

DIE VIERTE WAND

INITIATIVE THEATERMUSEUM BERLIN E.V.



Ausgabe 009

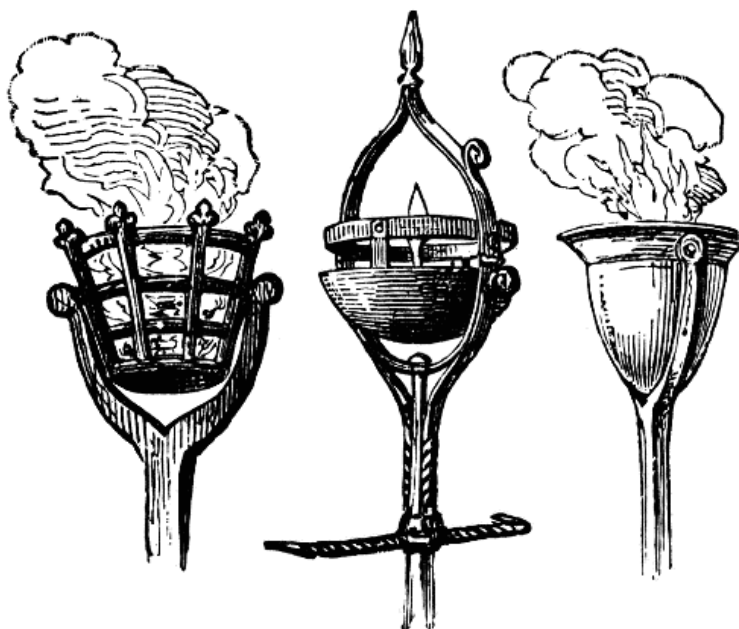
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FADING LIGHTS

Transitions in theatre lighting in a historical context

by Chris Van Goethem (english revision by Gitta Van Goethem)

Fading Lights is a cooperative project between the Expertise Center for Technical Theatre and the Stockholm Academy of Dramatic Arts. The project researches the history of lighting with a focus on the transitions between subsequent technologies. In the context of the imminent transition to more LED sources, it seems useful to us to look at earlier transitions and maybe learn something from them. In other words, we would like to find out how the technician, the designer, and the audience have adapted to the transition from candlelight to gas lights, to electrical lighting.

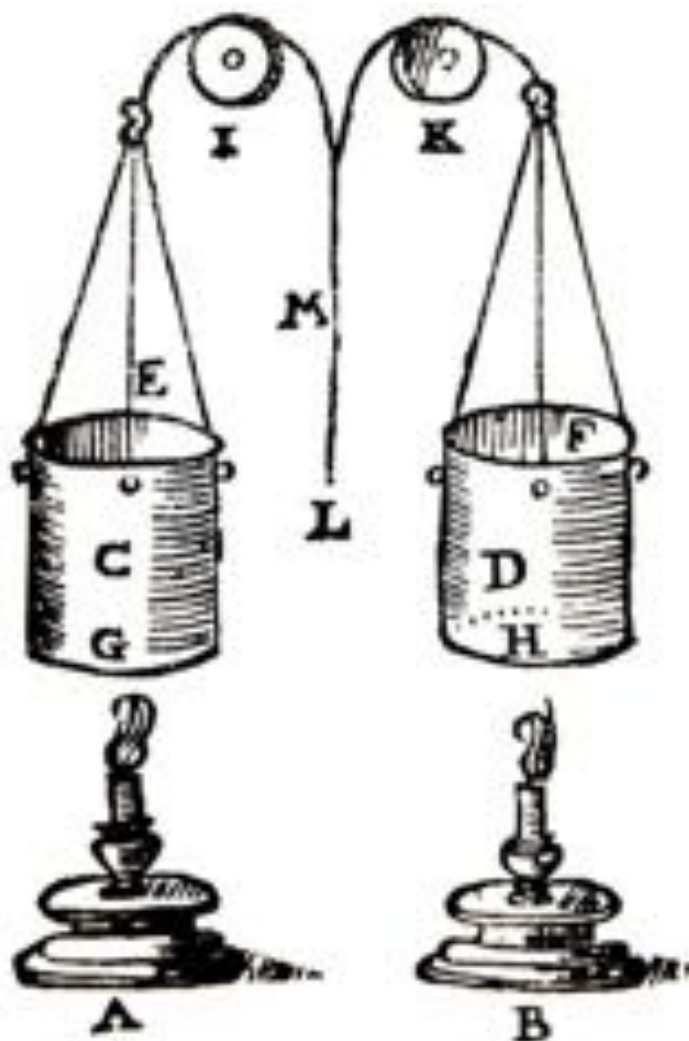


3 different types of cressets

The first types of theatre were performed in daylight or with the lighting equipment that was at hand for domestic use. Those would have been torches, cressets, tapers, etc. In smaller spaces, dipped candles from animal fat were used among other things. Those were cheap, but gave off a considerable amount of smoke and stench. Apart from that, lamps based on a wick dipped in vegetable oil were used. Candles from bees wax were expensive and were therefore only used in extraordinary circumstances, when high-ranking people were present. The most important function of these sources of light was making the actors visible. Although we must also point out that some light sources were manipulated by the actors so they could stress certain things. Some light sources were also used purely symbolic to, for example, show that it was night, even though the play was during the day.

