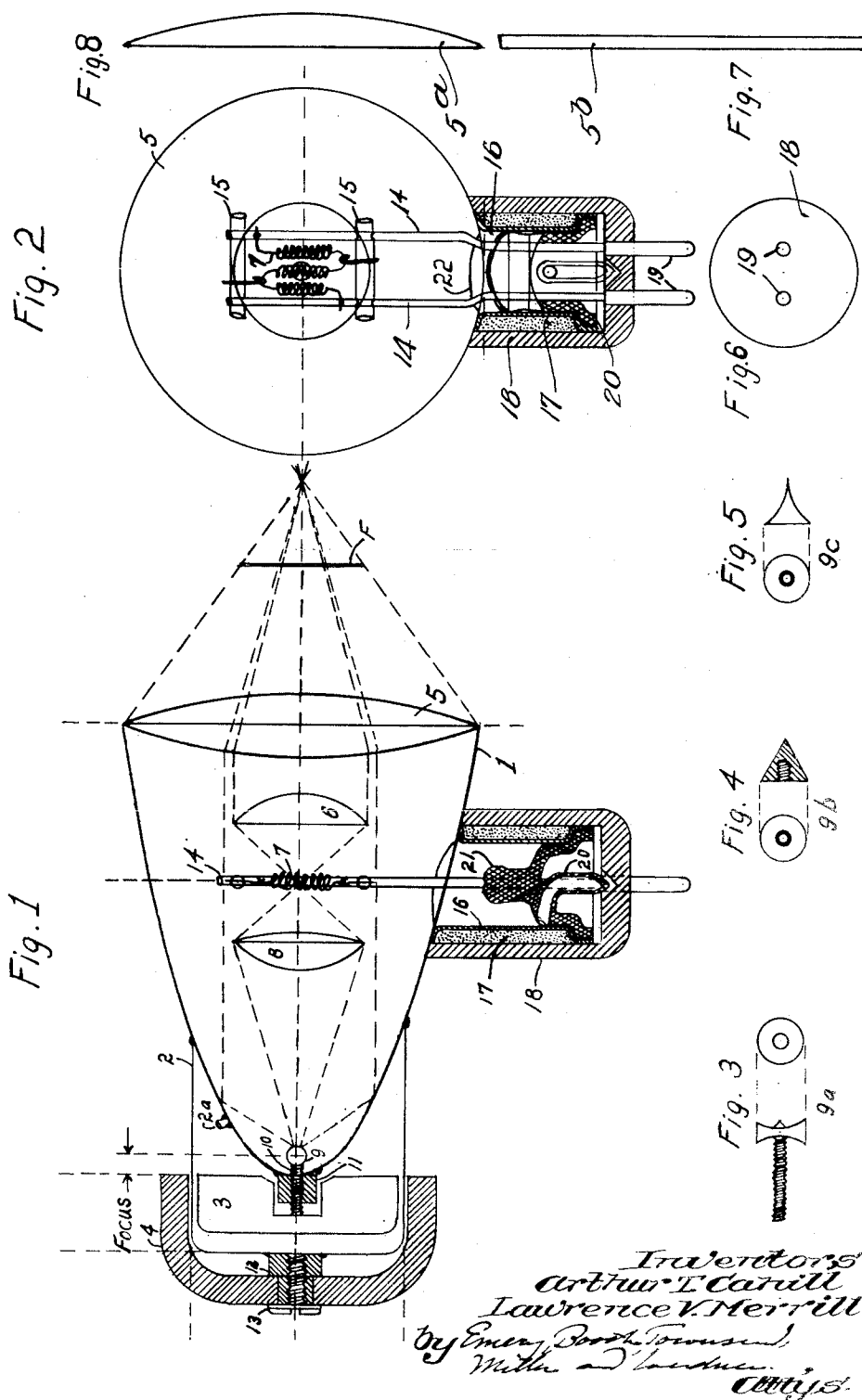


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 LIGHT-BEAM PROJECTING MEANS FOR PROJECTING
 PICTURES, FLOODLIGHTING, SPOTLIGHTING, ETC
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LIGHT-BEAM PROJECTING MEANS FOR
PROJECTING PICTURES, FLOODLIGHT-
ING, SPOTLIGHTING, ETC.Arthur T. Cahill, Weehawken, N. J., and
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23 Claims. (Cl. 313-111)

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This invention relates to light-beam projecting means for projecting pictures, etc.

