**Topic 024**

# Stage lighting mechanics

## PLANO CONVEX SPOTLIGHT

### DESCRIPTION

The PLANO-CONVEX (or PC) spotlight is the earliest form of theatre spotlight, to use a lens. It consists of a simple 'box'

housing containing a lamp and reflector behind a plano-convex lens. Modern units range from 300 to 2000 watts. Lens diameters include 5", 6" and 8" wide. Beam spreads typically are variable from approximately 10 to 65 degrees in a single fixture.

Originally developed for a 'limelight' source in the 1870's, this fixture was adapted for the incandescent lamp in the early 1890's. The plano-convex fixture was slowly replaced starting in the 1930's with the development of the ellipsoidal reflector fixture. The 'ER' not only provided a 'hard' defined beam edge, as did the PC fixture, but it also allowed the projection of integral framing shutters, an iris, or an etched metal pattern (gobo). The plano-convex fixture is still available today however from a number of manufacturers. They are very simple in construction and operation.

This fixture provides a circular beam pattern with a sharply defined 'hard' outer edge. Unfortunately, the field of light, (distribution of light across the beam) is often quite uneven. Further, optical aberrations in the form of rainbow effects, are often seen at the edges of the beam.

The lamp and reflector are mounted together, and move forward or backwards, in relationship to the lens. As they move closer to the lens, the beam expands in size. As they move away from the lens, the beam becomes narrower.

### APPLICATIONS

Plano-convex spotlights are useful in providing ACTING AREA lighting and localized lighting to specific areas of the stage. They have no beam controls (shutters, iris, barndoors) available.

### TYPES

The plano-convex spotlight is generally available everywhere in the world - except in North America. Although this flexible spotlight is in use almost everywhere else in the world it has never caught on in Canada or the USA. Priced between the ellipsoidal reflector (ER) and the

fresnel the plano-convex spotlight is still a very important, useful and efficient luminaire for many lighting applications. Strand Lighting, Selecon, ADB and others still produce a number of different models for the non North American market.

TYPE BEAM SPREADS WATTAGE DESCRIPTION
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Plano-Convex 10-65 variable 300-2000 ROUND beam, HARD edge
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INCLUDED: - (a) power cord.

OPTIONS: - (a) lamp, (b) pipe clamp, (c) color frame, (d) electrical connector, (e) safety cable.

**ELLIPSOIDAL REFLECTOR SPOTLIGHT**
**DESCRIPTION**
The ELLIPSOIDAL REFLECTOR spotlight, (sometimes known as the LEKO or LEKOLITE) is a common fixture for many stage lighting applications. The 'ER' as it is sometimes called is available from many different manufacturers and is available in a number of different sizes and beam spreads.
The ellipsoidal fixture was first introduced back in 1933 by Joseph Levy and Edward Kook, founders of Century Lighting, each giving half of their names to the new invention, 'Lekolite' or 'Leko'. About the same time, Kliegl Brothers introduced their EF fixture known as the 'Klieglight'. Although ER's are now commonly called 'Lekos', the name is now owned by Strand Lighting and correctly only refers to their ellipsoidal reflector products.
**APPLICATIONS**
The ER spotlight provides a narrow, directional beam with a hard edge. It is able to provide a sharp focus of integral metal shutters, an iris or a metal projection template. The ability to project a metal etched pattern (template or gobo), makes this fixture particularly useful to the stage lighting designer.
All ER's also allow focus adjustments by moving the lens tube forward or backwards. This produces an adjustable beam edge ranging from very sharp and hard to very soft. Some ER's do not allow the edges of the beams to soften sufficiently for the proper blending and sometimes the edge may need to be further softened using diffusion material.
Ellipsoidal reflector fixtures have one (1) or more lenses, usually, 4.5, 6, 8, 10 or 12" in diameter. Most ER's particularly the wider units, have two lenses. Generally, the narrower the beam spread (in degrees), the heavier the fixture will be, due to the longer lens barrel and the larger diameter lens, required.
Some (American) manufacturers specify a fixture by indicating the lens diameter then the focal length. For example a '6x9' (pronounced "6 by 9"), indicates a fixture with a 6" diameter lens and a 9" focal length. This tells the designer nothing about the beam spread of the fixture. Most modern lighting manufacturers now specify fixture beam spread simply in degrees. Approximate spread angles for typical ellipsoidal reflector fixtures are as follows: (in degrees) 4.5x9 =50, 6x9 =40, 6x12 =30, 6x16 =25, 6x22 =15, 8x13 =12, 10x23 =9.
**TYPES**

