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View of Night Construction at Site of New Power House, Station 5

GAS AND ELECTRIC NEWS

Vol. 4 OCTOBER, 1916 No. 4

Experiences in Pioneer Electrical Engineering

J. H. VAIL

OUR STORY begins with the period when the first Edison incandescent lamps were in operation, and at a time when some scientists were endeavoring to prove the impossibility of the sub-division of electric current for incandescent lighting. Others were certain that any system of electrical distribution was impossible, and others were skeptical of the possibility of manufacturing electricity on a commercial basis. The subsequent happenings are too numerous to admit of the writer's doing more than touch a few of the high spots.

The following leading scientific criticisms of Edison incandescent lighting appeared about this period—1880:

John T. Sprague:

"Neither Mr. Edison nor anyone else can override the well known laws of Nature and when he is made to say that the same wire which brings you light will also bring you power and heat, there is no difficulty in seeing that more is promised than can possibly be performed. To talk about cooking food by heat derived from electricity is absurd."

Sir William H. Preece:

"Hence the sub-division of the light is an ignis fatuus."

Dr. Paget Higgs:

"Much nonsense has been talked in relation to this subject. Some inventors have claimed the power to 'infinitely divide' the electric current, not knowing, or forgetting, that such a statement is incompatible with the well proven law of conservation of energy."

John Tyndall:

"Knowing something of the intricacy of the practical problem, I should certainly prefer having it in Mr. Edison's hands to having it in mine."

Professor Sylvanus B. Thompson:

"This I can tell you, as the result of all experience, that any system of electric lighting depending on incandescence will utterly fail from an economic point of view, and will be the more uneconomic the more the light is sub-divided."

When these scientific criticisms were appearing Mr. Edison had already enunciated the fundamental principals that have proved of vital importance to the success of incandescent lighting as follows:

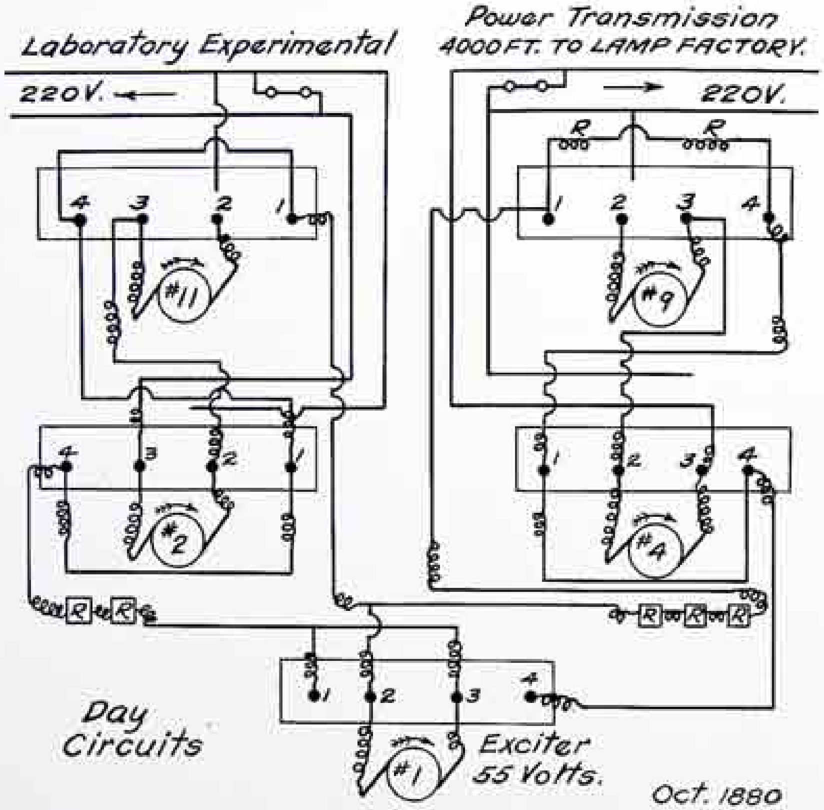
First: Lamps of high resistance.

Second: Generating dynamos of low resistance.

Third: Dynamos and lamps in multiple arc.

These conditions secured the independence of each unit, and also worked to the end of highest efficiency.

The standard of 110 volts was estimated and adopted by Mr. Edison as the best solution of the voltage that could be used to insure the commercial introduction of the incandes-



Figs. 1 and 2. Electrical connections of first Edison dynamos at Menlo Park used to supply power to the Experimental Laboratory, and also to the Lamp Factory.

cent light with a low cost of copper for the distribution system.

At this time Mr. Edison had clearly recorded in his note books, by his own hand, all the fundamental principals of the incandescent lamp, the generation of direct current, and the system of electrical distribution, all of which have made wonderful advances during the past 36 years. It must be borne in mind that we were forced to blaze the trail, there were no guide-posts or pathways, no text books for reference; the general instructions were—"Discover the way and get results." There existed a spirit of loyalty and devotion to the Edison interests that has rarely been attained in other lines of business. On many occasions Mr. Edison very clearly set forth in memoranda, the relative investment costs, and interest charges that should govern locations of stations, electrical conductors and types of lamps used. Amperes and volts were mysteries, kilowatts had not been conceived, indicating instruments, safety and controlling devices were wholly undeveloped.

It was the writer's personal privilege to gain employment with Mr. Edison in June, 1880, near this beginning of the industry, and the job was tackled with the most profound ignorance of the future. We were

at that time endeavoring to illuminate the shops and houses at Menlo Park, N. J., with about five hundred 16-candle-power Edison incandescent lamps, each requiring 110 volts and .83 amperes. It was at this very period that some noted scientists were publishing reasons why incandescent lighting was impossible.

The distribution lines were pairs of bare copper wires laid in a trough made of hemlock boards. The wires were surrounded with a mixture of asphalt and gas tar, and the troughs were laid about six to twelve inches below the surface of the ground—sometimes they were exposed.

Compared with present day practice, the method of installing the service lines to the house, and the interior wiring, was as bad as that of the distribution lines. In the absence of sockets which were an undeveloped article at that time, the lamps were suspended by their terminal wires which were twisted around

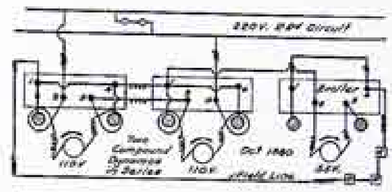


Fig. 3. Connections of dynamos used to supply power to the early Edison electric railway experiments.

the positive and negative lines in the building. There were no switches and the lights started and stopped simultaneously with the operation of the dynamos at the "plant." The only form of house cutout was a tapering brass plug in a split socket.

The original dynamo-room was a barn-like frame structure of 2 by 4 studs enclosed with 6-inch clapboards. The lines of shafting were in the basement. One small steam coil sputtered in spasmodic efforts to distribute a few heat units, and during the winter the temperature in

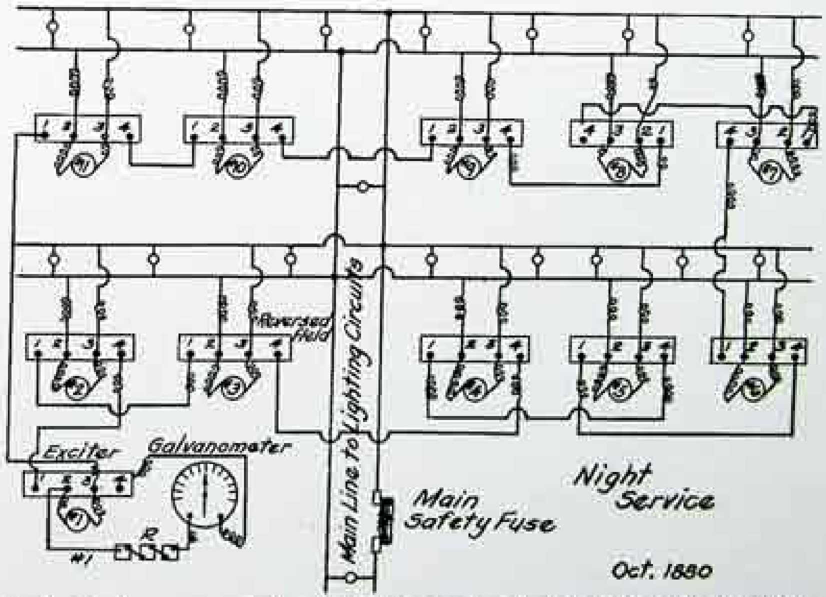


Fig. 4. Ten dynamos connected in multiple with one exciter, as used for the original exhibition lighting (Menlo Park) from 5 P. M. to midnight.

the room fluctuated between zero and 40 degrees. In this dynamo-room were operated fourteen of the first model Edison direct current six horse-power belt driven dynamos operating at 110 volts and 40 amperes. The armatures were frequently smoking hot, the commutators rough, and the copper wire brushes red hot, or fused into solid copper at the ends by vicious sparking.

As the fields, pillow blocks and brush-holder stands were fixed upon 2-inch plank bases, the warping of the wood easily twisted working parts out of alignment and materially assisted in keeping the bearings hot. It will be noticed from Figure 6 that the brush holder stands were of two lengths. A very liberal supply of oil and plenty of ice and snow frequently packed around the bearings, helped to sustain continued operation for a few hours each night from 5 P. M. to 12 P. M. These machines were applied to many varieties of service.

The connections for day use, 7 A. M. to 5 P. M., usually covered three kinds of service as shown in figures 1, 2 and 3. Fig. 4 shows connections for night service.

From these daily operations, experiments, tests and changing of connections, reversed polarities, burned-out armatures, destroyed commutators and fire spitting brushes, one may imagine that the man on duty had a somewhat strenuous experience, and a course of instruction not readily forgotten. All these dynamos were driven by belts from line shafts below the floor. It will be noted from the diagrams that one 55-volt dynamo used as an exciter energized the field circuits of all the dynamos connected in series. Later we learned that the large field cores retained a small amount of residual magnetism, and from this observation was developed the method of self-excitation of fields.

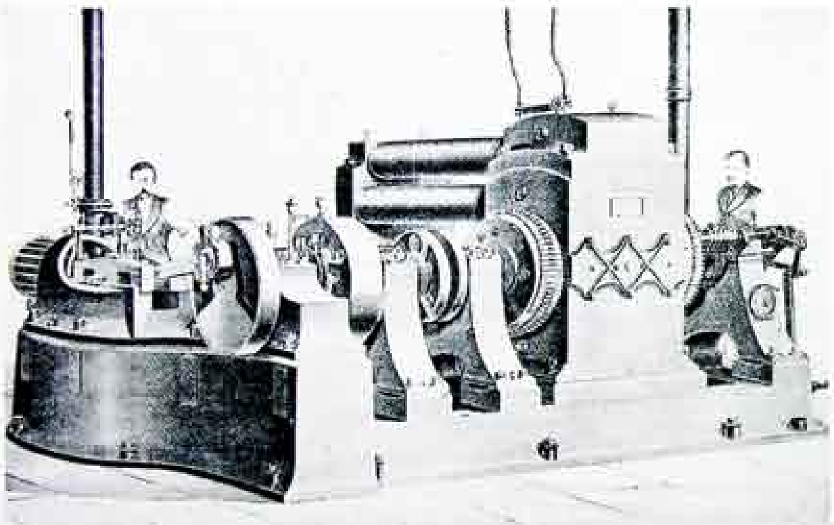


Fig. 5. First Edison engine and dynamo installed at Paris Exhibition in 1889.

