A STREET LIGHTING DESIGN FOR EAST LANSING, MICHIGAN

Thesis for the Degree of B. S.

ROBERT H. WAY

1929

A STREET LIGHTING DESIGN

FOR

EAST LANSING, MICHIGAN.

ROBERT H. WAY 29 E

THESIS

A WELL LIGHTED SMALL CITY

BUSINESS DISTRICT.

(Day time illustration)

104058

TABLE OF CONTENTS.

FORE WORD:-

In accepting the subject, "A Street Lighting Design for East Lansing, Michigan" as the topic for my thesis, I had a few very definite reasons for so doing:-

1. The very apperent need for an improved system in the city mentioned.
2. My personal interest in the subject of Illumination in general, and
3. The possibilities of Illumination as a Life Work.

Robert H. Way

THE PURPOSE OF STREET LIGHTING.

The reasons for the lighting of streets may be enumerated as follows:-

1. PROTECTION OF LIFE AND PROPERTY.

Tests have been conducted that show that modern street lighting is a deterent of crime. Increase in the amount of light on a steeet invariably results in a material reduction of crime.

2. FACILITATION OF TRAFFIC.

In this age in which we are living - the automobile age-- speed is everything. The automobile of today covers as much ground in a hour as a horse and buggy used to cover in a day.

It is a foregone conclusion that we must provide some means of street lighting in order that we may perceive objects in time to prevent accidents.

Statistics show that the number of automobile accidents is inversely proportional to the intensity and quality of street lighting provided

3. CIVIC PRIDE AND PUBLICITY.

The average individual is a proud one. He takes a decided interest in anything (in which he has a part) that is successful and makes a good impression.

Dark, gloomy streets depict a miserly

or unsuccessful town and an individual does not take pride or interest in such a town. But, a city which provides well lighted streets draws favorable comment from both the resident and the visitor from the neighboring towns.

People like to visit in well lighted successful apearing, cheerful acting towns. They will come to visit-shop and sometimes to live in such a town.

4. AID TO MERCHANTS.

Statistics show that a weel lighted street is a boon to the merchant whose stores are located on these streets.

DEFINITIONS OF TERMS USED

Definitions:-

The describing of an Engineering subject is usually facilitated by the use of engineering and technical terms.

These terms. to the layman, are not readily understandable, so for the sake of those laymen that will read this paper, a list of the terms used in this presentation will be included with their definitions.

BRIGHTNESS-- Degree to which the surface is lighted. Unit- Foot Candel.

BRIGHTNESS CONTRAST.-- Contrast between the brightness of two adjacent surfaces.

CANOPY-- A cone shaped affair which conceals the wiring connections of a lamp fixture.

Auto-Transformer.--A transformer in w which there is part of the winding which serves for both the primary and secondary circuits. Such a device, used in street lighting, permits the use of a high current lamp of a low current curcuit. Example, A 20 or 15 ampere lamp on a 6.6 ampere circuit.

CONSTA T CURRENT TRANSFORMER.-- A transformer whos primary winding is connected to a constant voltage circuit and whose secondary coil supplies a constant current regardless of the load on the circuit.

Cut-out Hangar -- A special hangar for overhead lights that breaks not only the mechanial but also the electrical connections . Thus facilitating the process of replacing or repairing the lamps or fixtures.

DIRECT VISION.-- Seeing by means of light reflected by the object to one's eye

DISTRIBUTION OR ILLUMINATION CURVES Curves showing which way the light, emited by the lamp, is directed by the enclosing globe or the reflector. These curves may show either the verticle or the horizontil distribution.

ENCLOSING UNIT OR THE GLOBE.-- That sturcture which surrounds the lamp to form an apparent source of light which is larger than the lamp.

FILM CUTOUT--- A protective device used in series circuits accross the lamp terminals. The action is such that when a lamp is removed or burns out there is a punctturing of a film which restores the circuit, thus tending to give continuity of service which is very desirable.

FOOT CANDLE -- a unti of intensity of illumination.

GLARE.-- A sensation of discomfort resulting from looking at surfaces th t have a high degree of illumination compared to the adjacent surfaces.

ILLUMINATION--Quantity of light falling onasurface.

Lumens-- Unti of luminous flux. Is equal to product of intensity and area.

SILHOUETTE-- The seeing of an object by the shutting of of light by the object which is in the line of sight from the obj eye to the light suorce.

WIRE CUTTER.---A practical device

WHITE WAY LIGHTING.--- Ornamental high intensity street lighting used in down town business districts.

GENERAL CLASSIFICATIONS OF STREET LIGHTING DISTRICTS WITH THEIR REQUIREMENTS.

CLASSIFICATION OF DISTRICTS.