Modern ER spotlights have beam spreads of 5 to 50 degrees and are available in wattages of 500 - 2000 watts.
They are available in both fixed focal length and variable focal length (zoom) models. Standard focal lengths include 5, 10, 20, 30, 40, 50 degrees, and many others in between. Generally, the adjustable focal length units are less efficient, heavier and more expensive than their fixed focal length counterparts. Some modern 'zoom' ER's however do perform very well and may indeed be the choice over comparable fixed focal length units.
ZOOM ER'S with adjustable focal lengths have been available since the 1970's. A typical fixture might provide spread angles of 12-35 degrees or 25-50 degrees. No single zoom fixture is available to provide a wide zoom range of say, 10-50 deg.

**INCLUDED:** - (a) power cord, (b) four framing shutters, (c) template slot, (d) removable lens tube.
**OPTIONS:** - (a) lamp, (b) pipe clamp, (c) color frame, (d) electrical connector, (e) safety cable, (f) template holder, (g) iris, (h) lens safety mesh, (i) special accessories including gobo rotators and color wheels.

**FRESNEL SPOTLIGHT**
**DESCRIPTION**

The FRESNEL SPOTLIGHT, (pronounced: 'fren-el') provides adjustable beam spreads, from SPOT to FLOOD, (about 15-70 deg.) all in one fixture. This fixture produces a directional beam with a very soft edge (only). Fresnels are used as an efficient means of providing ACTING AREA or COLOR WASH lighting.
All Fresnel spotlights use a single fresnel lens, deriving the name from the French physicist Augustin Fresnel, (1788-1827). A fresnel lens is simply a form of a plano-convex lens, with certain portions of glass removed, in parallel 'steps'. This results is a lens that is thinner, lighter and more efficient that an equivalent PC (plano-convex) lens.
Fresnels are considerably less expensive than comparable ellipsoidal reflector fixtures; however, they do not have the ability to project a pattern or produce a sharp beam cut-off edge, as does an ellipsoidal fixture. Fresnels are very similar in size and construction to their counterparts, the plano-convex spotlights, the only significant difference is one uses a fresnel lens, the other a PC lens.
A fresnel lens is easy to recognize from a series of concentric rings on it's surface. In addition, most fresnel lenses have a 'stipple' etched on the back side, to further soften the beam. The higher the wattage of the fixture, the heavier the fixture weight will be, due to the larger housing and lens diameter required to withstand the extra heat generated by the lamp.
**APPLICATIONS**
Fresnels are particularly useful in providing COLOR WASHES to acting areas or scenery. Typically, 27 fresnels might be arranged above the stage to illuminate 9 areas (with 3 fixtures each). Each area is said to have a 3 COLOR WASH. With dimmer control, and colored filters, it is possible to mix many different color combinations to each area.
Fresnel fixtures tend to 'flare' more than do ellipsoidal fixtures and as a result they are usually used with a barn door accessory, to help control unnecessary 'spill' light.

**TYPES**

Fresnels are generally available in wattages of 150 to 5000 watts, and come in lens diameters of 3, 6, 8, 10 and 12". The units most often used for the stage, include the 6" 1000 watt and the 8" 2000 watt fresnel.

| TYPE | BEAM | SPREADS | WATTAGE | DESCRIPTION |
|---|---|---|---|---|
| Fresnel | 15-70 variable | 500-5000 | ROUND beam, SOFT edge, Accessories: barn doors | Beam edge is soft ONLY |

INCLUDED: - (a) power cord.

OPTIONS: - (a) lamp, (b) pipe clamp, (c) color frame, (d) electrical connector, (e) safety cable, (f) lens safety mesh, (g) barn doors.

**PAR64 SPOTLIGHT**

**DESCRIPTION**

The PAR64 SPOTLIGHT (Parabolic Aluminized Reflector) fixtures, consist of a sealed beam lamp (like an automotive headlight), in a simple metal housing. PAR fixtures are highly efficient as the; reflector, filament and lens are all optically aligned and sealed into the lamp at the factory. The beam spread of PAR fixtures is determined by the design of the lamp, not by the design of the fixture.

