THE NEW KLIEGLIGHT *

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Twenty-five years ago the Klieglight was used extensively and successfully in indoor photography, following which came the high amperage arc spotlights. Then, for a long time the only developments that occurred were improvements in the general design of the equipment then in use, principally mechanical improvements. With sound came incandescent lighting and high-wattage lamps; and the principle of sun arc was widely adopted and is now universally used.

Chief among the disadvantages of the latter are its size, and the requirement of using "niggers" and "gobos" for subduing false light and for shaping the beam, and of "cellos" to render the field of light more uniform—a costly means of control. In 1932 a great deal of experimenting was done with differently shaped and designed reflectors, leading ultimately to the new Klieglight.

The rhodium reflectors that were used proved extremely successful. The accuracy of these electrolytically deposited reflecting surfaces was far greater than that of spun or cast surfaces, and far greater durability was achieved. The reflection factor was about 74 per cent, and the surface could withstand the heat of a 2000-watt spotlight bulb, in any kind of hood designed for that size of lamp. Fig. 1 shows the original now popular down-light employing a 250-watt bulb, the main reflector of which is elliptical in design.

FIG. 1. The original unit, employing a 250-watt lamp and elliptical reflector.

In the elliptical reflector the light emanating from the lamp filament is collected and then projected to the conjugate focus. In the new unit, however, the rays are intercepted by a flat rhodium mirror reflector placed at the exact center of what would be the completed ellipsoid, as shown in Fig. 2.

The action is as follows (Fig. 2): light ray *A* passes from the lamp to the reflector, then to the flat mirror, then back through the lamp, and out through the exit hole in the reflector—a two-reflection ray. There are, in addition, any number of four-reflection rays, as, for example, ray *B*, which missed the exit opening and had to travel through another series of reflections before emerging from the unit.

Upon leaving the reflector the rays are picked up by a set of lenses which

* Presented at the Spring, 1934, Meeting at Atlantic City, N. J.
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converge the rays into a crossing beam, permitting the light to pass through an opening in the ceiling only 4 inches in diameter. The unit has an efficiency of 24 per cent, approximately three times that of the standard spotlight.

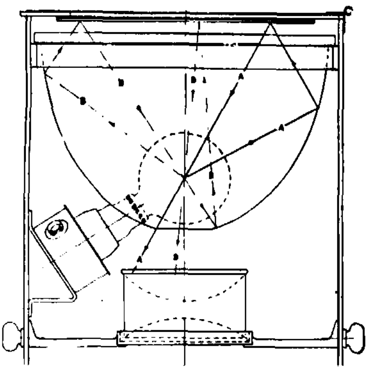

FIG. 2. Reflection of light rays in the unit shown in Fig. 1.

Fig. 3 shows the next step in the design of the Klieglight, which is practically a reversal of the down-light. The output of the exit hole is placed at the center of the reflector, which is located exactly as described before, and the lenses are placed beyond the conjugate focus. The exit hole is large enough to permit maximum pick-up by the lens—of the beams suffering only one reflection. The remainder of the light, missing the lens, is redirected by the mirror back into the reflector, which, in turn, sends it eventually out the exit hole into the lens. The efficiency of the unit is approximately 30 per cent as compared with 24 per cent for the previous lamp.

However, difficulty was encountered in attempting to employ lamps of higher wattage, containing larger filaments and entailing a corresponding loss of light because of the size of the filament, which difficulty, however, was solved by using lamps with filaments of the biplane type. However, the lamps had to be burned

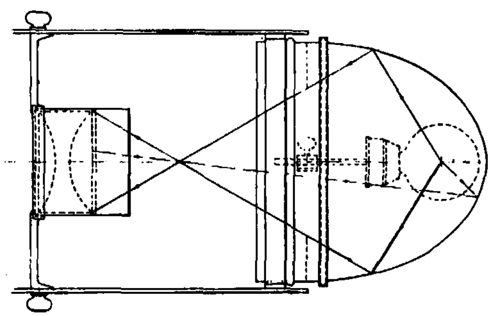

FIG. 3. A development of the Klieglight, practically a reversal of the down-light.

base downward, and an additional hole had to be made in the top of the reflector in order to be able to insert the lamp in the socket. While studying the output of the lamp it was found that if the filaments were faced toward the sides of the reflector, the pick-up of the latter would amount to nearly 90 per cent of the light emitted by the filament, all of which is directed by the reflector in one reflection to the lens. It is actually a fact that in the same reflector 40 per cent more light enters the lens when the filament faces the sides of the reflector than when it faces the lens.