In the Renaissance and Baroque we see that standard positions for lighting equipment are starting to develop. The audience area is lit by chandeliers, which also provide a minimum of front light. These lights would stay on even during the performance. Foot lights on the edge of the stage and lights that illuminate the sets from the wings are the standard. These could be complemented with a second row of foot lights to illuminate the backdrop. The first experiments to use light from the „heavens“ above, the fixed painted ceiling elements, appear to have very little success.

For the first time, they try to manipulate and control the light as well. Sabbattini's dimmer is presumably the most famous, but apart from that, foot lights could also be lowered under the stage and the beams that held the lighting in the wings could be turned away.



Dimmer from Nicola Sabbattini: *Pratica di fabricar scene e machine ne'teatri*, Ravenna 1638



Český Krumlov, Czech Republic: Footlights, lowered understage (top by Pavel Slavko) - wing lights (right)



The colour temperature of the light was constant, since it is dependant of the characteristics of the open flame. To colour and shape the light, Serlio and others experimented with concave and convex bottles that could be filled with a coloured liquid, and that coloured and directed the light in combination with a mirror. The further shaping of light was only possible by shielding it off, for example with the sets.



Serlio-experiment with bottles and coloured liquid



A Bozze - seventeen century theatre lighting

The rise of gas lighting

Even though Murdock¹ already used gas lighting to illuminate his house in 1792 and the first experiments with stage lighting happened in 1804 in the Lyceum Theatre, it took until 1816 for the first theatres with gas lighting to become operational. Around 1850 the use has taken hold, but still some theatres continue working with petroleum, carbide or oil lamps until after 1900.

During the transition from candle light to gas, the same lighting positions were used at first. The candles were simply replaced by gas burners. The basic composition with foot lights and lighting from the wings is later complemented with herzes or battens that are hung in between the borders. This is possible because a gas burner, as opposed to a candle or oil lamp, can be hung upside down. According to Bram Stoker², this basic composition can

¹ William Murdoch was a Scottish engineer and inventor who developed the first gas lighting systems

² Bram Stoker, was not only the writer of Dracula, but also Irving's business manager at the Lyceum Theatre in London.

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single jet



Argand gas burner

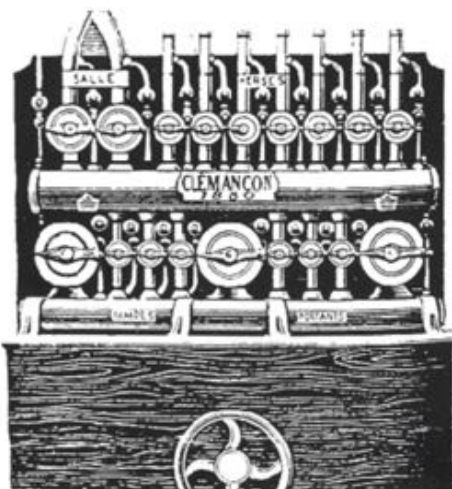


fishtail burner

be further complemented with moveable „standards“, that contain a cluster of burners and thus give off a very strong light, „ground rows“, that help correct the perspective of the scenery, and „all sorts of side and form“, that were built especially for a specific set piece.

All of these devices basically consist of a housing with a reflector and a protective metal gauze. There is a gas tube in the housing onto which several gas burners have been installed. The devices usually have a second connection for a pilot light. When the gas tap in the supply pipe is opened, the pilot light ignites the first burner, after which the flame is passed on from one to the next burner. The connections were made with rubber hoses that could be connected to a water trap – a power outlet for gas so to speak.

Depending on the type of light that you want and the intensity, different types of burners are used. The easiest burner is the single jet: just a tube with gas coming out of it. An improved version is the Argand burner, which provides a better oxygen flow and has a glass casing. Furthermore the fishtail burner, that creates a flat, tail-shaped flame, is popular, because it had a wide flame surface that can connect to the next burner with a minimal safety distance to the front. For the house lighting the traditional chandelier is replaced with a sun burner, a cluster of burners positioned in a sphere.



Clemençon „jeu d'orgue“ or gas table

It is important to underline that all of these burners have open flames. The colour temperature of the burners is stable, even when dimming them. The gas mantle that we know from gas lighting for camping trips wasn't invented until the end of the gas period, when electrical lighting was already on the rise. Operating the different (groups of) burners happens with a “gas organ” or “gas table”, a series of taps that supply both individual connections and the pilot lights. The light can be limitedly colour-

red by hanging woven „mediums“ in front of the rows of burners or by adapting the colours of the glass casings.