In each city there are various districts that are different in character and in their demands on a street lighting system.

Those classifications with the demands of each class are listed.

A. BUSINESS DISTRICT.

High level of illumination to attract the crowds, to increase business, to prevent accidents in the crowded sections and to decrease crime.

The light should be of such quality as to be pleasing, should be well diffused, andthere should be no glare.

The light should be so distributed that sufficient light will fall on the street surface, side walks and the building fronts.

The luminaire should be such that it will present a pleasing appearance both nite and day.

BOULEVARDS AND THOROFARES.

High level of illumination to allow for the safe movement of fast and heavy traffic.

The light should be of pleasing quality, there should be no glare, and the light should be well diffused.

The light should be distributed so that a majority of the light will fall on the sidewalks and the road surface

RESIDENTIAL DISTRICTS.

Light enoughto decrease the possibilities of crime, to allow fr moving about without eye strain, and to allow for fairly fast b t light traffic.

The light should be of pleasing quality, should be well diffused and of such nature that there will be no glare.

The light will be directed to the road and side walk surfaces and away from the porches as much as possible.

THE PROPOSED SYSTEM
OF
STREET LIGHTING FOR
E ST LANSING, MICHIGAN.

CLASSIFICATION OF
DISTRICTS
IN
EAST LANSING, MICH.

CLASSIFICATIONS.

BUSINESS DISTRICT

Grand River Ave from MAC to Evergreen Ave.

Abbot Road from Grand River Ave to Albert Ave.

THOROUGHFARES.

Grand River Ave City limits to City limits.

Michigan Ave form Grand River Ave to City Limits.

Abbott Road from Grand River Ave to City Limits.

M.A.C. Ave from Grand River Ave to the City Limits.

RESIDENTIAL DISTRICT.

The rest of the city of East Lansing.

SPECIFICATIONS AND THE LOCATIONS OF LUMINAIRES.

NOTE:-Lights will be placed at natural locations whenever possible, i.e:, at street crossings, bends in the streets, etc. Spacings are approximate.

BUSINESS DISTRICT.

GRAND RIVER AVENUE- ILC Ave to Evergreen Avenue. Reflecto-Lux Jr. Lantern -Arcadian "A" Posts- 6000 lumen 15 ampere lamps,-- Type ILC Constant current transformers in base 6.6 to 15 amperes -- Spacing- 125 feet--One side of the street only

ABBOTT ROAD- Grand River Ave to Ablert Ave.-- Same as abote except that lights will be on both sides of the road, staggared.

THOROUGHFARES.

GRAND RIVER AVENUE--MAC Ave to Bogue Street.-- Michigan Avenue-- Grand River Avenue to Harrison Road-- Reflecto-Lux Jr. Lantern-- Arcadian "A" Posts-- 6000 lumen 15 ampere Series type lamps,-- ILC Constand Current Transformers in the base, 6.6/15 amperes.-- Spacing 200 FeetOne side of the street only.

GRAND RIVER AVENUE--Evergreen to west city limits. Reflecto-lux Jr. Lantern--Arcadian "C" Posts 4000 lumen 6.6 ampere Series type lamps-- Spacing 200 feet Staggrred.

ABBOT ROADA- Grand River Ave to North City Limits.

M.A.C. AVE.- Grand Rivr Ave to North City Limits.

Same as W. Grand River --Except that spacing is 225 feet.

RESIDENTIAL DISTRICT. CLASS 1.

Saginaw Street

Ranney Road

Touraine Avenue

Audubon Ave.

Greenwood Road.

Cowly Ave.

Oakwood Drive

Wildwood Drive/

Harriason Road-- Grand River North.

Highland Ave.

West View Ave

Oak Ridge Ave.

Huntington Road.

Kensington Road.

Crescent wood Road

Chesterfield Parkway

University Drive

Shore Dr.

Ardson Road

Woodland Drive

Marshall Drive

Clifton Blvd.

Rose Wood Ave. Grand River to
Rose wood Street.

Center Lawn.

South Lawn Harrison to Rose
Wood Ave.

Oakhill Drive

Hill Crest Gd River to Oakhill

Delta.

Mich Avenue. Harrison to West
City Limits.

Valley Court

Evergreen Gd. River to Oakhill

Beech-Abbott road to MAC.

Elizabeth Abbott Rd to MAC

Linden " " " "

Park Lane.

Grove Street

Ann Street Albert to Bailey

Albert Abbott to Bailey.

E Grand River. Bogue to City
limits.

Reflecto Lux Jr. Lanterns

Arcadian "C" Posts

4000 Lumen 6.6 S

lamps.

Spacing 300 fe

RESIDENTIAL DISTRICT #2.