Dynamo Brushes. It is worth remembering that the first current collectors were real brushes made of

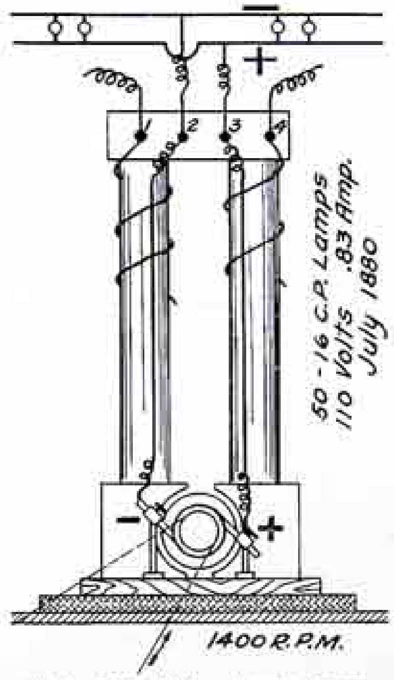


Fig. 6. Original Edison bi-polar dynamo.

hard copper wire. All brushes had to be lifted before the engine was stopped, because a partial reverse revolution would spread the wires. The brushes assisted the sparking, and red hot wire ends fused solid were daily troubles. The next collectors were made with several layers of thin hard rolled sheet copper. In 1889 the carbon collector was first applied to electric railway motors, and later on dynamos, thus assisting in solving some of the troublesome commutator problems.

Incandescent Lamps. The detail history of the Edison lamps would require volumes, but a few salient points will be briefly mentioned.

Mr. Edison's idea was to produce a lamp so cheap that it could be thrown away when its life was exhausted. His analysis of lamp life and relative cost was admirable and excellent in every detail. In 1880 the manufacturing cost of lamps exceeded $1.50 each but the lamps were sold for $1.00. Eighteen years later in 1898 lamps were sold in quantity for 17c each.

It should be remembered that Mr. Edison's first experiments were with lamps having metal filaments,—all known metals of promise were tested and abandoned. Continued experiments covered carbonized cardboard, compositions and fibres. After numerous experiments with platinum, and platinum and iridium, and after a search for carbon filaments, a cotton thread was carbonized. It showed a resistance of 275 ohms, and when tested as a lamp in a vacuum on October 21st, 1879, it burned 45 hours. Then came the search in Japan for bamboo, and for several years the carbonized bamboo filament held supremacy. In 1886 a three-man expedition was sent to South America with the hope of discovering a fibre superior to bamboo. Now after 37 years since the first experiments our most efficient lamps are made with a high resistance metallic filament of tungsten, a metal unknown at the birth of the Edison lamp. Thus do

Fig. 7. Letter from Mr. Edison to Mr. Vail in 1887. Five-wire system discussed.

we see the fulfillment of Mr. Edison's original effort to secure a lamp with metal filament.

For six years the carbon product was reasonably good, but manufacturing perfection fell off until short life, exploding bulbs, blackened globes and numerous other troubles caused an imperative appeal for Mr. Edison's personal attention at the lamp factory, with the result that in 1887 a new lamp was brought out requiring only 60.5 watts for 16 candle-power. These lamps were subjected to the most rigid test under the writer's personal supervision before they were allowed to be supplied to the public.

	Watts per Candlepower
In 1880 the 16 c.p. lamp required 91.3 watts	4.706
In 1887 the 16 c.p. lamp required 60.5 watts	3.75
In 1916 the 20 c.p. lamp requires only 20 watts	1.

In the early years of manufacturing carbon filament lamps the daily product showed variable resistances. All lamps were individually tested at the volts required, to give 16 c. p. and were assorted according to voltage. It was necessary to keep careful records of volts of lamps sent to each customer or central station in order to avoid errors when shipping renewals.

Lamp Sockets. The first lamps were connected directly to the terminal wires,—sockets not having then been developed. The first lamp terminal bases were of wood about 2 inches in diameter cemented on the glass bulb. The first sockets were also of wood about 2¾ inches diameter and 2 inches long. The well-known screw base was developed in 1881, and was followed by frequent improvements and reduction in size until the present perfect type was produced.

Electrical Distribution. At the beginning of incandescent lighting, electric distribution at once became one of the many important problems, because it was evident that the large investment required in copper conductors would handicap the industry. Mr. Edison personally formulated the permissable economic losses in conductors, establishing an average of 2 per cent loss in mains, and 10 per cent loss through feeders under full load, subject to modifications in feeder losses according to cost of power. Later in a memorandum dated May 20, 1887, he suggested that the loss on mains be reduced to 1½ per cent, and increased on feeders 12 to 15 per cent.

Many early tests were made on the several sizes of copper wire to determine current capacity, resistance and rise in temperature under increasing loads. The beginning of dangerous temperatures was ascertained by the carbonizing of thin cotton covering. From these tests a series of constants were prepared for quickly estimating sectional area of conductors for given load and distance.

It is interesting to note the method used at that time for laying out a new distribution system. In advance of preparing plans for a new system of distribution, men were sent to make a complete canvass of the town, recording all gas jets and oil lamps in use. All of this data was plotted on a map so that the sizes of mains and feeders could be calculated.

Engines. No small difficulty was encountered in the effort to secure engines of suitable speed and sufficiently close regulation for dynamo service. The public now accepts without complaint the pulsation from 25-cycle systems, whereas in 1882 it would not have been tolerated. Engine builders strove to produce an engine acceptable in all details. The Armington & Sims Engine Company, Providence, Rhode Island, was eminently successful to such an extent that in 18 years over 3,000 engines of this type were used in addition to many of other models.

To be continued.

Development and Manufacture of Incandescent Lamps

IT IS hard for many of us to picture conditions as they existed over 37 years ago. In our mad rush for efficiency, and in the face of the enormous strides of twentieth century inventions and public demands we fail to grasp the real significance of the many things that add to the comfort of our every day life. Light is one of the most important factors in life, and we as Central Station employees should be acquainted with some of the history and manufacture of the incandescent lamp.

Speaking of his Historical Collection of Incandescent Lamps, before the New York Electrical Society, Mr. W. J. Hammer said in part:

"In the year 1810, Sir Humphrey Davy, with his famous battery of 2000 cells and his pieces of willow charcoal, formed a 4-inch electric bow or "arc" and this experiment laid the foundation for all subsequent "arc" lighting systems. It is interesting to note that he was also founder of incandescent electric lighting, as he at this early period made both platinum and carbon incandescent by means of his famous battery....The first English patent on the incandescent electric lamp was that of De Moleyns in 1841.... Mr. J. W. Starr, a young man from Cincinnati, Ohio, in 1845 took out a patent thru his English attorney, King, in whose name the patent appears, for a lamp consisting of a strip of graphite in a Torricellian vacuum. In 1858 Gardner and Blossom took out the first American patent in this field, it being for a platinum lamp to be used for a railway signal lamp.

"Many men subsequently contributed to the Art, among those of an early period being Konn, Kosloff, Bouliguine, Lodyguine, Changy, Staite, Fontaine, Draper, Adams, Watson, Farmer, Roberts, Sawyer, Maxium and others; and it is but right that we should keep these names green in our memory because their work was work of importance even though it did not directly result in the establishment of the *commercial* incandescent electric lamp."

Speaking of his entrance into the field of electric lighting, Edison has said: "The idea struck me all of a sudden in 1878. In those days there was an outfit of one or two arcs traveling with a circus. It was easy to see what electric lighting needed—it wanted to be sub-divided. The light was too bright and too big, what we wanted was little lights, and to distribute them to people's houses like gas." Edison wanted to develop a lamp that would be cheap, and that could be thrown away when burned out.

This is the task that Edison set for himself. It meant that he had to develop a whole system—dynamos, and auxiliaries, distribution systems, lamps—everything in fact from the coal pile to the lamp. All these ideas were revolutionary! When Edison's inventions along these lines were brought out, as Mr. Vail pointed out in the previous article, the scientific world, the magazines and the newspapers vied with each other in condemning the inventor and proving mathematically that his system was fundamentally impossible.

In the face of all this adverse criticism, Edison pursued the even tenor of his way, investigating and experimenting; for as Edison says, "Impossible is an impossible word." Day after day and far into the watches of the night he and his associates adhered to their researches, snatching hasty meals at odd times and sleeping vicariously among the mops and buckets in the closet under the stairs, or stretched exhausted on some

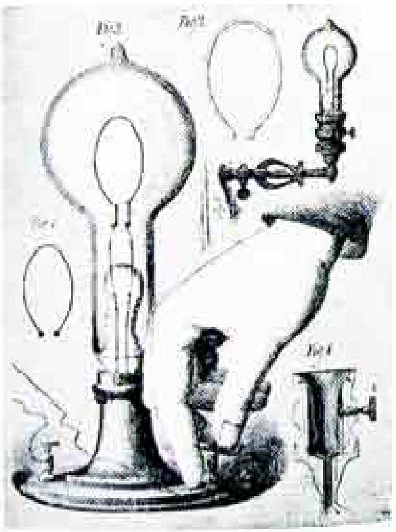
laboratory table. The purpose was to discover some material that would stand the high temperature necessary to secure the desired brightness of incandescence without losing its mechanical strength, and which would also under these conditions maintain its stability in the shape of a "filament" for a considerable length of time.

On October 21, 1879, Edison made his first successful attempt to burn a carbonized cotton thread as a filament in an all-glass globe, exhausted to a high vacuum. Thus was the commercial incandescent lamp born, and of the hour of victory Edison says! "We sat and looked, and the lamp continued to burn, and the longer it burned the more fascinated we were. None of us could go to bed, and there was no sleep for over forty hours. We sat and just watched it with anxiety and growing elation."

Of the investigation that was carried on before a suitable lamp

ly said, "We saw that carbon was what we wanted. The next question was, what kind of carbon? I began to try various things and finally carbonized a strip of bamboo from a Japanese fan, and found what we were seeking."