The use of gas lighting solved several disadvantages that are specific to candlelight. Since in theory, the burners could burn unlimitedly, there was no need for intervals to trim the candlewicks. It became possible to light from above. The light could be operated at a central place. This also means that dark became an element in the use of light. Stoker writes: „In fact, darkness was found to be, when under control, as important a fact in effects as light.“ In other words: the lacking of light becomes an additional element in the design.

Furthermore, this control makes it possible to darken the house and even do set changes with an open curtain and without light. To do this, it was necessary to train the stagehands and to provide them with „silent shoes“ and „dark clothing“. Or how the transition to gas lighting was the cause for technicians being dressed the way they are today.

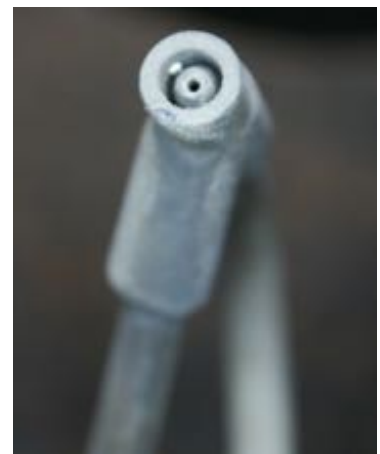
But there were also things to be taken into consideration and downsides that came with gas lighting. The heat emitted by the lamps and the combustion gases made the atmosphere in the theatres unbearable. This resulted in having to provide elaborate air refreshing installations. Less personnel was needed for operating, but the large quantity of unguarded, open flames caused many theatre fires and other accidents. A very dramatic example takes place on September 28, 1861 in Philadelphia's Continental Theatre. A ballerina wants to arrange her costume and hits a burner. When others come to her aid, their clothes set on fire as well. This results in the mourning of six victims.

The greater luminous intensity of the devices made it possible to play further down the stage, but this caused large drop shadows on the painted sets, shattering the illusion. This was because the frontal light only came from the foot lights. This also led to unnatural shadows in the actors' faces.

The rise of gas lighting led to better control of intensity and limitedly of colour, but the lighting was still largely limited to general, non-focused light. To achieve that, we had to wait for other sources of light such as limelight and arc lamps.

Limelight and arc lamps

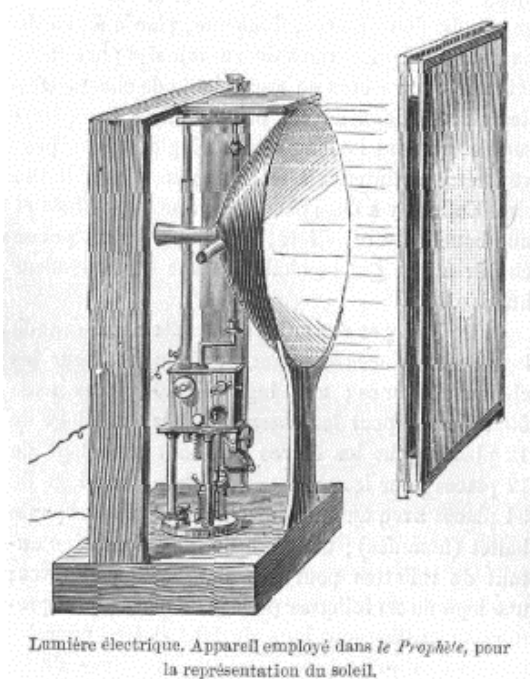
Pics Limelight Stadsschouwburg Bruges



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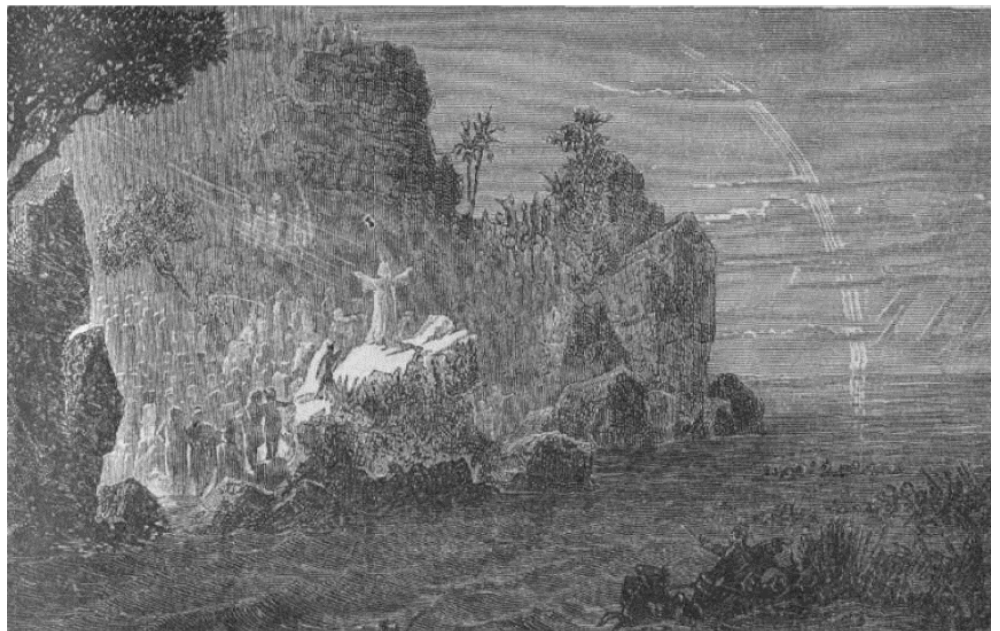


