

# History and Control Systems

## History of Lighting

An understanding of history is a powerful tool.

Light has a profound effect on the way we experience our lives. Here I try to trace some of those “ah Ha” moments mankind has had in using light as a device to enhance storytelling.

THE BIBLE “in the beginning...” light is used throughout the Bible for over 177 references.

PREHISTORY -tales around the campfire for greater dramatic effect with shadows projected on the walls of caves during rites of passage ceremonies-darkness manipulated as a right of passage

big time gap...

GOLDEN AGE OF GREECE around 500-300 BC

-events in theatre festivals timed with natural lighting for greatest effect.

ROMAN 400BC-80AD -light is part of important religious ceremonies- the Vestal Virgins tended the everlasting light – apparently, any virgin who broke their vow of chastity would be buried alive ( effectively turning off their lights)

Roman theatre used natural light for illumination but used torches and fire to indicate nighttime.

## THE DARK AGES

400AD invention of the candle as we know it today. Few were used by common people until 1400's –(expensive luxury ) used widely in the church both for illumination and symbolism. Theatre is used as a device for communicating dogma to uneducated “flock” leads to invention of simultaneous settings. w/ focus shifted by moving light sources.

## RENAISSANCE THEATRE

C.1500'S The primary source of illumination is candles and oil lamps. -auditorium and stage equally lit

-lanterns and candles used to indicate night



-some coloring of light –using colored liquids

- only very general light

-lots of smoke

-FIRE

1545: Sabastiano Serlio -- colored light liquids in bottles (red wine, saffron (yellow), ammonium chloride in a copper vessel (blue)).

Brightly-polished barber basin and a round bottle as a lens

1550: Leone de Somi - full illumination for happy scenes, but tragedy much darker (candles, crude oil lamps, torches, and cressets (hanging lamps)).

Stagehands walked around and snipped wicks, the audience was lit and often had hot fat and wax dropping on them. (Candles were of tallow and fat)

1573 Inigo Jones, and English stage designer returns from Italy with knowledge of Proscenium Arch and footlights.

1580 Teatro Olimpico built - 1st permanent theatre in Italy ( still standing) Still stands today with the original set on stage. Finished in 1584.

C.1600 BAROQUE(= no Monet)



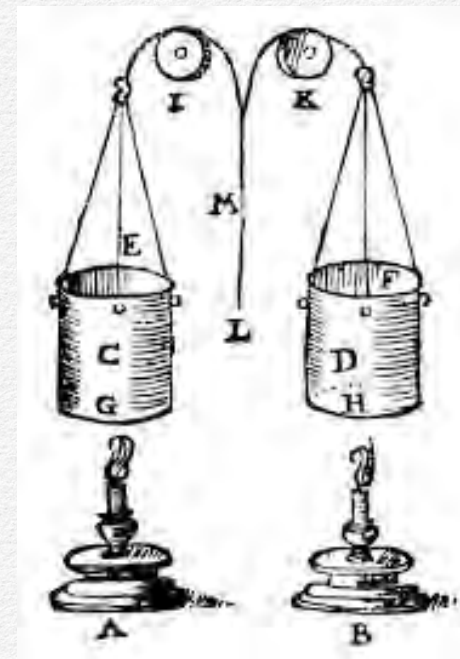
1618 Teatro Farnese - first permanent proscenium arch - destroyed in WW2 ( the good war )

-chandeliers over both house and stage

\*\*\*addition of reflectors to utilize more light

-consistent use of footlights = more light on performers

\*\*\*1638-system developed to lower cans over candles =1st dimming,





Giacomo da Vignola - ideal lighting angle is along the diagonal of a cube (later “discovered” by Stanley McCandliss in 1930’s)

-average life expectancy in 1600 – 33 years

**RESTORATION THEATRE - (a 1660)** During the interval of Puritan rule in Britain, all of the formerly supported stage productions were suspended (1640). The main source of light in Restoration theatre was usually chandeliers concentrated toward the front of the house, especially over the forestage. The chandeliers were somewhat of a nuisance however, as they had to do for indoor and outdoor scenes alike. Furthermore, they dripped hot grease on both audience and actors.

The candle snuffer was a characteristic figure of these times. Candlewicks needed frequent trimming, regardless of what was taking place on the stage.

**FIRST - USE OF WING LIGHTS - (1670)** There is reference to candles having been fixed behind the shutters (sliding flat wings), as early as 1670, at the Hall Theatre.



