July 14, 1959 H. EBER ET AL 2,894,428

LIGHT PROJECTING ARRANGEMENT FOR PROJECTORS

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Fig. 1

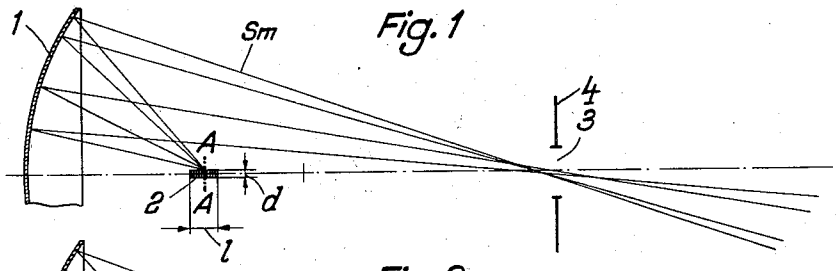


Fig. 2

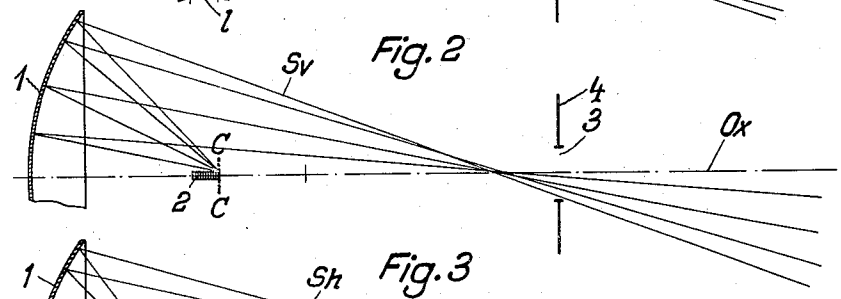


Fig. 3

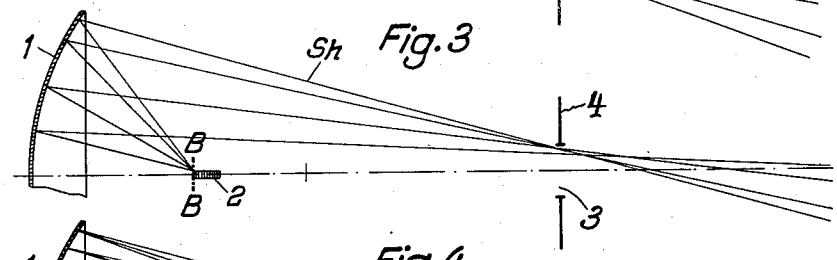


Fig. 4

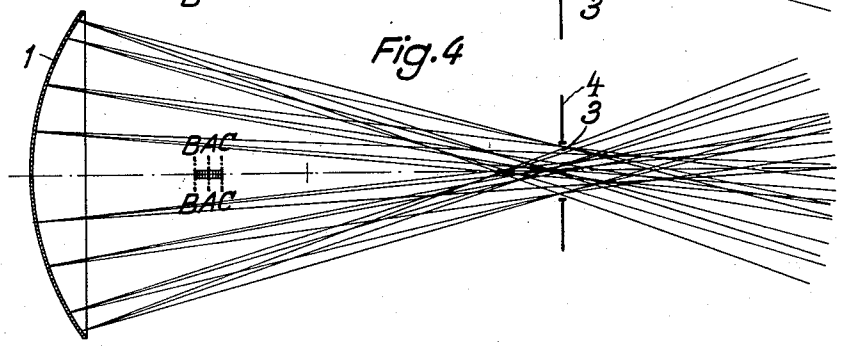
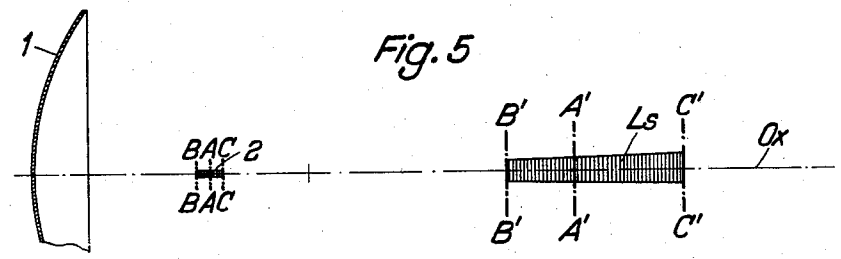