Bogue St.

Cedar St

River Street

Milford Road

Gunson Street

Durand Ave.

Kenzie Street

Orchard Ave

Haslett Street

Division St. Ann To City Limits

Charles Street " " " "

Fern Street

Evergreen Calhill to the Limits

Forest Ave

Sunset Lane.

Hill Crest " " " "

Rose Wood Street

Rose Wood Ave. Rose Wood St North

Hill Crest -Grand River South

Harrison Rd " " "

Oak Street Harrison Rd East

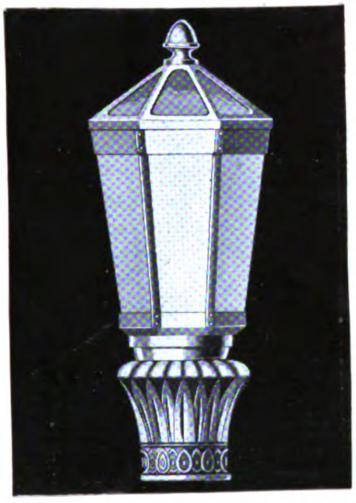
Center Street

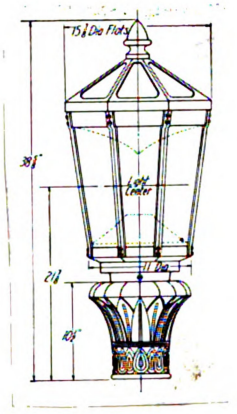
Beal
Louis

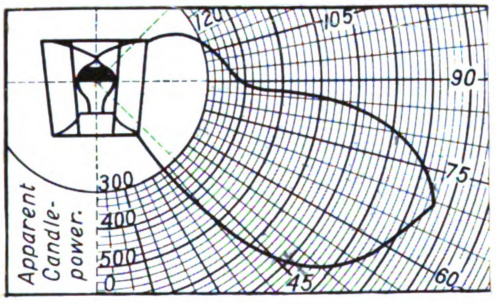
18" Radial Bowl Reflector with 8½" Holplane Skirted Bottom Refractor, supported by Cutter Boulevard Type Telescopic Brackets. Hung at approximately 18' height and about 6' from the pole Spacing 300 feet on one side of the street.

The Reasons for My Choice of Fixtures

REFLECTO LUX JR. LANTERNS.







DISTRIBUTION CURVE OF OCTAGONAL REFLECTO-LUX POST TOP WITH 600 CP. TYPE C BAND ENAMELED LAMP

The appearance of these Post Tops is pleasing to the eye, both Day and Nite.

These Post Heads are now in use in East Lansing.

The initial cost is comparatively low.

The distribution of the light is in accordance with the general demands, i.e. the perponderance of the light is directed in a downward direction ant an angle of about fifteen degrees from the horizontal

The Rippled Glass Panels Diffuse the light thus decreasing Glare and making the apparent source of light much larger than the real source.

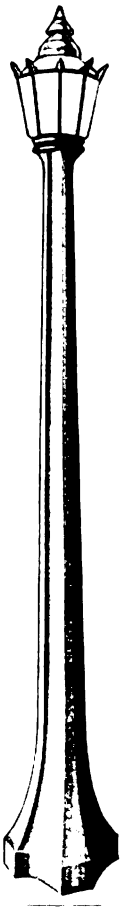
The Post Top is applicable to either the 4000 or the 6000 lumen series lamp, thus, conforming to the other details of the proposed system.

ARCADIAN "A" LAMPOSTS A D

ARCADIAN "C" LAMPPOSTS.

Heighth to light center "A" 16'.

Heighth to light center "C" 13'.



The general appearance ff bhese posts is pleaseing.

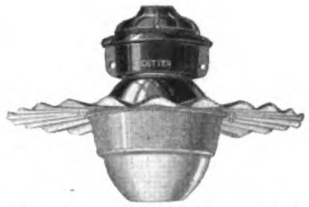
They are comparatively low in cost.

They are fitted with an opening in the base to allow for working onthe connections and base transformer.

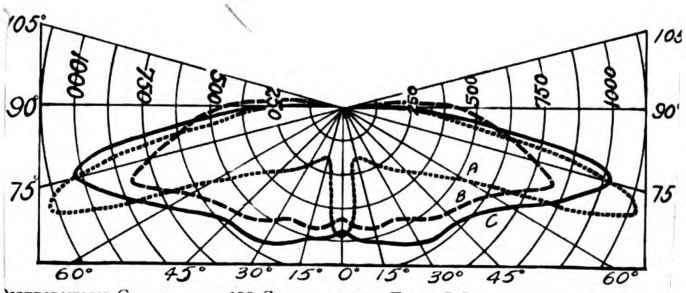
They ar standard equipment foruse with the Reflecto-Lux Jr. Post Tops.