top: Arc light sun effect

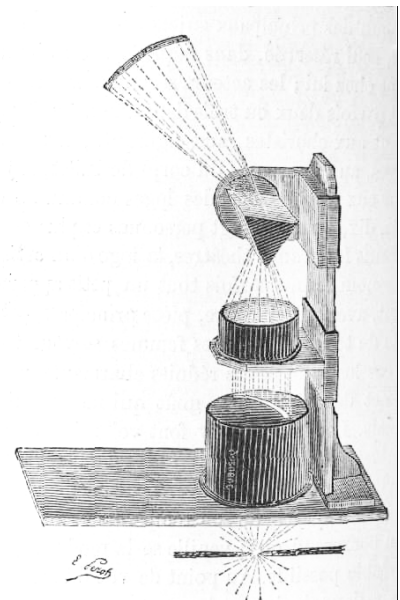
right: rainbow effect

of action. This is why the expression „in the limelight“ still means that someone is in the centre of attention.

The first form of electrical lighting in theatre is the arc lamp. The way an arc lamp functions can best be compared to a traditional welding station. Two carbon rods are connected to a DC voltage and brought closer and closer together until a spark jumps between them. This spark is the light source. Although the first experiments had already been conducted in early 1800, the first lamp, useable for theatre, is only taken into use in 1848 in the Princes Theatre in London. The effect was largely similar to the limelight, but the user friendliness was much greater and its functioning safer. The device worked on a battery or on an external DC voltage power supply and was rather easy to move around.



magic mirror



arc rainbow projector
both from Dubosq catalogue

Based on this principle, Dubosq developed a number of devices for different uses in Paris.

Apart from follow spots with different objectives, he designed lamps with a mirror, a sun effect, a rainbow effect and a magic mirror. In Germany, Brandt developed similar applications.

Every device had its own operator that handled the carbon rods and did the movement and the colour changes. In a first phase, the device is only used on the stage. It isn't until much later that they are also used from the house. The famous Super Trouper follow spots (Yes, indeed, ABBA's) that were built in 1956 worked using this principle. The technique will be applied in follow spots and movie projectors until the 90s. The carbon rods are even still for sale!

Both the limelight and the arc lamp introduce a source of light with a strong, focused light beam and a high colour temperature for the first time. The beam is controllable and visibly defined within the general theatre lighting.

Introduction of the incandescent light bulb

The invention of the incandescent light bulb in the 1870s by Edison, Swan and several others obviously creates new possibilities for theatres. The first theatre to completely be electrified is the Savoy Theatre in London. Besides the 824 six candle power Swan lamps, the Siemens installation included six (saltwater) dimmers and a generator. After all, there was no mains electricity yet. To gain the worried audience's trust, the manager went on stage with a burning light bulb wrapped in a flammable cloth. He then smashed the lamp, after which it went out without causing a fire. The audience was assured. But perhaps even more important is that the air in the theatre was a lot cleaner and cooler, according to the reporter of 'Engineering' in 1882.

The lamps were put on the same spots where the gas burners had been earlier. When the Opera of Paris replaces its gas installation by electrical lamps, L'Illustration even publishes a drawing of both systems next to each other.

And yet, not everyone was excited about the electrical lighting. Bram Stoker writes that electrical light was not sufficiently developed until 1891 to be used for general lighting purposes. This is why Irving introduced it step by step, starting with the foot lights. The most important complaints were that the lamps changed colour when dimming and that the light was unpleasantly white on stage, unless the lamps were tinted. Furthermore, the saltwater dimmers were



Figure 21—The electric lighting and control system used in the Paris Opera and described in L'Illustration, June, 1887. The inset shows the comparison between electric and gas button lights and wing lights. The dimmers are extremely interesting. It will be noted that the rheostats are mounted below the floor, and the leads brought up to contact buttons, connection to which is manipulated by means of lever arms. These lever arms can be adjusted independently or locked to a master shaft which is operated from the end by hand.

comparison of gas- and electrical light in the Paris Opera (1887)

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expensive and wasteful. And finally, the Lyceum Theatre had to invest in heating, because the lamps no longer heated the audience space.

