the mounting member and rotatably connected to one of the members, the lens member covering the lens of the light source so that light emanating from the source will pass through the lens member, and

drive means connected to one of the members for support and to the lens member for rotating the lens member, the drive means including an electric motor connected to rotate the lens member, and a photovoltaic cell connected to one of the members in position to be illuminated by light from the light source and electrically connected to energize the electric motor.

12. A device for use in combination with a projecting light source comprising a multicolored lens member for disposition adjacent the light source and for coloring light projected from the light source through the lens member, said lens member being movable to produce changing color patterns, and powered means for disposition adjacent the light source operatively coupled to move the lens member, the powered means comprising an electric motor coupled to move the lens member and means for converting energy produced by the light source to electric energy electrically coupled to drive the electric motor.

13. The device defined in claim 12 wherein the electric motor is housed in a watertight case and is coupled to the lens member by magnetic means disposed on opposite sides of the case and intercoupled by magneitc flux passing through the case.

14. In combination with a light source disposed in the side wall of a pool of liquid having a bottom and a free liquid surface, the light source being disposed below the liquid surface, a lens member disposed over the light source, a lower portion of the lens member being a first color and an upper portion of the lens member being a second color, the colored portions joining along a generally horizontal line intersecting the light projected from the source whereby light of the first color will be projected generally onto the bottom of the pool and light of the second color will simultaneously be projected generally upwardly to the surface of the liquid and from there be directed downwardly onto the bottom of the pool to form an intermingled pattern of the two colors.

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JOHN M. HORAN, *Primary Examiner.*

NORTON ANSHER, *Examiner.*

C. R. RHODES, *Assistant Examiner.*