They are now in use in East Lansing

18"RADIAL BOWL REFLECTOR-WITH 8½" SKIRTED REFRACTOR. WESTINGHOUSE CUTTER MFR.



18-INCH RADIAL BOWL STREETHOOD BODY WITH 8½-INCH HOLOPHANE SKIRTED REFRACTOR. TRADE NO. W27113



DISTRIBUTION CURVES FOR 600-CANDLEPOWER TYPE C LAMP WITH 18-INCH RAD BOWL REFLECTOR AND A—8½-INCH BOWL REFRACTOR. B—8½-INCH

Radial Bowl 8½" Skirted Refractor.

The distribution curve shows the main reason why this type of fixture was chosen. The light is directed at an angle of about 15 degrees below the Horizontal. This direction of the light will give good lighting over considerable spacing instead of in a spot.

The appearance of this type of Luminaire is pleasing both day and nite. The light source (apparent) is much larger than the actual light source thus decreasing Glare.

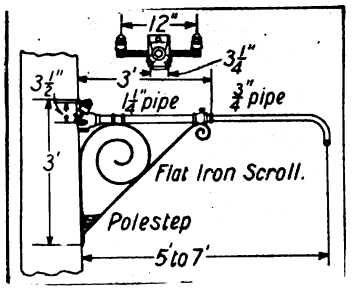
The light is well diffused thru the Refractor.

The Initial Cost of this fixture is nominal.

Maintainance cost is exceedingly low.

WESTINGHOUSE-CUTTER---BOULEVARD

TYPE TELESCOPIC BRACKET.



This bracket was decided upon for following reasons:-

The lamps are held a distance of 5'-7' from the poles.instead of 4' as is the case with most other brackets. This extra distance is utilized in escaping the cutting off of light by the trees that are usually located near or adjacent to the lighting fixtures.

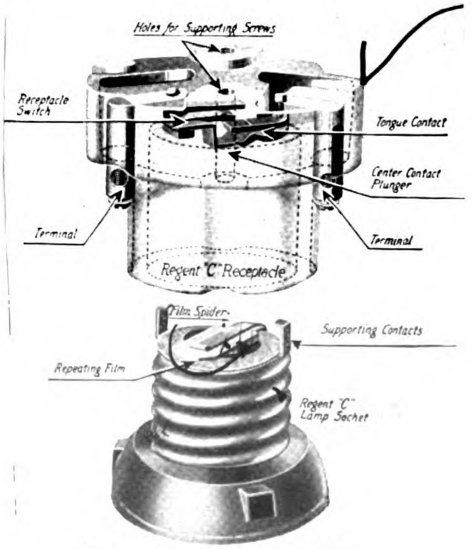
The appearance of this type of bracket is very pleasing to the eye.

The cost while it is more than is some of the other types of brackets is offset by the first advantage named.

REGENT"C" REPEATING FILM CUTOUT SOCKET.

NOTE:- These sockets will be used on e.chlighting fixture, both the post type and te bracket type fixtures.

This repeating film cutout socket automatically choses the series circuit by the puncturing of the film whenever the lamp is removed or blown out. The repeating feature of the film makes the replacing of the film, with each replacement of lamps, unnecessary. The ~~film~~ Procedure is merely turning the film about a center so that another part of the film is between the two points thru which the puncture takes place unpon the opening of the circuit.



PHANTOM VIEW OF REGENT "C" RECEPTACLE WITH VIEW OF LAMP SOCKET.

POTHEADS-DISCONNECTING TYPE.

All the post type fixtures will be fited with Potheads in the base of the lamp post. This will allow for the working on the posts with the current cut off.

The Potheads should be of such type that disconnecting will automatically short-circuit the circuit accross the lamp thus giving continuity of service which is very important in Street Lighting.

THE POWER SYSTEM.

USED TO

SUPPLY THE

POWER

TO THE

LIGHTING UNITS.

POWER SUPPLY.

The power used on this system will be supplied by the BOARD OF ELECTRIC LIGHT AND POWER OF LANSING, MICHIGAN.