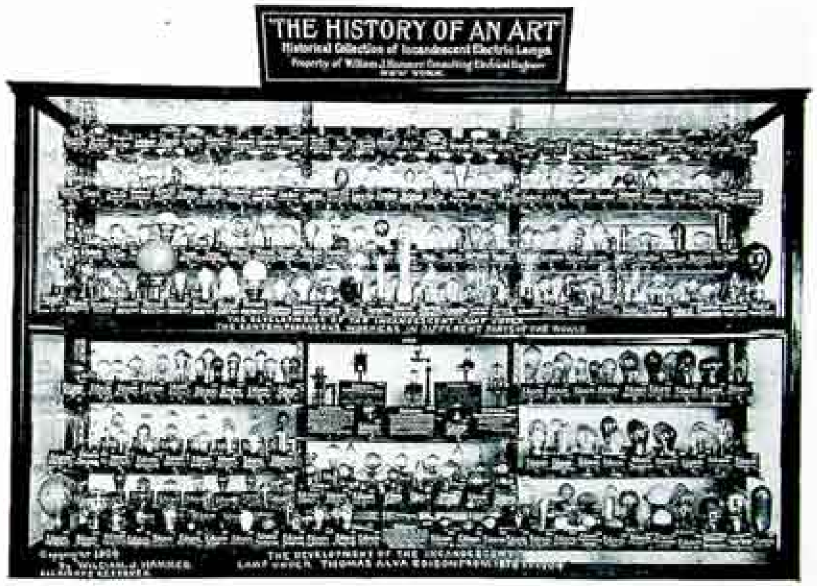
The patent records show what some of these "various substances" were. Ceaseless experiments—thousands of them. Edison's notebooks show that even 50,000 tests of the same thing, in the same way, were almost casual. Some of the substances experimented upon were electric arc light carbon made into paste and rolled into threads, cotton thread, vulcanized fiber, carbonized flax, threads made of lamp black and tar, soft paper, fish line, various combinations of paper and tar, linen, cardboard, celluloid, box-wood, cocoanut-hair and shell, shavings from hickory, bay wood, rose wood and a thousand or more other varieties of wood, lamp wick, punk, cork, bamboo fiber. These are but a few of the substances



Edison's first carbon filament lamp. From article in "Scientific American" announcing the invention of Edison "Horse Shoe Lamp."

investigated. The practical filament was found in the fiber growing just under the outside hard surface of a certain variety of bamboo. Imagine the almost endless search that was carried on before such an unlikely material could be discovered. There is said to be 3000 varieties of bamboo—400 of which are of some particular use. Edison gutted the terrestrial sphere of its supplies—China, Japan, Brazil, Cuba, Jamaica, Florida,

rial would stand. Metals were tried but they were not a success because at that time chemistry was not able to produce a metal sufficiently pure to stand the high temperatures demanded. Carbon does not melt at high temperatures but evaporates just as water does at ordinary temperatures. Upon evaporation it deposits upon the globe and blackens it. The "squirted filament" of artificial carbon is made by dissolving ab-



Part of magnificent collection of incandescent electric lamps formed by Mr. Hammer during 34 years, and comprising over 1000 specimens. The collection is in 5 large glass cases located in the Engineering Societies' Building, New York City.

South America and Far Cathay were all rifled.

For nearly ten years the Edison lamp was made with "bamboo filament" and to that lamp must be attributed in large degree the marvelous development of electric lighting. The carbon filament was eventually displaced by the "squirted filament" of artificial carbon. Edison chose carbon for his filaments because of the high temperature that this mate-

sorbent cotton in a chemical solution producing a thick syrup which is squirted through a platinum die into a solution of wood alcohol to harden and give a uniform cross section to the filament. After the filament is thoroughly washed it is wound upon large drums and the moisture allowed to evaporate, thus leaving a dry and fairly strong fibre. It is then wound upon forms to give the filaments their desired shape, packed in air tight crucible with charcoal and placed in a furnace. This completes the carbonizing of the filament.

Such a filament is of a porous nature and evaporates very quickly. Different forms of carbon show different evaporations; the carbon deposited from gasoline vapor for instance, can be run at higher temperatures than the ordinary carbonized filament without too rapid evaporation and blackening, thus improving the efficiency. This treating process is accomplished by depositing a dense form of carbon on the base carbon filament by passing a high electric current through the filament in the presence of a hydro carbon (gasoline) vapor. The heat generated decomposes the vapor, depositing a dense form of carbon on the filament so that the filament becomes somewhat similar in appearance to a rubber covered wire, the base carbon representing the wire and the coating the rubber insulation.

The treating process takes place in four successive steps:

(1) The air is exhausted (2) Benzine vapor is admitted (3) Current is applied to filament (4) The treated filament is taken out and replaced by untreated filament.

After the filaments are treated they are very carefully inspected for irregularities, defects, bad shapes, etc., and are then measured and cut.

About 1892 an improvement was made in the carbon filament by the introduction of the metallized carbon or "Gem" filament. This filament is made by taking the regular untreated carbon filament and subjecting it to the enormously high temperatures in a carbon tube (electric) furnace, thus converting the base filament into a more dense form. The filament is then treated as is the carbon filament and is again placed in the electric furnace to make the coating still more dense, thus forming "metallic carbon" which has the properties of a metal, and is more stable and permits of higher temperatures and efficiencies. This is the metallized filament.

All metals, even tungsten, melt at a lower temperature than carbon. However, the evaporation of even the "metallic carbon" is much higher at the same high temperature than that of some metals like tungsten, tantalum and osmium. With these metals we can go much nearer to their melting point without getting serious evaporation, they can be run at higher temperatures and so higher efficiencies are obtained.

Osmium was introduced first and gave 1.5 watts per candle, but osmium is such a rare metal that all the osmium ever found on earth would hardly be enough to supply the demand of incandescent lamps for more than a few weeks.

Tantalum was tried, and it gave two watts per candle (Gem lamp 2.5 watts per candle). Although tantalum can be found in large quantities, it is so scattered and in such percentages that it is most expensive to separate.

Tungsten is most difficult to get perfectly pure and to handle in form, so it took enormous work and research to get the present tungsten filament. Tungsten stands a higher temperature than osmium and therefore it is possible to run these lamps at a higher efficiency. The tungsten wire is made by compressing particles of pure tungsten under hydraulic pressure until the billet thus formed may be repeatedly fired and swedged to such a point that its character changes sufficiently to permit its being drawn through diamond dies. Tungsten in this form is very ductile and has a high tensile strength even greater than piano wire. A piece of tungsten the size of a lead pencil contains enough material for about five miles of filament for 40-watt lamps. Its melting point is about 3200° C.

The present Edison Mazda vacuum (Type B) lamps are made as follows:

Stem. This consists of a glass tube through which the leading-in wires are run. The tube is flared at one end where it will eventually be joined to the neck of the bulb, while at the other end it is pressed about the leading-in wires, forming an air-tight seal. At the time this seal is made a cane glass hub is welded to the stem. The purpose of this hub is to support and insulate the anchors on which the filament will be draped.

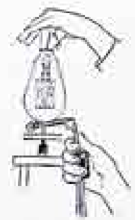
Mount. After the insertion of the anchors the proper diameter of tungsten wire is selected for the filament, depending on the amperes desired and this is cut to the proper length for the voltage required. One end is clamped to one of the leading-in wires and the filament is wound back and forth over the anchors until the end meets and is clamped to the other leading-in wire. This gives us the "complete mount."

Bulb. The manufacture of the bulbs is a complete industry in itself, requiring large plants and skilled glass blowers. As received from the glass works, the bulbs have considerable superfluous glass at the neck which has to be cut off.

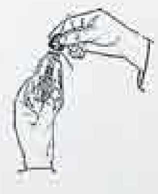
Tubulation. The process of tubulation consists in first melting a hole in the rounded end of the bulb. The exhaust tube is then welded to the bulb at this point; care being taken to maintain a free air passage so that later on the air may be pumped out through this tube.

Sealing-in. The tubulated bulb is then placed over the completed mount, both being held in their proper relative positions. Bunsen flames are applied at the neck of the bulb, and both the bulb and mount are rotated slowly until the neck of the bulb is welded to the flare of the stem tube. The seal thus formed at the neck of the bulb must be absolutely air-tight.

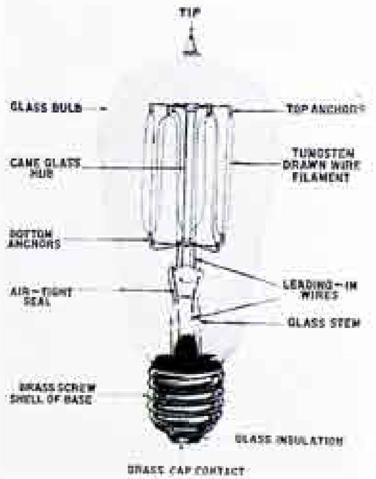
Exhaust. The exhaust tube is connected up to a vacuum pump and all air exhausted from the lamp. At the same time that this is being done the lamp is enclosed in an oven which is heated to a high temperature. When the exhaust is complete, the lamp is sealed off, forming a tip which almost everyone has noticed on incandescent lamps.



Basing. After exhausting, the lamp is based. One of the leading-in wires is brought down through and soldered to a cap at the end of the base. This cap is insulated from the shell by black glass. The other leading-in wire is soldered to the brass shell. We now have the completed lamp.



Gas Filled Lamps. Within the last few years there has been developed a new type (Type C) of Mazda lamp, in which the bulb, after being exhausted is filled with an inert gas (nitrogen) which is introduced at such a pressure that during the opera-



Complete Mazda Type B lamp with explanation of parts.

tion of the lamp it reaches about ten to fourteen pounds per square inch. The increased pressure raises the boiling point of the metal and therefore the filament can be run at a much hotter temperature before getting the same evaporation (causing blackening of globe) that would be obtained in a vacuum. Higher radiation efficiency is obtained, but this is partly offset by the loss due to heat convection.

The estimated temperatures of the filaments of different vacuum lamps are as follows:

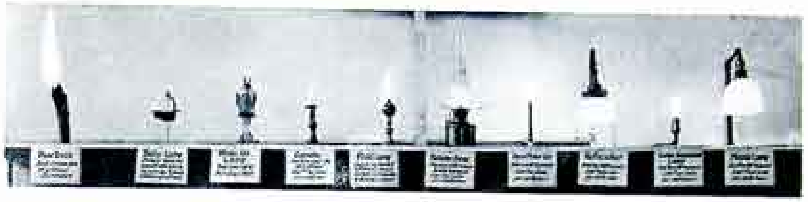
Carbon	3.5	watts per candle	1800° C.
Carbon	3.1	" " "	1900° C.
Tantalum	2.	" " "	1930° C.
Tungsten	1.25	" " "	2025° C.
Tungsten	1.	" " "	2100° C.
Tungsten	0.6	" " "	2350° C.

The drawn tungsten filament of the new units is wound on a mandrel to form a closely coiled helical spring which is mounted on the anchors as shown. The number of turns to the inch, space between each turn and other similar problems are highly important in perfecting this type of lamp. The purpose of the coiling is to prevent rapid cooling of the filament by the circulation of the gas in the bulb.

Life Test. With an incandescent lamp, leaving out initial rating and appearance, quality means the life of the lamp which is obtained at certain efficiencies. The testing for this life naturally destroys the lamp, and it is impossible to arrive at results hurriedly because it takes considerable time. A life of 1000 hours for instance means about 42 days of continuous burning. Life testing embraces the periodic selection at random of lamps of various types, an electric time recording device determines the actual life of each lamp, the voltage is regulated to within ¼ of 1 per cent, photometers measure the candle power, and many miles of copper wire is required for wiring up thousands of sockets. Many thousands of lamps are destroyed each year on life test, and in doing so an enormous amount of electric energy is consumed.

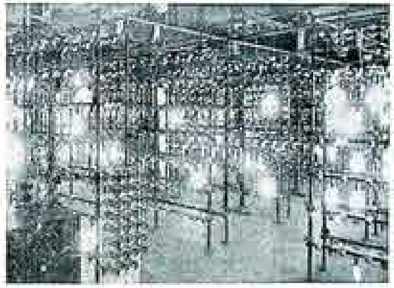
There are about forty different operations through which a lamp must pass before it is complete; some are complex and technical, others tedious and difficult. Some of the operations in the manufacture of the lamp require the highest skill; again some are of such a nature that a few seconds

Gas (nitrogen) filled lamp Type C.



"Progress in the Art of Illumination." A display made by this Company several years ago.

or even one second variation in the time, or a few degrees variation in temperature, will ruin the lamp. The vacuum is obtained to a degree undreamed of a few years ago.



Life testing room at Edison Lamp Works.

