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LIGHTING ENHANCES ARCHITECTURE AT "A CENTURY OF PROGRESS"

MANY PROBLEMS SOLVED --- A STROLL THROUGH THE GROUNDS

CHARLES J. STAHL
SPECIAL ILLUMINATION ENGINEER
WESTINGHOUSE ELEC. & MFG. COMPANY

The lighting for "A Century of Progress Exposition presented entirely different problems in Exposition lighting from those encountered in the past. Here, instead of buildings requiring decorative treatment by the use of colored light, are vividly colored buildings requiring for the most part only the so-called white light from the Mazda lamp. All the buildings are of modernistic design with rambling, expansive facades, with few attempts at decorative treatments. These, with their major dimensions, mostly in the horizontal, present extensive areas painted in brilliant hues.

Obviously mobile color lighting, which has contributed greatly to the beauty of expositions in the past, has practically no application to surfaces on which the color is definitely fixed, after carefully chosen color combinations have been established by competent authorities.

COLORFUL BUILDINGS - BY DAY OR NIGHT

Some very beautiful buildings have contributed much to the daylight vista of previous expositions. But relatively they have been rather drab by day as compared to

the impression at night. They were painted more by the illuminating engineer and less by the exterior decorator. The illuminating engineer has a decided advantage in his chamelon antics, being able to alter his colors at will to the extent of an ever changing sequence of hue and intensity. He has introduced opalescent intermingling of colors by dimming and blending and a great variety of other effects in changing shadows and colors; but once the exterior decorator applies his art in a bold manner the color is fixed and essentially static.

LIGHTS CHANGE COLORS OF PAINTED BUILDINGS

Colors can, of course, be altered by the illumination. For example - by the use of red light, blue surfaces may be changed to purple and by the use of blue light yellow surfaces may be made green. But such methods are inefficient and have a very limited range. When the exterior decorator does his job in a thoroughly conclusive manner as he has at this Exposition, the illuminating engineer had better apply himself to the task of revealing the decorator's work unaltered and to the fullest advantage.

EXHIBITION IS RHAPSODY IN COLOR

We speak of "symphonies in color". This Exposition insofar as the illumination of building exteriors contribute to the general vista at night, and except for their color stasis, may be properly termed in a rhapsody in color. The result is entirely pleasing and there is the decided advantage

in the gay coloration during the hours of natural light. The carnival spirit is greatly enhanced. After all, under daylight saving, the period of artificial lighting is relatively short.

It must also be recognized that a blue wall, or whatever the color may be, can be illuminated to a certain color intensity more effectively by the use of normal Mazda light than can a light colorless surface be illuminated to the same color value by the use of color filters at the lighting source. In the first case, in addition to creating the desired color value there is also more atmosphere illumination.

Although light sources are aimed primarily at given colored surfaces, intervening areas are illuminated and there is "spilled" light, all of which adds to the overall lighting efficiency. With white light there is not the necessity of shaping and fitting the light output of a certain color accurately to a limited area. Lighting equipment for accurately controlled beam pattern is in general less efficient than equipments giving a blunderbuss delivery.

UTILITARIAN LIGHTING PLAYS BIG PART

In general the lighting of "A Century of Progress" may be considered largely utilitarian. The lighting equipment, however, is supported on standards or housed in structures which are decorative in the modernistic aggregate. Both as to cost of lighting standards and as to cost per

foot-candle of illumination per unit of area the lighting for a Century of Progress is more economical than that of other recent expositions of comparable magnitude.

MANY FACTORS DETERMINE ILLUMINATION VALUES

Except for the portion known as Northerly Island, the exposition site is on a narrow strip of ground approximately three miles in length. Atmospheric conditions are often unfavorable. This together with the distances to be considered made necessary generous use of light in order to produce the desired continuity of vista as viewed from any position on the exposition grounds and especially from those positions occupied by the greatest number of people. The darker values of blue and green do not carry well to a considerable distance through a hazy atmosphere. With all the influencing factors in mind the following table of illumination values was adopted as the governing requirements throughout the lighting designs:

The Lighting Scale

	Foot Candles
Building Facades, Inner courts	1 to 2
" " Exterior	3 to 5
Tower " Minor	5 to 10
" " Major	10 to 15
Gardens and Grounds	.01 to .05
Concessions and Exhibits	Owner's option

Under these requirements the use of mobile color to

any considerable extent would result in excessive costs.