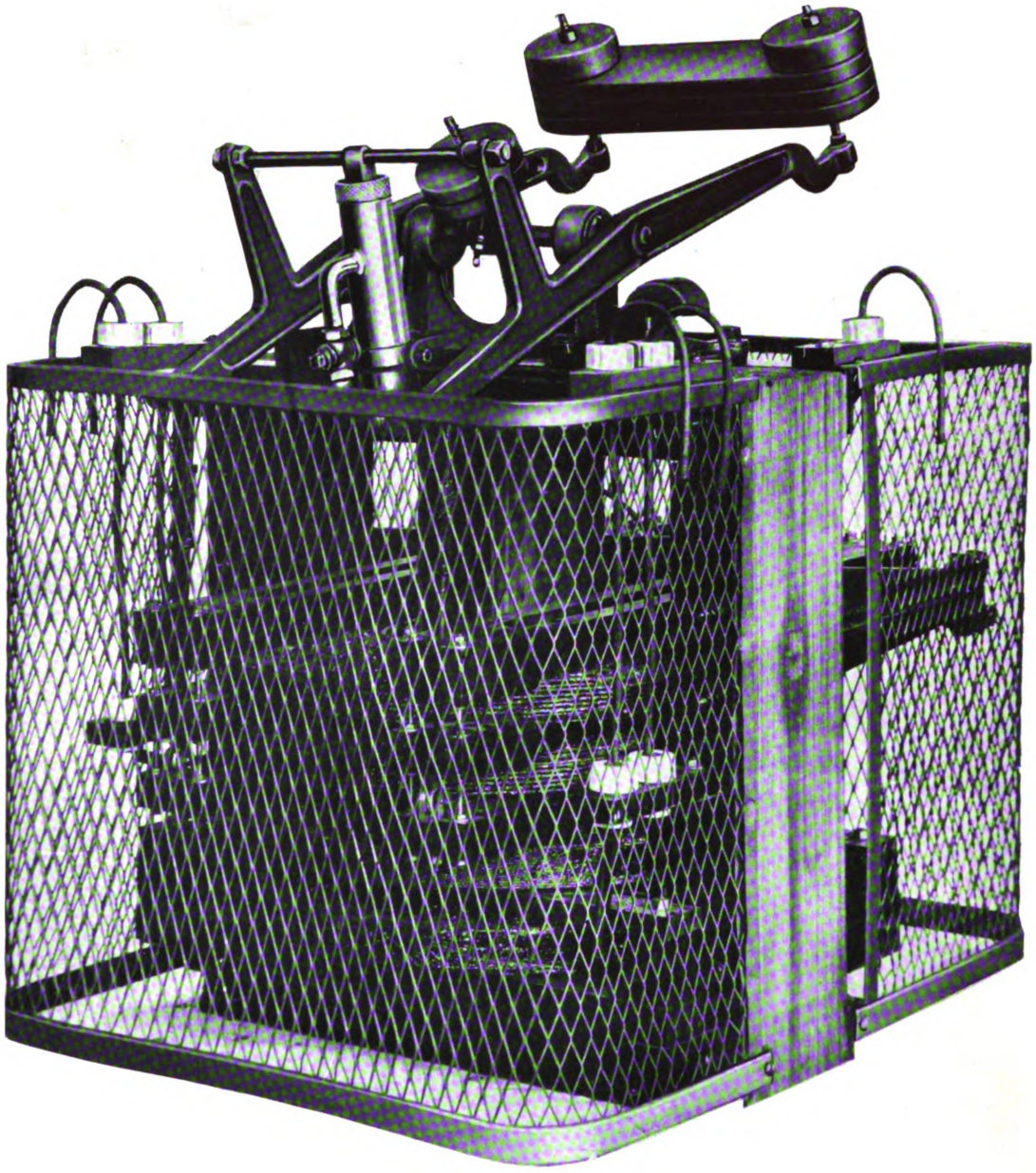
The power will be supplied thru 2-2300 volt mains from the Power Plant of that Board to the two transformer sub-stations used by the City Of East Lansing to supply their lighting needs. These two lines will take different routes so that a damage to one line is not so likely to mean a damage to the other.

These two transformer sub-stations will be located:

1. On North side of City owned Alley connecting Abbott Raod with MAC Ave, running parallel with E. Grand River Avenue and being about 175 feet Noth os said thoroughfare and located about 225 feet east of Abbott Road.

2. On City owned property adjacent to the City Pumping Station and Located just East of Hillcrest Ave and North of Valley Court.

PRIMARY CIRCUITS.



TYPE RF TRANSFORMER

An automatic, station-type, constant-current transformer for supplying series street-lighting circuits

WEST SIDE PRIMARY CIRCUIT.

The power to the West Side Primary Circuit will be supplied by a:

General Electric Co. Novalux Type RF Constant Current Transformer which furnishes power at constant current of 6.6 amperes, regardless of the load on the line.