It is not like all theatres made the switch right away either. Julius Cahn's theatre guide for the season 1903-1904, a yearbook for travelling companies that sums up the information on most theatres in the USA, gives a good overview of the varieties of lighting systems in use. A large number of theatres mentions „gas and electricity“ under the header „lighting“. But it is not always clear whether they are talking about the general lighting or about electricity for lighting for effects. Sometimes there is a mention, for example 50V 235A or 110V 30V that lets us assume this only concerns lighting for effects. Some of the theatres indicate whether they use AC voltage or DC voltage, with some among them providing both. The voltage in the theatres varies between 50V and 200V, with some theatres offering several voltages. My favourite among these is the Greenwood Opera House that indicates „plenty of Volt“.

Some theatres work only on electricity, but others indicate they work with gas, „gasoline“ (petroleum lamps), „acetylene“ (carbide lamps), or oil, with or without a possible combination with electricity.

And yet, the switch to electricity goes rather quickly after the turn of the century. AEG's catalogues proudly mention the dozens of theatres they have refurbished the past couple years. Among the theatres in all of Europe, the year 1906 also mentions Antwerp (Theatre Flamand) and Gent (Theatre Flamand and Grand Theatre).

Dimmers with resistance wire are developed and rather quickly, the white lights in the ramps and wing lights are divided into three groups, which allowed the light on stage to have different colours.

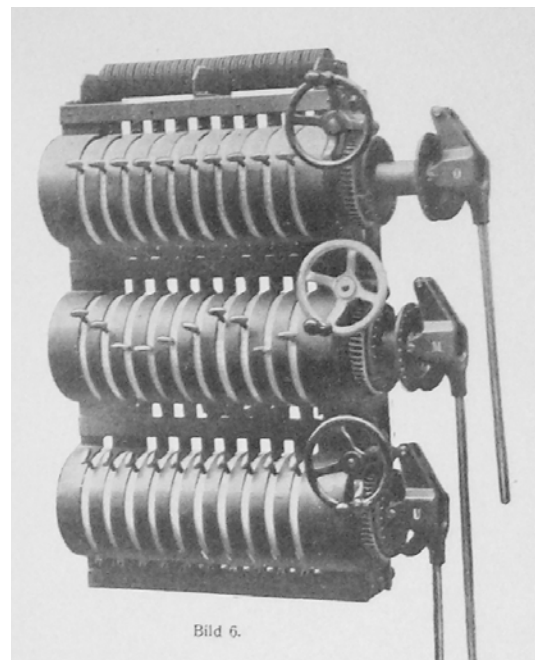
In the proposal from 1912 for the Stadsschouwburg of Kortrijk, Siemens-Schuckert suggests a configuration of

- 2 rampes (foot light) of 5m with 90 coloured lamps of 25 candles in white, red and blue
- 5 herzes (strip lights between borders) of 12m with 450 coloured lamps in total
- 10 portants (wing lighting) of 4m with 30 lamps
- 2 trainées (movable strip lights) of 5m with 36 lamps
- 2 corps mobile sur tripod (mobile elements on stands) with 18 lamps
- A light organ with 3 x 14 levers to operate the resistances.