Furthermore, the general economic situation imposed definite lighting budget restrictions. So everything considered and particularly in view of the short period when artificial lighting is required, it was fortunate that the exterior decorator rather than the illuminating engineer furnished most of the color on the exterior of structures.

ARCHITECTURE INTRODUCES PROBLEMS

Numerous difficulties were encountered due to the different elevations from which spectators view the exposition. Many of the buildings are, in elevation, a series of "set-backs" in which the roofs at several levels are utilized as a series of terraces.

Naturally the lighting of the vertical surfaces back of these terraces could not be had from remote sources at ordinary mounting heights and of usual brightness values without interposing objectionable glare in the view of observers occupying the terraces. On the other hand it was desirable to maintain continuity and uniformity in the placing of standards, which serve also as decorative elements in the view of distant observers.

There were, as usual, compromising decisions to make and certain objectionable features could not entirely be eliminated from all viewpoints. The aim was always to produce the best result from areas which would obviously be occupied by the greatest number of people.

Light sources were also screened with translucent

material to reduce glare from unfavorable viewpoints. Certain areas difficult to reach were illuminated from floodlights and searchlights mounted on the "Sky-ride" towers at an elevation of approximately 600 feet. This very high mounting height was decidedly advantageous in that it made possible the creation of most pleasing lighting effects and naturalistic shadows.

The form of luminaires and their supporting standards or structures is in moderinstic simplicity, with seldom much of an attempt to disguise either the material or the purpose. They have been frankly treated in the most direct manner, which is also the most efficient from the lighting standpoint.

GASEOUS TUBE LAMPS HELP

Relief, outline and also to a certain extent, decorative lighting, is accomplished by the generous use of gaseous tube lamps. Particularly is the use of hot cathode tubes significant of their great possibilities in the future floodlighting of building exteriors in colors.

The first Chicago "World's Fair" in 1893 was illuminated by George Westinghouse, who was at that time confronted with the most urgent need for various developments and improvements in electricity distribution, light sources and lighting practice. Every Exposition in the last forty years has substantially advanced the art of electric lighting and the present Exposition likewise has made substantial contributions.

A NIGHT STROLL THROUGH THE GROUNDS

In order to reach a fairly comprehensive understanding of the different types of lighting equipment employed, it is best to take an imaginary stroll through the grounds noting each type as indicated for the different roadways and buildings shown on the accompanying plan as this lighting inspection tour progresses.

Starting at the north end, Northerly Island is reached by means of a bridge which is indirectly illuminated by standards spaced 50 feet apart and built integral with the parapets on both sides of the bridge. Each standard is equipped with one 1000 watt wide angle floodlight having an etched aluminum reflector directed upward against the secondary reflecting surface from which the light is diffused over the deck of the bridge.

On both sides of the avenue leading eastward to the Planetarium are Zodiac Standards. The luminaire is a 20" ball-globe surrounded by a bronze band depicting the characters of the Zodiac as indicative of the astronomic demonstration within the Planetarium.

THE SEA OF LIGHT

Through the grounds to the right are numerous Mushroom lighting units of special design, developed by Westinghouse in conjunction with ideas advanced by Mr. Joseph Urban of New York City. Designed to illuminate the gardens, paths, and secondary roadways without detract-

See Fig.2

ing from the mass lighting of the main buildings, they not only add variety by introducing localized spots of color but they actually give to the visitor the effect of walking about waist deep in a sea of light free from all glare.