In order that the principle of the invention may be readily understood, we have disclosed a single embodiment thereof in the accompanying drawing, wherein:

Fig. 1 is a view partly in vertical, longitudinal section and partly diagrammatic, of the light beam projecting means constituting one embodiment of our invention;

Fig. 2 is a diagrammatic view, looking toward the left from the right-hand end of the projecting means shown in Fig. 1, representing the three lenses constituting a part of the projecting means and the focal reflecting means;

Fig. 3 is a detail showing in side view and in front elevation an alternative form of focal point light control means consisting of a double concave lens to be located at or near the focus of the parabolic shell shown in Fig. 1;

Fig. 4 is a view similar to Fig. 3 of a second alternative form of light-reflecting means to be located at or near said focus.

Fig. 5 is a combined end view and side elevation of a slightly modified form of cone from that shown in Fig. 4;

Fig. 6 is an end external view of the filament mounting means shown in Figs. 1 and 2;

Fig. 7 is a side view of a plain, parallel sided glass front for the projector when used as a floodlight; and

Fig. 8 is a single lens for the projector when used as a spotlight.

Referring more particularly to the drawing, this invention concerns a new form of projector lamp and lens system for projecting pictures, or for throwing a very powerful and controllable beam of light on any distant area by an exceedingly small amount of electricity. It differs widely from the types now in use in projecting machines used for homes and schools, and we believe it to be new and a radical departure from them. Instead of having the lamp in a cylindrical light-house which has a small hole in one side of it into which the first concentrating lens is fitted, and so only getting from one and a half to two per cent of the light of the lamp into the optical beam, as is now considered good practice in the trade, our system is so constructed that many times that efficiency is secured. Efficiency is always valuable, and particularly in projecting machines where it is now almost at zero. Our system is also so constructed that the outside edges of the beam are materially reinforced.

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In Fig. 1, a parabolic shell or housing is indicated at 1, in which the optical system is mounted. Its interior is polished silver, or else silver plated. When the parts of the system have been mounted, the shell 1 should be evacuated and then filled with an inert gas under pressure, such as Krypton or Zenon, so that the bright silver surface will never tarnish, and its highlight reflecting value will be preserved to the end of the life of the lamp. The compressed gas also serves to conduct the heat away from the filament to all parts of the lamp housing and so dissipates it. The wires which support the filament and also carry the current are brought in from the sides through insulating reinforcements which render the housing air-tight. Filament support wires and a tube for evacuating and refilling the lamp are all mounted on an insulating stem so as to facilitate replacing a burned-out filament. This matter, not herein specifically claimed, is described at a subsequent point.

There is secured to the rear of the shell 1 a nonmagnetic drawn cup or supplemental shell 2. It is closed at the rear end and also at the front end where it is attached to the shell 1 and is therefore air-tight. A vent 2a, connected to the interior of both shell 1 and cup 2, permits evacuating and then refilling with gas of both the shell 1 and cup 2 at one operation.

A so-called rotor vane 3 is provided within the rear end of the cup or supplemental shell 2. Removably mounted outside and at the rear end of the cup 2 is a permanent magnet 4, to be subsequently fully referred to.

The front of the shell 1 is closed by a concentrating lens 5, being double for projection of film images, single for a spot light as shown at 5a in Fig. 8, and a plain window for a floodlight as shown at 5b in Fig. 7. At the proper distance from a relatively small concentrating lens 6 is placed a filament 7, so that a wide angle beam of about 90° of light traveling forward from the front side of the filament reaches such lens 6 and is projected forward in parallel lines, to be redirected by the concentrating front lens 5 onto the film F.