**FIRST - USE OF FOOTLIGHTS - (1673)** One of the first recorded use of footlight can be seen in the French painting 'Les delices du genre humain', 1670. The painting of the Comedie Francais in Paris shows a row of small protruding flames along the downstage edge of the stage. Four chandeliers with candles are also shown, hanging above the stage.

Another of the first recorded uses of footlights in the English theatre (also with chandeliers above the stage) can be seen from the drawing (front piece) to Francis Kirkman's 'The Wits', published in 1673. ('The Wits' or 'Sport upon Sport', was a collection of short comedies acted in private halls during the Puritan ban of the theatres between 1642 and 1660.) The footlights are candles (or possibly, oil lamps). Oil lamps usually had two or more wicks in individual containers, and their use certainly predates this print.

**GARRICK, DAVID - (1717 - 1779)** David Garrick was the leading figure of the English stage from 1741 to 1776. He was responsible for many innovations in the theatre.

Perhaps the most significant lighting of the eighteen Century was practiced at the Drury Lane Theatre under the management of David Garrick. On his return from the Continent in 1765, Garrick began to institute his so-called reforms at the theatre. While in Paris he was particularly impressed with the lighting and staging techniques at the Paris Opera that he de-



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cided to import many of the French stage techniques and lighting equipment, to Britain.

Further Garrick removed the traditional chandeliers, and lighting shifted to sources located behind the proscenium and across the apron. We know in Britain that the sidelight unit had been in use for some years and that the footlight unit had been in use since 1673. Garrick put footlights into the Drury Lane Theatre in 1765 and masked them from the audience with metal screens which also served as reflectors. The notion that Garrick brought the footlight from France is clearly false.

**DE LOUTHERBOURGH, PHILIPPE - (1740 - 1812)**De Loutherbourg, artist and designer received his early training in Paris. In 1771 he was engaged by [GARRICK], the English actor and producer, to design at the Drury Lane Theatre. He often would combine two and three dimensional scenic elements and he also conceived many of his designs in terms of light.

De Loutherbourg eventually left the theatre to devote his time to an idea known at the time as the 'Eidophusicon'. The Eidophusicon consisted of a miniature theatre constructed to conduct a performance of nothing but scenic effects using light, space, color, movement and sound.

\*\*\*1744 lights on ladders-scene blinds – foot lights lower into stage.

**LIGHTING OF CANDLES - (1761)**In 1761, at the coronation of George III, groups of 3000 candles were connected together with threads of gun cotton, and lit in half a minute. Those clustered below were showered with hot wax and burning thread.

1770 DeLoutherbourg makes changes in the way light is used and he introduces stretched silk screens for reflecting and coloring light.

- More control of house lighting

- chandeliers move up and down

- chiarosuro scenery invented, golden age of scenic painting

\*\*\*discovery of light and shadow and distribution of light for sake of greater illusion.

**ADDITIVE COLOR MIXING - (1769)**In 1769, Guyot (French) discovered the additive method of color mixing, by experimenting with transparent colored papers.

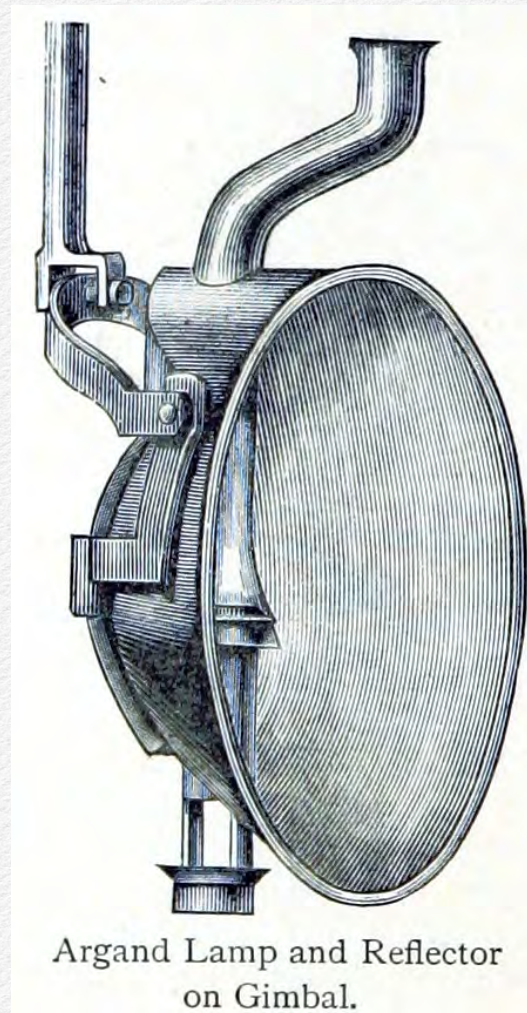
1788-1827 Augustin Jean Fresnel – developed a wave model for light that accounted for reflection, refraction, interference and polarization. Also designs Fresnel lenses for light houses.  
( by the way)



-\*\*1785 introduction of the Argand or Patent lamp. Was a wick with glass chimney, creates brighter steadier light, chimney could be colored with pigmented lacquer.