The "Mushroom" luminaire consists of a short aluminum standard on which is mounted an inverted cone of translucent Micarta, the colors of which varies for different parts of the grounds. Concealed under the cone is a 150 watt clear Mazda lamp in a prismatic refractor, which distributes most of the light approximately ten degrees below the horizontal, giving maximum spread without glare.

The height from the ground to the lower edge of the Micarta cone is 45 inches and the cone is 30 inches in diameter. The light directed by the refracting prisms to the grass and pathways is ordinary clear light, while that transmitted to the eye from the cones is of low intensity in glowing colors. The "Mushrooms" are spaced approximately 80 feet apart and the sensation of walking about, in an aura of color emanating from sources close to the ground, is mysterious in the extreme.

SEA-SHELL GLOBES

Turning southward along the east side of the lagoon we find the Dairy Building floodlighted by standards. The luminaire is a large enclosing globe in the form of a sea shell. One side has a heavily enameled ceramic finish to serve as an efficient reflector and the side facing the building is of

clear glass. The light distribution from this globe is well adapted to the lighting of high building facades. On each standard are three of these globes each with a 500 watt lamp; spacing is approximately 50 feet. The grounds to the south are illuminated by Murhroom units.

To the east is the Agricultural Group, the back (east) side of which is illuminated by shell standards, spaced 75 feet apart. Along the front, as viewed from the shore of the lagoon, is a row of 13 standards of 5.1 kw. capacity every 50 feet. In the upper chamber of each of these structural standards are housed 21 - 200 watt floodlights with porcelain enameled reflectors and stippled lenses. There are also 9 - 100 watt bare lamps to transilluminate the decorative canvas which encloses the chamber on three sides, the face towards the building being left open. All these lamps are inside frosted.

At the back of the Agricultural Group is a bathing beach which is illuminated by 24 - 1000 watt floodlights mounted on poles. This, as well as the rest of the exposition lighting, is only to serve for a period of five months.

WEEPING WILLOWS

Southward along the shore of the lagoon is the States Group with the U.S. Government Building in the foreground. Here again the front facades are illuminated by standards which form a continuous line along the entire east shore of the lagoon as seen from the mainland. The back of the States Group is illuminated by shell Standards just

as used for the Agricultural Group. Within the enclosed court formed by the States Group and the U.S. Government Building, See Fig.4 are 10 Shower Standards , each having 323 -15 watt, intermediate base, F-10 bulb, flame tinted lamps in a weeping willow form of showers with lamps spaced 4 inches apart. These present a beautiful decorative impression and effectively illuminate the entire court and the inner facades in a warm glow of soft amber tint. This lighting not only introduces a novelty effect, but it also solves the facade lighting problem here encountered, for the use of floodlights was impossible because of the glare to which occupants of the terraces would be subjected.

The U.S. Government Building has a large central dome surrounded by three very large pylons. The dome and these pylons are illuminated by 68 - 1000 watt floodlights. Here again the terraced construction introduced difficulties in determining the floodlight emplacements. Fortunately the Sky-ride tower near by offered a very favorable location for a battery of 25- 24" incandescent searchlights, each with a 1500 watt G-bulb flood-lighting lamp. Eight of these are directed at the dome and pylons producing a very interesting effect of high lights with naturalistic shadows due to the incidence of the light being at approximately 45° with the horizontal. To the south of this group of buildings is a landscaped picnic grounds which is illuminated in a novel manner by the use of Mushrooms.

Continuing southward on the island the Hall of Social Science and the Electric Group are reached. Above the north entrance to the Hall of Social Science are four characteristic

pylons illuminated by 10 - 1000 watt floodlights with an overcast predominating light from two of the already mentioned battery of searchlights on the Sky-ride tower. Six of these searchlights illuminate the deck of the bridge connecting to the mainland at this point. Through the entire frontage of the group standards, spaced 75 feet, illuminate the facades.