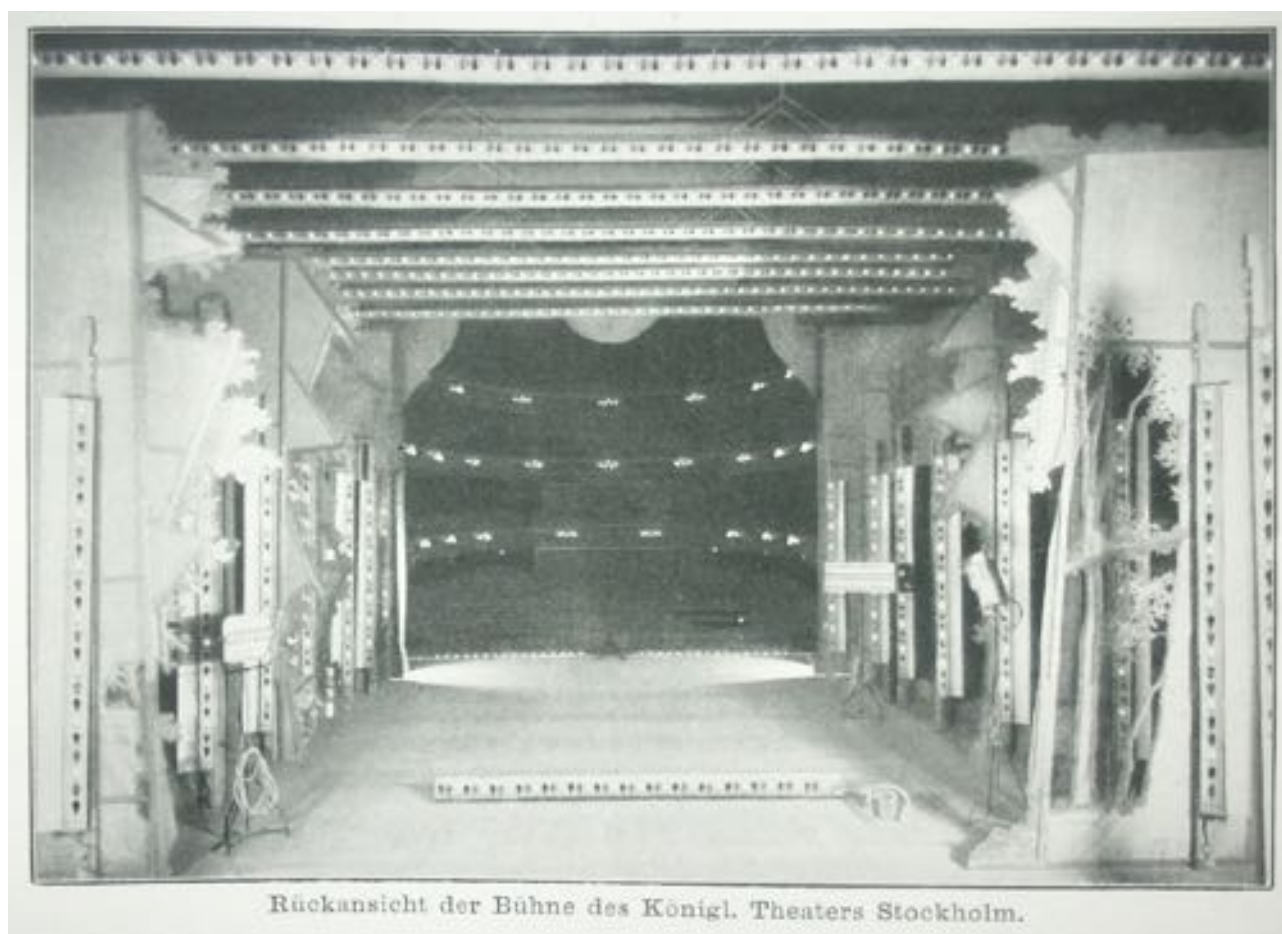
Two options for lamps were offered, painted lamps or lamps with coloured glass, that were 1,1 franks more expensive for red and 40 cents more expensive for blue.

After the first proposal a second followed, where certain things were cut to take the price down. It turns out that it is possible to limit the amount of dimmers to one or two per device and thus only dimming one or two colours and switching the other on and off. The „portants“ didn't make the cut in the second proposal either.

Apart from a list of already built installations, the attached catalogue also provides several examples. The photo of the Opera of Stockholm above provides a good image of what the installation can look like.



Siemens-Schuckert Catalogue 1912



View on lighting setup of the Royal Theatre in Stockholm (AEG catalogue 1912)

The use of colour becomes more and more important and detailed as well. Rosco starts making gelatin colour filters around 1910. In 1915, the Rosco swatchbook contained three blues: Medium Blue, Dark Blue and Green Blue. By 1930 the gamma has already expanded to six with Daylight Blue, Pale Blue and No Colour Blue. While in the early years, people only talked of colours, this moves towards talking of hues.

Lighting slowly becomes a worthy medium that adds to making the performance. When before people were happy that the sets and the actors were visible, they now start realising that „An audience, or the bulk of it at any rate, always notices effect, though the notice is not always conscious. It is influenced without knowing the reason.“ To fully benefit from this, Irving organises lighting rehearsals where every transition is thoroughly prepared and rehearsed. The lime operators, who have to be coached, remain the most important party here. They are the ones that can add accents to the general lighting after all.

Experiments with lighting and design

In the meantime, there is a lot of experimenting going on. In 1906, Fortuny³ develops a panorama with a half dome, which is supposed to replace the naturalistic backdrops and painted theatre drapes. On this horizon, rather abstract colours and shapes are being projected.

Appia goes even further. He no longer wants painted sets with painted shadows, but shapes that only come to life through the light. In 1919 in Hellerau, he builds a theatre space with walls and a ceiling that consist of white plains with hundreds of light bulbs behind them. The

³ Mariano Fortuny is a Spanish lighting designer, architect, painter, fashion designer, photographer, and fine artist.

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set consists of abstract, white shapes. He combines the lighting with the light bulbs, which usually create a shadowless light, with a strong arc lamp that stresses the shadow and thus the shape. Later, he writes about this: "Light, just like the actor, must become active [...] it can create shadows, make them living and spread the harmony of their vibrations in space just as music does."

There is intense thinking going on about the use and the meaning of light and how all that relates to the rest of the design and the actors. These reflection exercises are limited, however, by the lacking of lighting devices for general lighting that can be manipulated as well, since the general light up until this point was unfocussed and non-directional.

