

BETTER THAN



DAYLIGHT

1919 DIARY

BETTER THAN



DAYLIGHT

CALENDAR, 1919

1919	Sunday	Monday	Tuesday	Wed'day	Th'rsday	Friday	Saturday
Jan.	...	...	...	1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
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April	30	31	...	1	2	3	4
	5	6	7	8	9	10	11
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May	...	...	...	...	...	1	2
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	24	25	26	27	28	29	30
June	...	...	...	...	...	...	...
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	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	...	...	...	...	...

IDENTIFICATION.

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Telephone No. _____

Business Address _____

Telephone No. _____

The 1919 Diary

Issued by the
Cooper Hewitt Electric Co.

General Office and Works
Eighth and Grand Streets

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INDEX

Cities, Population of.....	46-48
Cities, Ten Largest in the World..	46
Cities of over 100,000 Population..	46
Cooper Hewitt Lamps—	
Blue Printing, by.....	29
Commercial Photography, by...	27
Enlarging, by.....	26
Industrial	14-22
Motion Picture Studio Lighting..	24
Photographic Purposes, for.....	22-23
Photographic Reproduction.....	29
Portrait Studio Lighting, by....	23
Postal Card Studio Lighting, by	24
Printing, by.....	26
Typical Installations.....	34-38
Electrical Formulae.....	13-14
Light and Illumination, Condensed	
Information on.....	3-13
Map of New York and Vicinity...	30-31
Metric Equivalents.....	45
Parcel Post Rates.....	40
Rates of Postage.....	32-33
Temperature Rise by Resistance..	38
Useful Information.....	39
Weights and Measures.....	44-45
Wire Tables.....	41-43

Condensed Information on Light and Illumination.

Light—The word light is used in two different senses, one signifying a physical cause in the form of a succession of mechanical impulses, the other a physiological effect in the form of the sensation of vision. In treating of light scientifically the physical meaning is understood, according to the following:

Definition—Light is a form of energy that produces the sensation of vision when acting through the human eye.

The energy is exerted by a series of extremely rapid impulses, or vibrations, and is transmitted in the form of wave motion through a hypothetical medium called ether, which is assumed to be omnipresent.

Light possesses two characteristics resulting from its physical nature; the force of the impulse produces the effect called intensity, or brightness; the frequency, or rapidity, of the impulses produces the effect known as color.

Law of Inverse Squares—The intensity of light varies inversely as the square of the distance from the source. This is a characteristic of all wave systems that spread out uniformly in all directions through space, and rests upon mathematical proof rather than upon the testimony of the senses.

Measurement of Light—As all physical measurements are based upon the sense perception of equalities, the fundamental

measurement of light is based upon the perception of equality in brightness between two light-sources at equal distances, one of the light-sources being taken as a standard. This is called unit intensity. Multiples of the unit are derived by the use of the law of inverse squares from observations of equality of brightness.

Standards of Light—The original standard of light, i. e., light of unit intensity, was a candle of carefully specified size, material, and conditions of burning. Any other light which, coming from a source at the same distance, appears of equal brightness, is of one candle-power intensity. If the other light appears of equal intensity with that of the candle when coming from a source at twice the distance, then according to the inverse squares law, it is four times as intense, i. e., of 4 candle-power intensity.

The candle is no longer used as a working standard, incandescent electric lamps that have been carefully compared with a standard candle, or with other lamps so standardized, being more practical.

International Candle — The standard candle-power in the United States, Great Britain and France is known as the International Candle. It is slightly less than the former British candle and greater than the Hefner candle which is used in Germany. The present International Candle is equal to 1 American Candle, 1 Pentane Candle (Great Britain) or 1

Bougie Decimale (France) and 1.11 Hefner Candle (Germany).

Candle Power—The real significance of the term candle-power is often misunderstood. Such misconceptions will be avoided by considering that intensity of light expressed in candle power applies only to a beam of light entering the eye, and does not measure the total output, or quantity of light produced by the light-source. Actual light-sources do not give out beams of equal candle-power intensity in all directions. An intensity of unit candle-power is that of the beam of light received by the eye when the candle-flame is on the same level with the eye: i. e., it is the horizontal beam that is taken as the standard. The direction in which the light-source is viewed must therefore be stated or understood to give candle-power measurements a definite value.

A Photometer is an instrument for numerically comparing the intensities of different lights with that of a standard.

Illumination is the result of light falling upon a physical surface.

The Measurement of Light as a Quantity (volume, or flux) is accomplished by introducing area of surface as a factor, i. e., by measuring the amount of illumination it can produce, and is therefore the product of the intensity of the illumination by the area illuminated. Intensity of illumination is the intensity of the light at the surface upon which it falls, and therefore depends upon the

distance of the surface from the light-source, in accordance with the inverse squares law.

Foot-Candle—When a light of unit intensity (1 candle-power) falls upon a surface at unit distance (1 foot) it produces an illumination of unit intensity, called a foot-candle.

Lumen—A unit area of surface (1 square foot) illuminated with a unit intensity of illumination requires a unit quantity (flux) of light; this unit is called the lumen.

Lux—The intensity of illumination produced by a light of 1 candle-power at 1 meter distance is called a meter-candle, also lux.

Mean Spherical Candle Power is a term formerly in general use for comparing quantities of light. The unit 1 m. s. c. p. is the quantity of light required to produce an illumination of 1 foot-candle over the surface of sphere of 1 foot radius, and is therefore equal to 4π or 12.57 lumens.

Intrinsic Brilliancy—Since every point of a luminous surface radiates light, the intensity of a beam of light from a measureable surface will depend upon the area of the surface and the intensity of the light from an element (point) of the surface. The ratio of the intensity of light to the area of surface is called intrinsic brilliancy. The ratio is usually expressed in candle-power per square inch.

Surface Brightness is the ratio of the intensity of light reflected from an illu-

minated surface to the area of the surface.

An **Illuminometer** is an instrument for measuring intensities of illumination and of surface brightness.

The **Luminous Efficiency** of a light source is the ratio of the energy consumed to the quantity of light produced, and is expressed in watts per lumen. Watts per candle-power is not a definite ratio since candle-power does not represent a quantity of light; hence the expression is useful only for comparing light-sources of the same kind, in which the candle-power has a fixed relation to the lumens of light-flux.

Reflection and Transmission — When light falls upon a material surface a portion of it is absorbed (by conversion into heat) and the remaining portion is reflected. If the substance also transmits light without changing the relative directions of the rays, so that objects may be seen through it, it is called transparent. If it transmits light, but changes the directions of the rays so that objects cannot be distinguished through it, it is translucent.

Laws of Reflection—The reflection of a ray of light follows a simple mathematical law, viz: the angles of reflection and incidence are equal and in the same plane. The reflection of a beam of light, i. e., of the radiations falling upon a measureable area of surface, will follow this law to an extent depending upon the smoothness of the surface. If it is smooth enough to

produce images by the reflected light it is called a mirror, or speculum, and the reflection is said to be regular, or specular. If the surface is such that it scatters the reflected rays, the surface is called matt, and the reflection diffuse.

Coefficient of Reflection—The ratio of the quantity of light reflected to the quantity falling upon the surface is the coefficient of reflection of that surface.

Color, when used with reference to light, signifies the different effects produced upon the human eye by impulses of different frequencies, or what is the same thing, energy waves of different lengths. The lowest frequencies, or longest waves, produce the sensation which is called red, while the shortest waves, or highest frequencies, produce the sensation called violet. Between these two extremes the different frequencies produce all the colors of the rainbow, running through red, orange, yellow, green, blue, indigo and violet, as the rapidity of the impulses increases. Color, used with reference to non-luminous objects, indicates the color of light which they reflect. Color is therefore the physiological effect of which wave length of light is the cause.

Colored Surfaces—Matt surfaces which reflect all the different colors to an equal extent are white; those which absorb the larger part of all rays are black; those which reflect a part of the colors and absorb the others are colored.

Fluorescence—Some substances have the peculiar property of changing the

color of the light which they reflect, and are called fluorescent. This fact is taken advantage of in the Cooper Hewitt light-transforming reflector, which converts a portion of the shorter wave-lengths into red light by reflection.

Law of Wave Motion—The length of the wave varies indirectly as the rapidity of the impulse, or vibrations producing it; i. e., the more rapid the vibration, the less the length of the wave. In expressing the length of light-waves, the term micron is used meaning "one millionth of a meter". Thus light waves are of all lengths, from 4.4 to 0.7 microns.

White Light—Light made up of all the different colors, or frequencies, combined, like sun light, is called white light.

Complementary Colors—Two colors of light which produce white light when combined are called complementary colors.

Spectra—The succession of colors produced by separating the different rays in the order of their wave-lengths is called a spectrum. The rainbow is thus the spectrum of sun light, or solar spectrum. Spectra are of two kinds: continuous, when the colors blend into one another without interruption from one end to the other of the band, as in the solar spectrum; line, or band, when there are black spaces, or lines, between the succeeding colors, as in the spectrum of the Cooper Hewitt lamp. Light from glowing solids gives continuous spectra; from glowing gases, gives band spectra.

Invisible Radiations always accompany light rays. These consist of waves of lower frequency than red, hence called infra-red rays; and those of higher frequency than violet, called ultra-violet rays. The former produce the sensation, and other effects of heat; the latter produce chemical action, shown physiologically in tan and sun-burn, and technically in photographic processes.

The Organs of Vision consist of two sets of apparatus: the eye, which is an optical instrument containing exactly the same elements as a photographic camera, viz., a convex lens, a stop or diaphragm, a sensitive surface for receiving the image produced by the lens, and a means of focusing images on this surface; and the optic lobes of the brain, with their nerves connecting with the retina, by which the physical and chemical action of the light is transformed into the sensation of vision.

Visual Acuity—The essential conditions for clear and distinct visual sensation are a sharply defined image on the retina, with all the gradations of light and shade clearly produced. Distinctions of color are of little importance for practical purposes, as is shown by the fact that persons who are color blind do not find it a serious handicap. Light having a full spectrum does not give as sharply defined images as light that is of simpler color composition. The sharpest images are produced by light in the yellow and green regions of the spectrum.

Good Illumination—When the action of the light received by the eye produces clear and distinct sensations, which the mind can act upon without question or delay, and does not unduly strain or fatigue the muscles of the eye or the nerves and brain-cells, then the illumination is good; to the extent that it fails in any of these respects it is poor. Conditions of illumination which are prejudicial to good vision are:

Glare, produced by light of excessive brilliancy from small surfaces in the field of vision, usually bare light-sources or direct reflections of them. It corresponds to halation in a photograph.

Too Much or Too Little General Brightness caused by excessive or insufficient lighting. It corresponds to over and under-exposure in photographs, the former giving too great, and the latter too little contrast in light and shade.

Light Containing an Undue Amount of Invisible Rays; the red and infra-red rays produce destructive chemical action in the retinal cells, which prevent their normal functioning. This corresponds to "solarization" in photography.

Light From the Wrong Direction, distorting perspective and relief, and giving an unnatural appearance to objects.

Light From a Single Small Source, giving silhouette effects, black shadows and white high-lights without detail.

Light From Two or Several Small Sources, giving cross shadows, which are confusing to the visual sense.

The Efficiency of a Light-Source is the ratio of the quantity of light produced to the energy consumed. The most efficient light-sources known at the present time do not have an efficiency of more than ten per cent.