The light traveling backward from the back of the filament 7 strikes another concentrating lens 8 of the same size as the lens 6, which is placed at such a point between the filament and a small silvered ball 9 that the light from the back of the filament 7 will be concentrated on the top of the ball 9 set at or near the focus of the parabola and will be reflected at many angles against the

sides of the parabola shell 1 near its focus and so reflected forward usefully. In this way almost all the light emitted by the back of the filament 7 is used and the outer edges of the beam will be materially reinforced. The film is represented at F.

In Fig. 3 is shown a small double concave diverging lens 9a which may be used instead of the ball 9, and in Fig. 4 is shown a silvered cone 9b which may also be used instead of the ball 9. Anyone skilled in the art will understand that a lens designer, by varying the shape of the ball, the cone, shown in Fig. 4, or double concave lens, shown in Fig. 3 can materially change the distribution of light in the outside of the beam. A slightly modified shape of cone is represented both in end view and in side elevation at 9c. It reflects the light onto the parabolic surface when properly designed somewhat differently either from the double concentrating lens shown in Fig. 3 or the cone shown in Fig. 4.

All the lenses and the ball 9 are on the central optical axis of the parabola shell 1 and at a right angle to it. The small silver ball 9 is approximately equal in diameter to the focal length of the parabola shell 1, so as to clear the parabola shell all around, and is mounted on a small threaded stud 10 which passes through the exact center of the curve of the small end of the parabola shell 1, and through a tapped reinforcement 11 fast on the apex of the parabola shell 1, so that the center of the ball 9 shall be on the exact axis of the said parabola shell 1, and may be moved forward or backward as desired, so as to change the distribution of light in the outer part of the beam. The ball 9 is secured firmly to the stud in any desired manner.

The threaded stud 10 is a neat fit in the reinforcement 11, so that it can be turned easily. The permanent magnet 4 is carried by a shaft 12 which is fast to the cup 2. The permanent magnet 4 is movably mounted and secured in place by screw 13, or it may be easily disconnected and removed, if desired, by removing the screw 13.

In order to insert and to support a filament such as shown at 7 in Figs. 1 and 2, we may provide the following construction.

Conducting wires 14, 14 are provided, which carry the current, and also insulating rods 15, 15, which support the filament 7 and also hold the wires 14, 14 in place, so as to be readily put in and taken out. A metallic tubular shell 16 is made fast and air-tight to the shell 1. A thick coating 17, desirably of cement, is applied to the shell 16, and over the coating 17 is applied a shell 18 of suitable material, such as Bakelite or glass. There is shown at 20 a hollow extension through which the shell 1 is evacuated, and an inert gas is forced in under pressure. Such extension is then sealed up. We have shown at 21 a glass unit through which the wires 14, 14 pass, and to which they are connected, soldered, or otherwise attached. This constitutes a neat fit in the shell 16 and so holds the wires 15, 15 and the filament 7 accurately in place. There is provided a hole 22 in the wall of the shell 1 for the insertion of the filament 7, the wires 14, 14 and the insulating rods 15, 15.

Since the cup or supplemental shell 2 is air-tight, there is no way of getting directly at the rotor vane 3, so as to turn it by hand. This can easily be accomplished, however, by turning the permanent magnet 4 around by hand, and it will pull the iron rotor vane 3 along with it. In this way the ball 9 can be easily moved in and out

along the central axis of the parabola shell, and so the disposition of the light, particularly in the outside edges of the entire light beam, may instantly be changed materially as desired. The compressed inert gas to which we have referred serves two purposes. It prevents the inner brilliant silver surface of the shell 1 from tarnishing, and by its density it conducts the intense heat of the filament 7 rapidly to all parts of the shell 1, where it is rapidly dissipated.

We provide light-beam projecting means for projecting pictures, or for floodlights, or for spot lighting, having the herein disclosed air-evacuating, inert, gas-filled, sealed shell of parabolic shape containing an electric-light source and having an inner light-reflecting surface, the front end of the shell being provided in part at least by (a) a single concave lens when the apparatus is used as a spotlight, or (b) a double concave lens when the apparatus is used for projecting pictures, or (c) a parallel sided glass when the apparatus is used as a floodlight.