Fig. 5



Inventors

Hans Eber and
Paul Ruf

by: Michael S. Striker
agt

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Fig. 6

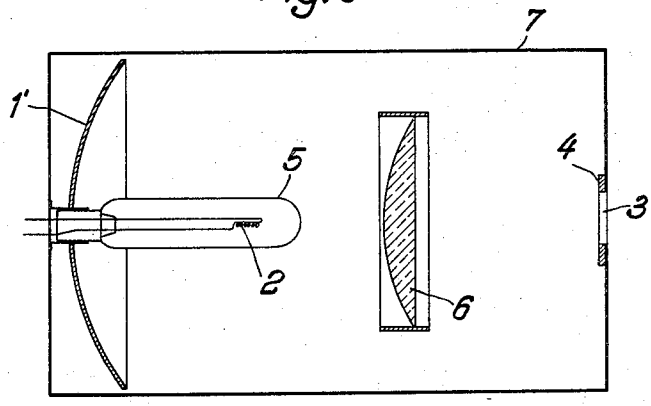
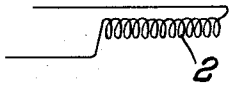


Fig. 7



Inventors

Hans Eber and
Josef Ruf

by: Michael S. Striker
atty

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LIGHT PROJECTING ARRANGEMENT FOR PROJECTORS

Hans Eber, Freiburg, Breisgau, and Paul Ruf, Wasser uber Emmendingen, Germany, assignors to Lytak-Werke G.m.b.H., Breisgau, Germany

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2 Claims. (Cl. 88—24)

The present invention relates to a projecting arrangement, and more particularly to a projecting arrangement for efficiently utilizing an elongated source of light.

The standard projecting arrangement includes a source of light, which should be as point-shaped as possible, a condenser or reflector, an aperture, and an objective lens.

In the event that arc lamps are used, the source of light can be considered to be point-shaped as compared with the area of the aperture. In the event, however, that incandescent lamps are used which have standard incandescent coil-shaped filaments, the source of light is not point-shaped but is spread out.

The area covered by the filament in a plane perpendicular to the optical axis of the arrangement determines the possible light yield, which corresponds to the efficiency of the arrangement. Due to the fact that the transverse area covered by the standard incandescent filament increases with increased wattage, the efficiency of strong electric bulbs is further reduced.

In the event that substandard film such as 16 mm. or 8 mm. film is used, the transverse area of the incandescent filament is about the same size, and sometimes even larger than the aperture which has to be completely lighted, so that even a large condenser can collect only a comparatively small amount of rays corresponding to a small angle of a conical light beam. Consequently, the rays collected by the condenser only partly pass through the aperture.

It is the object of the present invention to overcome the disadvantages of the projecting arrangements employing an elongated source of light, and to provide a projecting arrangement which operates at high efficiency.

It is another object of the present invention to provide a projecting arrangement in which an incandescent filament, or any other elongated source of light, is so positioned that it has the effect of a point-shaped source of light.

It is the main object of the present invention to position a coil-shaped incandescent filament with its longitudinal axis in the optical axis of a projecting arrangement to obtain a maximum light yield.

With these objects in view the present invention mainly consists in a projecting arrangement which comprises an elongated source of light having a transverse extension substantially smaller than the longitudinal extension thereof, and means for forming an image of said source of light passing through an aperture in gate means which are located in the longitudinal axis of the source of light.