\*\*\*1808 carbon arc first demonstrated by sir Humphrey Davies (also credited with discovery of laughing gas), lack of electrical supply makes it un-usable. Used widely in the theatre by 1876

\*\*\*1816 Thomas Drummond invents limelight ( insists on calling it the Drummond Light ) has 2 cylinders of compressed gas Oxygen and hydrogen, heated a col-



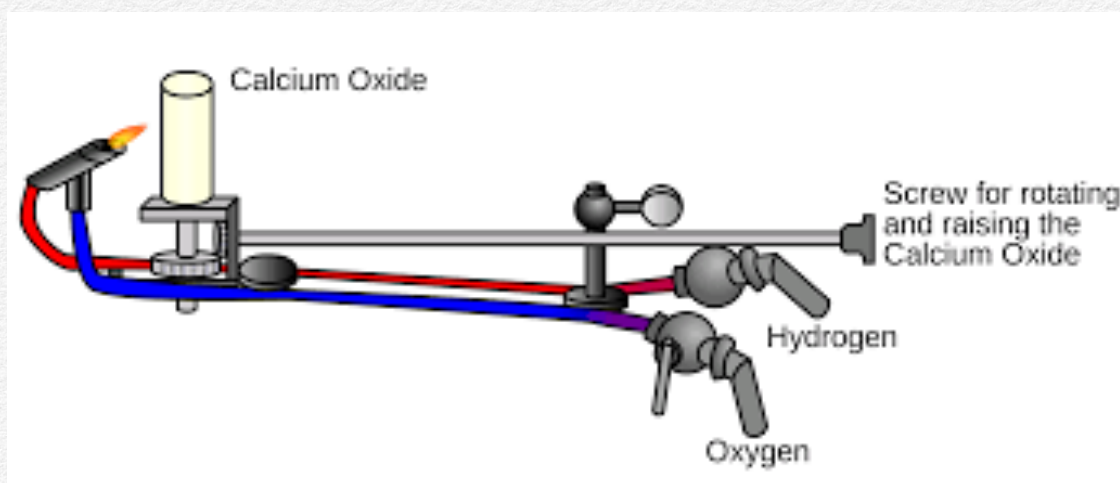
umn of lime to incandescence. Was placed inside a hood, fitted with lens and reflector and becomes 1st spotlight given up as too expensive (and that name!) widely used by 1850.

DAGUERRE, LOUIS JACQUES MANDE - (1789 - 1851) Daguerre was a French scene painter known for his illusionistic stage sets. He was also the inventor (with C.M. Bouton), of the diorama. The diorama was a three dimensional setting usually melded with two dimensional painted backgrounds and realistic lighting effects. Today dioramas are commonly used by museums for display or exhibit applications.

Daguerre, working, with J. Nicéphore Niépce, developed the daguerreotype, a photograph formed on a copper plate coated with silver and treated with iodine vapor. This was the first practical photograph.

19TH CENTURY STAGE LIGHTING - (1800's) At the beginning of the 19th Century stages were illuminated by [ARGAND] oil burners. They were provided as footlights, stage side lights and by overhead chandeliers. For stage use, the glass chimney was often made from colored glass. During the Century, [GAS LIGHTING] developed and flourished. Other sources such as the [ELECTRIC ARC] lamp and the [LIME LIGHT] were also developed and put to use on stage.

However, up until this point in time, all lighting devices had one major drawback - they all were flame sources. They had to burn





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right side up, be supplied with air, protected from objects that might catch fire, and be protected from drafts. Also, they were difficult to start, and they were a source of pollution.

**GAS LIGHTING - ENGLAND - (1814)**The first general use of gas street lighting took place in London in 1814. By 1823 nearly 40,000 lamps had been installed in 215 miles of London streets. It was the introduction of gas lighting to the theatre that began the first real advance in theatre lighting. Gas was manageable and controllable. Centralized remote control systems were developed, usually in wings, backstage. The 'gas plate' contained control valves between the main gas supply and each gas lighting 'circuit', and allowed the footlights, wing lights, etc. to be dimmed, brightened or extinguished at will.