Efficiency of Illumination is of two kinds: proximate efficiency, and ultimate efficiency. The former is the ratio of the light falling upon the objects intended to be illuminated to the total quantity of light produced. A theoretical plane thirty inches from the floor is generally taken as the surface intended for illumination. The quantity of light falling on this plane is commonly called "lumens effective."

The Ultimate Efficiency of illumination is the degree to which it fulfills all the purposes for which it is produced. While it can not be measured mathematically it is of greater practical importance than proximate efficiency. This is especially true in

Industrial Lighting, which includes all cases where illumination is used to expedite manual labor. The efficiency of labor is largely influenced by the character of the illumination by which it is performed. Muscular action necessarily follows perception; hence imperfect visual impressions retard motion and impair the accuracy of its application. Ordinary artificial illumination usually reduces the output of labor from ten to twenty per cent.

Production Curves—The ultimate efficiency of artificial illumination is best shown by a curve formed by plotting the output of an individual operative, or of a number of operatives performing the same task, against the successive periods of time throughout the twenty-four hour day. The theoretically perfect production curve is a straight line, or "flat curve", showing no change in output on account of change from the best daylight illumination to artificial illumination.

Cooper Hewitt Light Insures a "Flat Production Curve"—This has been demonstrated by fourteen years use in practically every branch of industrial lighting. It is attributed to the fact that the Cooper Hewitt lamp is free from glare, and that the light contains no red rays, which overheat the retina and reduce the sharpness of the image, thereby producing mental and physical fatigue. Cooper Hewitt light has been found to surpass daylight for many purposes where particularly sharp vision is required.

Electrical Formulae.

1. Formula showing the relation of volts, amperes and watts for direct current.

E = pressure in volts.

I = current in amperes.

R = resistance in ohms.

W = energy in watts.

$$E = IR \quad R = \frac{E}{I} \quad I = \frac{E}{R}$$

$$W = EI = I^2 R = \frac{E^2}{R}$$

2. The same formula applied to alternating current, showing the power factor.

f = frequency of the circuit.

L = inductance in henries.

$\cos \phi$ = Power factor.

Z = Impedance = $[R^2 + (2\pi fL)^2]^{\frac{1}{2}}$

$$E = IZ \quad Z = \frac{E}{I} \quad I = \frac{E}{Z}$$

$$W = EI \times \cos \phi$$

Cooper Hewitt Electric Lamps

These lamps consist essentially of an exhausted glass tube provided with electrodes at both ends and containing mercury. By the passage of electric current through the tube the mercury is vaporized and rendered luminous.

Cooper Hewitt lamps are of the low pressure, glass tube type and are operated at low temperature with corresponding low temperature of vapor. To obtain the maximum efficiency the glass tubes have to be made 50 inches long for operation in multiple, or two 20-inch tubes operating in series on 110 volts. In either case the tubes are 1 inch in diameter.

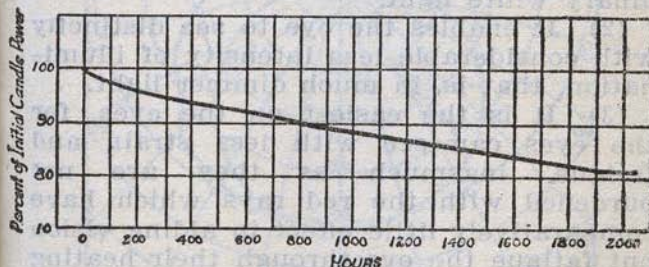
In addition to the tubes, which are mounted in reflectors, there is included in the complete lamps the necessary electrical apparatus for starting, and series

accessories for maintaining them in steady operation.

The Cooper Hewitt tube lamps are manufactured for direct current circuits of 110, 220, to 550 volts, and for alternating current circuits of 110, 220, and 440 volts at 25, 40, 50 and 60 cycles.

Cooper Hewitt lamps involve no expense for trimming. The maintenance expense consists in renewing the tubes, which, however, have an average life of about 5000 hours. It is necessary, however, that tubes and reflectors should be cleaned at certain intervals to remove accumulation of dust and dirt.

During the past year improvements in the manufacture of tubes have been such that the average candle power throughout the life of the tubes has been materially increased. During 2000 hours burning the depreciation does not exceed 20 per cent of the initial candle power.



Depreciation of Candle Power of Cooper Hewitt Lamps.

Advantages for Factory Lighting

The light produced by the glowing va-

por in these lamps differs radically from that of all other electric lamps. It contains practically no red rays but is composed of blue, green and yellow rays, thus giving a greenish-blue color. The greatest portion of the visible light lies in the line 546 at the point of the spectrum where the eye is most efficient. These lamps operate at relatively low temperatures at the same time maintaining high penetrative power and in this respect are not duplicated in any other type of lamp.

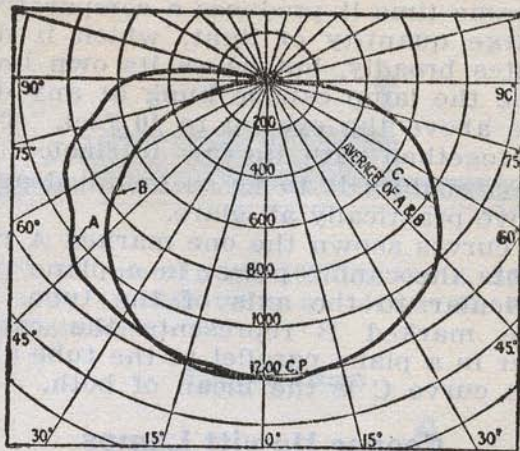
In industrial plants where Cooper Hewitt lamps are used this peculiar color composition of the light gives important advantages in enabling the eye to see small objects and fine details with the lowest intensity.

(1) It increases acuity of vision enabling the eye to see small objects and fine details with greater sharpness than ordinary white light.

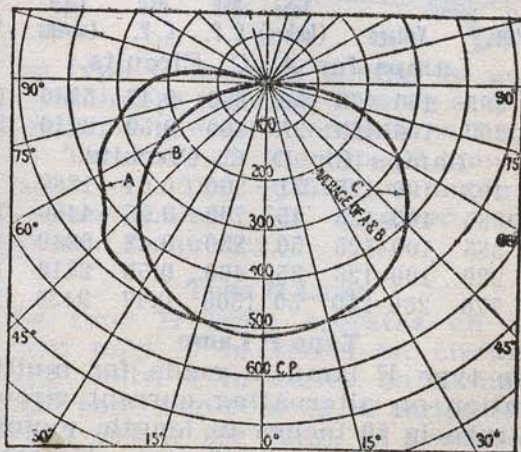
(2) It enables the eye to see distinctly with considerable less intensity of illumination, that is, in much dimmer light.

(3) It is the easiest on the eyes, for the eyes can see with less strain and fatigue, inasmuch as they are not burdened with the red rays which have comparatively little effect in aiding vision but fatigue the eye through their heating action.

(4) The Cooper Hewitt lamp is the only commercial light source that does not dazzle the eyes when used without any accessory for diffusing its light. At



Total Candle-power Distribution, Type F and F Lamps.



Distribution of Type H Lamps.

the same time it produces a comparatively large quantity of light, which it distributes broadly, but below its own level. Hence the lamp can be hung at any distance above the eye up to 40 feet. This fact together with its low intrinsic brilliancy, enables it to be so installed as to remove practically all glare.

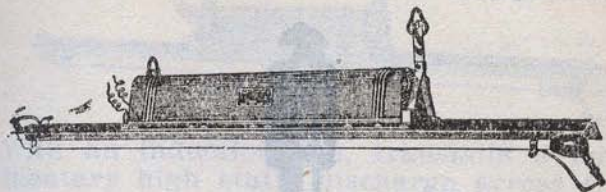
In curves shown the one marked A represents the candle power in a plane perpendicular to the axis of the tube, the curve marked B represents the candle power in a plane parallel to the tube axis, while curve C is the mean of both.

Cooper Hewitt Lamps For Industrial Illumination

Type	Watts	Voltage	Length Tube (Inches)	Watts per		Total Lumens	Lumen per Watt
				M. L. HSP C. P.	M. L. HSP C. P.		
Lamps for A. C. Circuits.							
F	385	100-460	50	850	0.47	5340	13.9
E	200	100-460	35	400	0.50	2510	12.5
Lamps for D. C. Circuits.							
H	193	100-125	21	300	0.64	1880	9.7
K	385	100-125	45	700	0.55	4400	11.4
P	385	100-125	50	850	0.48	5340	13.9
L	220	100-125	35	400	0.55	2510	11.4
PP	770	200-250	50	1500	0.47	9420	12.3

Type F Lamp

The type F lamp is made for multiple operation on alternating current circuits. The tube is 50 inches in length, mounted in an enamelled steel reflector. By means of different auto transformers it can be



made to operate on 100-120 volts, 200-240 volts or 400-460 volts at either 25, 40, 50 or 60 cycles.

Type E Lamp

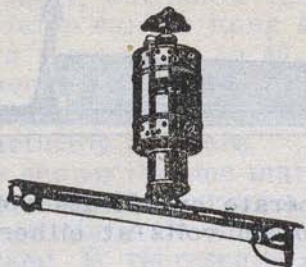


The type E lamp is similar in general construction to the type F lamp and made for multiple operation on alternating current. The tube on the type E lamp is 35 inches long. The outfits are made with auto-transformers for a given voltage range and frequency.

Type H Lamp

The type H lamp operates on direct current only, 2 in series on circuits of 100-125 volts, 4 in series on circuits of 200-250 volts and 9 or 10 in series on circuits of 500 or 600 volts, at a current of $3\frac{1}{2}$ amperes. It can be started by tilting

it by hand, or automatically by an electro-magnet.



The tube in this lamp is 21 inches long and is equipped with an enamelled metal reflector to distribute the light downward.

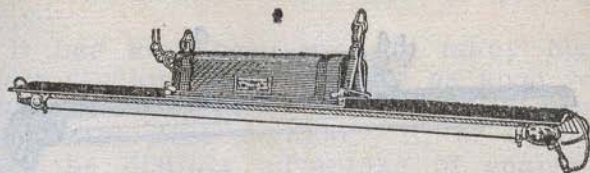
Type K Lamp



The type K lamp consists of a tube 45 inches in length, mounted in a suitable reflector. It is lighted by tilting the tube, and can be operated in multiple on 110 volts direct current, or two in series on 220 volts direct current at $3\frac{1}{2}$ amperes.

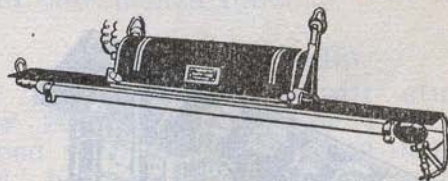
Type P Lamp

The type P lamp is 50 inches in length, mounted in a suitable reflector. This lamp is started automatically by the operation of a shifter which, in connection



with an induction coil, transmits a momentary high static discharge across the tube. This lamp operates on direct current in multiple on 100-125 volts, or two in series on 200-250 volts.

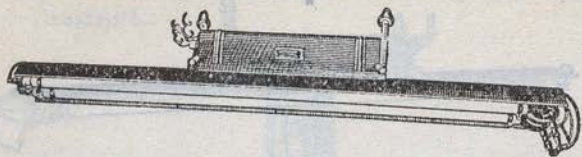
Type L Lamp



The type L lamp is similar in most respects to the type P lamp, except that it has a tube 35 inches long. The type L lamp is also self-lighting and made for operation in multiple on 100-125 volts direct current, or two in series on 200-250 volts direct current.