At the back (the east side) a large court is beautifully landscaped and illuminated indirectly by tree lighting boxes each housing 6- 200 watt floodlights. Supplementing this lighting are a number of Mushrooms. The driveway passing this court is lighted in the most simple manner by the use of elliptical angle reflectors on pipe standards providing only enough light for safety. The indirect lighting of the building facades, enclosing this court on three sides, is supplemented by trough lighting along the top edges of the facades. However, without the contribution of indirect light from the trees the illumination would have been much too uneven as well as inadequate.

MOONLIGHT COLORING:

In the center of this court are four huge structures in the form of pylons. Their value is solely to complete the architectural and color composition. These structures are illuminated by 12- 1500 watt, 24", searchlights, two at each corner of the court. As these pylons are painted green the reflected light overcasts a moonlight color quality through the court, with very pleasing effect.

At the front of the Electrical Group is a boat landing, where gondolas and motor boats discharge and receive passen-

gers. Here are two enormous pylons of interesting form, decorated in Egyptian style. These are floodlighted by 4 standards each housing two 1000 watt floodlights for the pylons and two 200 watt bare lamps to illuminate the landing area thru the translucent fabric encasing the upper portion of the structure.

HUGE ELECTRIC FOUNTAIN:

Moving southward along the shore of the lagoon there comes to view the beautiful circular court of the Electrical Group which presents a noteworthy lighting accomplishment. In the center of this court is a fountain illuminated in color. In the stepped basin are four concentric circles having a total of 496 jets thru which spurts 1200 gallons of water per minute. The outer and lower circle is red, the next amber, then green and the smaller circle in the upper basin is illuminated blue. There are 135 underwater floodlights, 48 red, 32 yellow, 30 green and 25 blue, having a total rating of 42 KW. The red and yellow units have 250 watt G-bulb floodlighting lamps. The green and blue units have 400 watt lamps of the same type. The illumination of this fountain is constant.

Out of the center of this fountain rise supports for a huge canopy, 31 feet in diameter, which is approximately 70 feet above the ground level. The under surface of this canopy is of hammered copper, chromium plated. Each indentation reflects the four colors of light from below and the result is an iridescent canopy of superb beauty. The illumination of the circular facade which almost enclosed this court is the result of the approximately synthetic white light produced by the four reflected colors.

It is noteworthy to observe how beauty and utility are combined in this fountain. The jets of water, as in most fountains, intercept less than 10% of the light. However, a very large part of the light is received by the canopy and is thus reclaimed and directed to the lighting of the court area and the facades. Furthermore, the canopy which makes possible such effective utilization is also a decorative complement of great beauty.

On the face of the expansive circular facade, at the center of the arc, is a series of mercury vapor tubes simulating a waterfall from over the edge of the parapet, to the terrace below. The proportionment of wattage as to color screens in this court was determined so as to result in a light pink overcast throughout, whereas in the east court there is a diffused atmosphere of light green. Radiating from above the water fall of mercury vapor tubes is a great sky canopy in the form of a silver fan of searchlight beams.

BIGGEST INCANDESCENT SEARCHLIGHTS:

Seventeen 3 kw., 32 volt, 36" incandescent searchlights each developing 21,000,000 candle power produce this effect. These searchlights are placed out of view on the roof of the Electrical building. They represent a new accomplishment in the use of Mazda lighting aggregating the largest battery of incandescent searchlights ever employed to produce a spectacular effect. On special occasions color screens may be used. The back facade of the Electrical Group is floodlighted by standards spaced every 75 feet.

To the south is the children's playground, known as the Enchanted Island. Next is the Horticultural Building and then Hollywood. These, as in the case of all exhibits and concessions, are lighted by the owners and among them many interesting lighting effects are found. This description, however, undertakes only a brief outline of the lighting provided by "A Century of Progress" for areas not devoted to concessions and exhibits, and for spectaculat effects.

Returning to the mainland and starting at the North end of the Exposition Grounds is first the 12th Street entrance consisting of a structure surrounding a circular area 275 feet in diameter which is indirectly illuminated by the use of floodlights in connection with the reflecting cove.