By 1817, Covent Garden, Drury Lane and the Lyceum were all lit by gas. The last London theatre to adapt to gas was the Haymarket, where candles and oil lamps were used until April 1843.

#### C.1820 ROMANTIC STYLE

-1827 friction match invented by druggist, John Walker.

-development of gas lighting by 1840 widespread

**FARADAY MICHAEL - (1832)**In 1832, Michael Faraday (England) announced that he had converted magnetism into electricity. He had sent a current through a coil of wires, creating a magnetic field which induced a momentary current in a second

coil. In America Joseph Henry affirmed that he had done much the same thing at about one year earlier. The discovery of electromagnetic induction led to the development of electric motors, generators and dynamos. Einstein kept a picture of Faraday in his study for inspiration.

-1843 Comedie Francaise installs gas light but retains oil footlight as actresses consider gas light to be too harsh.

-light can be dimmed by adjusting flow of gas

-1850 1st control board – the gas table ( a panel of valves for intensity control)

C.1870 -black masking used to keep light from stage from spilling into audience

-auditorium darkened during performance

lacquered glass used as early gel

#### THE ELECTRIC AGE

\*\*\*\*1881 first all electric performance – the Savoy Theatre in London. Used nearly 1200 lights. Power from a special steam generator in the lot next door.

-1882 First all electric American installation in the Bijou theatre in Boston.



Richard D'Oyley (often: D'oyly) Carte, was the enterprising manager of the new Savoy Theatre in London. In 1881 he opened the theatre and advertised that the Savoy was the first public building lighted 'entirely' by electricity. In fact, there were a total of 1158 of the new Swan lamps, used to light the auditorium, the dressing rooms, the corridors and the stage. The electrical and dimmer system was by Siemens Brothers and Company, one of the early pioneers in stage lighting control systems. There were six (6) dimmers in all.

1893 IATSE founded

1856 first followspot. A limelight on a moving stand first used to follow a performer.

-Saltwater dimmer (mechanical dimmer) used actually is 1st electric dimmer

-1903 The Kliegl Brothers develop an elaborate 96 dimmer system for the Met in NYC

APPIA, ADOLPHE - (1862 - 1928) Appia was a Swiss theorist of stage lighting and decor. His use of light and shade when staging [WAGNER'S] operas revolutionized modern scene design and stage lighting. He was also one of the first to realize the great potential of light in the theatre, once electricity had been introduced. Appia rebelled against naturalism and defined the stage in terms of time and space and suggested the use of light



An old salt water dimmer.

ate mood and composition. He called the familiar light of his time (from borderlights and footlights) general illumination (Hel-  
ligkeit). According to Appia, this type of light was useful, per-  
haps, but inadequate, there must be a new kind of light, a 'form  
revealing light' (gestaltendes Licht) to give objects on stage

to

cre-



their natural three-dimensional quality - there must be 'living light' for living people.

MCCANDLESS, STANLEY - (c 1900 - 1967)