PAR LAMPS are available in a number of different diameters and wattages. Typically PAR64 (1000 watt) lamps are used for stage and studio lighting applications. Smaller PAR lamps are used for display and architectural applications, and include the PAR56 and the PAR38.

(To determine the diameter of any PAR lamp, divide the PAR # by 8 - ie: a PAR56 is: 7" in diameter, a PAR 38 is: 5.5" in diameter).

**APPLICATIONS**

Where flare and a very soft beam edge is not a problem, these fixtures are particularly useful for ACTING AREA and WASH LIGHTING. They are also usually the fixture of choice for COLOR WASH and BACK LIGHTING for entertainment productions, again, where flare and spill are not a problem.

**TYPES**

The most common PAR fixture used in the theatre industry is the PAR64-1K (1000 watts). The fixture is generally available in both steel and aluminum. Both black and chrome versions are available. The color frame for a PAR64 fixture is usually 10" x 10".

This fixture uses the PAR64 lamp. This lamp has an 8" diameter lens and comes in four different standard beam spreads, and several different voltages. This 1000 watt lamp is extremely efficient at producing light - more so than an equivalent 1000 watt ellipsoidal or fresnel fixture. The PAR64 has is the only spotlight that has an oval (not round) beam pattern. The PAR64 has a very soft beam edge and a high degree of beam 'flare' making it totally unsuitable for many lighting applications and very well suited to others.

| TYPE | BEAM SPREADS | WATTAGE | DESCRIPTION |
|---|---|---|---|
| PAR64 | 10-70 fixed | 500-1000 | OVAL Beam, SOFT edge |

INCLUDED: - (a) power cord.
OPTIONS: - (a) lamp, (b) pipe clamp, (c) color frame, (d) electrical connector, (e) safety cable, (f) lens safety mesh, (g) snoot.

**PAR PIN SPOTLIGHT**
**DESCRIPTION**
The 'pin spot', although one of the least used fixtures, can be one of the most useful for many stage and entertainment lighting applications. Pin spots are available from a wide range of manufacturers in several different wattages.
Pin Spots are simply very narrow angle, low voltage PAR lamps, in a basic 'can' type housing. These PAR lamps are manufactured for use in portable hand lanterns, for architectural lighting, marine lighting and for use as aircraft landing lights. Beam spreads are very narrow and range from approximately 5 to 10 degrees. Pin Spots are sometime referred to as 'rain lights'.
All PAR lamps for pin spots are low voltage and operate on various voltages on either 5.5, 6, 12, 24 or 28 volts. All pin spots require transformers to transform the mains voltage (120 or 240 vac) to the proper lamp operating voltage. Usually, the transformer is incorporated into the rear of the fixture.
**APPLICATIONS**
Pin spots can be very useful for providing accents, highlights and specials. This very low cost fixture provides an almost parallel beam of light (similar to a beam projector) can be used to provide special very 'tight' lighting to actors and objects. Pin spots can be particularly effective when all general lighting is dimmed down low allowing the pin spot(s) to highlight or draw attention to something (for example the clock on the wall, the door knob or any other very small localized area. Most pin spots can be dimmed from conventional (SCR) type dimming systems and most have color frame clips.

**TYPES**
TYPE BEAM SPREADS WATTAGE DESCRIPTION
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PAR36-64 PIN 5 -10 fixed 25 - 480 OVAL Beam, SOFT edge
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INCLUDED: - (a) power cord, (b) internal transformer.
OPTIONS: - (a) lamp, (b) pipe clamp, (c) color frame, (d) electrical connector, (e) safety cable

**BEAM PROJECTOR SPOTLIGHT**
**DESCRIPTION**
The BEAM PROJECTOR (or BEAM LIGHT), is similar to a fresnel fixture, without a lens. A typical Beam Light produces a very narrow intense beam of light with a very soft edge.
Beam lights range in wattage from 500 to 2000 watts and they typically have an open circular front (10-24" in dia.). They uses a parabolic reflector to provide a near parallel beam of light. In this respect, the beam light is not really a spotlight; instead, it is more of a searchlight.
This fixture is considered more of a 'specialty fixture' in North America and Britain, however, they are widely used in Germany and other European countries.