Although Edison lamps are manufactured at the rate of over 300 a minute at the present time, every working day of the year, the bulb must average a specified thickness from which it may not vary 0.006 inch; the filament may not vary from a definite diameter in any particular lamp more than 1/100,000 of an inch; the glass tubing must not vary in diameter 0.45 millimeters; the basing cement is prepared according to chemical formula which must not vary from fixed proportions. All Edison Mazda Lamps are made up in accordance with standard specifications; the rating of each lamp sold is decided upon only after careful investigation of the many different factors involved.

When one considers that every building, and practically every residence, that trains, boats, electric cars, automobiles, mines, streets and highways are equipped with electric lights which are now as common as the air we breathe, it is almost a miracle that all this development should have taken place in such a short time. Expensive laboratories are maintained and intensive research is continually in progress. Innumerable problems are investigated by experts who in some cases devote 5 to 10 years on one detail. These are some of the hidden forces many of us do not appreciate.

From one incandescent lamp 37 years ago the industry has grown so that now it is estimated that over 125,000,000 lamps are connected to central station circuits. Three hundred Edison Lamps alone are manufactured every minute. Who can grasp the possibilities of the future?

An Interesting Advertisement taken from "Electrical World" of 1885.

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Engineering and Construction
Homer C. Deffenbaugh

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Do Something

Every milestone along the various pathways of success has been monumented by thousands of earnest men and women, and many of those who have achieved success have carefully pointed out the ladder by which they climbed. The strong have given us the secret of how to get and keep well, while the powerful and the rich have explained their various methods. Those who are admired constantly radiate the truth upon which their popularity depends. These methods and this knowledge have been the common property of all classes of society for ages. The migration of individuals, which has been constantly underway from and between the classes, has been facilitated or retarded according to the individual use or disuse of this universal fund of knowledge.

There is presented in these pages from time to time various expositions of these fundamental facts which have been selected for their forcefulness, their sympathetic insight, and their originality. To many these appeal as simply, "the same old bunk,"and for this class the present article is written.

Successful men in general don't write "bunk," and hints which come to us from them should not be lightly cast aside.

The degree of earnestness with which we desire success will determine the intensity with which we accept truthful criticism and root out our own weaknesses. It will also determine the degree of courage and persistency with which we will apply the truths of experience to ourselves.

The keynote, however, is "Do Something." To whatever extent one accepts the preceding, its acceptance even in part requires action. Action now—initiative action made up of reflection and execution. In general, self-improvement must be made in order that we may realize the success to which our talents entitle us. Each year—how they do fly!—we are that much older and consequently have greater difficulty in adapting ourselves to changing conditions and in throwing off bad habits. Keep a firm but open mind.

Night School Work

Now that summer with its heat and vacations has passed, and fall with its stimulating weather has arrived, most of us are making plans for the winter months—especially evenings. There are many things that we have "put off," there are books we intend to read, something we are going to make, or perhaps it is a particular subject we want to study. We are especially fortunate to live in a city with so many good institutions of learning. Many of these schools including the public schools, conduct courses at night so that those who are unable to attend during the daytime, may pursue their studies after working hours.

The public schools are offering courses of every description to meet the demands of both men and women, and many thousand make use of this exceptional opportunity each year. The fee is only a dollar, and it is returned if the student attends 80 per cent of the classes. An announcement of the courses can be obtained at the Municipal Building, or the editors would be glad to furnish them upon request.

Success Through Effort

"Men give me credit for some genius. All the genius I have lies in this: When I have a subject in hand, I study it profoundly. Day and night it is before me. I explore it in all its bearings. My mind becomes pervaded with it. Then the effort which I have made is what people are pleased to call the fruit of genius. It is the fruit of labor and thought."—*Alexander Hamilton.*

Some achieve success and distinction because fortunately endowed with natural ability and peculiar talent. Those who do are few. Most great achievements in all the fields of human endeavor are rather the result of perseverance and well-directed energy than natural ability and peculiar talent. Success that can be easily acquired is not the kind of success that has spelled universal progress. Hamilton in his day was a powerful illustration of energy specially applied, the sort that in the present era of specialization has become a necessary attribute of success. Just as new economic forces have produced concentration of previously disintegrated units of capital and labor in specialized effort and intense division of functions in production, distribution and exchange, so these new forces have compelled a concentration of individual initiative to a specialization of effort. To know one's task in all its details is the "fruit of labor and thought." Even the one of genius must labor and think to give to the world the product of his genius. Edison, the greatest inventor of his age, has contributed to the benefit and comfort of all mankind the practical results of his genius only after an intense and patient exercise of labor and thought. Oftentimes the potential powers of genius, like the potential power of an unused waterfall, idly consume their energy in practical possibilities because neither wisely conserved nor well directed. The man who studies his business, profession or trade "profoundly and explores it in all its bearings" wins the greatest success. The man who hopes to succeed by chance loses by ignorance.—*Pacific Light and Power Co. Bulletin.*

Lamp Delivery by Parcel Post

H. C. MARQUARDT

IT WAS thirty-six years ago when Mr. F. R. Upton, a pioneer in the electrical industry, went from Menlo Park, New Jersey, to New York City having on his arm a market basket containing all the incandescent lamps in the world. These lamps were fragile and precious! A year after that Mr. Upton was manager of the first lamp factory—a thousand lamps were finished each day—and a thousand lamps or the day's product had to be shipped each day. The packing troubles were severe enough, but there were also many ludicrous incidents to help brighten the dark spots. A story is told of a shipment of lamps which was sent to a customer with the usual memorandum which in this case read: "100 lamps, 110 volts." The customer returned the memorandum with this note written at the foot, "Lamps received but cannot find the volts in the package."

Shipping and delivery problems of the carbon lamps were reduced to a minimum after the manufacturers learned how to pack them. However it was only about ten years ago that the metal filament lamps were put on the market and they had to be handled more carefully than eggs on account of the fragile filaments. Shipping and delivery difficulties were again a prominent factor, and one would start breathing normally only after the lamp was in the socket and burning. The quality of the filament was soon bettered however, until now it will withstand many severe shocks without breaking. The methods of packing for shipment also changed until now there is practically no breakage of filament or globe from the time the lamp leaves the factory until it reaches the customer.

After the lamps arrive in Rochester it is necessary to distribute them to this Company's customers. A large percentage of the lamps are sold over the counter, but there are still large numbers which have to be delivered. For a long time the lamps were delivered by an electric truck. When the parcel post was put into effect a few years ago many industries took advantage of its favorable points. This Company, which was one of the first Utility Companies to use this method for lamp delivery, has been using the parcel post for delivering lamps since July 1st, 1915, and the results have more than justified its use.

The cost per lamp by this means of delivery has shown a decided reduction over the former method of electric auto delivery. All orders are checked, packed, wrapped and delivered to the postoffice the same day they are received, for delivery the following day. By using pre-cancelled stamps any packages re-

ceived at the postoffice before 9 A. M. are delivered that same day. In order to obtain the privilege of using pre-cancelled stamps, an application blank must be filled out at the postoffice, and then forwarded by the Postmaster to the proper department in Washington for approval. The approval is not difficult to secure if the reasons for desiring it are strong enough. The elimination of all unnecessary handling, pounding during cancellation, shaking and jarring during sorting, are reasons that speak in favor of the pre-cancelled stamps.

The type of men employed by the Government in this service is as a rule different from the usual delivery service drivers. They are very careful, use good judgment, and they show great pains in performing their work. In fact, the postoffice has cooperated in every possible way to insure prompt and safe delivery. On one occasion they returned a package with a broken lamp, thus enabling the Company to replace the lamp, and save both time and inconvenience for the customer.

This Company delivered 26,000 lamps by parcel post during the first four months. In the first few weeks about twenty lamps were broken. This, upon investigation, showed carelessness in packing rather than in handling during transit, and since that time there has been little or no breakage. Even during the last Christmas holiday season with the usual rush at the postoffice, reports show prompt deliveries, and no complaints from customers on failure to receive lamps. The only breakage recorded was one lamp for this period, while an average of 500 lamps a day were being delivered.

The method of packing at first, was to enclose the cartons as received from the Edison Lamp Works in single backed corrugated cardboard for re-inforcement, and then to wrap with the usual strong wrapping paper and tie with a stout twine. Now, however, the Company uses a heavy corrugated carton in a range of two sizes, (3x6x 11⅞ inches, 6x6x 11⅞ inches), which require only tying with a strong twine, and the pasting on the address in the form of a sticker which is part of the original order blank upon which the order for lamps is taken. These cartons did cost about two cents each, but are cheaper and quicker than the less expensive cardboard which had to be cut and fitted on each package before the package was wrapped with paper and tied. Recent quotations on corrugated boxes show an increase of over 100 per cent with the possibility of going still higher. As a result the Company may have to resort to the old method of packing in order to keep the cost of delivery within reason. The total cost per lamp delivered over a period of time, averages about one and one-half cents. The postage represents approximately one-half of this, and the remaining half is divided between packing, material and labor.

The average total cost per package is about ten cents, and each package contains an approximate average of eleven lamps. This round figure of $.015 a lamp for delivery was exceeded by automobile expense alone, without figuring in the wages of the operators.

A few of the packages ready to be taken to P. O. at end of day

Triangulation Survey at Station 5

NORMAN H. GUINTER

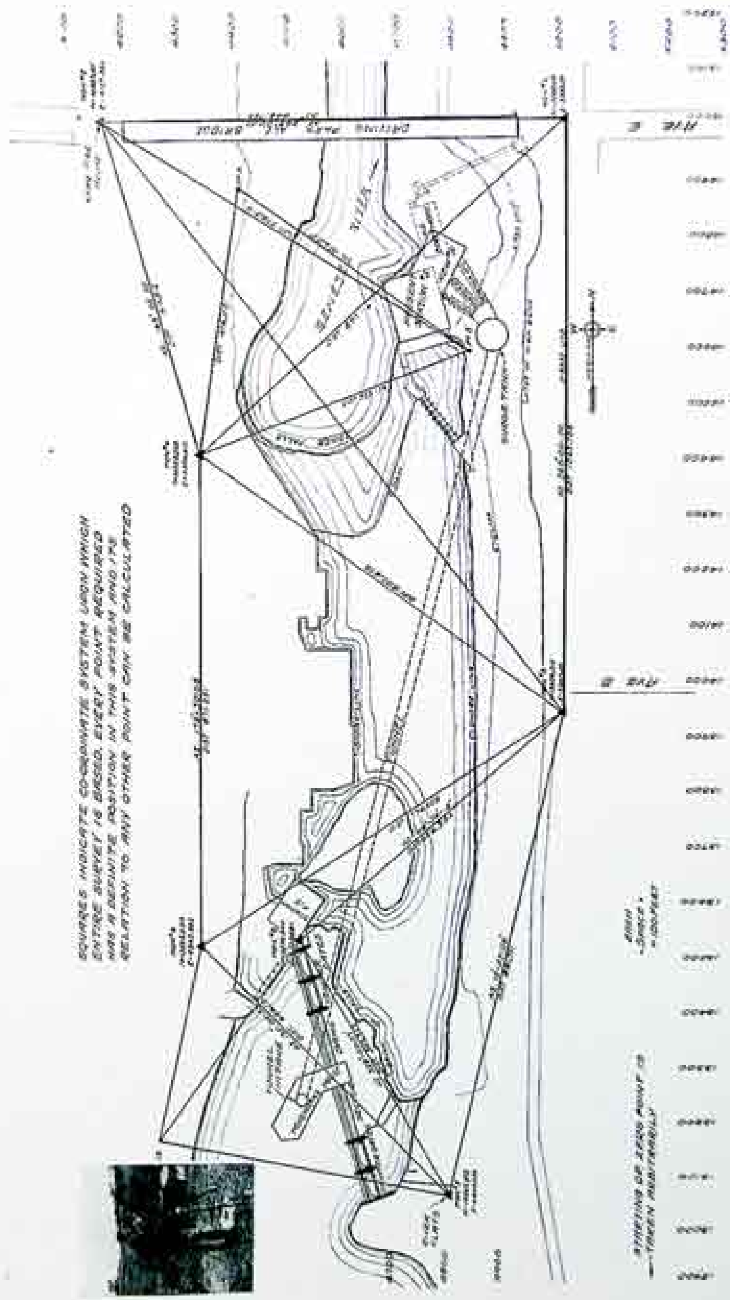
THE work now being done in connection with the Station No. 5 Improvement consists of the building of a tunnel, dam, intake house, surge tank, penstocks, power house and appurtenances, to be located in and beneath the bed of the Genesee River, between Driving Park Avenue on the north, and the dam at the Middle Falls on the south, covering in all an area of about 26 acres. In order to lay out this work, an accurate triangulation survey was necessary for the reason that the work extended from one side of the river to the other and direct measurements made with a tape were impracticable.