Type PP Lamp

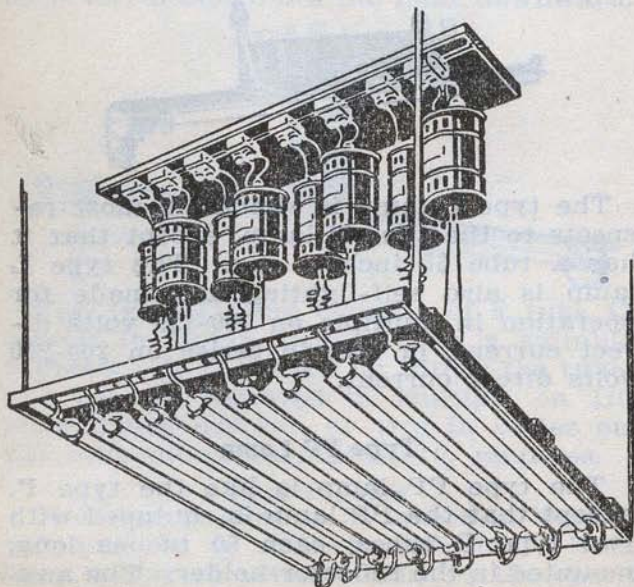
The type PP lamp is like the type P, except that the PP lamp is equipped with two type P tubes, each 50 inches long, mounted in the reflector-holder. The auxiliary is made for operating the lamp out-



fit on 200 to 250 volts direct current. This lamp lights automatically.

Cooper Hewitt Lamps for Photographic Purposes

Cooper Hewitt light—familiar to everybody as the light for post card portraits made “while you wait”—is by no means



Skylight Frame for Studios.

confined to the rush class of photography.

It has long been used in many high class studios where it gives as good results in all respects as can be obtained under the best skylight. It, of course, has the distinct advantage of enabling the photographer to take pictures at all hours, and of making him entirely independent of the weather.

Cooper Hewitt outfits for studio work are made in several different styles, both for alternating and direct current. The largest outfit is equipped with seventeen 50-inch tubes. The smallest outfit consists of one 20-inch tube.

Portrait Studio

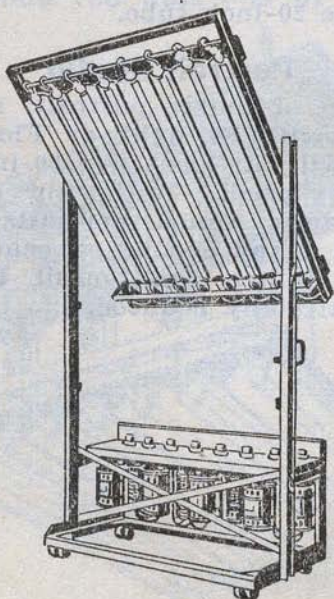
For the ordinary portrait studio, a Cooper Hewitt Skylight or Floor Stand equipped with at least five 50-inch tubes should be used. With an outfit so equipped fully timed portraits can be made with a half second exposure. With an eight 50-inch tube outfit this time can be materially reduced.

Postal Card Studio

The ordinary postal card, or all night studio does not require a large volume of light, and with one or two 50-inch Cooper Hewitt tubes mounted on stands, photographs can be taken in minimum time, which will satisfy the public. A single lamp with a curved reflector and a side screen permits the photographer to run his studio day and night. Two lamps give a wider scope for group lighting.

Motion Picture Studios.

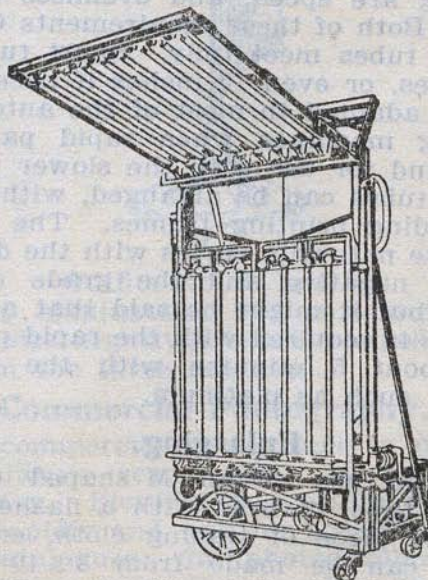
For lighting motion picture studios properly a large volume of light is abso-



Floor Stand for Studios.

lutely necessary. With Cooper Hewitt lamps this requires about 100 watts per square foot of stage. A small studio requires approximately five Cooper Hewitt skylights overhead, with three or four floor stands for side lighting; whereas with stages which run about 40 ft. back of the front line about 15 skylights are necessary, with a half dozen floor stands.

For this field the lamps are particularly adapted, as they radiate very little heat, even though 150 or 200 tubes are used over a single stage. Actors can work with comfort and with minimum eye-strain on account of the low intrinsic brilliancy of the light source.



Elevator Stand for Studios.

For studios where it is impossible on account of structural details to install an overhead trolley system to carry skylight outfits, so called elevator stands either with or without wings can be furnished. This stand can be raised to a point so that the tubes are 18 ft. from the floor. It consists of a frame containing nine 50-inch tubes controlled by a raising and lowering device and if desired, wings can be added to the sides consisting of 8 additional tubes, making a total of 17 tubes for the entire outfit.

Printing.

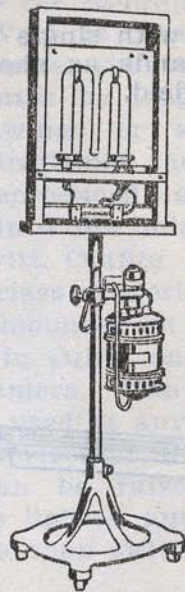
The two essentials in photographic printing are speed, and evenness of the print. Both of these requirements Cooper Hewitt tubes meet fully. Short tubes of 20 inches, or even 10 inches if necessary, can be adapted to most of the automatic printing machines when rapid paper is used, and for use with the slower papers longer tubes can be arranged, with racks for holding printing frames. The printing time naturally varies with the density of the negative and the grade of the paper, but it might be said that about 5 seconds is required with the rapid papers, and about 5 minutes with the slower papers, such as platinum.

Enlarging.

By the use of an M-shaped Cooper Hewitt tube, covered with a flashed opal glass or piece of tracing cloth, enlargements can be made from 8 x 10 nega-

tives without the use of condensing lenses.

The high first cost of the lenses and the equally high charge for replacement is



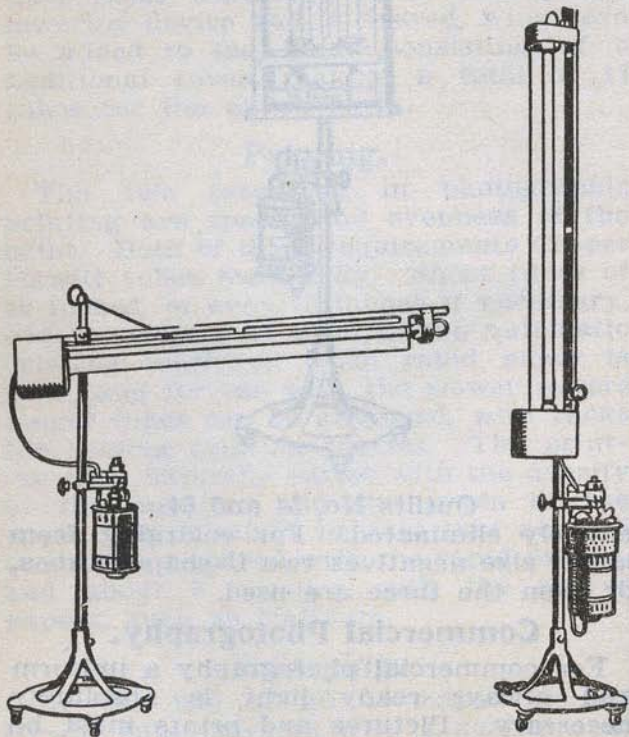
Outfits No. 54 and 64 entirely eliminated. For enlarging from larger size negatives two U-shaped tubes, or even the three are used.

Commercial Photography.

For commercial photography a uniform and always ready light is absolutely necessary. Pictures and prints must be made rapidly and well for advertisements and catalogues. In photographing for catalogue work Cooper Hewitt light

brings out to a wonderful degree the grain in wood or leather, shades and contour of the models, and penetrates into the recesses, reproducing all details accurately.

Floor stands with single tubes mounted on movable stands as shown below are useful in this field.



Outfits No. 47 and 46
For Lighting Copy of All Sorts

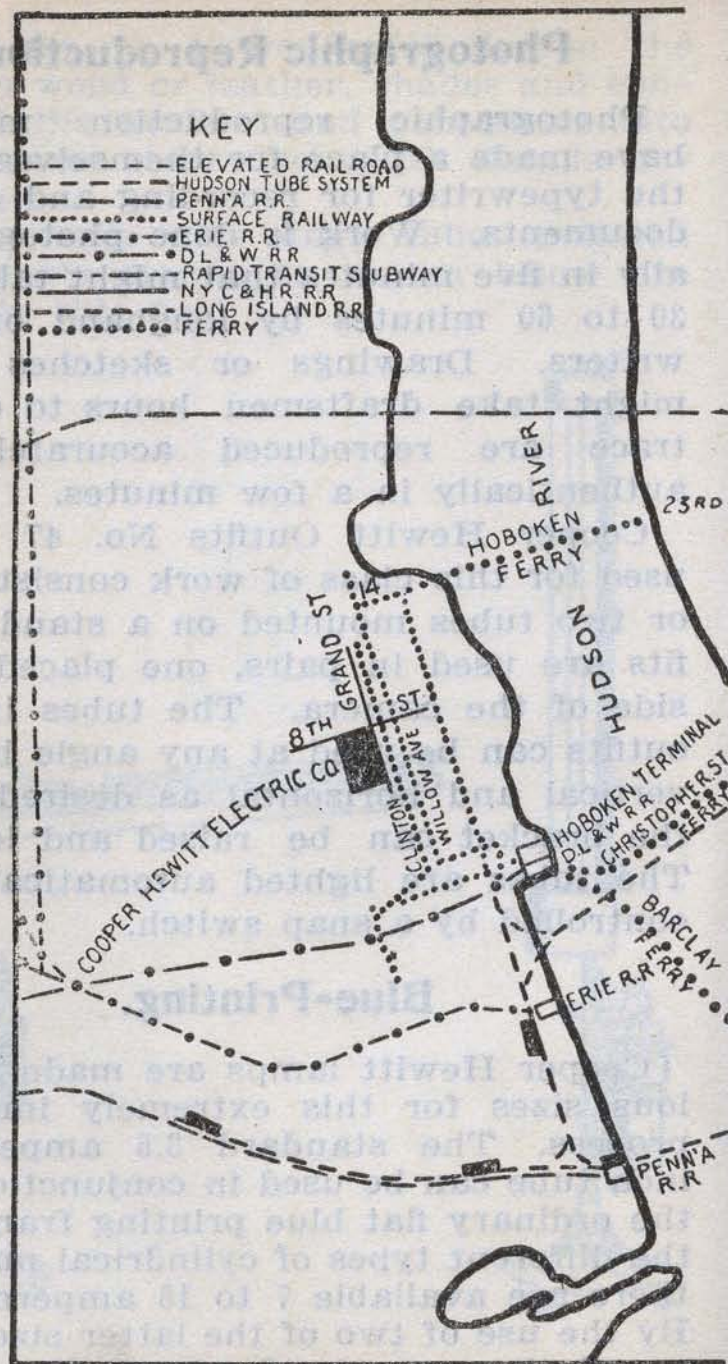
Photographic Reproduction.