From this point there is an imposing view down the Avenue of Flags extending to the Hall of Science. The flags are floodlighted and on both sides of the Avenue by lighting Standards spaced 75 feet apart. Each standard has 22 - 100 watt inside frosted tubular lamps 30 inches in length. These tubular lamps are naturally not the most efficient source for street lighting, but efficiency is of little importance when the primary aim is novelty and the creation of a gay environment.

The Hall of Science is a colorful structure, the north exposure being illuminated by 66 - 1000 watt floodlights, supplemented by 6 of the 1500 watt, 24" searchlights in the battery of 25 of these units, 600 feet above the ground level on the west tower of the Sky-ride. The west facades are floodlighted by standards 75 feet apart and at distances varying

from 50 to 110 feet from the facades. On the east the Hall of Science forms three sides of a court opening onto the lagoon. In this court are four large pylons in addition to the illuminated trees. The floorlighting of these trees not only makes them more ornamental, but adds materially to the illumination of the court. There is also the light from another six of the 1500 watt units in the searchlight battery. The light from this source, being incident at approximately 45° with the horizontal, creates a highly satisfactory effect with naturalistic shadows.

To the south of the Hall of Science is the Lief Eriksen Drive illuminated by standards spaced opposite at 100 feet each having 1- 1000 wattlamp.

Here to the right is the General Exhibits Group with its five courts, A, B, C, D & E.

See Fig.6 Court A between this building and the Hall of Science is illuminated by two standards.

In Court B, the northern of those formed by the General Exhibits building is a featured lighting pylon 38 feet in height, and diamond shaped. The construction is a series of louvers concealing alternately hot cathode neon and mercury vapor tubes. Recently developed dimming equipment for the control of hot cathode tubes is employed so as to cause the color of this pylon to change very gradually from neon red to the greenish yellow of the mercury vapor tube. The illumination of the facades, therefore, changes from neon red to approximately synthetic white passing thru the intermediate blends as the color cycle progresses.

See Fig.8

Forty eight hot cathode neon tubes and an equal number of mercury vapor tubes are concealed in this pylon.

Courts, C, D and E, of the General Exhibits groups are lighted by standards. Courts C and D each having one and Court E two of these standards.

Continuing southward the grounds are entirely occupied by exhibitors with their various individual lighting effects and except for the Mushrooms which are found throughout the Exposition area, there is provided by A Century of Progress only utilitarian lighting for the roadways until the 23rd Street Entrance is reached. Here the area devoted to wickets, turnstiles
See Fig.7
and minor concessions is illuminated by standards each with 76 - 100 wattlamps. The stairway which discharges visitors into the entrance area illuminated by 4 lighting units with 26 - 60 watt lamps each. These are supported at a height of 15 feet on tubular steel poles.

THREE ILLUMINATED FOUNTAINS:

Off shore and just north of the 23rd Street bridge crossing to the Island are three fountains. They are set on piles and arranged approximately 150 feet apart on a north and south line. The center fountain is illuminated in changing colors from 70 under-water floodlights with red, amber, green and blue lenses. The lighting control is by means of Thermionic tubes and reactors. The two outer fountains are constantly illuminated with white light. While they differ in lighting the water effects are the same in all three for they are all controlled from the same electrically operated valve. Eight dis-

tinct water effects are obtained by jets at different angles and by varying water pressures, each effect lasting for a period of 75 seconds during which time the cycle of color change takes place in the central fountain. The entire program extends over a period of ten minutes. There are in these three fountains a total of 507 water jet and spray nozzles discharging 3600 gallons of water per minute, spurting at times to a height of 80 feet.

Farther to the south is the amusement section with its Kaleidoscopic variation in motion and colors and, except for the roadways, all lighting for a considerable distance is provided by the exhibitors and concessionaries. Beyond is the flood-lighted Travel and Transport Building.

In order that visitors at night would be sure to observe that the Exposition extends far beyond the amusement area, it was decided to locate the lighting spectacle having the longest range of visibility well toward the south end of the grounds. It was also essential to have such a spectacle to draw visitors to the large and very interesting exhibits found in the south end of the grounds.