The source of light which is used according to the present invention has a longitudinal extension which is a multiple of its transverse diameter and is arranged in the optical axial of the projecting arrangement. Cross sections taken in transverse planes through the source of light are substantially point-shaped. When light rays emanating from the source of light are reflected by suitable reflectors towards the aperture, a column-shaped reflected image is formed which passes through the aperture. Such image is enlarged as compared with the source of light due to the effect of the reflector used in the projecting arrangement. The ratio between the area of aperture and the area of a transverse cross section of the source of light is preferably such that the enlarged column-shaped image just fills the entire aperture which occurs when the transverse extension of the column-shaped image is substantially equal to the greatest dimension of the aperture.

The efficiency of the arrangement can be improved by providing a condenser by which the rays reflected from the reflector are further concentrated.

The source of light is so positioned that its center portion produces a reflected image substantially located in the plane of the aperture whereas the ends of the source of light produce images located, respectively, before and behind the aperture.

According to a preferred embodiment a coil-shaped elongated incandescent filament is used as a source of light and is placed with its axis in the optical axis of the projecting arrangement. Since the length of the coil-shaped filament is a multiple of the transverse diameter of the coil-shaped filament, the transverse cross sectional areas of the filament coil can be considered to be point-shaped. The reflector produces an image of each point-shaped cross sectinonal area of the coil-shaped filament, and the arrangement is such that the aperture in the film gate means is completely lighted by the column-shaped image of the source of light.

Instead of a coil-shaped filament, a gas flame, or a fluorescent lamp may be used as a source of light. It is only important that an elongated source of light is used whose cross section is substantially point-shaped so that it is possible to derive from a bright source of light an image located in the gate aperture and having a small transverse extension. A coil-shaped filament of high wattage arranged according to the present invention can be fully utilized.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a schematic side view, partly in section illustrating an arrangement according to the present invention and showing the path of the rays emanating from the central portion of the source of rays;

Fig. 2 is a side view similar to Fig. 1 illustrating a path of the rays emanating from one end of the source of light;

Fig. 3 is a side view similar to Fig. 1 and illustrating the path of the rays emanating from the other end of the source of light;

Fig. 4 is a side view, partly in section, of an arrangement according to the present invention and illustrating the path of the rays emanating from an elongated source of light located in the optical axis of a projecting arrangement;

Fig. 5 is a schematic side view illustrating the source of light and the reflected image produced by the same;

Fig. 6 illustrates an embodiment of the present invention in which a condenser is provided; and

Fig. 7 is a fragmentary side view of a coil-shaped incandenscent filament used in the arrangement of the present invention.

Referring now to Figs. 1 to 5, a reflector means 1 reflects the rays emanating from a source of light 2 towards

projection gate means 4 which are provided with aperture 3. The reflector means 1 has an optical axis Ox which passes through the center of the aperture 3. A source of light 2 having an elongated shape has a longitudinal axis coinciding with the optical axis Ox of the arrangement. In the illustrated embodiment the source of light 2 is a coil-shaped incandescent filament as best seen in Fig. 7. The incandescent filament 2 is placed with its longitudinal axis coinciding with the axis of the system, and at such distance from the reflector means that the image of its central portion is substantially located at the intersecting point between the transverse plane in which the aperture 3 is located and the optical axis Ox of the system.

As is clearly shown in Figs. 1 to 7, the length l of the coil-shaped incandescent filament 2 is a multiple of the transverse diameter *d* and substantially greater than the same.

A section taken on line A—A in Fig. 1 through the filament will show a very small cross section of the source of light so that in this plane a substantially point-shaped source of light rays is provided. The rays Sm emanating from this portion are reflected by the reflector 1 and intersect the optical axis Ox in the region of the transverse plane of the aperture 3. The end portion of the source of light which is located in the plane C—C and closer to the aperture produces light rays Sv which are reflected by the reflector means 1 to intersect at a point located in front of the aperture 3 as is shown in Fig. 2. Fig. 3 shows the path of the rays Sh emanating from the other end of the source of light located in the plane B—B and it will be understood that the reflected rays mainly intersect behind the aperture. Consequently, the reflected rays Sm, Sv, and Sh pass through different portions of the aperture 3 and together fill the entire area of the same.