A triangulation consists of the actual measurement of a mathematical triangle or series of triangles, defined on the ground by points or monuments at the vertices or intersections of the sides. Straight line figures can be reduced to triangles. A triangle consists of six parts, viz., three sides and three angles and according to the principles of trigonometry when any three of these parts are known the others can be computed. A triangulation then embraces the location of a triangle on the ground where at least one side can be accurately measured with a tape, and the measurement of all the angles by means of a transit instrument furnishes the additional data required. From this observed data the lengths of the sides not susceptible of measurement are calculated, resulting in the determination of the relative positions of the monuments. When one triangle has been so measured, it is a simple matter to extend the system of measurement and calculation through adjacent triangles, and finally when a sufficient number of such have been measured, the actual construction work is laid out from them.

At Station 5, a reconnaissance or preliminary examination was first made of the area to be surveyed, with a view to the best possible location of base lines and triangulation stations. These were selected so that the sights for the instruments would be unobstructed, the triangles as nearly equilateral as possible and situated to the best advantage in locating the construction work. Seven triangulation stations were selected, three on the east bank of the river, three on the west bank and one on Station 15, thus forming a polygon of six sides, as shown in Figure 1. Each station was marked with a concrete monument, the exact point being marked by a small punch hole in a copper plug set in the concrete.

The angles were measured by repetition in sets of twenty, ten turned direct and ten turned reversed. For purposes of illustration this may be considered analagous to several measurements of a short line say four and a fraction feet long, with a tape, starting the second measurement on the tape at four and a fraction feet, where the first one left off, and so on. When the line had been measured twenty times in this way the twentieth measurement coming near the 100 ft. end, the measurements would be reversed, gradually working back on the tape to the zero or beginning end. An average of all these measurements would be an accurate determination of the length of the line. A reading is recorded for the initial angle or first measurement and also for each ten repetitions. The arithmetical mean of each ten repetitions was compared with the value of the initial angle. Sixty or more measurements were taken on each angle in all triangles.

The error of closure or the amount by which the angles failed to meet the geometric requirements was zero

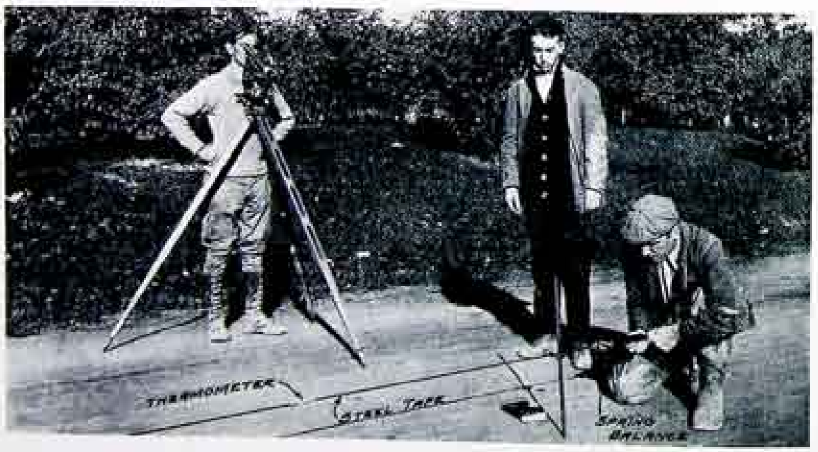


Map showing general layout of new construction work at Station 5. Lines of triangulation survey and seven points where monuments are located, are also shown.

on the skeleton or outline figure and therefore no adjustment was necessary. The error of closure in the individual triangles varied from 2 to 8 seconds, thus requiring very little adjustment.

The base line measurements were made with a 100-foot steel tape which had been compared with the standards of the United States. Points were set on the base line a little less than 100 feet apart and the distance between them was measured with the tape supported on iron standards at intervals of 20 feet and stretched with a tension of 15½ lbs. avoirdupois applied with a spring balance. Four or more readings were taken at each point, reading each end of the tape to 0.001 of a foot. Corrections were made for temperature and for reduction to a horizontal or level line. Two determinations of the length of the "base line" were obtained, the corrected lengths being 1063.788 feet. The base line was assumed to be a

Precise measurement of "base line": Note standards used to keep tape level. Spring balance used so that pull on tape will always be the same as under original U. S. test. Thermometer attached to tape so temperature correction can be made.



Spring balance shows about 15 pounds pull; man at instrument is reading the measurement on the tape

true meridian, or north and south line, and the angular variation therefrom, or the azimuth of each line of the triangles was calculated. The length of each side was then computed from the base line measurement to 0.001 of a foot. The latitude and departure, *i. e.*, the distance north or south and east or west from the north end of the base line, was calculated for each triangulation station and co-ordinated to 0.001 of a foot.

Auxiliary points were located in convenient places as the work progressed, the same methods being used, and the same accuracy being obtained. Bench marks or points of known elevation were established and their elevations were determined by a number of runs or series of measurements made from independent "bench marks" of known value located on each side of the river. These runs were brought together at each end and the differences averaged. All measurements of elevation or readings were taken to 0.001 of a foot.

The results so far obtained from the preliminary work as described above, are sufficiently accurate to permit the exact laying out of the work now in progress. The surveying work will be repeated several times during the progress of the job and a final determination of all points will ultimately be made.

In boring holes beneath a river as is being done in this case, an enormous loss might be sustained through a small error in position. This warrants great care on the part of careful and experienced men. It is often pleasant in viewing the spectacular feats of the construction forces, to remember that back of the dynamite and steel are the intangible mathematical lines traced by the surveying instruments which guide these mighty forces.

Safety of the Family

Do your children play in the streets where automobiles and street cars are passing? Warn them to be careful.

Does your little boy hook on wagons? You may save his life by telling him of the danger of such a practice.

Do the children cross the car tracks while going to school or church? Teach them to stop, look and listen.

Does your boy ride a bicycle? Tell him of the dangers, especially of those at the street inter-section and along street car tracks.

Are you careful about extinguishing the burning match when you light your pipe? Many disastrous conflagrations are due to such negligence.

Have you an open grate in your house? Warn the little tots about the danger. Tell them about the case of the child you knew who was burned to death by such a cause, or better still, install a screen in front of your grate.

Is there a pile of rubbish in the basement or attic? Remove such fire hazards. Many fires are caused by the spontaneous combustion of rubbish or old papers.

Have you any leaky gas fixtures about the home? See that they are promptly repaired.

Be careful with the vessels of scalding hot water on the floor or on the table or stove. The baby may be scalded.

Do you keep carbolic acid and poisonous medicines in the medicine chest? Mistakes will happen. Remove them to a place where they will not be so readily accessible.

Have you a broken ladder about your home? Repair it or destroy it.

Do the children play on the roof of the buildings about your home? Warn them of the danger of falling.

Do you know of dangerous conditions in your neighborhood? Report them to the proper persons.

Women's Club October Party on Main Floor of Office Building

Women's Club October Party

On Thursday evening, October 5th, the main floor of the office building wore an unusually gay and festive aspect. Long tables which were attractively decorated with beautiful flowers and set with tempting dainties occupied most of the floor space—conspicuous among them being the Bridal Table. About sixty happy-looking, hungry girls of the Women's Club were eagerly watching a screen which had been placed in the doorway at the foot of the stairs. Suddenly the strains of the Wedding March burst joyously forth, the screen vanished and through the door appeared the "Bridal Party." Two fair maidens in yellow, two in pink and two in blue, and then came the Bride leaning on the arm of the stalwart, handsome groom, Miss Skinner.

When the "Bridal Party" was seated, the famished girls partook of a delicious supper. After the pangs of hunger had been more than appeased, Miss Atkinson, President of the Club, presented to the Bride a purse of gold, with the sincere good wishes of friends and co-workers in the office, and voiced the sentiments of all present when she said that she was exceedingly sorry that the Company was about to lose Mrs. Gay, but was very glad that the Club would not lose her.

Then followed a variety shower, each parcel bearing an appropriate or funny couplet which Mrs. Gay read aloud for the edification of the girls. When the shower was over, Mrs. Kate Myers took her place at the piano, rendering so artistically and entrancingly the various One-Steps, etc., that all felt compelled to "Trip the light fantastic." Special Norwegian dances were imported for the occasion. The "Skatalinganinginen" whirl was introduced and bids fair to be the most popular dance of the coming season.

After a very enjoyable evening, the party broke up and all went to watch the soldiers returning in parade.

ERRATA

Under "Commercial Duplicator No. 2" on page 43 August issue:

The compound is 15 feet long, not 9.

Number of impressions from one roll depends upon kind of work, size of forms, and number of copies from one original.

Up to 25 copies from one original each portion of surface of roll can be used 90 times. For more than 25 copies, 30 to 60 times.

100 copies can be made from one original, instead of 30 copies from one impression as stated.

Gas and Electricity in the Home

BY THE GAS DEMONSTRATORS

Mrs. Gabrielle Gay, Miss Frances E. Moore, and Miss Mona A. Pratt

Textile Talk

MISS WALSH

THE HOME is the greatest factor in the happiness of the race, and in it woman's part is supreme. As she becomes wiser in selection and purchase the home will increase in value. The ability to use money wisely has not increased as rapidly as wealth. The production of wealth as heretofore occupied mankind's attention to the exclusion of the best way to use it.

This is the season of the year when the house-wife does her shopping for the winter, and to do it wisely she must study the service of each textile.

Some hints in regard to textile buying.

(a) Have a knowledge of standard cloths, well-known mixed goods and adulterated materials.

(b) Know the approximate width and prices of standard materials in order to be able to compare them with the cheaper and also the finer grades.

(c) Have exact knowledge of the amount of material required for a garment and do not rely on the salesman for information.

(d) Have a certain sum to spend and spend no more.

(e) Know what materials and colors wear and look best.

(f) Remember the use to which the garment or cloth is to be subjected, also its laundering and wearing qualities.

(g) Try to keep harmony in your clothes, it counts in taste and economy.

(h) Don't buy cheap flimsy things if you want them to wear well and look attractive.

(i) Look for imperfections in cloth.

(j) Always have a sample when matching material.

(k) Buy one good garment instead of two cheap ones.

(l) Remember bargains are not always economy.

(m) Buy when necessary—not because something attracts you.

(n) Buy firm lace and embroidery.