A 1500-watt *bipost-base up-burning* lamp, with a biplane filament in the *T-24* size bulb, was then developed, and the hood of the lamp was again redesigned, as shown in Fig. 4. The bulb is designed to operate at any angle within 45 degrees of the vertical, and by off-setting it in the fashion shown a full 90-degree down-tilt is permitted. The filament is placed far down in the tip of the lamp, resulting in two advantages:

(1) There is very little glass inside the reflector system.
(2) All the blackening of the bulb occurs near the top of the neck, outside the reflector, enabling the system to retain its initial efficiency over a much longer period of time.

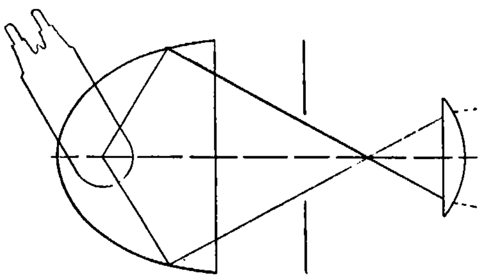

FIG. 4. The final arrangement of the spotlight, employing a 2000-watt bi-post up-burning lamp operated 45 degrees from the vertical.

The lamps are made in both the 1000- and 1500-watt sizes in a *T-24* bulb, and a 2000-watt size in a *T-30* bulb. The centering of the filaments of all three lamps is the same. Both the square and iris adjustable shutters are used, as well as the single-lens pick-up and control system. The flat mirror reflector has been omitted, because the increase of light effected by it was found to be very slight in proportion to the direct pick-up. The shutters are at the focal point of the lens, and the spread is determined by the distance of the lens from the conjugate focus of the reflector. By using lenses of various focal lengths the divergence of the beam can be changed.

In order to illustrate effectively the performance of the new lamp, comparative measurements of the intensity of the spots and floods of the three spotlights indicated in Table I were made.

Note that the intensity of the spot cast by the standard Klieglight is about the same as that of the flood, which is to be expected as the lens position is unchanged, the size of the beam being regulated by the shutter. It is an interesting feature of this type of lamp, that the field intensity remains constant while the beam is varied. The unit lends itself readily to lenses having any degree of spread, either circular or in only one direction.

TABLE I

Comparative Tests of Spot and Flood Intensity
(51-Ft. Throw)

Spotlight	Standard	Klieglight (Fig. 4)	Model *F*
Lens	8"×16"	6" × 8" (Single Lens)	Combination of Two Lenses
Reflector	$5^1/_4$ Rhodium Spherical	Rhodium Elliptical (No Front Mirror)	
Control		Shutter	Shutter and Adjustable Lenses
Lamp	2000-w. Monoplane 115-v.	2000-w. 200-hr. Biplane 115-v.	2000-w. 200-hr. Biplane 115-v.
Spot Intensity (6 ft.)	24	32	70
FloodIntensity (20 ft.)	11	32	32

Referring again to Fig. 4, a unit of such type is very suitable for proscenium lighting, balcony-front units, ceiling floods for illuminating stages and orchestra pits, for general spotlighting on the stage, and for indoor and outdoor flood-lighting—anywhere where a sharply cut-off beam of high intensity without spill is required. Lenses can be had for beam-spreads varying from 49 to 5 degrees.

The Model *F* Klieglight resulted from the further development of the present standard, the variation of the intensity and spread of the beam being effected by adjustment of the lenses—without dimmers. Two lenses are used in combination, the shutters remaining fixed, by which means the total luminous output of the lamp is utilized at all times. Although the intensity of the illuminated area decreases as the area increases, the minimum intensity, which occurs in the flood position, is about the same as the intensity of the standard Klieglight. The maximum, which occurs in the spot position, is more than three times as great. The shutters can, of course, be adjusted during the alteration from flood to spot or *vice versa*, so that any intensity within the range of the lamp may be achieved. The transition from spot to flood is effected much more gradually than is possible with a dimmer. The most important features of the new spotlight are the method of controlling the beam, the absence of spill light, and the attendant reduction in the lighting expense and operating cost.