The first spotlights

Around the 20s, the first spotlights that can be used for general lighting appear. These are often existing designs of image projectors, limelights, or arc lamps that are adapted for the use with light bulbs. Now, not only colour and colour temperature (amber drift) can be adapted, but the angle of incidence, the beam angle and the beam definition can be manipulated as well. This also makes it possible to place devices in the house, making the foot light less important. In comparison to the general, shapeless light that was available before, this provides unknown possibilities. The time is ripe to continue working on new concepts involving design. In 1932, McCandles writes 'A method of Lighting the Stage' and starts the first (partial) training program for stage lighting at Yale in 1926.

McCandles is the first to divide the stage into parts that are each lit by 2 spotlights. Ideally, the spotlights are in a 90° angle from each other, where one spotlight had a warm colour and the other a cold one. Additional light can come from above or behind. Our contemporary way of lighting is based on (the extension of) this principle as well.

Apart from the technical aspect of this construction, McCandles is also the first to give meaning to light. He starts from four functions: visibility, naturalism, composition and mood. He writes that these functions help pan out the emotional, mental and psychological reaction from the spectator the light will cause. To accomplish these functions, the designer can use intensity, colour, distribution and movement. With this, he creates the base for the future design theories of Pilbrow, Keller, and others. As the possibilities of the devices increase further and the insight into the perception of the audience advances, both the parameters and the functions are deepened further.

It is not so, however, that every new device is added to the arsenal of possibilities just like that. This can best be illustrated with a couple of examples. PAR lamps were already being used in the popular music sector for a long time. In a theatre environment, they were avoided because the bundle of light could not be controlled enough and the devices caused a lot of spill light. The exception to this was the use in herzes in the US and the use as lighting for effects in theatre.

A second example are moving spotlights. Apart from obvious practical problems such as the background noise of the ventilators, the most important problem was that the devices may move, but they also stay in place. Because of that, the angle changes when moving, which happens to be one of the most important elements of the language of lighting in theatre.

A third example are automated light boards. These were quickly integrated in the theatre practise, but developments which limit control during the performance couldn't count on a lot of support. This is because one of the fundamental parameters – movement in the sense of change – could no longer fully be controlled during the performance, which limits the operator in the interaction with the actors.

Conclusion

We can see a number of similarities between the several transitions of the technologies. The theatres are not necessarily early adaptors. The technique has to have a high level of perfection to allow designers to reproduce what they did before. The demands for controllability, colour temperature, colour, shape, the ability to dim,... are high. But there are good reasons for this.

The vocabulary of the lighting designer exists thanks to the mastering of all the parameters of light (colour, colour temperature, amber drift, intensity, definition, shape). The use of these parameters is adapted to the cultural uniqueness and perception of the audience.

To illustrate this with an example: if you get up in the morning, you know what kind of weather it is without looking out the window. Unconsciously, we read the colour temperature of the light in the room and the sharpness of the shadows to know whether the weather outside is sunny or cloudy. The audience in a performance is not aware of the subtle differences in the lighting of a performance, but unconsciously they do receive additional information. This is part of the quality of the performance and the message it conveys.

When someone takes away the possibility to use these subtle differences from the designer, they are in fact taking away his freedom of expression. Sometimes, it seems like we react very emotional when it comes to this, and partially, this is justly so: our assignment is not to make light, but to trigger emotions. We need the nuance and the subtlety.

The primary reasons to make a change to new light sources or methods (modernity, safety,...) are often less important than the usability, the controllability or the new possibilities. In this context, the event industry and the music sector are not as critical. They often work outside or with permanent surrounding light. Light often becomes more scenery than experience.

Theatres are early experimenters: they are permanently searching for extra tools, additional possibilities, new effects. Specific sources start as an effect, become standard and end as effects again. But every transition has an impact on the whole. The light is part of the design and the performance. You can only appreciate it fully in relation to style, actors and sets.

What does this say about the transition to LED?

Even though LED sources have a lot of potential, they also have a number of limitations. We are slowly coming out of the phase of mimicking previous light sources. The development to new, well-considered sources is only just getting started. But the technology is not fully-grown yet. To make the subtle use in theatre possible, we still have some work to do concerning amber drift and the quality of the colour spectrum. For travelling companies, there is no colour standard yet or the guarantee of having devices that deliver a similar result. A logical transition first replaces house- and work lighting and then less critical things (horrors, etc). After that, the rest will follow just like that. But halogen lights need to be kept for specific applications. That is what the Opera of Stockholm determined, after they made the complete switch to LED. For specific productions or functions, they have started using halogen lights again, because specific effects are not possible or they create a different perception.

It is important that we keep on looking, that we keep exploring and questioning new light sources, that we involve the designers, technicians and companies in these test cases to start building a new tradition this way.