(o) Buy good substantial shoes.

(p) Pay cash for your purchase, charge accounts are a convenience but are oftentimes a mistake and cause extravagance.

Teach your dollars sense (cents).

Heavy Quality.

A good way to test the endurance of any material is to press the thumbs together on the cloth and then pull the material straight out, first warp way and then filling way. If it tears or frays in either direction it shows a lack of strength.

To discover if material will bear strain in the seams, the threads of the warp and woof should be tested to see if they move easily. If they can be pushed with the finger nails without difficulty and are thin and brittle, the material is not strong. Another way to test material for strain is to weave a needle in and out of the double of the material as if making a tuck and then drawing the cloth away from each side of the needle; if a row of holes shows clearly alongside of the needle the material will not bear strain. Soft silks which are good otherwise will sometimes draw in the seams, and should be made up into garments that will be subjected to a small amount of strain.

Fastness to Friction or Rubbing.

Rub the colored goods briskly over a clean white handkerchief. If the handkerchief is discolored in anyway it shows that the color in the fabric is not fast to friction and therefore the goods is not suitable for lining material.

Weighting.

By rubbing between fingers white goods that are suspected of being weighted with starch, clay or other heavy material will often reveal the weighting substances in the form of dust. When tearing causes dust to fly this may be taken as a sign of heavy weighting.

Weaving test.

Close, even firm weaves are usually enduring. Loose and open ones are apt to catch on small obstructions, to pull out of shape and look shabby.

Test for continued use.

Expose material to sun and air for a couple of weeks on a window ledge or roof and cover one-half of the sample with a card. The sun, air, rain and changing atmosphere will effect the part that is not covered and will indicate the result to be expected from continued use.

For spotting.

Some materials are finished in such a way that they spot easily with water, and must be sponged or washed before making up. These should be tested by dropping water on a sample before purchasing the cloth.

Test to determine whether wool will turn shiny.

The shun or shiny surface on worn wool fabrics is due to the fact that the loose fibers, fuzz or nap is pressed down or worn off thereby completely exposing only the surface of fibers lying lengthwise in the yarn of which the fabric is composed. Cloths made from the long, lustrous, straight fibers are more liable to turn shiny than shorter, softer and more crinkly wools, there being fewer ends exposed. If loose fibers are simply pressed down they may be raised, removing the shine by steaming, and rubbing with a similar material and then pressing carefully. Dark colored or hard-woven fabrics seem to become shiny more easily.

Feminine Facts and Fancies

Laundering of Woolen Goods.

Woolen goods can be cleansed by washing in warm water with soap solution or soap bark. A soap solution is made by simmering, not boiling, one cake of soap in two cups of water. Soap bark is prepared for use by putting five cents worth in a few quarts of water. After it has stood an hour, strain it and pour into the luke-warm water in which material is to be washed. Wash and rinse carefully, always rinsing in the same warm temperature as the washing so as not to shrink by sudden shock. Bath temperature is about right. Press cloth on the wrong side when almost dry or with damp cheesecloth on right side.

Dry Cleaning at Home.

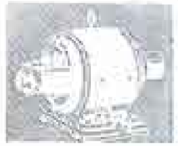
Make a stock solution of eight ounces strong ammonia, half an ounce of chloroform and half an ounce of ether. Cork tightly. Keep solution away from the face. Dissolve a bar of naphtha soap in three gallons of hot water, add half a teaspoonful each of baking soda, salt and alum and three tablespoonsful of the ammonia, chloroform and ether mixture.

To clean Oriental or other rugs to their original brightness make a lather and dip a scrub brush in it, shaking out superfluous water. Go over the rug with this brush, and the lather dries almost immediately. No harm whatever is done to best rug.

To sponge spots from clothing, delicate silk and upholstery, dip a soft sponge in the lather, wring as dry as possible and sponge off the spot.

To wash sweaters, blankets or other flannels let the mixture become nearly cold, soak the garments in it half an hour or less, squeeze dry, rinse in clear water, squeeze dry again and hang up.

The various ingredients used not only remove grease and dirt, but set and brighten colors.



Sales

The Use of Electricity in a Modern Sausage Factory

H. O. STEWART

An Up-to-Date installation of sausage-making machinery has just been completed by the Rochester Packing & Cold Storage Company at its Maple Street plant.

The old machinery was operated from an engine driven line shaft, whereas each of the new machines is direct-connected to an induction motor. The meat grinder is direct-connected to a 15-horsepower motor, the cutter is driven by a 20-horsepower motor, and the mixing machine requires a 7½-horsepower motor.

Typical motor-driven cutter used in sausage factory.

The method of making sausage is approximately as follows:

The meat is first fed into the grinder at the rate of 2,500 pounds per hour. It then goes through the cutter, and from there to the mixing machine, where it is seasoned.

The cutter as shown in the cut, has a semi-spherical bowl which revolves in a horizontal plane at a slow rate of speed, while the three knives under the protecting hood marked "43," revolve many hundred revolutions a minute in a vertical plane. Where sausage is made in small quantities it is possible to season it in the cutting machine, but where large quantities are made it is best to put the meat in the mixing machine which merely consists of a revolving bowl equipped with paddles.

The mixture is transferred from the mixing machine to a large cylinder equipped with a piston to force the mixture out into the sausage casings which are drawn on the proper sized tube mounted on the end of the cylinder. The casings are of various diameters and lengths, those of smaller diameter being used for small sausages and vice versa. The stuffed casing is then twisted at regular intervals to make the separate links or sausages.

The sausages are made at the rate of 200 per minute by each of the two filling machines. The wiener and bologna sausages, are smoked, steamed, cooled off and packed for shipment. The pork and liver sausages are not smoked, but otherwise go through the same processes as the other types.

It is expected that the new installation will materially reduce the cost of sausage making and pay for itself in a short time. Previous to the installation of the new motors there were several motors aggregating 30 horsepower in this packing company, so that the total motor load is now more than 70-horsepower.

Henry Wray & Sons, manufacturers of brass specialties, have just closed a contract with this company to run a 6-inch gas service and to install the necessary piping for the distribution of gas in their foundries and machine shops. They will require for immediate use sufficient gas to supply a tilting furnace of 500 pounds' capacity, a large annealing furnace, a tempering furnace, a tinning furnace and several bench forges and blow torches. As soon as their new building is completed they intend to equip all their crucible furnaces for gas. Henry Wray & Sons are pioneers in brass foundry work and from their experience they find that gas is the best fuel to use to melt brass. They have considered the use of gas from the stand-points of safety, efficiency, cleanliness, convenience and cost, and they feel that the over-all economy is higher than with the use of any other fuel.

❖

There has been erected in the shops at the Company's Front Street yards a soft-metal furnace of 3,500 pounds' capacity. This furnace was designed primarily to melt stereotype metal used in newspaper work but it may also be used for melting lead, tin, zinc, etc. From tests and experiments it has been found that this furnace will well compete with coal or coke-fired soft-metal furnaces. The principle of the design of this furnace is as follows:

The flame, instead of being located directly beneath the pot, is so arranged as to whirl around the pot, thus giving a uniform and efficient distribution of the heat. The flue gases, instead of going up the stack at a temperature of from 600 to 900 degrees, as they do in coal or coke-fired furnaces, are reduced to a temperature of from 100 to 170 degrees. This is done by pre-heating the air through a series of coils located between the stack and the furnace.

❖

The Menihan Shoe Company has agreed to try this Company's electric service for the additional power load of 30 to 40 KW that would have been placed on their power plant by the machines in a recent addition to the factory. During an investigation it was found that 230 V, AC service was carried on a 4-wire system, thereby subjecting the lights to 133 V. An auto transformer will be installed at slight expense, so that the lamps will operate at 115 V, thus resulting in considerable increase in the life of the lamps, with a decrease in annual cost of lamp re-placements.

❖

The saving in labor and maintenance together with the elimination of the engine and boiler, have been the means of changing a number of steam

Two-thirds-yard concrete mixer belted to 10 H.P. motor under platform. This is an ideal drive, especially where safety and efficiency are important factors.

driven concrete mixers to electric motor drive. The illustration shows a ⅔-yard Smith concrete mixer belted to a 10-horsepower motor. The motor was placed under the loading platform and does not occupy space of any value.

❖

The use of electric motors for excavation and construction work has increased very rapidly during the last five years. All of the big jobs in and about Rochester are electric motored. During 1916 over 3000 horsepower in motors has been used on this class of work. These facts show that the contractor has found the electric motor to be far superior to the steam engine. In connection with this, it might be stated that the Company has purchased two single-drum, one-ton electric hoists to help meet the persistent demand for the rental of these machines for building construction work. The Company's stock now consists of five single-drum and two-double drum hoists.

❖

A large paper mill is now being erected just outside of East Rochester by Messrs. M. J. Lawless and D. F. Lawless. The mill is on Irondequoit Creek just north of the N. Y. Central Railroad. All of the machinery except the variable speed part of the paper machine will be motor driven. The total electric load will be approximately 250-horsepower and will consist of one or two large motors and several small ones. A description of this plant will be given in a future issue of the magazine.

❖

Mr. Chas. E. Sager is building a new one-story garage, 100 ft. x 144 ft., at the corner of Culver and Blossom Roads. The battery room and repair shop will occupy a space 100′ x 20′. The converting equipment (AC to DC 120V) will consist of 1-30 KW, and 1-15 KW Martin Rotary Converter. This will be the first large converter installation in this city and it is expected to give excellent satisfaction both regarding efficiency and simplicity of operation.

❖

An additional 30 KW load is being connected to the Cluett, Peabody & Company's service. Their total load will be increased thereby to 125 KW.

❖

Some Recent Gas Installations

The Rochester Club has purchased a complete gas equipment for its new kitchen, to replace the coal ranges. It consists of a 3-section hotel range, baker's oven, coffee urns, steam vegetable cooker, stock kettle, waffle irons, cake griddle and Rex Ray surface combustion broiler.

❖

The Davis Machine Tool Company has installed in its tool room a large hardening and annealing furnace, and also a cyanide hardening furnace. Increased efficiency.

❖

The Eisler Manufacturing Company has installed a hardening furnace and a bench forge for annealing, hardening and tempering tools. Economy means larger dividends.

❖

The Nazareth Academy has purchased gas hotel ranges, coffee urns, cocoa urns, steam tables, vegetable steamers, and broilers for its new kitchen.

❖

Mr. Harry Jee, 316 East Main Street, has purchased a complete gas equipment for his new chop suey restaurant.

❖

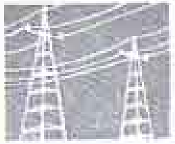
The Unitube Auto Radiator Co. has installed six more soldering furnaces. Business is growing.

❖

The Odd Fellows' Temple is installing gas ranges in its kitchen.

❖

The New Central Hotel has installed a large gas range and broiler.



Electric Distribution

Meeting of Electric Distribution Branch of the Empire State Gas and Electric Association

F. C. ALCOTT

THE meeting was opened by Mr. E. J. West, Vice-President of the Adirondack Electric Power Corporation and President of the Glens Falls Chamber of Commerce, who gave a very interesting talk on what the Central Station man owes the public and by "Golden Rule" treatment gain the confidence and co-operation of those he serves.