It is believed that the herein disclosed lamp and lens system have at least twenty-five times the efficiency of the present conventional lamps and lighthouses, and will therefore put twenty-five times as much light on the film as the conventional lamps and lighthouses do at present.

Since it is well known that a very small amount of light will destroy the film in projecting still pictures, the present disclosure must and does cooperate with the cooling mechanisms patented by Arthur T. Cahill, No. 2,413,288, dated December 31, 1946, which remove from the film practically any amount of light that can be put upon it.

In using the Cahill cooling devices, we are projecting 16 mm. Kodachrome pictures by 1500 watts of light, which is sufficient, if put upon the film without such cooling mechanism, to destroy it in a tiny fraction of a second, probably somewhere between $\frac{1}{50}$ and $\frac{1}{100}$ of a second. By using quartz, whose thermal conductivity or caloric capacity is twelve to fifteen times that of glass, and by speeding up the coolant proportionately, we can safely put twelve or fifteen times as much light on 16 mm. film as we can do now when using glass units, by speeding up the coolant proportionately. That is, with quartz units we can put 18,000 to 22,500 watts of light on 16 mm. "still" film, and keep it there indefinitely. Considering the fact that no one else has ever projected 16 mm. "still" film at all, we have made a very marked advance in the art. With reference to the practical use of the light-beam projecting means for pictures herein disclosed, we note, as is well known, that heat is the deadly enemy of picture films. Light, when stopped always produces heat. A little light applied, and the silver salts which are on only one side of a film, expand, and the film consequently moves slightly backward out of focus, producing the well known "pin cushion shape." With a little more light, the film embosses and is ruined.

We believe that with the great efficiency of our projector a 40-watt incandescent lamp will give as much light as a 1,000 watt lamp in an ordinary projector, but it will, we believe, give only one-twenty-fifth as much heat.

Having thus described one illustrative embodiment of the invention, it is to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

We claim:

1. Light-beam projecting means for projecting pictures, or for floodlighting, spot lighting, etc. comprising in combination; an air-evacuated, inert, gas-filled, sealed shell of parabolic shape containing an electric light source, and having an inner light-reflecting surface, lens means in said shell in advance of said light source for projecting light beams from said light source forward upon the picture to be projected, lens means in said shell in the rear of said light source for projecting light beams rearwardly from said light source, and light-reflecting means in said shell in the rear of said last mentioned lens means at approximately the focal point, and spaced from the inner surface of said shell, onto the surface of which light-reflecting means the light beams are received from said last mentioned lens means and are reflected therefrom onto the inner surface of said shell, and from thence are reflected forward onto the picture to be projected.

2. Light-beam projecting means for projecting pictures, etc. comprising in combination; a sealed shell containing a light source, and having an inner light-reflecting surface, lens means in said shell in advance of said light source for projecting light beams from said light source forward upon the picture to be projected, lens means in said shell in the rear of said light source for projecting light beams rearwardly from said light source, and light-reflecting means in said shell in the rear of said last mentioned lens means onto the upper surface of which light-reflecting means the light beams are received from said last mentioned lens means, and are reflected therefrom onto the inner surface of said shell, and from thence are reflected forward onto the picture to be projected.

3. Light-beam projecting means in accordance with claim 2, wherein the said light-reflecting means in the shell in the rear of the lens means is a reflecting ball substantially at the focus of the parabola.

4. Light-beam projecting means in accordance with claim 2, wherein the said light-reflecting means in the shell in the rear of the lens means is a cone having a reflecting surface at or near the focus of the parabola.

5. Light-beam projecting means in accordance with claim 2, wherein the said light-receiving means in the shell in the rear of the lens means is a double concave lens.

6. Light-beam projecting means in accordance with claim 1, wherein the light-reflecting means in the parabolic shell in the rear of the lens means is a ball having a reflecting surface and is held in position substantially at the focus of the parabola, and means for adjusting the position of said ball.

7. Light-beam projecting means in accordance with claim 1, wherein the light-reflecting means is supported in substantially the focus of the parabola, and wherein means is provided to adjust from the outside of the light-beam projecting means the position of said light-reflecting means while maintaining the sealed condition of said parabolic shaped shell.