Photographic reproduction machines have made a place for themselves beside the typewriter for recording and copying documents. Work is done photographically in five minutes that might take from 30 to 60 minutes by longhand or typewriters. Drawings or sketches which might take draftsmen hours to copy or trace are reproduced accurately and authentically in a few minutes.

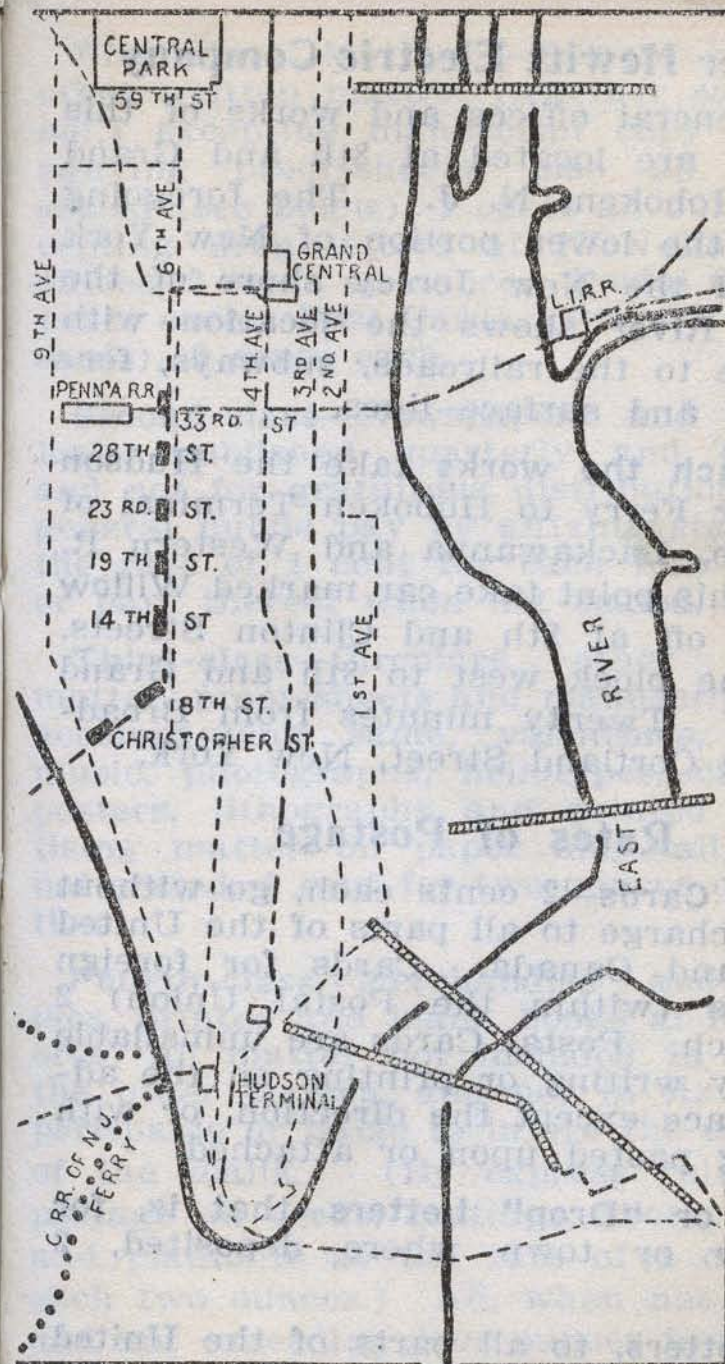
Cooper Hewitt Outfits No. 47 and 46 used for this class of work consist of one or two tubes mounted on a stand. Outfits are used in pairs, one placed either side of the camera. The tubes in these outfits can be used at any angle between vertical and horizontal as desired. Also the bracket can be raised and lowered. The tubes are lighted automatically and controlled by a snap switch.

Blue-Printing.

Cooper Hewitt lamps are made in various sizes for this extremely important process. The standard 3.5 amperes, 50 inch tube can be used in conjunction with the ordinary flat blue printing frame. For the different types of cylindrical machines there are available 7 to 15 ampere tubes. By the use of two of the latter size tubes, a printing speed of about 6 feet per minute can be obtained.



Map of New York
(See page 32.)



and Vicinity
(See page 32.)

Cooper Hewitt Electric Company

The general offices and works of this company are located at 8th and Grand street, Hoboken, N. J. The foregoing map of the lower portion of New York City and the New Jersey shore of the Hudson River shows the location with reference to the railroads, subways, ferry boats and surface lines.

To reach the works take the Hudson Tubes or Ferry to Hoboken Terminal of Delaware, Lackawanna and Western R. R. At this point take car marked Willow and get off at 8th and Clinton Streets. Walk one block west to 8th and Grand Streets. Twenty minutes from Broadway and Cortland Street, New York.

Rates of Postage

Postal Cards—2 cents each, go without further charge to all parts of the United States and Canada. Cards for foreign countries (within the Postal Union) 2 cents each. Postal Cards are unmailable with any writing or printing on the address space except the direction, or with anything pasted upon or attached.

Local or "Drop" Letters—that is, for the city or town where deposited, 2 cents.

All Letters, to all parts of the United States, Canada and Mexico, 3 cents for each ounce or fraction thereof.

First-class Matters—Letters and all other written matter, (whether sealed or not,) excepting manuscript copy accompanying proof-sheets, also all matter sealed (see below), 3 cents an ounce, excepting drop letters at NON-CARRIER offices, 2 cents an ounce. Postal Cards, 2 cents each. Post Cards, (Private mailing cards), 2 cents each.

Second-class—Newspapers and periodicals, published quarterly and oftener, and not for gratuitous distribution. The general public pay by affixing stamps at the rate of 1 cent for each four ounces or part thereof when not sealed.

Third-class—Circulars, other printed matter, proof-sheets and manuscript copy accompanying same, valentines, sheet-music, photographs, heilotypes, chromos, posters, lithographs and printed advertising matter on paper only—all, when not sealed, 1 cent for two ounces or fraction.

Fourth-class—Merchandise and samples, printed and blank books and paper; ores; all matter not included in any of the other classes, and not in its nature perishable or liable to injure the contents of the mails. (By express ruling the postage on seeds, cuttings, roots, scions, and plants is at the rate of 1 cent for each two ounces.) All, when not sealed, and not exceeding four ounces in weight, 1 cent an ounce, or fraction. For parcels over 4 ounces see parcel post regulation.

Typical Installation of Cooper Hewitt Lamps for Different Classes of Work

Class of Work—	Type of Lamp	Watts per Sq. Ft.	Feet Above Floor
Metal Working Plants			
Foundries.			
Casting floor	F	.74	11'
Forge shop	F	.74	11'
Forge shop	P	.77	10'
Casehardening	H	.82	12'
Tempering	K	1.28	9'

Machine Shop with Small Tools

Gen. mach. wk. F	.92	12'
Gen. mach. wk. F	1.04	10'
Gen. mach. wk. F	.99	10'
Gen. mach. wk. F	.89	10'
Gen. mach. wk. F	1.05	25'
Gen. mach. wk. F	1.14	15'
Gen. mach. wk. F	1.27	12'
Gen. mach. wk. F	1.35	9'
Gen. mach. wk. F	.85	24'
Gen. mach. wk. F	.94	14'
Gen. mach. wk. F	.91	16'
Gen. mach. wk. F	.82	12'
Gen. mach. wk. F	1.02	30'
Gen. mach. wk. P	.8	12'
Gen. mach. wk. P	1.23	14'
Gen. mach. wk. PP	.91	25'
Gen. mach. wk. L	.85	12'
Automobile pts. F	.92	13'
Revolver parts F	.95	10'
Gun parts P	1.80	12'
Gun parts P	1.37	12'

Gun parts H	.88	9'
Gun parts H	.89	9'
Torpedo mfg. H	1.18	14'
Tool room F	.8	12'
Tool room F	.8	10'
Tool room F	1.48	10'
Tool room P	.8	14'
Milling machs. F	1.15	10'
Milling machs. H	1.09	7'
Reamers F	1.12	10'
Model making F	1.12	10'
Screw machs. P	1.0	12'
Screw machs. H	.81	8'

Heavy Machine Work

Punch presses F	.95	9'
Punch presses F	.83	10'
Punch presses P	1.07	12'
Grinding F	1.14	12'
Polishing F	.8	12'
Polishing H	.74	9'
Tank shop F	.75	12'
Assembling and erecting F	.89	15'
Assembling and erecting F	.77	36'
Assembling and erecting P	.79	16'
Assembling and erecting H	.81	12'
Assembling and erecting H	.94	10'
Assembling and erecting H	.88	9'
Auto eng. tests F	1.95	12'
Auto eng. tests F	.9	12'
Inspecting F	.82	12'

Woodworking Plants

Woodwkg. shop	P	1.28	8'
Woodworking	H	.91	10'
Woodworking	H	.96	10'
Carpenter shop	H	.83	10'
Varnish shop	H	.82	10'

Auto Body Finishing	F	2.28	8½'
" "	F	2.86	8½'
" "	P	2.23	7'

Silk Mill

Reeling	F	.95	9'
Spinning	F	.8	12'
Spinning	F	1.52	10'
Spinning	P	1.0	12'
Spinning	P	1.47	10'
Spinning	P	1.02	12'
Spinning	K	1.4	10'
Spinning	H	1.02	10'
Silk throwing	F	1.0	..
Winding	P	1.28	12'
Warping	P	1.11	12'
Warping	P	1.16	12'
Warping	P	1.08	10'
Quill winding	P	1.51	10'
Entering	P	1.65	12'
Weaving	F	1.37	10'
Weaving	P	1.0	14'
Weaving	P	1.27	11'
Weaving	P	1.21	11'
Weaving	P	1.30	11'
Weaving	P & H	1.47	12'
Weaving	P & H	1.18	14'
Weaving	P & H	1.15	8'
Weaving	P & H	1.6	11'
Ribbon loom	H	1.54	9'
Picking	P	1.65	12'

Cotton Mill

Twisting	P & H	1.68	12'
Weaving	P	.74	12'

Woolen and Worsted Mills

Winding	F	.94	10'
Weaving	H	.78	9'
Weaving	K	1.13	10'

Knitting Mills

Knitting machs.	P	.94	10'
Stitch. machs.	P	1.33	10'
Stitch. machs.	P	.94	10'

Embroidery Plants

Auto. machines	F	.95	14'
Hand machines	H	.98	9'

Printing Plants

Comp. room	P	2.3	12'
Comp. room	P	1.51	12'
Comp. room	P	1.93	10'
Comp. room	P & H	1.84	10'
Comp. room	H	1.7	10'
Stereotype rm.	P	1.03	12'
Stereotype rm.	P	1.77	10'
News. presses	H	.84	8'-14'
News. press.	P & H	.82	27'
Job presses	P	1.19	12'
Engrav. presses	P	1.82	10'

Clothing Manufacturing

Cutters	P	1.72	10'
Hand sewing	F	1.74	10'
Pressing	F	1.6	10'

Power House Lighting

Boiler room	F	.61	16'-22'
Boiler room	H	.6	18'
Boiler room	H	1.18	12'

Glass Manufacturing

Lehr inspection	P	2.0	12'
Stripping	P	.71	15'
Final inspection	P	1.28	10'
Machine cut.	F	.85	12'

Shipping and Storage

Shipping dept.	P	.49	12'
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Motion Picture

Studios	P	100.	8'-10'
"	P	128.	8'-14'
"	P	100.	8'-15'
"	P	99.	8'-13'
"	P	104.	8'-13'
"	P	89.	8'-12'

Temperature Rise by Resistance

Approximate Formula.