THE SCINTILLATOR:

This spectacle, known as the Scintillator accomplishes the desired result by means of powerful light beams from 24 - 36" arc searchlights in two banks of 12 each, on different levels. Each arc draws 125 amperes of direct current at 110 volts and the entire battery produces a total of 1,440,000,000 candle power. The Scintillator is operated by a group of trained attendants who change the color filters and the position of each beam accord-

ing to prearranged schedules in mancuvers directed by the Captain in charge.

Supplementing this scintillating display are illuminated steam clouds from perforated pipes in various formations. These steam plumes, fans, pinwheels, etc., are beautifully illuminated in varying colors from the beams of the searchlight battery. Fireworks, smoke screens, and smoke bombs, which are exploded high in the air in the field of the Scintillator, provide other striking effects.

The exterior lighting of the buildings constructed by "A Century of Progress Exposition" and the decorative and spectacular lighting described was undertaken jointly by the Westinghouse Electric and Manufacturing Co., and The General Electric Co. Engineers from both organizations collaborated in the design and execution of these lighting effects. The installation of the lighting equipment and the design and installation of the entire electrical distribution system was under the supervision of Mr. J.L. McConnell, electrical and mechanical engineer of the Exposition.

The entire connected load for the exterior lighting sponsored by "A Century of Progress" is in excess of 3200 kw. with a minimum demand of approximately 2500 kw. More than 15000 Mazda lamps are employed ranging in size from 10 to 3000 watts in addition to the floodlights, searchlights, and hundreds of feet of neon and mercury vapor tubes. The distribution system must, of course, serve the additional lighting provided by exhibitors and concessionaries as well as all the interior light-

ing, making a total of approximately 30,000 kw.

At the time of going to press with this article, some of the lighting standards were not entirely completed. Photographs of most of them were being taken but for the sake of uniformity and to accurately illustrate the relative size of the different designs, the writer considered it best to use sketches. These sketches were prepared by Mr. H.L. McDowell, Architectural Department, A Century of Progress.

TOTAL EXTERIOR LIGHTING LOAD EXCLUSIVE OF EXHIBITS AND CONCESSIONS

		KW
72	-- 24 Inch Incandescent Searchlights	108
17	-- 36 Inch Incandescent Searchlights	51
24	-- 36 Inch Arc Searchlights	360
3	-- Lagoon Fountains	450
1	-- Electrical Court Fountain	67
915	-- Special Lighting Standards	895
500	-- Mushrooms	75
1000	-- Floodlights	750
1	-- Mercury-Neon Pylon	75
30000	-- Feet of Vapor Tubes	300
	Miscellaneous Grounds Lighting (original South Park Board lighting left undisturbed)	100
		3231

Captions for illustrations:

218819. The spectacular lighting in court of the Electrical Building.

218820. Looking east across the lagoon. At the left is the 12th Street Bridge. The electrical group is in the center with the Federal Building at the left and the Horticulture Building at the right.

218821. Looking Northwest from the east end of the 16th Street Bridge. Mushroom lights give the impression of walking in a sea of light.

T-54833. East view of the Hall of Science at night. The tower in the center of the picture is illuminated with blue and rose Neon tubes.

218104. Visitors at the Century of Progress in Chicago will walk around in a shallow sea of colored light, created by these "mushroom" luminaires.

Fig. 2 Designed sketch of Mushroom lights.
Fig. 4 Designed sketch of the States Showers standards.
Fig. 6. Designed sketch of the Pendent Cylinderical Standards.
Fig. 7. Designed sketch of the 23rd Street Standard
Fig. 8. Designed sketch of the Mercury-Neon standards

(Note - Similar sketches are available of the other lighting units (except Figures 16, 17, 18, 19) and electrotypes will be sent upon request.

197050 Compare this night view of the 1893 Chicago World Fair with that forty years later at the Century of Progress.

Note to Editor:
Photographs or electrotypes will be supplied upon request.