8. Light-beam projecting means in accordance with claim 1, wherein the light-reflecting means is supported in substantially the focus of the parabola, and wherein are provided a permanent magnet rotatably mounted upon the outer rear end of the projecting means a supplemental shell sealed to the rear end of the parabolic shaped shell and an armature within the supplemental

shell and having an operative connection to said light-reflecting means, to adjust the position of said light-reflecting means while maintaining the sealed condition of said shell.

9. Light-beam projecting means in accordance with claim 1, wherein a non-magnetic gas-filled cup is sealed to the rear end of said shell.

10. Light-beam projecting means in accordance with claim 1, wherein a non-magnetic gas-filled cup is sealed to the rear end of said shell, and wherein means is provided in said cup and extending into the said shell to support said light-reflecting means.

11. Light-projecting means in accordance with claim 1, wherein the front end of said shell is provided in part at least by the said lens means in advance of the light source.

12. Light-projecting means in accordance with claim 1, wherein the front end of said shell is provided in part at least by the said lens means in advance of the light source, and wherein a smaller concentrating lens is positioned between said light source and said concentrating lens at the front end of the shell, and wherein a concentrating lens is positioned between said light source and the rear end of said shell.

13. Light-beam projecting means in accordance with claim 1, wherein the light-reflecting means is supported in the focus of the parabola, and wherein are provided a permanent magnet rotatably mounted upon the outer rear end of the projecting means a supplemental shell sealed to the rear end of the parabolic shaped shell and an armature within the supplemental shell, and having a screw secured thereto and extending through the rear end of said shell and to the inner end of which said light-reflecting means is secured.

14. Light-projecting means in accordance with claim 8, wherein said permanent magnet is removably mounted upon the rear end of the light-beam projecting means.

15. Light-projecting means in accordance with claim 1, wherein the front end of said shell is provided in part at least by the said lens means in advance of the light source and wherein a smaller concentrating lens is positioned between said light source and said concentrating lens at the front end of the shell, and wherein a concentrating lens is positioned between said light source and the rear end of said shell, and wherein all the said lenses are mounted on the longitudinal axis of said parabolic-shaped shell at right angles to said axis.

16. Light-projecting means in accordance with claim 1, wherein the inner surface of said shell is silver.

17. Light-projecting means in accordance with claim 1, wherein the electric light source is a filament, and wherein wires to support the filament and to supply the current are brought in through the wall of the shell by an insulating reinforcement, and wherein the evacuating and filling tube is a part of the unit.

18. Light-beam projecting means in accordance with claim 1, wherein a gas-filled cup is sealed to the rear end of said shell.

19. Light-beam projecting means in accordance with claim 1, wherein a gas-filled cup is sealed to the rear end of said shell, and wherein a vent is provided to permit evacuating and refilling with gas of said shell and said cup.

20. Light-projecting means in accordance with claim 1, wherein the front end of the shell is provided in part at least by a single concave

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lens when the projecting means is used as a spot-light.

21. Light-projecting means in accordance with claim 1, wherein the front end of the shell is provided in part at least by a double concave lens when the projecting means is used for projecting pictures.

22. Light-projecting means in accordance with claim 1, wherein the front end of the shell is provided in part at least by a parallel-sided glass when the apparatus is used as a floodlight.

23. Light-beam projecting means for projecting pictures, or for floodlighting, spot lighting, etc., comprising in combination an air-evacuated, inert, gas-filled, sealed shell of parabolic shape containing an electric light source, and having an inner light-reflecting surface, lens means in said shell in advance of said light

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source for projecting light beams from said light source forward upon the picture to be projected, lens means in said shell in the rear of said light source for projecting light beams rearwardly from said light source, and light-reflecting means in said shell in the rear of said last mentioned lens means at approximately the focal point, onto the surface of which light-reflecting means the light beams are received from said last mentioned lens means and are reflected therefrom onto the inner surface of said shell, and from thence are reflected forward onto the picture to be projected.

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No references cited.