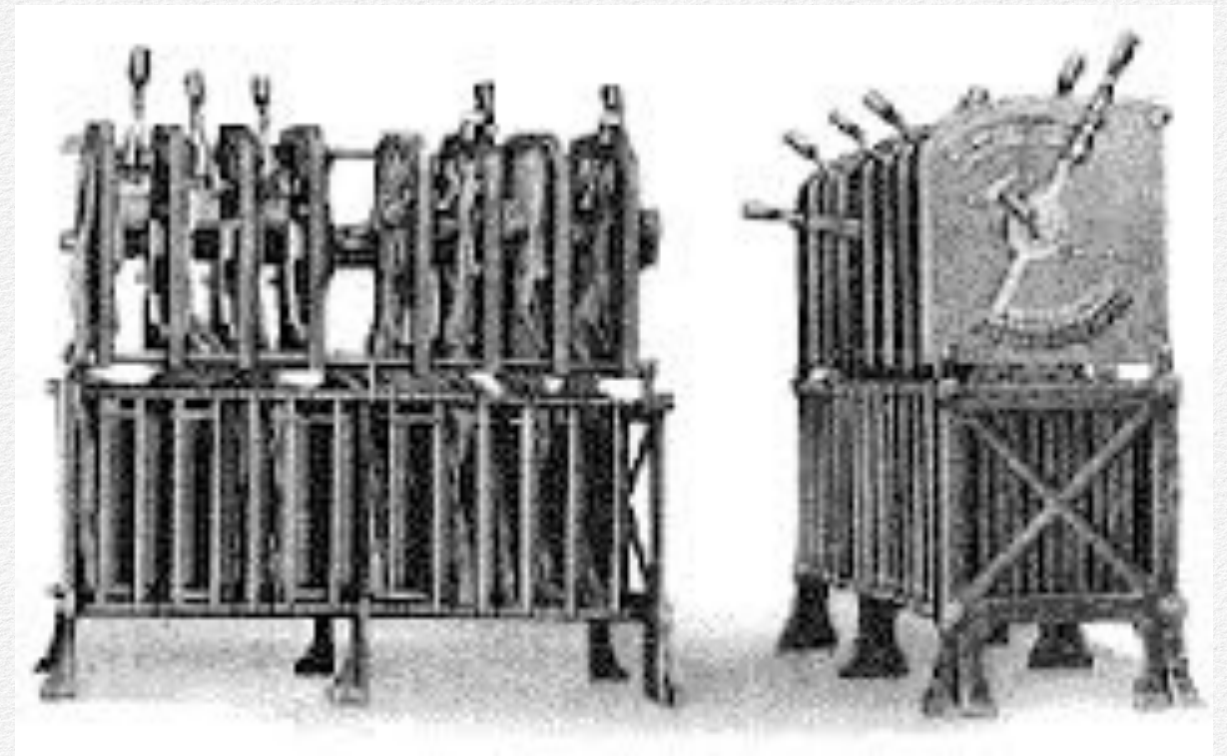
Stanley McCandless (American) is often regarded as the 'father' of modern stage lighting design. He worked as a teacher, educator and lighting designer, throughout his career. After graduating from the University of Wisconsin, "Mac" got his degree in architecture at Harvard. He then worked as an architect for some time and in the late 1920's he opened an office in New York City as an independent lighting consultant. He was the architectural lighting consultant for Radio City Music Hall and many other important projects. With the opening of the Yale School of Drama in the 1920's he was asked to teach stage lighting. He taught at Yale between 1925 and his retirement in 1964.

McCandless wrote two very important books on stage lighting "A method of lighting the Stage" (1st published, 1928), and "A Syllabus of Stage Lighting". McCandless provided a 'method' of lighting that is still the foundation of modern lighting methods today. He taught visibility of the actor first, and illumination of the surrounding scenery, second. He proposed a system of dividing a typical (proscenium) stage into 'acting areas'. Each area was lighted with two fixtures - placed at 90 degrees to each other, and in a 45 degree frontal position to the actor. For additional

interest, McCandless recommended a 'warm' color from one side and a 'cool' color from the other.

McCandless was also the holder of numerous patents in the architectural lighting field. He consulted on some of the largest and most important projects at the time in the American nation. He taught many lighting professionals in the field and lectured and wrote extensively in architectural and illumination publications.

-1920 1st Fresnel spotlight-Resistance dimmer (mechanical)