Let R_{25} = Resistance in ohms at 25 degrees Centigrade.

R_h = Resistance in ohms hot.

R_c = Resistance in ohms cold or at air temperature.

T_h = Temperature of winding hot in degrees Centigrade.

T_c = Temperature of winding cold in degrees Centigrade.

then assuming the temperature co-efficient of copper at 25 degrees Centigrade as .0038,

$$R_h = R_c + .0038 R_c (T_h - T_c).$$

$$R_h - R_c \quad R_h - R_c$$

$$T_h - T_c = \frac{.0038 R_c}{R_h - R_c} = 263$$

$$\text{Rise in temperature above } 25^\circ\text{C.} = \frac{R_c}{R_h - R_{25}}$$

$$263 \frac{R_c}{R_{25}}$$

$$R_{25}$$

Useful Information

Diameter of Circle—Multiply circumference by .31831.

Circumference of Circle—Multiply the diameter by 3.1416.

Area of Circle—Multiply square of diameter by .7854.

Surface of Sphere—Multiply square of diameter by 3.1416.

Cubic Inches in Sphere—Multiply cube of diameter by .5236.

Capacity of a Cylinder in Gallons—Multiply area in inches by length of cylinder in inches and divide by 231, the number of cubic inches in a gallon.

Weight of Coal—One cubic foot of anthracite coal weighs about 53 pounds.

Cement—One bushel of cement and two bushels of sand will cover $3\frac{1}{2}$ square yards one inch thick— $4\frac{1}{2}$ square yards, $\frac{3}{4}$ inch thick— $6\frac{3}{4}$ square yards $\frac{1}{2}$ inch thick.

British thermal unit (B.t.u.) = unit of heat or amount required to raise the temperature of one pound of water from 59° F. to 60° F. or equivalent to 778 foot pounds of work. Therefore 1 h.p. is equivalent to 42.41 B.t.u. per minute.

Foot pound = unit of work. The amount of work required to lift one pound through a vertical distance of one foot.

Horsepower = unit of power or rate of doing work.

Horsepower = 33000 ft. lb. per min. or 550 ft. lb. per sec.

Horsepower-hour = unit of mechanical energy.

Parcel Post Regulation

ZONES

Weight in Pounds	I		II	III	IV	V	VI	VII	VIII
	Local Rate	Zone Rate 50 Mi.	50 to 150 Mi.	150 to 300 Mi.	300 to 600 Mi.	600 to 1,000 Mi.	1,000 to 1,400 Mi.	1,400 to 1,800 Mi.	All Over 1,800 Mi.
1.....	\$0.05	\$0.05	\$0.05	\$0.06	\$0.07	\$0.08	\$0.09	\$0.11	\$0.12
2.....	.06	.06	.06	.08	.11	.14	.17	.21	.24
3.....	.06	.07	.07	.10	.15	.20	.25	.31	.36
4.....	.07	.08	.08	.12	.19	.26	.33	.41	.48
5.....	.07	.09	.09	.14	.23	.32	.41	.51	.60
6.....	.08	.10	.10	.16	.27	.38	.49	.61	.72
7.....	.08	.11	.11	.18	.31	.44	.57	.71	.84
8.....	.09	.12	.12	.20	.35	.50	.65	.81	.96
9.....	.09	.13	.13	.22	.39	.56	.73	.91	1.08
10.....	.10	.14	.14	.24	.43	.62	.81	1.01	1.20
11.....	.10	.15	.15	.26	.47	.68	.89	1.11	1.32
12.....	.11	.16	.16	.28	.51	.74	.97	1.21	1.44
13.....	.11	.17	.17	.30	.55	.80	1.05	1.31	1.56
14.....	.12	.18	.18	.32	.59	.86	1.18	1.41	1.68
15.....	.12	.19	.19	.34	.63	.92	1.21	1.51	1.80
16.....	.13	.20	.20	.36	.67	.98	1.29	1.61	1.92
17.....	.13	.21	.21	.38	.71	1.04	1.37	1.71	2.04
18.....	.14	.22	.22	.40	.75	1.10	1.45	1.81	2.16
19.....	.14	.23	.23	.42	.79	1.16	1.53	1.91	2.28
20.....	.15	.24	.24	.44	.83	1.22	1.61	2.01	2.40
21.....	.15	.25	.25						
22.....	.16	.26	.26						
23.....	.16	.27	.27						
24.....	.17	.28	.28						
25.....	.17	.29	.29						
26.....	.18	.30	.30						
27.....	.18	.31	.31						
28.....	.19	.32	.32						
29.....	.19	.33	.33						
30.....	.20	.34	.34						
31.....	.20	.35	.35						
32.....	.21	.36	.36						
33.....	.21	.37	.37						
34.....	.22	.38	.38						

Packages are limited in weight to fifty pounds for any distance and to seventy pounds within the 1st, 2nd and 3rd zones, and in dimensions not to exceed seventy-two inches in length and girth combined.

How to Remember the Wire Table

The copper wire table, B. & S. gauge, has simple relations, such that by remembering a few constants the whole table can be constructed with approximate accuracy.

A wire which is three sizes larger than another wire has half the resistance, twice the weight and twice the area. A wire which is 10 sizes larger than another wire has one-tenth the resistance, 10 times the weight and 10 times the area.

No. 10 wire is 0.10 in. in diameter (more precisely 0.102); it has an area of 10,000 circular mills (more precisely 10,380); it has a resistance of 1 ohm per 1000 feet at 20 degrees Centigrade (68 degrees Fahrenheit), and weighs 32 pounds (more precisely 31.4 pounds) per 1000 feet.

The weight of 1000 feet of No. 5 wire is 100 pounds.

The relative values of resistance (for decreasing sizes) and of weight and area (for increasing sizes) for consecutive sizes are: .50, .63, .80, 1.00, 1.25, 1.60, 2.00.

Circular Mills—The conductors of large size are usually specified in circular mills (c.m.). For example, 500,000 circular mills, 750,000 circular mills.

The number of feet per ohm is one-tenth of the circular milage.

To find weight in pounds, drop four ciphers from the number of circular mills and multiply by the weight of No. 10 wire.

Table of Dimensions, Weights and Resistances of Pure Copper Wire (Bare)

Brown & Sharpe Gauge

Gauge No.	Diam. Inches	Area Circular Mils (d ²) 1 Mil. = .001 Inch	Weight		Length Feet per Lb.
			Lbs. per Mile	Lbs. per 1000 Ft.	
*	1.152	1000000.	16165.	3050.	.3275
*	1.035	800000.	12932.	2440.	.4100
*	.963	700000.	11315.5	2135.	.4680
*	.891	600000.	9699.	1830.	.5460
*	.819	500000.	8082.5	1525.	.6550
*	.728	400000.	6466.	1220.	.8200
*	.590	250000.	4038.6	762.	1.32
0000	.4600	211600.	3375.66	639.3	1.56
000	.4096	167805.	2677.01	507.0	1.97
00	.3648	133079.	2123.03	402.0	2.49
0	.3248	105538.	1683.58	318.8	3.14
1	.2893	83694.	1335.21	252.8	3.99
2	.2576	66373.	1058.85	200.5	4.99
3	.2294	52634.	839.68	159.0	6.29
4	.2043	41742.	665.91	126.1	7.93
5	.1819	33102.	528.05	100.0	10.00
6	.1620	26250.	418.81	79.32	12.61
7	.1442	20816.	332.11	62.90	15.90
8	.1284	16509.	263.37	49.88	20.05
9	.1144	13094.	208.88	39.56	25.28
10	.1018	10381.	165.63	31.37	31.38
11	.0907	8234.	131.37	24.88	40.20
12	.0808	6529.	104.17	19.73	50.69
13	.0719	5178.	82.63	15.65	63.91
14	.0640	4106.	65.68	12.44	80.38
15	.0570	3256.	51.96	9.84	101.63
16	.0508	2582.	41.24	7.81	128.14
17	.0452	2048.	32.68	6.19	161.59
18	.0403	1624.	25.92	4.91	203.76

Table of Dimensions, Weights and Resistances of pure Copper Wire (Bare)

Brown & Sharpe Gauge

Resistance at 75° F.			Carrying Capacities		Gauge No.
Length Feet Per Ohm	R Ohms Per 1,000 feet	Ohms Per Lb.	Rubber Ins. Amperes	Other Ins. Amperes	
95100.	.01051	.000003442	650	1000	
76100.	.01313	.000005380	550	840	
66600.	.01501	.000007030	500	760	
57100.	.01751	.000009579	450	680	
47500.	.02101	.00001376	400	600	
38050.	.02627	.00002155	325	500	
23750.	.04203	.00005600	240	350	
20383.	.04906	.00007673	225	325	0000
16165.	.06186	.00012039	175	275	000
12820.	.07801	.00019423	150	225	00
10166.	.09838	.00038500	125	200	0
8062.3	.12404	.00048994	100	150	1
6393.7	.15640	.00078045	90	125	2
5070.2	.19723	.0012406	80	100	3
4021.0	.24869	.0019721	70	90	4
3188.7	.31361	.0031361	55	80	5
2528.7	.39546	.0049863	50	70	6
2005.2	.49871	.0079294	38	54	7
1590.3	.62881	.012608	35	50	8
1261.3	.79281	.020042	28	38	9
1000.0	1.	.031380	25	30	10
793.18	1.2607	.050682	23	27	11
629.02	1.5898	.080585	20	25	12
498.83	2.0047	.12841	17	23	13
395.60	2.5278	.20322	15	20	14
321.02	3.1150	.31658			15
248.81	4.0191	.51501	6	10	16
197.30	5.0683	.81900			17
156.47	6.3911	1.3023	3	5	18

WEIGHTS AND MEASURES

Troy Weight

24 grains = 1 pwt. 12 ounces = 1 pound.
20 pwt. = 1 ounce

Used for weighing gold, silver and jewels.

Apothecaries' Weight

20 grains = 1 scruple. 8 drams = 1 ounce.
3 scruples = 1 dram. 12 ounces = 1 pound.

The ounce and pound in this are the same as in troy weight.

Avoirdupois Weight

28 $\frac{1}{2}$ grains = 1 dram. 4 quarters = 1 cwt.
16 drams = 1 ounce. 2,000 lbs. = 1 short ton.
16 ounces = 1 pound 2,240 lbs. = 1 long ton.
25 pounds = 1 quarter.

Dry Measure

2 pints = 1 quart. 4 pecks = 1 bushel.
4 quarts = 1 peck. 36 bushels = 1 chaldron.

Liquid Measure

4 gills = 1 pint. 31 $\frac{1}{2}$ gallons = 1 barrel.
8 pints = 1 quart. 2 barrels = 1 hogshead.
4 quarts = 1 gallon. 16 fluid ounces = 1 pint.