**APPLICATIONS**

Where a near parallel, intense beam of light is need, the beam projector is the fixture of choice. Designers find this fixture useful to simulate sunlight, moonlight and to provide strong motivated beams of light. The edge of the beam light is generally round, but has a very soft edge.
Beam lights are also sometimes used as follow spots, due to their tight, near parallel beams. They can be excellent for this application and sometimes are mounted directly behind the prosecenium arch in a 'perch' or 'tormentor'position.

**TYPES**

The most common beam light for the North American Market is 10-12 inches in diameter, and rated to a maximum of 1000 watts.

TYPE BEAM SPREADS WATTAGE DESCRIPTION
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Beam Projector 5-15 variable 500-2000 ROUND Beam, SOFT edge
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INCLUDED: - (a) power cord.
OPTIONS: - available: (a) lamp, (b) pipe clamp, (c) color frame, (d) electrical connector, (e) lens safety mesh.

**FOLLOWSPOT SPOTLIGHT**

**DESCRIPTION**

The FOLLOW SPOT is simply a narrow spotlight, used to 'follow' or to spotlight a performer on a stage. The follow spot usually consists of a 'movable', high power fixture mounted on a stand, with an attendant operator. Typical mounting distances range from 25 to 250 feet.
In 1826, a new, very intense light source was developed, (in Scotland). This was the 'limelight'. Fed by two separate lines, the limelight burned oxygen and hydrogen against a block of lime, heated to incandescence. Around 1860, limelights were fitted with lenses thereby becoming the first modern theatre lighting spotlights.
The electric arc (or carbon arc) was developed in 1808 by Sir Humphrey Davy. The carbon arc, was soon to replace the limelight. This type of fixture (example Strong, Super Trouper) served the industry for many years, and still does in some parts of the world. In the modern theatre industry however, the carbon arc spotlight has been replaced by newer incandescent and sealed electric arc lamps.
Modern follow spot fixtures usually consist of a cylindrical housing, 4-6 feet in length, mounted on a telescopic stand with castered legs. They are usually fitted with a manual iris and a color filter changer. Usually a followspot is designed to provide a 'hard' beam edge. Controls often exist, to 'soften' the beam edge, when required.

**APPLICATIONS**

Designers typically use the followspot fixture to provide HIGHLIGHTS to a performer or a group of performers. Modern musicals, operas, and other large productions, may frequently use from 2 to 12 follow spots or more.
Follow spots are traditionally mounted 'as high as possible' at the rear of an auditorium, so as to 'front light' the actors. Follow spots are also gaining increased use in a 'bridge' position, above the stage, providing a steep' front, back or side light to the performer.

**TYPES**

Today, follow spotlights are available that use either incandescent or HID (discharge) type of lamps. They are manufactured for; short, medium and long throw applications and usually are mounted on stands. Various arc lamps used include: CIS, HID and Xenon. They come with color changers and usually have an iris and sometimes a dowser. Beam spreads are very narrow and typically range from approximately 1 to 10 degrees. Followspots range in size from the small 600 watt model suitable for community theatre to the giant 2500 watt "Strong Super Trouper" used in large arena events.

TYPE BEAM SPREADS WATTAGE DESCRIPTION
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Followspot 1-10 variable 500-2500 ROUND Beam, VARIABLE edge
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INCLUDED: - (a) power cord, (b) stand, (c) color changer, (d) ballast if required).
OPTIONS: - (a) lamp, (b) electrical connector.

**FLOODLIGHTS**

**DESCRIPTION**
FLOODLIGHT fixtures, (Scoops and Box Floods) are the simplest of all stage lighting fixtures, consisting simply of an enclosed light source in a box with one open side. Floods are designed to provide a wide, even distribution of light, over a large area. Typical beam spreads range from 70-150 degrees. Most units come with a fixed 'beam spread' however a few units are adjustable between 'flood' and 'wide flood'. Typical wattages range from 500 to 1500 watts. Floodlights do not use lenses, however some may have a clear protective safety glass. The 'scoop' is really just a streamlined box flood, usually with similar lighting characteristics.

**THE BOX FLOOD**
The single unit box flood has been a standard stage lighting fixture for many 100's of years and was probably the first actual stage lighting fixture. First using oil or candles, then gas and now the electric filament lamp, this simple flood light is still the most basic of all lighting instruments. The design of the box floodlight has changed little over the years however; the modern box flood now uses an internal reflector, for greater efficiency.