The combined reflected rays Sm, Sv, and Sh produce an image Ls of the source of light which is shown in Fig. 5. The image Ls of the source of light is column-shaped and passes through the aperture 3 so that the same is fully lighted. The end portions of the source of light which are located in the transverse planes B—B and C—C produce real images which are located in the planes B'—B' and C'—C', respectively. The center portion of the source of light which is located in the transverse plane A—A produces a corresponding real image located in the transverse plane A'—A'.

Referring now to Fig. 6, according to the embodiment illustrated in this figure, a reflector 1' has a central portion from which a light bulb projects. This light bulb includes a coil-shaped incandescent filament as described with reference to Figs. 1 to 5. As is clearly shown in Fig. 6 the incandescent filament is located in the optical axis of the reflector and has a length which considerably exceeds its transverse diameter. In addition to the reflector, a condenser 6 is provided which further concentrates the rays emanating from the source of light 2 and reflected by the reflector 1. A casing 7 envelopes the entire arrangement and supports the projection gate means 4 in which the aperture 3 is provided.

The arrangement according to the present invention permits a particularly efficient use of an elongated source of light such as a coil-shaped incandescent filament. The yield of light is surprisingly great, and permits the use of lamps of much smaller wattage as compared with the arrangements according to the prior art in which the filament is located transverse to the axis of the system.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of projecting arrangements differing from the types described above.

While the invention has been illustrated and described as embodied in a projecting arrangement having an elongated source of light extending in the direction of the optical axis of the system, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can be applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a light projecting arrangement, in combination, reflector means having an optical axis; projection gate means having an aperture located in said optical axis and extending in a plane transverse to said optical axis, said aperture having a predetermined area in said transverse plane; and an elongated coil-shaped incandescent filament located intermediate said reflector means and said projection gate means and having a longitudinal axis coinciding with said optical axis, said elongated coil-shaped incandescent filament having a longitudinal extension being a multiple of the transverse extension thereof and a transverse cross-sectional area smaller than said predetermined transverse area of said aperture so that said elongated coil-shaped incandescent filament is substantially point-shaped in transverse direction, said elongated coil-shaped incandescent filament having zones of different brightness along the length thereof and having a central portion and two end portions located in said optical axis and being positioned with respect to said reflector means to be imaged as conical-shaped reflected enlarged image passing through said aperture and having a transverse extension substantially equal to the greatest dimension of said aperture, the image of said central portion being substantially located in said transverse plane of said aperture, and the images of said two end portions of said elongated coil-shaped incandescent filament being respectively located before and behind said aperture so that the projection of the image of each turn of the coil-shaped filament on the plane of said gate aperture is located between the images of two other turns of said filament.

2. In a light projecting arrangement, in combination, reflector means having an optical axis; projection gate means having an aperture located in said optical axis and extending in a plane transverse to said optical axis, said aperture having a predetermined area in said transverse plane; and a light bulb projecting from the center of said reflector means and including an elongated coil-shaped incandescent filament located intermediate said reflector means and said projection gate means and having a longitudinal axis coinciding with said optical axis, said elongated coil-shaped incandescent filament having a longitudinal extension being a multiple of the transverse extension thereof and a transverse cross-sectional area smaller than said predetermined transverse area of said aperture so that said elongated coil-shaped incandescent filament is substantially point-shaped in transverse direction, said elongated coil-shaped incandescent filament having zones of different brightness along the length thereof and having a central portion and two end portions located in said optical axis and being positioned with respect to said reflector means to be imaged as a conical-shaped reflected enlarged image passing through said aperture and having a transverse extension substantially equal to the greatest dimension of said aperture, the image of said central portion being substantially located in said transverse plane of said aperture, and the images of said two end portions of said elongated coil-shaped incandescent filament being respectively located before and behind said aperture so that the projection of the image of each turn of the coil-shaped filament on the plane of

said gate aperture is located between the images of two other turns of said filament.

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