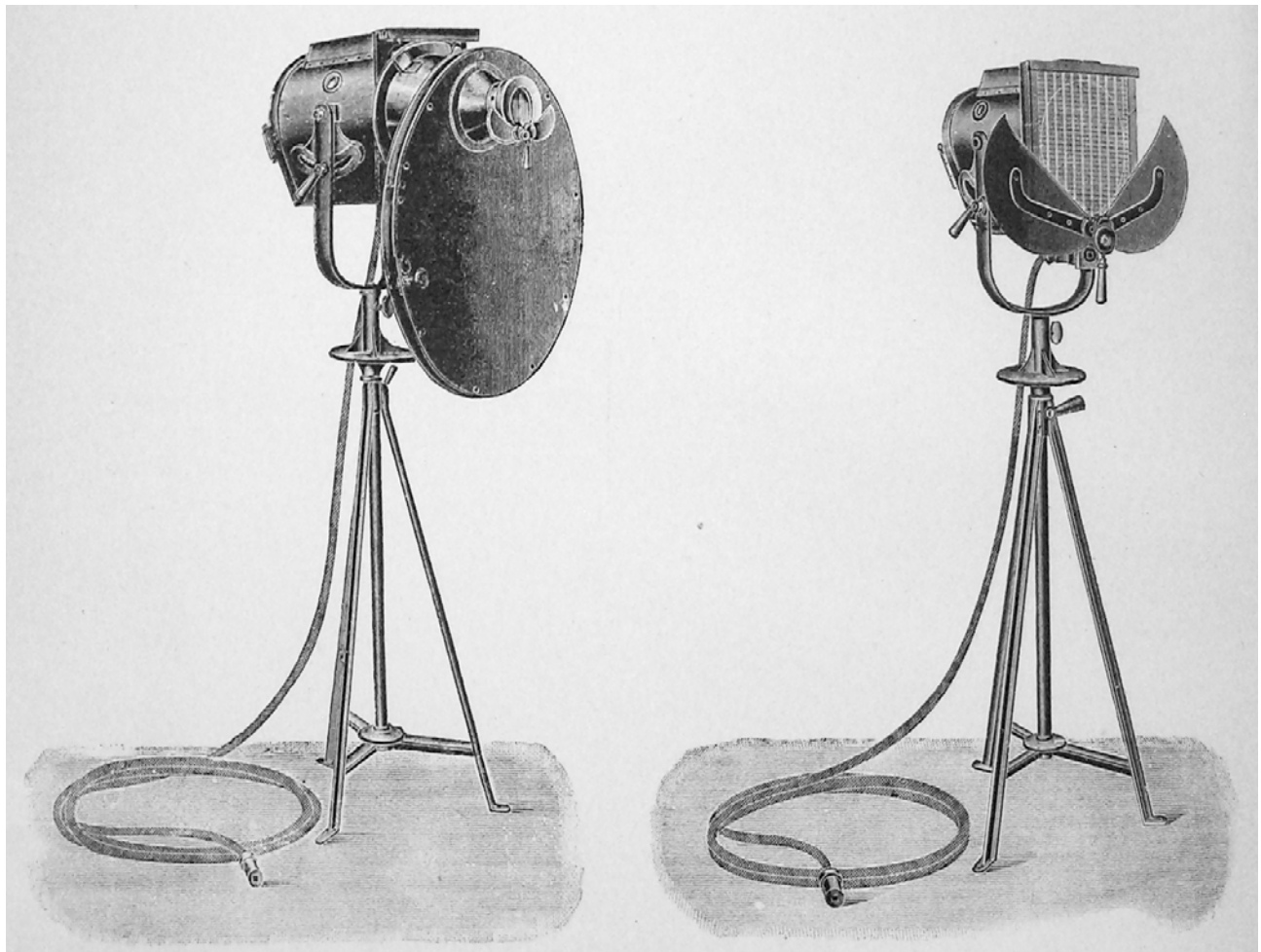
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Other published articles include „Ergonomie barocker Bühnentechnik - ein anderer Blick auf die Geschichte“, DIE VIERTE WAND #006 (2016) and „Help it's 3D - about how to deal with our history“, DIE VIERTE WAND #007 (2017).

<https://www.ritcs.be/en/programmes/stage-management>

<https://www.ritcs.be/nl/podiumtechnieken>



Stage light with electric arc-light - combination system for lighting and projection (AEG catalogue 1912)

german description:

II. Bühnen-Scheinwerfer

Einen wesentlichen und wichtigen Fortschritt auf dem Gebiete der Apparate zur Erzeugung von Bühnenlicht-Effekten mit Hilfe des elektrischen Bogenlichts, bildet der nachstehend abgebildete kombinierte Apparat für Scheinwerferbetrieb und Projektionszwecke. An den meisten Bühnen, teilweise sogar an den allerbedeutendsten, verwendet man heute noch für Scheinwerferbetrieb und zu Projektionszwecken getrennte Apparate. Kombinationen von Scheinwerfer und Projektionsapparat sind zwar bereits in Verwendung, jedoch ist bei den meisten derartigen Vorrichtungen auf eine Verstellung des Bogenlichtkolbens, - dergestalt, dass in beiden Fällen die jeweilig günstigste Lichtausstrahlung erfolgt - nicht genügend Rücksicht genommen.



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