At the close of Mr. West's address, Mr. J. O. Montignani of the Rochester Railway & Light Company, read a paper relative to Lightning Protection on Overhead Lines. The paper dealt very thoroughly with the latest principles and theories advanced by electric engineers and manufacturers on the protection of overhead lines. Mr. Montignani laid stress on the fact that the proper placing of lightning arresters, the exposure of the line, and the application of the overhead ground wire were very important factors to be considered, when protecting distribution circuits and transmission lines.

The discussion brought out the feasibility of placing lightning arresters at each individual transformer. The Rochester Railway and Light Company is at present following this plan of protection, keeping a very careful record of the results obtained. These will be valuable to member companies in considering lightning protection for future installations.

The subject of Poles and Cross-arm Inspection and Renewing Preservative Treatment, etc., was one with which all attending members were thoroughly acquainted. The discussion seemed to show but little variation in the method in which the different companies treated preserved cross-arms and poles. Carboleneum was the preservative most commonly used and the brush, or dip treatment, the common method of applying. As there had been no attempt made to keep records of the life of a treated or untreated pole or cross-arm by attending members, no definite conclusion could be reached as to the prolonged working life of a treated pole or cross-arm, as against the untreated; but the unanimous opinion was that the extended life of a treated pole more than offset the cost of treatment. Each member closed his discussion by emphasizing the necessity of properly weather-seasoning all cross-arms by allowing them to stand at least six months before applying the preservative.

Through the inability of Mr. Adam Gunn of the Buffalo General Electric Company to attend, the subject of Sector Cable was not thoroughly discussed. Mr. Gunn prepared a very interesting paper on this subject, which was read by Mr. A. J. Wagner of the Rochester Railway and Light Co. At present the Buffalo General Electric Company has installed and in operation about 100,000 feet of three-conductor sector cable, which has proved very satisfactory. The principle reasons advanced for its use against the present circular type conductor, is that in taking into consideration a three-inch tile duct, a cable of the sector

type of much larger current capacity and with a larger surface for the radiation of heat can be drawn in, in place of the circular conductor used in the past.

The methods pursued by the different companies in answering trouble complaints, depend upon the number of complaints and territory covered by the particular company. In the larger companies whose territory of service covers a wide area, men are kept constantly at the Line Department Office to take care of this class of complaints. The smaller companies depend upon finding one of their men at home and directing him to the particular location from whence the complaint came.

The subject of allowing customers to re-fuse their service should a fuse become defective, was considered by some as good policy. The majority however, thought that too great a hazard was involved.

This meeting had the same informal aspect and freedom from timidity as those held in the past and the writer feels that the future success of this branch of the Empire State Gas and Electric Association in a measure depends upon the continuity of this feature.

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The operation of a steam shovel near the Company's lines on the Barge Canal necessitated the raising of the conductors on the 60,000 volt Niagara transmission line which follows the Lehigh Valley Right-of-Way from Mortimer to Station 33. Two thirty-five foot wooden poles were bolted to each tower which carries the conductors over the canal, thereby increasing the clearance about twenty-five feet.

The change was made under the supervision of Mr. Seth Creighton, Foreman of the Line Department.

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The work of installing the tie line from Station 6 to Station 1 has been completed after six weeks' work. This tie line was obtained by removing "No. 410" which constituted a tie line between Station 6 and Station 33. The cable is three-conductor, 250,000 C M, 11,000 volts, the total length being 12,000 ft.

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On Wednesday, August 30th, Rochester experienced very severe lightning conditions which resulted in over 400 trouble complaints. These complaints were marked O. K. on the log book in the Line Department by three p. m., except a small number of very serious complaints which necessitated two crews working throughout the night.

❖

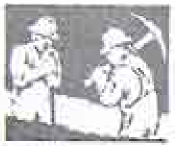
The installation of fifty 300 watt class-I lamps between North Street and Culver Road on University Avenue has been completed.

Electric Generation

Due to the fact that the river has been very low during the summer and early fall, a large part of the load had to be carried by the steam stations. September was another record breaking month for generation at Station 3. During the month, 6,350,525 KWH. were generated in this station, making the total for August and September approximately, 12,400,000 KWH or 700,000 KWH. more than was generated by steam in the entire year of 1915.

Approximately 8000 tons of coal were burned to evaporate 70,000 tons of water. 2.275 pounds of coal were used per KWH. For treating the water used for boiler feed, the station used ten tons of lime, fourteen tons of soda ash and one and a quarter tons of iron sulphate. Six and a half thousand tons of steam were sent out to the Company's steam customers, the remaining 63½ thousand tons being used for electric generation.

Gas Distribution



In order to lessen the amount of condensation in the 8″ gas service that supplies one of the Bausch and Lomb buildings it was necessary to change the line from the 24″ main which acts as the inlet to No. 9 Gas Holder, to a 30″ outlet main. Inasmuch as this is the main low pressure feed line of the city, it was necessary to tap the main instead of making a cut out in order to place a tee. In order not to shut off the gas supply it was necessary to by-pass from the 30″ main to the 8″ service while raising the end of the latter to make a suitable connection. This was accomplished without seriously interrupting the usual supply.

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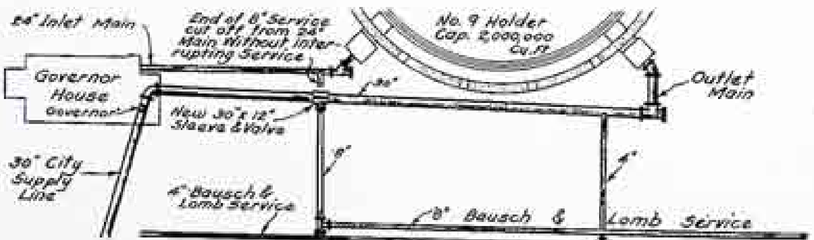
Another good use has been found for reinforced concrete. Hereafter, it will be used to support gas mains where they cross sewer trenches and other wide excavations. It has always been the custom to use a brick or stone pier which costs a great deal, especially for the labor involved. Reinforced concrete posts, 6″ or 7″ thick, of any desired length can be made up in any number at a considerable saving. The concrete is also a stronger support.



A drilling machine, which is a unique device for tapping water or gas mains with practically no escape of water or gas, was procured from the Rochester Water Works Department for this purpose. A combination sleeve and valve is first leaded on over the main at the desired point. The drilling machine is then bolted on to the valve which is opened so that a circular cut can be made in the pipe. When the hole is cut through the pipe the machine draws out the cut part, the valve is closed and the operation is completed. In the above instance the whole procedure was entirely successful, there being no noticeable escape of gas. A 12″ x 8″ reducer was placed on the 12″ valve and the 8″ service was connected directly into the reducer and cut off at the 24″ main, as shown in the accompanying cut.

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Prompt work on the part of the Street Department prevented a serious leak of gas at the corner of East Main Street and North Union Street on September 13th. The New York State Railway's Company was making track repairs, and the concrete was being removed by a machine which was not only very effective as a concrete breaker, but also as a pipe breaker. A six-inch gas main was cracked in two places because it was buried somewhat shallower than is usually the case. With the aid of the "Gasco Protector," the new respirator, the breaks were finally located and the leak repaired. It was necessary to cut off the main and insert a new section of pipe.

Booster Pump on East Rochester Gas Main

WM. H. EARLE

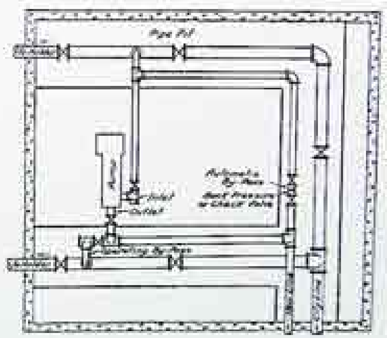
In conjunction with the recently completed gas main extending from the Holder at Blossom Road to the communities to the east of the city, a high pressure gas pump or "booster" was installed to insure adequate pressure on the new line at all times. The unit consists of a pump built by the Connersville Blower Company and classified by them as an 8 x 15 Boston Type High Pressure Gas Pump, direct connected to a 15 H.P. A.C. motor.

The booster has a displacement of 1.1 cubic feet per revolution and with the motor operating at 570 revolutions per minute the rated capacity of the unit is 37,620 cubic feet per hour. Allowing 15% slippage of gas around the pump blades, the capacity is reduced to approximately 30,000 cubic feet per hour. The pump is designed to operate against an outlet pressure up to five pounds per square inch.

The hourly delivery of the pump is probably greater than the 24-hour load on the mains at the present time. With this condition in mind, the builders equipped the pump with an inch and a half by-pass, and a counter-balanced diaphragm regulating valve. The by-pass and the regulator which may be set to operate at any established pressure, are designed to automatically take from the outlet side of the pump all gas in excess of the demand on the line and discharge it on the inlet side of the pump. Considering the difference between the capacity of the pump and its present duty, it is obvious that the by-pass must handle a large proportion of the gas at all times and during certain hours of minimum load it might have to take care of the entire delivery from the pump.

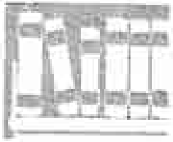
The heat of compression induced by forcing so large a volume of gas through the 1½″ by-pass at high velocity, was so great that the pump bearings and casing became too hot to touch. To overcome this condition, a secondary six-inch (the same as the pump connections) by-pass and valve was installed to discharge the excess gas into a sixteen-inch holder inlet connection which conveys the excess gas back into the holder, where any heat which may be created is dissipated, and the pump in turn has a steady supply of cool gas to work on. The unit has been operating continuously for several weeks, with a constant pressure on the main, and there has been no tendency to heat. The valve on the six-inch by-pass is partially open at all times, and occasional hand control is sufficient to maintain a constant pressure.

To further insure continuity of service and safety to consumers, it was necessary to provide against failure of the pump due to a break in the electrical service, or of the mechanical parts by installing a second six-inch by-pass to connect the outlet of the holder with the outlet of the pump. The by-pass is equipped with a valve which will automatically open at any time when the pressure on the main drops below the holder pressure.



Piping connections of "Booster Pump" on East Rochester gas main.