Time Measure

60 seconds = 1 minute. 24 hours = 1 day.
60 minutes = 1 hour. 7 days = 1 week.
28, 29, 30 or 31 days = 1 calendar month (30 days = 1 month in computing interest.)
365 days = 1 year. 366 days = 1 leap year.

Long Measure

12 inches = 1 foot. 40 rods = 1 furlong.
3 feet = 1 yard. 8 furlongs = 1 sta. mile.
5 $\frac{1}{2}$ yards = 1 rod. 3 miles = 1 league.

Cloth Measure

2 $\frac{1}{4}$ inches = 1 nail. 4 quarters = 1 yard.
4 nails = 1 quarter.

Square Measure

144 sq. inches = 1 sq. ft. 40 sq. rods = 1 rood.
9 sq. ft. = 1 sq. yard. 4 roods = 1 acre.
30 $\frac{1}{4}$ sq. yds. = 1 sq. rd. 640 acres = 1 sq. mile.

Surveyors' Measure

7.92 inches = 1 link. 4 rods = 1 chain.
25 links = 1 rod.
10 sq. chains or 160 sq. rods = 1 acre.
640 acres = 1 sq. mile.
36 sq. miles (6 miles sq.) = 1 township.

Cubic Measure

1,728 cubic in. = 1 cu. ft. 128 c. f. = 1 cord (wood)
27 cubic ft. = 1 cubic yd. 40 c. f. = 1 ton (shpg.)
2,150.42 cubic inches = 1 standard bushel.
231 cu. in. = 1 standard gallon (liquid).
1 cubic ft. = $\frac{1}{6}$ of a bushel.

Metric Equivalents

Linear Measure

1 centimeter = 0.3937 in. 1 kilometer = 0.62137 mi.
1 decimeter = 3.937 in. 1 in. = 2.54 centimeters.
= 0.328 feet. 1 ft. = 3.048 decimeters.
1 meter = 39.37 inches 1 yd. = 0.9144 meter.
= 1.0936 yards. 1 rod = 0.5029 dekameter.
1 dekameter = 1.9884 1 mile = 1.6093 kilometers.

Square Measure

1 sq. centimeter = 0.1550 1 sq. inch = 6.452 sq. centimeters.
sq. in. 1 sq. foot = 9.2903 sq. decimeters.
1 sq. decimeter = 0.1076 1 sq. yd. = 0.8361 sq. meter.
sq. ft. 1 sq. rd. = 0.2529 are.
1 sq. meter = 1.196 sq. 1 acre = 0.4047 hectare.
yds. 1 hector = 2.47 acres.
1 are = 3,954 sq. rds. 1 sq. m = 2.59 sq. kilometers.
1 hector = 2.47 acres.
1 sq. kilometer = 0.386 sq. mi.

Weights

1 gram = 0.03527 ounce. 1 ounce = 28.35 grams.
1 kilogram = 2.2046 lbs. 1 lb. = 0.4536 kilogram.
1 metric ton = 1.1023 1 English ton = 0.9072 metric tons.

Approximate Metric Equivalents

1 decimeter = 4 inches. 1 liter = 1.06 qts. liquid
1 meter = 1.1 yards. 0.9 qt. dry.
1 kilometer = $\frac{5}{8}$ of a mi. 1 hektoliter = 2 $\frac{1}{2}$ bus.
1 hectare = 2 $\frac{1}{2}$ acres. 1 kilogram = 2 $\frac{1}{4}$ lbs.
1 stere, or cu. meter = 1 metric ton = 2,200 lbs.
 $\frac{1}{4}$ of a cord.

CENSUS 1910

Ten Largest Cities in the World

Cities	Year of Census or Estimate	Population
1 LONDON	1909	7,429,740
2 NEW YORK	1910	4,766,883
3 PARIS	1906	2,763,393
4 TOKIO	1908	2,186,079
5 CHICAGO	1910	2,185,283
6 BERLIN	1908	2,101,933
7 VIENNA	1909	2,085,888
8 ST. PETERSBURG	1905	1,678,000
9 PHILADELPHIA	1910	1,549,008
10 MOSCOW	1907	1,359,254

Cities of Over 100,000 Population

Albany, N. Y.....100,253	Mpls. Minn. 301,408
Atlanta, Ga. 154,839	Nashville, Tenn...110,364
Baltimore, Md. 558,485	Newark, N. J....347,469
Birmingham, Ala.132,685	New Haven, Conn.133,605
Boston, Mass. 670,585	New Orleans, La.339,075
Bridgeport, Conn.102,054	N. Y., N. Y....4,766,883
Buffalo, N. Y.....423,715	Oakland, Cal. 150,174
Cambridge, Mass.104,839	Omaha, Neb. 124,096
Chicago, Ill. 2,185,283	Paterson, N. J....125,600
Cincinnati, Ohio 364,463	Ph'd'phia, Pa. 1,549,008
Cleveland, Ohio ..560,663	Pittsburgh, Pa....533,905
Columbus, Ohio ..181,511	Portland, Ore. 207,214
Dayton, Ohio.....116,577	Providence, R. I.224,326
Denver, Colo.....213,381	Richmond, Va. 127,628
Detroit, Mich.....465,766	Rochester, N. Y...218,149
Fall River, Mass...119,295	St. Louis, Mo. 687,029
Gd. Rpd's, Mich...112,571	St. Paul, Minn...214,744
Indianapolis, Ind.233,650	San Fr'n'co, Cal.416,912
Jersey City, N. J..267,779	Scranton, Pa. 129,867
Kansas City, Mo..248,381	Seattle, Wash....237,194
Los Angeles, Cal.319,198	Spokane, Wash...104,402
Louisville, Ky....223,928	Syracuse, N. Y...137,249
Lowell, Mass. 106,294	Toledo, Ohio 168,497
Memphis, Tenn. .131,105	W'ingt'n. D. C...331,069
Milwaukee, Wis...373,857	Worcester, Mass..145,986

Cities from 25,000 to 100,000 Population

Akron, Ohio 69,067	Elizabeth, N. J....73,409
Allentown, Pa. ...51,913	El Paso, Texas....39,279
Altoona, Pa. 52,127	Erie, Pa. 66,525
Amsterdam, N. Y.31,267	Evansville, Ind. ...69,647
Atlantic City, N. J.46,150	Everett, Mass. 33,484
Athens, Ga. 26,508	Fitchburg, Mass. ...37,826
Auburn, N. Y.....34,668	Flint, Mich. 38,550
Augusta, Ga. 41,040	Fort Wayne, Ind...63,933
Aurora, Ill. 29,807	Ft. Worth, Texas..73,312
Austin, Tex. 29,860	Galveston, Texas ..36,981
Battle Cr., Mich.25,267	Green Bay, Wis...25,226
Bay City, Mich....45,166	Hamilton, Ohio ...35,279
Bayonne, N. J....55,545	Harrisburg, Pa. ...64,186
Bingh'm't'n, N. Y...48,443	Hartford, Conn. ...98,915
Berkeley, Cal. 40,434	Haverhill, Mass. ...44,115
Bloomington, Ill. .25,768	Hazleton, Pa. 25,452
Brockton, Mass. ...56,878	Hoboken, N. J....70,321
Brookline, Mass...27,792	Holyoke, Mass. ...57,730
Butte, Mont. 39,165	Houston, Texas ...78,800
Camden, N. J.....94,538	Hunt'gt'on, W. Va.31,161
Canton, Ohio 50,217	Jackson, Mich. 31,433
Cedar Rapids, Ia...32,811	Jacksonville, Fla...57,699
Charleston, S. C...58,833	Jamestown, N. Y...31,297
Charlotte, N. C....50,000	Johnstown, Pa. ...55,482
Chattanooga, Tenn.44,604	Joliet, Ill. 34,670
Chelsea, Mass. 32,452	Joplin, Mo. 32,073
Chester, Pa. 38,537	Kalamazoo, Mich...39,437
Chicopee, Mass. ...25,401	Kan. City, Kas....82,331
Clinton, Ia. 25,577	Kingston, N. Y....25,908
Col. Springs, Col..29,078	Knoxville, Tenn. .36,346
Columbia, S. C....26,319	La Crosse, Wis....30,417
Council Bluffs, Ia.29,292	Lancaster, Pa. 47,227
Covington, Ky. 53,270	Lansing, Mich. 31,229
Dallas, Texas 92,104	Lawrence, Mass. ...85,892
Danville, Ill. 27,871	Lewiston, Me. 26,247
Davenport, Ia. 43,028	Lexington, Ky. 55,099
Des Moines, Ia....86,368	Lima, Ohio 30,508
Decatur, Ill. 31,140	Lincoln, Nebr. 43,973
Dubuque, Iowa 33,494	Little Rock, Ark...45,941
Duluth, Minn. 78,466	Loraine, Ohio 28,883
Easton, Pa. 28,523	Lynchburg, Va....29,494
E. Orange, N. J...34,371	Lynn, Mass. 89,336
E. St. Louis, Ill...58,547	Macon, Ga. 40,665
Elgin, Ill. 25,976	Madison, Wis....25,531
Elmira, N. Y.....37,176	Malden, Mass. 44,404

Cities from 25,000 to 100,000 Population

Manchester, N. H. 70,063
 Meriden, Conn. ... 27,265
 McKeesport, Pa. ... 42,694
 Mobile, Ala. 50,521
 Mt. Vernon, N. Y. 31,919
 Montgomery, Ala. ... 38,136
 Muskogee, Okla. ... 25,278
 Nashua, N. H. 26,005
 New Britain, Conn. 43,916
 New Bedford, Mass. 96,652
 Newark, Ohio 25,404
 Newburgh, N. Y. ... 27,805
 Newcastle, Pa. 36,280
 Newport, Ky. 30,309
 Newport, R. I. 27,149
 N. Rochelle, N. Y. 28,867
 Newton, Mass. 39,806
 Niagara Falls, N. Y. 30,445
 Norfolk, Va. 67,452
 Norristown, Pa. ... 27,875
 Ogden, Utah 25,580
 Okla. City, Okla. ... 64,205
 Orange, N. J. 29,630
 Oshkosh, Wis. 33,062
 Pasadena, Cal. 30,291
 Passaic, N. J. 54,773
 Pawtucket, R. I. ... 51,062
 Peoria, Ill. 66,950
 Perth A'b'y, N. J. 32,121
 Pittsfield, Mass. ... 32,121
 Portsmouth, Va. ... 33,190
 Portland, Me. 58,571
 Poughkeepsie, N. Y. 27,936
 Pueblo, Colo. 44,395
 Quincy, Ill. 36,587
 Quincy, Mass. 32,642
 Racine, Wis. 38,002
 Reading, Pa. 96,071
 Roanoke, Pa. 34,874
 Rockford, Ill. 45,401
 San Jago, Cal. 39,578
 San Jose, Cal. 28,946
 Sacramento, Cal. ... 44,696
 Saginaw, Mich. ... 50,510