The transformer will be controlled by a:

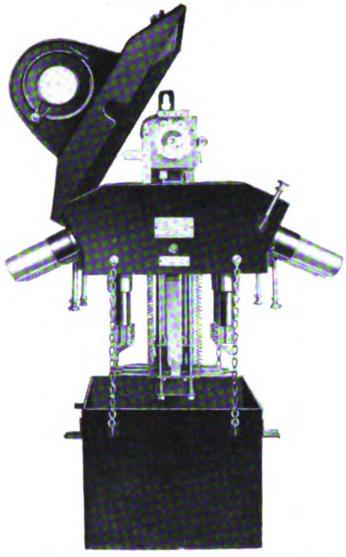
General Electric Co Sauter Time Switch.

This Time switch automatically opens or closes the Primary side of the transformer at predetermined times.

The Transformer is protected from the current surges due to an open on the secondary side of the transformer by:

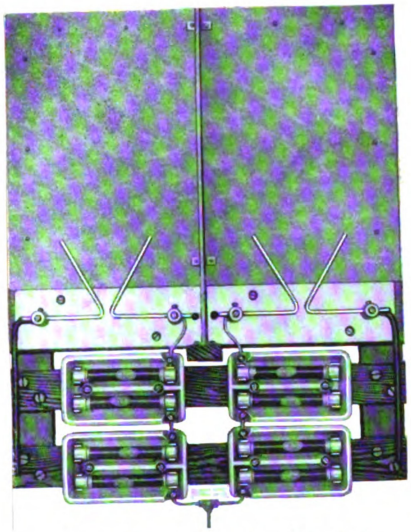
General Electric Co. Series Circuit Protective Device for Type RF Constand Current Transformers.

This automatically opens the Primary side of the Transformer in case



Sauter Time Switch, showing cover lifted and oil tank lowered

Series Circuit Protective Device for Novalux Type RO Transformers



Horn Gap Lightning Arrester for indoor service

Pellet Type Lightning Arrester for outdoor installation

an "OPEN" appears in the series Circuit.

The transformer will be protected from Lightning by:

Pellet Type Lightning Arresters on the 2300 volt side. (Outdoor)

And by:

Horn Gap Lightning Arresters on the Series Circuit side. (Indoor)

There will be Disconnecting Switches of Disconnecting Pot Heads on each line leading to or from the transformer so that it may be isolated for repairs and replacements.

This Primary Circuit will supply power to all the lights West of Abbott Road with the exception of one block on W. Grand River Avenue.

The bracket-type lamps will be supplied direct from this circuit and the post-type lamps thru type SL Constant Current Transformers.

The locations of the bracket-type lamps and the SL Transformers are indicated on the map.

The Primary Circuit is also indic-

EAST SIDE PRIMARY CIRCUIT.

The power will be supplied by a :

General Electric Co. Novalux

Type RO Consant Current Transformer

This will be located on the platform which is located in the alley at the rear of College Manor.

The Circuit will carry six and six tenths(6.6) amperes consant current.

The transformer will be controlled by:

General Electric Co. Novalux

Series Control.

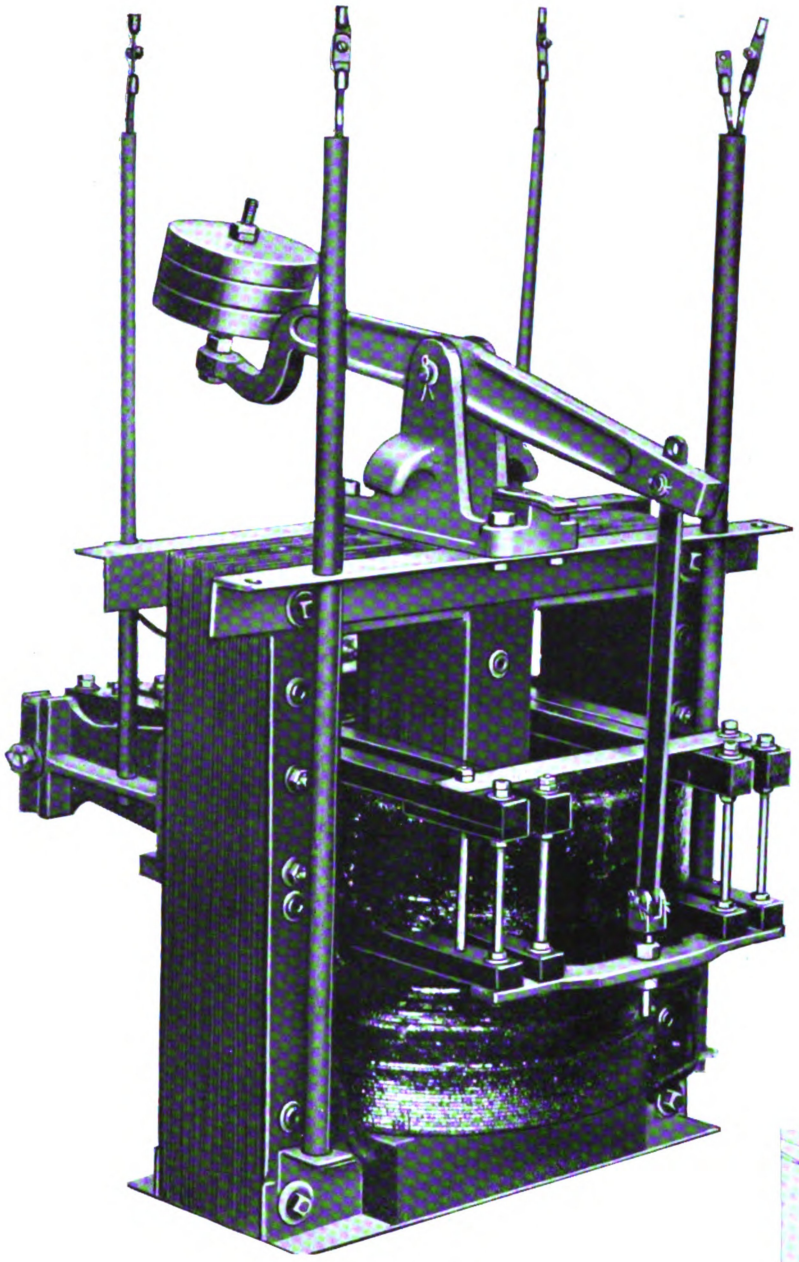
which is in turn controlled by the Sauter Time Switch thru 110 volt Constant Voltage Line.