Auditing



Monthly Report on New Business

Net Increase in Consumers in First Eight Months of 1916

	Dec. 31, 1915	Aug. 31, 1916	Increase
Gas	69,090	71,574	2,484
Electric	19,664	21,276	1,612
Steam	41	43	2
	88,795	92,893	4,098

Net Increase in Consumers in Twelve Months Ending August 31st, 1916

	Aug. 31, 1915	Aug. 31, 1916	Increase
Gas	68,306	71,574	3,268
Electric	18,497	21,276	2,779
Steam	37	43	6
	86,840	92,893	6,053

Statement of Consumers by Departments as of August 31st

July 31st	Gas	Electric	Steam	Total	Increase each yr.
1908	39,281	5,531	....	44,812	
1909	42,777	6,058	....	48,835	4,023
1910	48,318	7,151	...	55,469	6,634
1911	53,453	8,567	16	62,036	6,567
1912	57,831	10,454	19	68,304	6,268
1913	62,957	13,188	22	76,167	7,863
1914	66,550	15,242	30	81,822	5,655
1915	68,360	18,497	37	86,840	5,018
1916	71,574	21,276	43	92,893	6,053
Inc. in 8 Yrs.	32,293	15,745	43	48,081	48,081

Increase in Consumers by Months

	1914	1915	1916
Increase in January	228	364	252
Increase in February	231	144	219
Increase in March	281	247	317
Increase in April	469	460	654
Increase in May	564	306	716
Increase in June	451	544	613
Increase in July	426 (Dec)	132	584
Increase in August	619	421	743
	3,269	2,354	4,098

Company' Savings Depositors

STATEMENT TO OCT. 1ST, 1916

No. of depositors Sept. 1, 1916	73
Decrease during Sept. 1916	2
Amount deposited during Sept	$798.17
Increase over Aug. deposits	63.75

Miscellaneous Data

	Aug. 31, 1915	Aug. 31, 1916	Increase
Miles of Gas Main	429	439	10
Miles of Underground Cable	1,006	1,048	42
Miles of Overhead Line	1,683	1,796	113
Miles of Subway Duct	883	937	54
No. of Street Arc Lamps	4,335	4,092 (Dec.)	243
No. of Street Incandescent Lamps	3,856	4,700	844
Total No. of St. Lamps	8,191	8,792	601
No. of Employees	1,102	1,225	123
Amt. of Payroll (Mo.)	$87,119.59	$103,879.65	$16,760.06

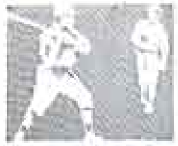
Employees' Benevolent Association

Statement to Sept. 30, 1916

Receipts		
Bal. on hand 1st of month		$1,957.79
Dues—Members	$482.03	
Dues—Company	482.03	
Assessment No. 3—Mem.	.50	
Assessment No. 4—Mem.	157.50	
Assessment No. 3—Com.	.50	
Group Life Insurance	8.56	$1,131.12
Total		$3,088.91
Disbursements		
Sick Benefits	$271.29	
Accidents off Duty Ben.	46.23	
Accidents on Duty Ben.	40.50	
Group Life Ins.	131.62	
Medical Examiner's Exp.	18.00	
Mem. Additional Life Ins.	38.88	$546.52
Bal. on hand Oct. 1, 1916		$2,542.39

Membership

Membership August 31st, 1916	756
Affiliated during month of Sept.	2
Unaffiliated during month of Sept.	13
Loss	11
Membership Sept. 30th, 1916	745



Athletics

Final Standings of the Clubs

	Won	Lost	P.C.
Kodak Park	12	3	.800
R. R. and L.	10	5	.667
Nationals	10	5	.667
Eagles	7	8	.467
Maltops	6	9	.400
Independents	0	15	.000

A Successful Season

The baseball team tied with the Nationals for 2nd place in the City League, by defeating them in the final game of the season, score 10–4. The game was featured by heavy batting of the Company's team, viz., 17 hits among which were several long distance drives. Kircher who twirled against the Champion Kodaks the previous week and held them to low score for championship, was knocked out of the box in the 4th inning.

The season was a most successful one, considering that it was the first attempt of the boys to compete in Semi-Pro ball. The Kodak team was the only team to win a series from the Lighters. Eagles, conquerors of the Kodaks were severely trounced by us in each of the three games, constituting a series; also three games were taken from the Independents, two from the Maltops and two from the Nationals. Ray Connell, the Iron Man holds a pitching record in the City League, viz., on two occasions, he struck out 14 opponents and he pitched also two double headers in consecutive games.

Standing: J. Stokes, Mg'r; L. Groh, M. Friedman, R. Guppy, Capt.; R. Connell, F. Rapp, S. Peartree, H. Habel, Chas. Walker, Scorer; Sitting: Lavine, Webber, Brown and Flynn. Durbin, 2nd base, not in picture.

Personals

Annual Gas Shop Clam Bake

On Saturday, September 16th, about fifty employees of the Gas Shop together with Supt. Frank Hellen and Mr. F. Knapp, Manager of the Pittsburgh Water Heater Company, held their second annual clam bake at Point Pleasant. Baseball was the main diversion during the afternoon. Dinner was announced at 5 P.M. and it certainly didn't take the boys long to sit down to an excellent menu of clam chowder, blue fish, fried chicken, sweet potatoes and clams. It is said, that long after all others had finished Dick Hoddick, Bud Harrington and W. Spears remained at the table until clam shells were heaped mountain high. Bud finally won out with a mark of 146. He said he was unable to do himself justice owing to a late lunch.

During the evening several of the boys entertained the crowd with singing. Pat Maher's Irish melodies and Paul Bitzke's German songs were the leaders. At the close Ransom Barlow rendered the "A Perfect Day."

Jos. Matthews and Chester Schlenker were in charge of the arrangements and are to be congratulated.

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Mr. Geo. Meyers, lamp counter salesman at Main Office, has returned from his vacation.

Mr. John J. Schwan and Mr. Wm. E. Griffith have been employed in the Meter Reading Department.

Mr. I. Milow, of the Domestic Sales Department, has been transferred to the Collection Group.

Mr. Robert Mullen, of the Domestic Sales Dept., is away on his vacation.

Mr. J. McCormick who sustained a crushed rib, has returned to work after being absent for two weeks.

Mrs. Moore, mother of Mr. C. E. Moore, of the Power Consumers' Department, died Monday, September 18, 1916.

Mr. C. Sprague, of Station 35, believes that the Adirondack Mountains afford all the opportunities for a very beneficial vacation.

Mr. J. Martin, formerly with the Brooklyn Gas and Electric Company, has been employed in the Order Group.

Mr. Marquardt is to be congratulated on the many beautiful window displays which are attracting considerable attention.

Mr. Chas. Rhoades spent his vacation on his fruit farm down in Irondequoit. Charlie reports a bumper crop.

Joseph Furlong, has been transferred from the Mailing Department to the Engineering Department, to fill the vacancy left by John Weyl.

Walter S. Riley, of the Meter Reading Department, has resigned to enter the Georgetown University, where he will study medicine.

We are pleased to see that Mr. J. W. Brown, salesman in the Domestic Sales Dept., is well and on the job again.

Miss Ida Cook, of the Billing Department, is spending a delightful vacation in Pittsburg, Pa., and Youngstown, Ohio.

Mrs. Judson Jennings, mother of C. S. Jennings, of the Tabulating Department, died at Ithaca, N. Y., on Friday, September 22nd.

Mr. L. B. Russell, (Station 4), better known as "Bob," spent his vacation painting his house. Bob is some thrifty painter.

Mr. William J. Nolan, of Station 4, decided that the Horse Show and the Industrial Exposition offered many attractions for an enjoyable vacation.

Mr. Gustave Haak, Foreman at Station 35, is spending his vacation enjoying an auto trip to Evans Mills, Jefferson County, and also to Sodus.

Mr. Ross L. Milliman, timekeeper, and Mr. Norman H. Webb, clerk on Station 5 construction work, have left to resume their college courses.

Mr. Donald Huff, of the Meter Reading Group, has just returned from an enjoyable vacation spent at Auburn and Waterloo.

Mr. William Hill, former operator at Station 6, has resigned to accept a position with the General Electric Co., at Buffalo.

Mr. George S. Durbin, of the Meter Reading Department, has resigned to resume his studies at the University.

Mr. John Nichols, of the Collection Department, left for Canada on September 16th for a two weeks' vacation.

Mrs. Helen Haftenkamp, wife of Mr. J. P. Haftenkamp, Supt. of the Gas Manufacturing Dept., died Monday, September 25th, at the family residence 204 Pierpont St.

Mr. Leon E. Jackson, a graduate of Cornell and recently employed by the N. Y. S. Highway Department, has been engaged to assist in the design of the new Station 5.

Mr. John Weyl, former junior clerk in the Engineering-Industrial Department, has resigned to accept a position with the John C. Moore Corporation.

We are glad to welcome Mr. Ralph Crowell, timekeeper, Mr. Mortimer F. Rebaz, inspector of construction and Mr. Carl F. Palmer, also inspector of construction at Station 5.

A bonus system went into effect September 1st for the special men in the Order Group, who are engaged in turning on and shutting off gas and electric meters.

Mr. Henry Bauman, of the Gas Shop, was recently united in marriage with Miss Lillian Hurd of Rochester. Mr. and Mrs. Bauman are at home at 179 Adams St.

Mr. Hall and Mr. Schell of the Engineering Drafting Department, are again teaching Mechanical Drawing at Mechanics Institute night school.

New employees in the Mailing Department are Miss Gertrude Rotmans, Assistant Mailing Clerk; Hyman Neurich and John Ford, office boys.

The Gas Shop welcomes back Mr. C. Rawnsley and Mr. J. Vink who have been confined to their homes for a considerable length of time, on account of sickness.

Sergeant Claes Hallencreutz, of the Engineering Department, left the latter part of September for Mac Allen, Texas, where he will act as Instructor to the 1st New York Cavalry, Troop H.

Prof. John C. Parker of the University of Michigan, formerly with this Company, gave a very interesting talk on reactances at the September meeting of the local section of the A. I. E. E.

Mr. William Simon is a new member of the Engineering Draft-Department. Mr. Simon has had electrical engineering and drafting experience in Germany, France, Mexico, Chile and in this country.

Mr. Samuel Jap, of the Gas Shop, and Miss Isabel Gottlieb of this city, were married on Sept. 5th. After a short honeymoon spent in Toronto, Mr. and Mrs. Jap returned to 19 Edwards St.

Mr. L. S. Wood who has had considerable experience in engineering structure, buildings and mechanical work, has been employed to work on reinforced concrete designs for Station 5.

Miss Ethel McKenna and Mr. John Banker of the Electric Meter Department were married on Wednesday, August 30th. After September 15th they will be at home at 440 Troup Street.

Miss Edna Lord, of the Billing Department, resigned September 12th. Miss Lord was married on

September 26th, and her associates presented her with a beautiful silver piece, together with best wishes for a long happy life.

Assistant General Manager Herman Russell who has been ill at his home for some time with an attack of typhoid fever has returned to his desk, and Room 2 no longer has that lonesome appearance.

We are glad to welcome Messrs. C. Wilson, Bennett Shippy and A. O'Dell, turbine operators; and Oilo Field, Chas. Wright, James Schnure, William Petherick, B. Curtis, Chas. Lane, Chas. Hill and Tom Owens, boiler operators at Station 3.

Mr. D. W. Patterson, of the Telephone Department, and Miss Katherine Reiff, of Webster Avenue, were married, September 23rd, 1916, at the Rectory of Christ Episcopal Church, by Rev. D. L. Ferris. After a trip East, Mr. and Mrs. Patterson will be at home at 381 Andrews Street.

Mr. Harry W. Peck formerly with this Company but now Vice-President and General Manager of the Schenectady Electric Illuminating Company and Mr. C. S. Van Dyke, General Superintendent, were visitors of General Manager J. T. Hutchings on September 28.

Mr. Ralph Turner, formerly of the Consumers' Bookkeeping Department, paid us a visit, August 28th. Mr. Turner is now special agent in the Compensation & Liability Department of the Travelers Insurance Company located at Cleveland.

About 20 office friends of Mr. E. H. Fisher recently gave "Ed" a barnyard shower. It was some shower—fish, chickens, rabbits, turtles, dogs, parrot, guinea pig and egg shower, were all in evidence. It is not known whether "Ed" is going to start a stock farm or circus. An impromptu rehearsal of the circus was given the first night the animals met.

The 18-foot motor boat shown in the illustration was recently built by Messrs. Stewart and Clumb of the Electric Meter Department. The power plant consists of a 4-cylinder 4-cycle gasoline engine developing 12-horsepower at a speed of 1800 R.P.M. The steering wheel, starting mechanism, engine control and lighting switches are all centrally located on the dash board. The lighting equipment consists of a search light, starboard, port and stern lights and two lights under the hood. Good work, boys!

18-foot motor boat designed and built by Messrs. Stewart and Clumb, of the Electric Meter Department