Salem, Mass. 43,697
 Salt L. City, Utah. 92,777
 San Antonio, Tex. ... 96,614
 Savannah, Ga. 65,064
 Schenectady, N. Y. 72,826
 Sheboygan, Wis. ... 26,398
 Shenandoah, Pa. ... 25,774
 Shreveport, La. ... 28,015
 Sioux City, Iowa ... 47,828
 Somerville, Mass. ... 77,236
 S. Bend, Ind. 53,684
 S. Omaha, Neb. 26,259
 Springfield, Ill. ... 51,678
 Springfield, Mass. ... 88,926
 Springfield, Mo. ... 35,201
 Springfield, Ohio ... 50,000
 St. Joseph, Mo. 77,403
 Stamford, Conn. ... 25,138
 Superior, Wis. 40,384
 Tacoma, Wash. 83,743
 Tampa, Fla. 38,524
 Taunton, Mass. 34,259
 Terre Haute, Ind. ... 58,157
 Topeka, Kan. 43,684
 Trenton, N. J. 96,815
 Troy, N. 76,813
 Utica, N. Y. 74,419
 W. Hoboken, N. J. 35,403
 Waltham, Mass. ... 27,834
 Waterbury, Conn. ... 73,141
 Waterloo, Iowa ... 26,693
 Watertown, N. Y. ... 26,730
 Wheeling, W. Va. ... 41,461
 Wichita, Kan. 52,450
 Wilkes-Barre, Pa. ... 67,105
 Williamsport, Pa. ... 31,860
 Wilmington, Del. ... 87,411
 Wilmington, N. C. 25,748
 Woonsocket, R. I. 38,125
 Yonkers, N. Y. 79,803
 York, Pa. 44,750
 Youngstown, Ohio. 79,066
 Zanesville, Ohio. ... 28,026

JANUARY, 1919

Thursday 30

Friday 31

Saturday February 1, 1919

Memoranda

DECEMBER, 1919

Sunday 28

Monday 29

Tuesday 30

Wednesday 31

TELEPHONE NUMBERS

Name John

Exchange	Number
1	1
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Number

MEMORANDA



CALENDAR, 1920

1920	Sunday	Monday	Tuesday	Wed'day	Th'rsday	Friday	Saturday	1920	Sunday	Monday	Tuesday	Wed'day	Th'rsday	Friday	Saturday
Jan.	...	...	...	...	1	2	3	July	...	...	...	...	1	2	3
	4	5	6	7	8	9	10		4	5	6	7	8	9	10
	11	12	13	14	15	16	17		11	12	13	14	15	16	17
	18	19	20	21	22	23	24		18	19	20	21	22	23	24
	25	26	27	28	29	30	31		25	26	27	28	29	30	31
Feb.	...	...	...	...	...	...	...	Aug.	...	...	...	...	...	...	...
	1	2	3	4	5	6	7		1	2	3	4	5	6	7
	8	9	10	11	12	13	14		8	9	10	11	12	13	14
	15	16	17	18	19	20	21		15	16	17	18	19	20	21
	22	23	24	25	26	27	28		22	23	24	25	26	27	28
	29	...	...	...	...	...	...		29	30	31	...	...	...	...
Mar.	...	1	2	3	4	5	6	Sept.	...	...	...	1	2	3	4
	7	8	9	10	11	12	13		5	6	7	8	9	10	11
	14	15	16	17	18	19	20		12	13	14	15	16	17	18
	21	22	23	24	25	26	27		19	20	21	22	23	24	25
	28	29	30	31	...	...	...		26	27	28	29	30	...	...
April	...	...	...	...	1	2	3	Oct.	...	...	...	...	...	1	2
	4	5	6	7	8	9	10		3	4	5	6	7	8	9
	11	12	13	14	15	16	17		10	11	12	13	14	15	16
	18	19	20	21	22	23	24		17	18	19	20	21	22	23
	25	26	27	28	29	30	...		24	25	26	27	28	29	30
May	...	...	...	...	...	1	...	Nov.	...	...	...	...	...	...	...
	2	3	4	5	6	7	8		...	1	2	3	4	5	6
	9	10	11	12	13	14	15		7	8	9	10	11	12	13
	16	17	18	19	20	21	22		14	15	16	17	18	19	20
	23	24	25	26	27	28	29		21	22	23	24	25	26	27
	30	31	...	...	...	...	...		28	29	30	...	...	...	...
June	...	...	1	2	3	4	5	Dec.	...	...	...	...	1	2	3
	6	7	8	9	10	11	12		5	6	7	8	9	10	11
	13	14	15	16	17	18	19		12	13	14	15	16	17	18
	20	21	22	23	24	25	26		19	20	21	22	23	24	25
	27	28	29	30	...	...	...		26	27	28	29	30	31	...

MADE BY WESTERN NOVELTY CO., MILWAUKEE, WIS.
W. E. WILLIAMS CO., PITTSBURGH, PA. EASTERN AGENTS

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Selected text only that is related to the Cooper Hewitt Electric Co., Hoboken.

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page [1]

The 1919 Diary

Issued by the

Cooper Hewitt Electric Co.

General Office and Works

Eighth and Grand Streets

Hoboken, N. J.

DISTRICT SALES OFFICES

Boston, Mass. 141 Summer Street

Chicago, Ill. 215 Fisher Building

Cincinnati, O. First Nat. Bank Building

Cleveland, O. Engineers Building

Detroit, Mich. Ford Building

Los Angeles, Cal. Keese Engr. Corp.

Milwaukee, Wis. 1011 Majestic Building

Philadelphia, Pa. Drexel Building

Pittsburgh, Pa. Westinghouse Building

St. Louis, Mo. Central Nat. Bank Bldg.

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page 2

Index

Cities, Population of.....46-48

Cities, Ten Largest in the World.. 46

Cities of over 100,000 Population.. 46

Cooper Hewitt Lamps—

Blue Printing, by.....29

Commercial Photography, by... 27

Enlarging, by.....26

Industrial 14-22

Motion Picture Studio Lighting.. 24

Photographic Purposes, for.....	22-23
Photographic Reproduction.....	29
Portrait Studio Lighting, by.....	23
Postal Card Studio Lighting, by	24
Printing, by.....	26
Typical Installations.....	34-38
Electrical Formulae.....	13-14
Light and Illumination, Condensed	
Information on.....	3-13
Map of New York and Vicinity...	30-31
Metric Equivalents.....	45
Parcel Post Rates.....	40
Rates of Postage.....	32-33

Temperature Rise by Resistance.. 38

Useful Information.....39

Weights and Measures.....44-45

Wire Tables.....41-43

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excerpt from page 13

Cooper Hewitt Light Insures a "Flat Production Curve"—This has been demonstrated by fourteen years use in practically every branch of industrial lighting. It is attributed to the fact that the Cooper Hewitt lamp is free from glare, and that the light contains no red rays, which overheat the retina and reduce the sharpness of the image, thereby producing mental and physical fatigue. Cooper Hewitt light has been found to surpass daylight for many purposes where particularly sharp vision is required.

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excerpts from pages 14-15

Cooper Hewitt Electric Lamps

These lamps consist essentially of an exhausted glass tube provided with electrodes at both ends and containing mercury. By the passage of electric current through the tube the mercury is vaporized and rendered luminous.

Cooper Hewitt lamps are of the low pressure, glass tube type and are operated at low temperature with corresponding low temperature of vapor. To obtain the maximum efficiency the glass tubes have to be made 50 inches long for operation in multiple, or two 20-inch tubes operating in series on 110 volts. In either case the tubes are 1 inch in diameter.

In addition to the tubes, which are mounted in reflectors, there is included in the complete lamps the necessary electrical apparatus for starting, and series

accessories for maintaining them in steady operation.

The Cooper Hewitt tube lamps are manufactured for direct current circuits of 110, 220, to 550 volts, and for alternating current circuits of 110, 220, and 440 volts at 25, 40, 50 and 60 cycles.

Cooper Hewitt lamps involve no expense for trimming. The maintenance expense consists in renewing the tubes, which, however, have an average life of about 5000 hours. It is necessary, however, that tubes and reflectors should be cleaned at certain intervals to remove accumulation of dust and dirt.

During the past year improvements in the manufacture of tubes have been such that the average candle power throughout the life of the tubes has been materially increased. During 2000 hours burning the depreciation does not exceed 20 per cent of the initial candle power.

[chart]

Depreciation of Candle Power of Cooper Hewitt Lamps.

Advantages for Factory Lighting

The light produced by the glowing va-15

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text page 16

por in these lamps differs radically from that of all other electric lamps. It contains practically no red rays but is composed of blue, green and yellow rays, thus giving a greenish-blue color. The greatest portion of the visible light lies in the line 546 at the point of the spectrum where the eye is most efficient. These lamps operate at relatively low temperatures at the same time maintaining high penetrative power and in this respect are not duplicated in any other type of lamp.

In industrial plants where Cooper Hewitt lamps are used this peculiar color composition of the light gives important advantages in enabling the eye to see small objects and fine details with the lowest intensity.

- (1) It increases acuity of vision enabling the eye to see small objects and fine details with greater sharpness than ordinary white light.
- (2) It enables the eye to see distinctly with considerable less intensity of illumination, that is, in much dimmer light.
- (3) It is the easiest on the eyes, for the eyes can see with less strain and fatigue, inasmuch as they are not burdened with the red rays which have comparatively little effect in aiding vision but fatigue the eye through their heating action.
- (4) The Cooper Hewitt lamp is the only commercial light source that does not dazzle the eyes when used without any accessory for diffusing its light. At

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text pages 18-19

the same time it produces a comparatively large quantity of light, which it distributes broadly, but below its own level. Hence the lamp can be hung at any distance above the eye up to 40 feet. This fact together with its low intrinsic brilliancy, enables it to be so installed as to remove practically all glare.

In curves shown the one marked A represents the candle power in a plane perpendicular to the axis of the tube, the curve marked B represents the candle power in a plane parallel to the tube axis, while curve C is the mean of both.

Cooper Hewitt Lamps For Industrial Illumination

Length M. L. M. I. lumen

Tube HSP HSP Total per Type Watts Voltage (inches) C. P. C. P. Lumens Watt

Lamps for A. C. Circuits.

F	385	100-460	50	850	0.47	5340	13.9
E	200	100-460	35	400	0.50	2510	12.5

Lamps for D. C. Circuits.

H	193	100-125	21	300	0.64	1880	9.7
---	-----	---------	----	-----	------	------	-----

K	385	100-125	45	700	0.55	4400	11.4
P	385	100-125	50	850	0.48	5340	1b.9
L	220	100-125	35	400	0.55	2510	11.4
PP	770	200-250	50	15000.47	9420	12.3	

Type F Lamp

The type F lamp is made for multiple operation on alternating current circuits. The tube is 50 inches in length, mounted in an enamelled steel reflector. By means of different auto transformers it can be

made to operate on 100-120 volts, 200-240 volts or 400-460 volts at either 25, 40, 50 or 60 cycles.

Type E Lamp

The type E lamp is similar in general construction to the type P lamp and made for multiple operation on alternating current. The tube on the type E lamp is 35 inches long. The outfits are made with auto-transformers for a given voltage range and frequency.

Type H Lamp

The type H lamp operates on direct current only, 2 in series on circuits of 100-125 volts, 4 in series on circuits of 200-250 volts and 9 or 10 in series on circuits of 500 or 600 volts, at a current of $3 \frac{1}{2}$ amperes. It can be started by tilting

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text pages 20-21

it by hand, or automatically by an electro-magnet.

The tube in this lamp is 21 inches long and is equipped with an enamelled metal reflector to distribute the light downward.

Type K Lamp

The type K lamp consists of a tube 45 inches in length, mounted in a suitable reflector. It is lighted by tilting the tube, and can be operated in multiple on 110 volts direct current, or two in series on 220 volts direct current at 3% amperes.

Type P Lamp

The type P lamp is 50 inches in length, mounted in a suitable reflector. This lamp is started automatically by the operation of a shifter which, in connection

with an induction coil, transmits a momentary high static discharge across the tube. This lamp operates on direct current in multiple on 100-125 volts, or two in series on 200-250 volts.