The transformer will be protected from"open" and the Series Circuit by:

General Elect. Co. Novalux

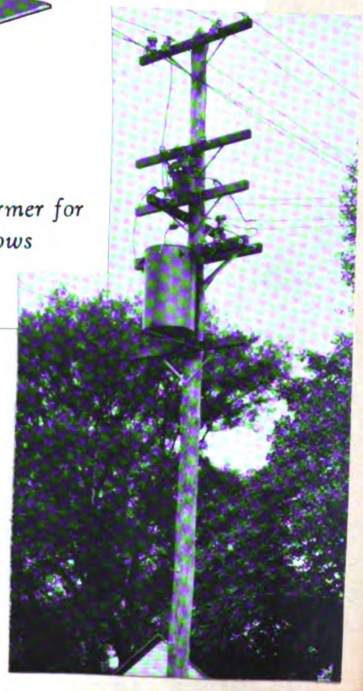
Series Circuit Protective Device.

which automatically opens the supply side of the transformer when open. appears in the constant current side.



TYPE RO TRANSFORMERS

An automatic outdoor constant-current regulating transformer for supplying series street-lighting circuits. This photo shows transformer removed from its oil tank



Lightning Protection will be supplied by:

Pellett Type Lightning Arrester on the 2300 volt side of the transformer and by:

Horn Gap Type Lightning Arrester on the series side of the transformer.

Both of the Arresters are of the outdoor type.

This circuit will supply power for all lights on the East Side of town including Abbott Road and one block of W.Grand Riv. Ave.

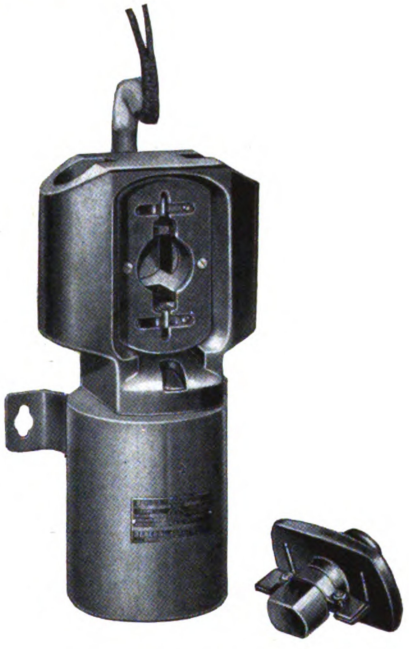
Bracket-type lamps will be supplyied direct and the Post-type lamp thru SL Transformers.

Locations of lamps and transformers as well as the course of the primary circuit are indicated on the map.

THE SECONDARY CIRCUITS

TYPE SL TRANSFORMER

This is an oil-filled pole-type series lighting transformer of one-to-one ratio for sizes of five, seven and one-half, and ten kilowatts



Type ILC Transformer

Type ILC Transformer mounted in the base of an ornamental lighting standard. By removing the plug the lamp is entirely disconnected from the series circuit

SECONDARY CIRCUITS.