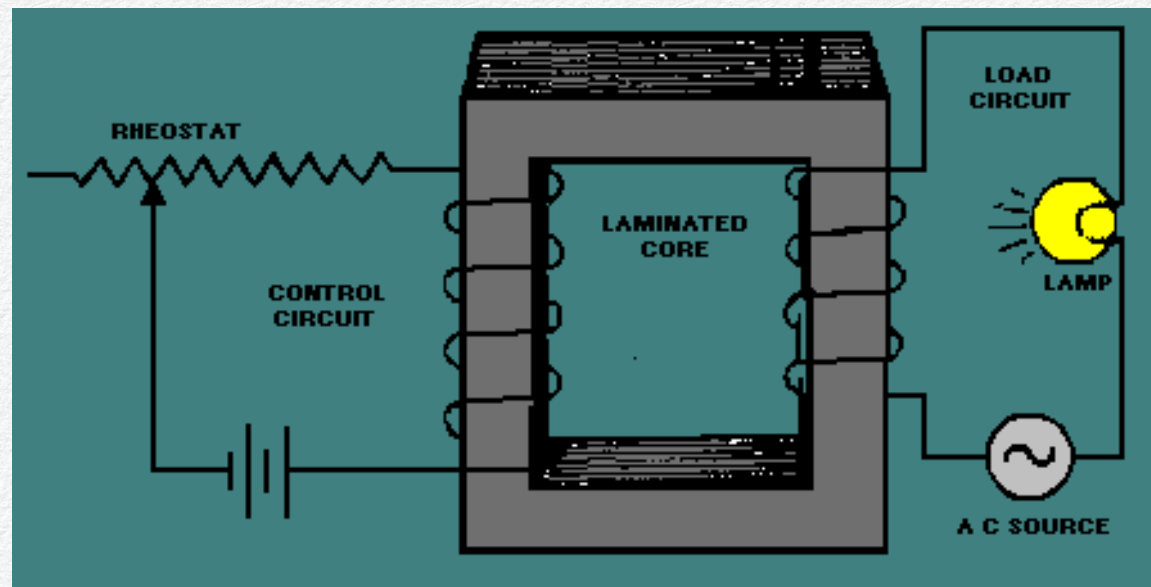


=rheostat functioned as a large capacity resistor. Converted electricity to heat, requires full loading and ghost load.



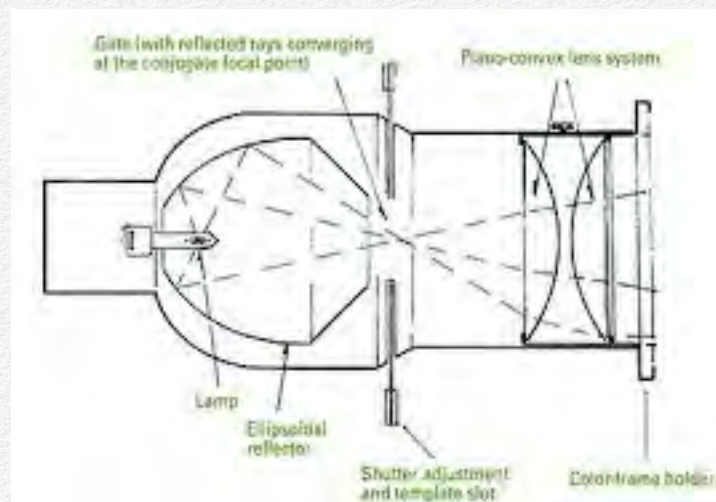
Created lots'o heat –bumpy fades. Consumes entire rated capacity of electricity at all times it is on.

1920's Saturable core dimmer (electronic) uses a DC current to magnetize an iron core which allows AC power to flow through



it

as it becomes magnetic. As the level of magnetism increases, the conductivity of the core increases, and the lights connected to the dimmer come on.



-1929 Keigl introduces first Fresnel lens spotlight

-1933 Ellipsoidal Reflector Spotlight

-1933 LEKO almost the same as above but incorporated beam shaping shutters also named for Joseph LEve and Edward Kook founder of Century lighting company.

-1933 Gobo/template

-1933 Autotransformer dimmer (mechanical) has a wire wrapped around in such a manner that the magnetic fields created, work against each other causing a phenomenon called back EMF or back voltage. If the wire is arranged properly a variable voltage will be available along the coil. Because this tapped off votage doesn't depend on a resistance relationship between the coil and the lamp, it will be the same regardless of the load. -smooth dimming  
-doesn't use full capacity all the time  
-creates little heat  
-actually varies the voltage of the circuit





- 1937 florescent lamp – roughly 65-80 lumens/watt



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Dim-  
1st  
ple  
gat-  
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in

the circuit is controlled by rapid switching on and off. Tyratron tubes were very large, special vacuum tube which required a long warmup time and didn't last very lo

-1950 United Scenic Artists is created. This is today, the union governing scenic designers, scenic artists, lighting and costume designers.

-1950's Magnetic Amplifier Dimmer ( electronic ) a more efficient version of the saturable core dimmer, quickly replaced by the advent of the SCR dimmer.

-1940  
PAR  
lamp  
  
-1947  
Tyra-  
Tube  
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which

- 1958 SCR dimmer introduced by GE allowed the design of compact, remote controlled dimming systems – with no moving parts. Uses gating.

- heat sensitive
- electronic gating
- can cause 60hz hum
- does not vary voltage

1971 Altman lighting introduces the 360Q axial ellipsoidal reflector spotlight.

1992 ETC introduces the Source4 Ellipsoidal Reflector spotlight.

1990- MOSFET

metal oxide semiconductor field effect transistors.





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## 1991-IGBT

insulated gate bipolar transistors

-both very important new dimming technology

-very short circuit resistant

-silent “you won’t believe what you don’t hear”