Type L Lamp

The type L lamp is similar in most respects to the type P lamp, except that It has a tube 35 inches long. The type L lamp is also self-lighting and made for operation in multiple on 100-125 volts direct current, or two in series on 200-250 volts direct current.

Type PP Lamp

The type PP lamp is like the type P, except that the PP lamp is equipped with two type P tubes, each 50 inches long, mounted in the reflector-holder. The auxiliary is made for operating the lamp out-

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text pages 22-23

fit on 200 to 250 volts direct current. This lamp lights automatically.

Cooper Hewitt Lamps for Photographic Purposes

Cooper Hewitt light—familiar to everybody as the light for post card portraits made "while you wait"—is by no means

Skylight Frame for Studios

confined to the rush class of photography.

It has long been used in many high class studios where it gives as good results in all respects as can be obtained under the best skylight. It, of course, has the distinct advantage of enabling the photographer to take pictures at all hours, and of making him entirely independent of the weather.

Cooper Hewitt outfits for studio work are made in several different styles, both for alternating and direct current. The largest outfit is equipped with seventeen 50-inch tubes. The smallest outfit consists of one 20-inch tube.

Portrait Studio

For the ordinary portrait studio, a Cooper Hewitt Skylight or Floor Stand equipped with at least five 50-inch tubes should be used. With an outfit so equipped fully timed portraits can be made with a half second exposure. With an eight 50-inch tube outfit this time can be materially reduced.

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text pages 24-25

Postal Card Studio

The ordinary postal card, or all night studio does not require a large volume of light, and with one or two 50-inch Cooper Hewitt tubes mounted on stands, photographs can be taken in minimum time, which will satisfy the public. A single lamp with a curved reflector and a side screen permits the photographer to run his studio day and night. Two lamps give a wider scope for group lighting.

Motion Picture Studios.

For lighting motion picture studios properly a large volume of light is abso-

Floor Stand for Studios.

lutely necessary. With Cooper Hewitt lamps this requires about 100 watts per square foot of stage. A small studio requires approximately five Cooper Hewitt skylights overhead, with three or four floor stands for side lighting; whereas with stages which run about 40 ft. back of the front line about 15 skylights are necessary, with a half dozen floor stands.

For this field the lamps are particularly adapted, as they radiate very little heat, even though 150 or 200 tubes are used over a single stage. Actors can work with comfort and with minimum eye-strain on account of the low intrinsic brilliancy of the light source.

Elevator Stand for Studios

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text pages 26-27

For studios where it is impossible on account of structural details to install an overhead trolley system to carry skylight outfits, so called elevator stands either with or without wings can be furnished. This stand can be raised to a point so that the tubes are 18 ft. from the floor. It consists of a frame containing nine 50-inch tubes controlled by a raising and lowering device and if desired, wings can be added to the sides consisting of 8 additional tubes, making a total of 17 tubes for the entire outfit.

Printing.

The two essentials in photographic printing are speed, and evenness of the print. Both of these requirements Cooper Hewitt tubes meet fully. Short tubes of 20 inches, or even 10 inches if necessary, can be adapted to most of the automatic printing machines when rapid paper is used, and for use with the slower papers longer tubes can be arranged, with racks for holding printing frames. The printing time naturally varies with the density of the negative and the grade of the paper, but it might be said that about 5 seconds is required with the rapid papers, and about 5 minutes with the slower papers, such as platinum.

Enlarging,

By the use of an M-shaped Cooper Hewitt tube, covered with a flashed opal glass or piece of tracing cloth, enlargements can be made from 8 x 10 nega-

tives without the use of condensing lenses.

The high first cost of the lenses and the equally high charge for replacement is

Outfits No. 54 and 64

entirely eliminated. For enlarging from larger size negatives two U-shaped tubes, or even the three are used.

Commercial Photography.

For commercial photography a uniform and always ready light is absolutely necessary. Pictures and prints must be made rapidly and well for advertisements and catalogues. In photographing for catalogue work Cooper Hewitt light

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text pages 28-29

brings out to a wonderful degree the grain in wood or leather, shades and contour of the models, and penetrates into the recesses, reproducing all details accurately.

Floor stands with single tubes mounted on movable stands as shown below are useful in this field.

Outfits No. 47 and 46 For Lighting Copy of All Sorts

Photographic Reproduction.

Photographic reproduction machines have made a place for themselves beside the typewriter for recording and copying documents. Work is done photographically in five minutes that might take from 30 to 60 minutes by longhand or typewriters. Drawings or sketches which might take draftsmen hours to copy or trace are reproduced accurately and authentically in a few minutes.

Cooper Hewitt Outfits No. 47 and 45 used for this class of work consist of one or two tubes mounted on a stand. Outfits are used in pairs, one placed either side of the camera. The tubes in these outfits can be used at any angle between vertical and horizontal as desired. Also the bracket can be raised and lowered. The tubes are lighted automatically and controlled by a snap switch.

Blue-Printing.

Cooper Hewitt lamps are made in various sizes for this extremely important process. The standard 3.5 amperes, 50 inch tube can be used in conjunction with the ordinary flat blue printing frame. For the different types of cylindrical machines there are available 7 to 15 ampere tubes. By the use of two of the latter size tubes, a printing speed of about 6 feet per minute can be obtained.

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excerpt text page 32

Cooper Hewitt Electric Company

The general offices and works of this company are located at 8th and Grand street, Hoboken, N. J. The foregoing map of the lower portion of New York City and the New Jersey shore of the Hudson River shows the location with reference to the railroads, subways, ferry boats and surface lines.

To reach the works take the Hudson Tubes or Ferry to Hoboken Terminal of Delaware, Lackawanna and Western R. R. At this point take car marked Willow and get off at 8th and Clinton Streets. Walk one block west to 8th and Grand Streets. Twenty minutes from Broadway and Cortland Street, New York.

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page 34

Typical Installation of Cooper Hewitt Lamps for Different Classes of Work

Type of Watts per Feet Above Class of Work— Lamp Sq. Ft. Floor

Metal Working Plants

Foundries.

Casting floor	F	.74	11'
Forge shop	F	.74	11'
Forge shop	P	.77	10'
Case hardening	H	.82	12'
Tempering	K	1.28	9'

Machine Shop with Small Tools

Gen.	mach.	wk.	F	.92	12'
Gen.	mach.	wk.	F	1.04	10'
Gen.	mach.	wk.	F	.99	10'
Gen.	mach.	wk.	F	.89	10'
Gen.	mach.	wk.	F	1.05	25'
Gen.	mach.	wk.	F	1.14	15'
Gen.	mach.	wk.	F	1.27	12'
Gen.	mach.	wk.	F	1.35	9'
Gen.	mach.	wk.	F	.85	24'
Gen.	mach.	wk.	F	.94	14'
Gen.	mach.	wk.	F	.91	16'
Gen.	mach.	wk.	F	.82	12'
Gen.	mach.	wk.	F	1.02	30'
Gen.	mach.	wk.	P	.8	12'

Gen. mach. wk.	P	1.23	14'
Gen. mach. wk. PP		.91	25'
Gen. rnach. wk.	L	.85	12'
Automobile pts.	F	.92	13'
Revolver parts	F	.95	10'
Gun parts	P	1.80	12'
Gun parts	P	1.37	12'

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page 35

Gun parts	H	.88	9'
Gun parts	H	.89	9'
Torpedo mfg.	H	1.18	14'
Tool room	F	.8	12'
Tool room	F	.8	10'
Tool room	F	1.48	10'
Tool room	P	.8	14'
Milling machs.	F	1.15	10'
Milling machs.	H	1.09	7'
Reamers	F	1.12	10'
Model making	F	1.12	10'
Screw machs.	P	1.0	12'
Screw machs.	H	.81	8'

Heavy Machine Work

Punch presses	F	.95	9'
Punch presses	F	.83	10'
Punch presses	P	1.07	12'
Grinding	F	1.14	12'
Polishing	F	.8	.12'
Polishing	H	.74	9'
Tank shop	F	.75	12'
Assembling and			
erecting	F	.89	15'
Assembling and			
erecting	F	.77	36'
Assembling and			
erecting	P	.79	16'
Assembling and			
erecting	H	.81	12'
Assembling and			
erecting	H	.94	10'
Assembling and			
erecting	H	.88	9'
Auto eng. tests	F	1.95	12'
Auto eng. tests	F	.9	12'
Inspecting	F	.82	12'

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page 36

Woodworking Plants

Woodwkg. shop	P	1.28	8'
Woodworking	H	.91	10'
Woodworking	H	.96	10'
Carpenter shop	H	.83	10'
Varnish shop	H	.82	10'

Auto Body Finishing F 2.28 8 1/2'

" " P 2.86 8 1/2'

" " P 2.23 7'

Silk Mill

Reeling F	.95	9'
Spinning	F	.8 12'
Spinning	F	1.52 10'
Spinning	P	1.0 12'
Spinning	P	1.47 10'
Spinning	P	1.02 12'
Spinning	K	1.4 10'
Spinning	H	3.02 10'
Silk throwing	F	1.0 ..
Winding	P	1.28 12'

Warping	P	1.11	12'
Warping	P	1.16	12'
Warping	P	1.08	10'
Quill winding	P	1.51	10'
Entering	P	1.65	12'
Weaving	F	1.37	10'
Weaving	P	1.0	14'
Weaving	P	1.27	11'
Weaving	P	1.21	11'
Weaving	P	1.30	11'
Weaving P	& H	1.47	12'
Weaving P	& H	1.18	14'
Weaving P	& H	1.15	8'
Weaving P	& H	1.6	11'
Ribbon loom	H	1.54	9'
Picking P	1.65	12'	

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page 37

Cotton Mill

Twisting P & H 1.68 12'

Weaving P .74 12'

Woolen and Worsted Mills

Winding P	.94	10'
Weaving H	.78	9'
Weaving K	1.13	10'

Knitting Mills

Knittingmachs. P	.94	10'
Stitch. machs. P 1.33		10'
Stitch. machs. P .94		10'

Embroidery Plants

Auto. machines F	.95	14'
Hand machines H	.98	9'

Printing Plants

Comp. room P 2.3		12' -
Comp. room P 1.51		12'
Comp. room P 1.93		10'
Comp. room P & H	1.84	10'
Comp. room PI 1.7		10'
Stereotype rm. P	1.03	12'
Stereotype rm. P	1.77	10'
News. presses H	.84	8'-14'
News. press. P & H	.82	27' .
Job presses P 1.19		12'
Engrav. presses P	1.82	10'

Clothing Manufacturing

Cutters P	1.72	10'
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Hand sewing F	1.74	10'
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Pressing F	1.6	10'
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Power House Lighting

Boiler room F	.61	16'-22'
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Boiler room H	.6	18'
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Boiler room H	1.18	12'
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excerpt page 38

Glass Manufacturing

Lehr inspection P	2.0	12'
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Stripping P	.71	15'
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Final inspection P	1.28	10'
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Machine cut. F	.85	12'
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Shipping and Storage

Shipping dept. P	.49	12'
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Motion Picture

Studios P	100.	8'-	10'
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" "	P 128.	8'-	14'
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" "	P 100.	8'-	15'
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" "	P 99.	8'-	13'
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" "	P 104.	8'-	13'
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" "	P	89.	8'-	12'
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