**APPLICATIONS**
Floodlight fixtures are particularly well suited for lighting backdrops and sky cloths. Typically, a continuous row of floodlights is arranged above and parallel to the backdrop, at a distance of 3-10 feet away. For additional interest and impact, a row of fixtures may be also used to 'bottom light' the drop, from the floor.
Floodlights are also sometimes used for the lighting of scenery or to provide large area WASHES. Less often they are used for toning and blending. Floodlights are typically used in every theatre as 'work lights'.

**TYPES**

Individual fixtures are commonly available in both SCOOP (round, open front) and BOX FLOOD (square or rectangular, open front) designs. Few manufacturers now make the scoop, preferring to offer the more sophisticated box flood instead.
The BOX FLOOD is available, either as a single unit, or as a 'ganged', or multiple unit of 2, 3 or 4 compartments, usually connected, end to end. This type of fixture is used to provide a 1-4 color wash to backdrops and large areas of scenery.

Box Flood fixtures are available with either a SYMMETRICAL or ASYMMETRICAL reflector design. The SYMMETRICAL type, (standard) provides regular square law illumination. That is, if the fixture is placed on the floor at a distance of 4', from a backdrop, the bottom of the drop will be much 'brighter than the top, (say 25 feet away). A fixture with an ASYMMETRICAL reflector, will 'push' more light to the top of the drop, and provide less to the bottom. The visual result being, more even overall illumination. The fixture type and mounting distance must be carefully selected, to provide the required distribution of light and visual effect.

INCLUDED: - (a) power cord.
OPTIONS: - (a) lamp, (b) pipe clamp, (c) color frame, (d) safety cable, (e) electrical connector, (f) safety mesh, (g) floor mounting hardware.

**STRIPLIGHTS**
**DESCRIPTION**

Often the simple compartment floodlight is combined into multiple units connected together, forming a STRIPLIGHT. The striplight is one of the oldest stage lighting fixtures first having been developed for oil and candles and later for gas lighting. The striplight is also sometimes referred to a BATTEN or BORDER light as it often hung between the overhead masking borders.
With the introduction of the electric filament lamp it was possible to wire (or gang) a number of compartment floods together, forming a long linear fixture. The striplight has changed very little in the past 100 years. The typical unit of today is 4-9 feet long and is wired in 3 or 4 electrical circuits. By using alternating color filters (usually red, blue, green and sometimes amber) the striplight makes a very flexible color wash lighting fixture.

**APPLICATIONS**
Permanent striplights are often found installed in older theatres, auditoriums and schools. Typically several units are used, running continuously from stage-left to stage-right. The 'strips' are usually installed downstage, centre stage and upstage. Through dimmer control, and using the 3 primary colors of light, the designer can mix almost any color. One moment the entire stage can be bathed in deep cold blue and the next it can be transformed into a warm golden amber. Overhead striplights as a general source of 3 color illumination are seldom used today, most designer preferring the more controlled use of the fresnel spotlight or even the PAR64, for wash, toning and blending applications. (p> Today, 3 or 4 circuit striplights are commonly used to light the top and bottom of backdrops and cycloramas (sky cloths).
FOOTLIGHTS are simply striplights placed on the floor, along the downstage edge of the stage. Once a principal source of stage lighting, footlights were also often wired to provide 3 or 4 color washes. Although seldom used today, footlights still can prove invaluable for certain lighting

applications. Used sparingly, they can provide excellent low 'fill' light to a performer's face and can help eliminate shadows from overhead lighting, from hats, roofs, etc.

**TYPES**

The modern STRIPLIGHT typically consist of a row of MR16, PAR, R (reflector) or double ended halogen lamps, mounted into a single compartmented fixture approximately 6-9 ft. long. The modern striplight is also wired in 3 (or 4) color circuits. Striplights are manufactured in various sizes, to use lamps with wattages of 75, 150, 300, 500 or 1000 watts each. Striplight fixtures commonly use glass or plastic colored filters in removable color frames. The modern striplight is used both in overhead and floor mounted applications (downlight and uplight)

| TYPE | BEAM SPREADS | WATTAGE | DESCRIPTION |
|---|---|---|---|
| Striplights | 70-100 | fixed 75-1000 | VERY SOFT edge |

INCLUDED: - (a) power cord (usually 3 or 4).
OPTIONS: - (a) lamps, (b) pipe clamps, (c) color frames, (d) safety cables, (e) electrical connectors, 3 or 4, (f) hanging hardware, (g) floor mounting hardware.