The Secondary Circuits will be supp
plied power from:

Gen. Elect. Co. Novalux

SL Consant Current Transformers

6.6 amperes

These transformers are located
as shown on the map.

The circuits are underground Series
cables.

The cable is laid in impregnated
paper conduit which is laid in concrete
as a level of about18" below the sur-
face and just inside the line of the
curve.

These secondary circuits supply power
to the Post-type lamps.

The secondary circuits are traced on
the map.

There will be potheads (disconnecting)
on all leads to and from the trans-
formers.

15AMPLE CIRCUITS

This type of circuit is found in the Business District and in thoroughfares.

The power is supplied by:

Gen. Elect. Co.

Type ILC Constant Current Transformers.

These transformers are placed in the secondary series circuit.

They supply power at 15 amps. to the 6000 lumen 15 amp. lamps which are specified for these districts.

Disconnected potheads will be supplied on all leads.

MAINTAINANCE.

MAINTAINANCE.

In picking the types of luminaires care was exercised to choose such types that had ~~an~~ low maintainance cost.

These Series Type lamps have a life of approximately six months.

They should be replaced at this time. This will prevent dark streets which result from burned out lamps.

Exceeding care should be exercised in the installation of the equipment-- especially the underground cable.-- so that the maintainance-cost of the power circuits will be kept at a minimum.

Luminaires should be cleaned at least twice a year for the following reasons:

1. appearance.

2. dirty lamps absorb light thus cutting down the efficiency of the lamp.

BILL OF MATERIALS.

BILL OF MATERIAL

General Electric Co. Novalux.

Constant Current Transformer.

Type RF. 2300 volt 60 cycle.

6.6 ampere secondary.

50kw. -------1.

General Electric Co. Novalux.

Type RO 2300 volt 60 cycle.

Constant Current Transfromer.

6.6 Ampere Seconaary.

35. kw. ------ 1.

General Electric Co. Novalux

Type SL. 6.6/6.6 ampere

Constant Current Transformer.

5 kw. -------16

General Electric Co. Novalux.

Constant current Transformers.

TypeLLC 6.6-15 amp.

--------36.

Gen. Elec Co.

Horn Gap Lightning Arresters.

10000 volt 60 cycle,

-------- 2.

Gen. Elec. Co

Pellett Type Lightning Arresters.

3300 volt 60 cycle. 2

General Electric Company

Series Protective Devices for

Typr RF Constant Current Transformers.

2300 volt--6.6 amp. 60 cycle. ---1.

General Electric Company

Series Protective Device for

Type RO Constant Current Trans.

2300 volt -6.6 ampere 60 cycle.--1.

General Electric Company

Sauter Time Switch.

2300 volt 60 cycle. --------1.

General Electric Co. Novalux.

Series Controll Switch.

2300 volt 110 volt control.-----1.

General Electric Company Novalux

Protective Devices for Type SL

Constant Current Transformers. --16.

General Electric Company Novalux.

Disconnecting Pot Heads.

2300 volt 60 cycle. -----12.

7000 volt 60 cycle -----32.

1100 volt 60 cycle -----72.

Westinghouse Elec. and Mfg. Co.

Cutter Type

Octagonal- Reflecto Lux Jr. Lanterns.

with Stippled Glass Panels- Parabolc

Reflectors- fitted with Regent "C"

repeating film sockets. 6.6 amp

Series Sockets. ----165

Same with 10 amp repeating Film Series

Sockets. ----36.

Westinghouse- Cutter Company.

Arcadian "C" Cast Iron Lamp Posts.

----115.

Westinghouse-Cutter Co.

Arcadian "A" Cast Iron Lamp Posts.

---36.

Westinghouse-Cutter Company.

18"Radial Bowl Reflector with

6½" Holplane Skirted Refractor.

---- 74.

Westinghouse-Cutter Company.

Boulevard Telescopic Brackets.

--- 74.

NOTE:

I have omitted any consideration of cost except comparative costs for the following reasons:

1. labor costs vary and are not readily available.

2. material costs vary considerably.

I have not considered the present circuits as I was unable to trace them or to find anyone who were fairly certain of their courses.

My design is based on:

The effectiveness of the lighting, the appearance and comparative costs.

Robert H. Way

Robert H.Way.

MAP OF THE CITY OF EAST LANSING MICHIGAN 1928 DISTRICTS FOR USE REGULATIONS

N

KEY

- Secondary Circuit
- Primary Circuit
- 4000 Lumen Post Lamp
- 4000 Lumen " "
- 4000 Lumen Bracket Lamp
- S.L. Trans. #8
- R.F. Transformer
- R.O. Transformer
- #8 Sec. Circuit #8

A
B
C
D
E

Robert H Way

WED 28
Armitron
INSTALITE