**PROJECTORS**
**DESCRIPTION**

Scenic projection has existed in the theatre for hundreds of years. From the early days of the shadow puppet to the Laterna Magica (magic lantern) to the optical projector of today, projection technology has grown and developed to become an important part of modern stage lighting. Today many modern stage shows make use of sophisticated projection from conventional projectors and from a new range of dynamic automated fixtures.

**LINNEBACH PROJECTOR**

One of the simplest and first projectors used for scenic projection was the Linnebach projector developed in Germany by Adof Linnebach. Developed in the early 1900's, this very simple projector consisted only of an enclosed box with a large transparent slide placed on one side. A point light source inside the box caused an the image of the slide to be projected and enlarged onto an adjacent background. The image had a slightly soft definition (due to no lens) and was particularly well suited to a stylized theatrical productions. Many early designers produced elaborate hand painted slides for a wide variety of productions. The Linnebach projector is seldom used today as it requires a rather large transparency and is almost impossible to find manufacturers that produce the unit. They are however very easy to make.

**THE OPTICAL PROJECTOR**

The modern optical projector of today is simply a refinement of the ancient Laterna Magica. One of the first magic lanterns was demonstrated by Kircher about 1560. Others including Huygens and Walgenstein also take credit for the invention of the device. Scenic projection developed over the years and many major lighting companies produced large scale projectors, including Century, Kliegl and Strand.

Today for large scale professional stage productions, where projection is used, it is almost always from the 'Pani' projector. This Austrian company (Ludwig Pani) makes a wide range of optical projectors and accessories. Their projectors are the best in the world for large scale projection and are available in wattages of 2000 to 10,000 watts.

**APPLICATIONS**

Projection and projection effects have a wide range of applications for theatre, dance, opera and other entertainment productions. Background projection is common and is usually provided by a 'rear screen' projection system. Alternately, background projection can also be 'front screen' projection. There are many moving effects available for the Pani projection system, including clouds, rain, water, fire, etc.

In addition to backgrounds, projections can provide information and help create a special mood and atmosphere. Projectors can also provide area lighting to highly stylized productions. This takes a great deal of time and planning.

INCLUDED: - (a) power cord.

OPTIONS: - (a) lamp, (b) objective lens (c) condenser lens) (d) safety cables, (e) electrical connector, (f) hanging hardware, (g) floor mounting hardware, usually included.

**AUTOMATED FIXTURES**

**DESCRIPTION**

In the history of the stage lighting, no fixture has revolutionized the art more than has the automated fixture. Throughout all of recorded history and up until the 1970's, all stage lighting fixtures had one thing in common. They were static. They provided a single color, a single focus and were useful only for a single lighting application.

It was only a matter of time before someone decided to try and automate a lighting fixture. Early designs in the 1970's included motors to pan and tilt the fixtures in real time, much as a human operator manipulates a follow spot. Although rather primitive at first, the automated lighting fixture was indeed born. During the 1980 and 1990's the technology continued to develop. Companies such as Vari*Lite, Clay Paky, Hi-End Systems and Martin all started to produce automated fixtures. Some fixtures actually moved (moving fixtures). Other fixtures remained static and a moving mirror directed the light beam (moving mirror). As fixtures developed they became known as 'intelligent' fixtures.

Today the modern automated lighting fixture is a technological wonder. Using modern light sources, they move, change color, dim, project patterns and images, strobe effects and much more.

**APPLICATIONS**

Automated fixtures are available in two basic types; moving fixture or moving mirror. Each has their advantages and disadvantages and each are suited for specific lighting applications. Generally fixtures are designed for COLOR WASH lighting (wide angle) or AREA LIGHTING AND IMAGING EFFECTS (narrow angle).

Automated fixtures can be, and are used for all lighting applications, depending on the design of the particular fixture. The lighting designer is advised to work closely with the manufacturer in order to select a unit best suited to his needs, as this technology changes almost daily.
Many current automated fixtures are quite noisy in operation, mainly from the fan required to cool the lamp. This fact and their general overall expense and poor record of reliability have kept the automated luminaire from replacing conventional fixtures for most stage lighting applications. As these fixtures become quieter and more reliable they certainly will find more and more use for theatre, dance and opera related productions.