# GAS MANUFACTURE AND DISTRIBUTION

ROCHESTER GAS AND ELECTRIC CORPORATION

*Gas and Electric Building*
*Rochester, N Y.*
*Eighty-nine Ea.. Avenue*

# G A S

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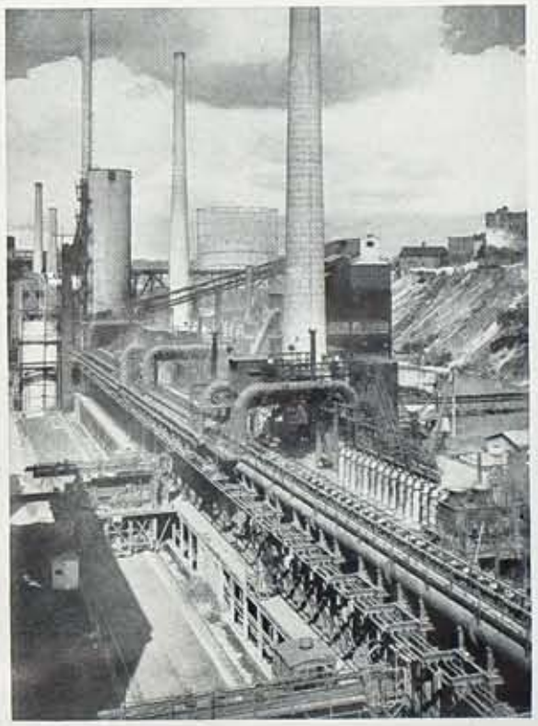
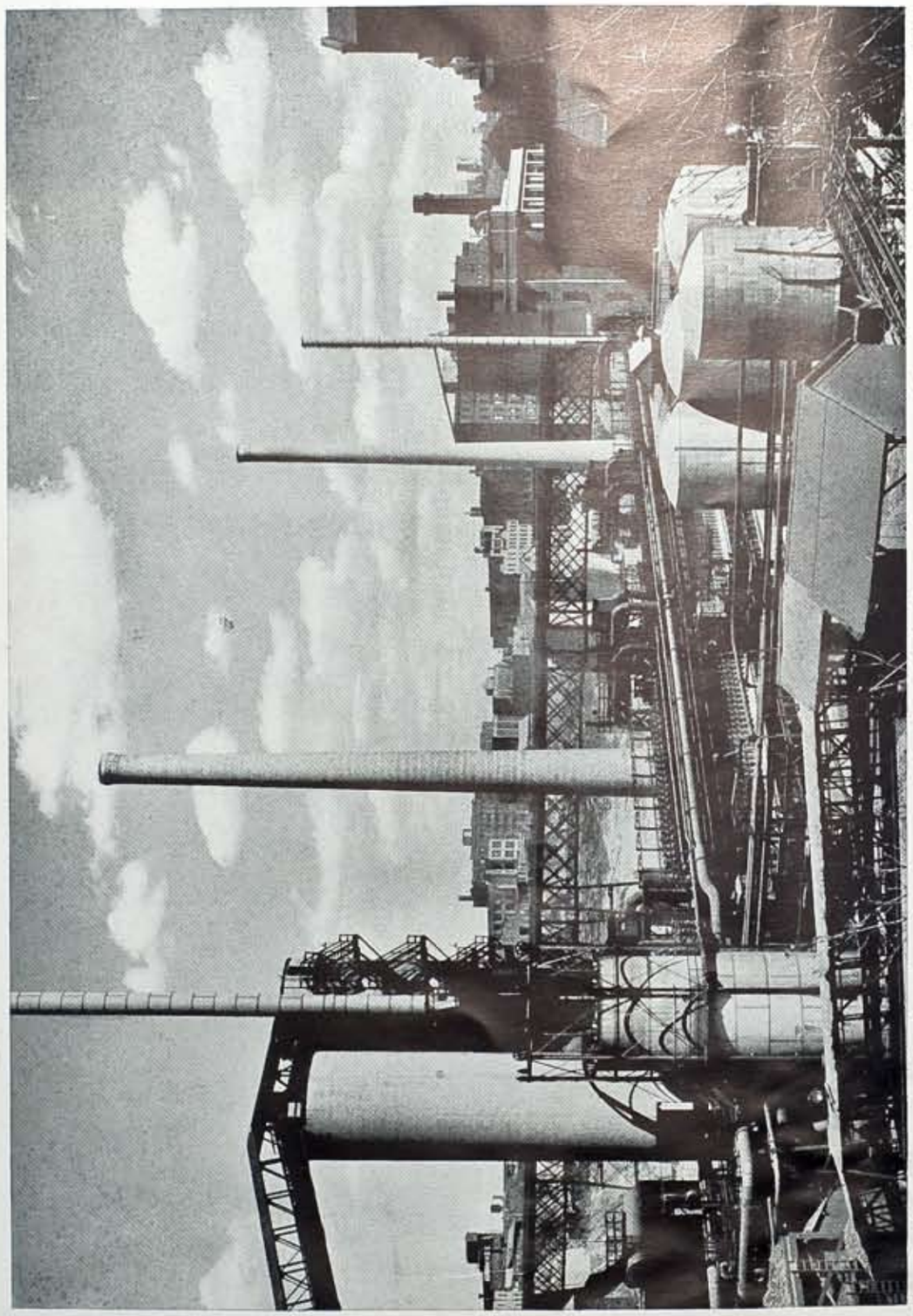
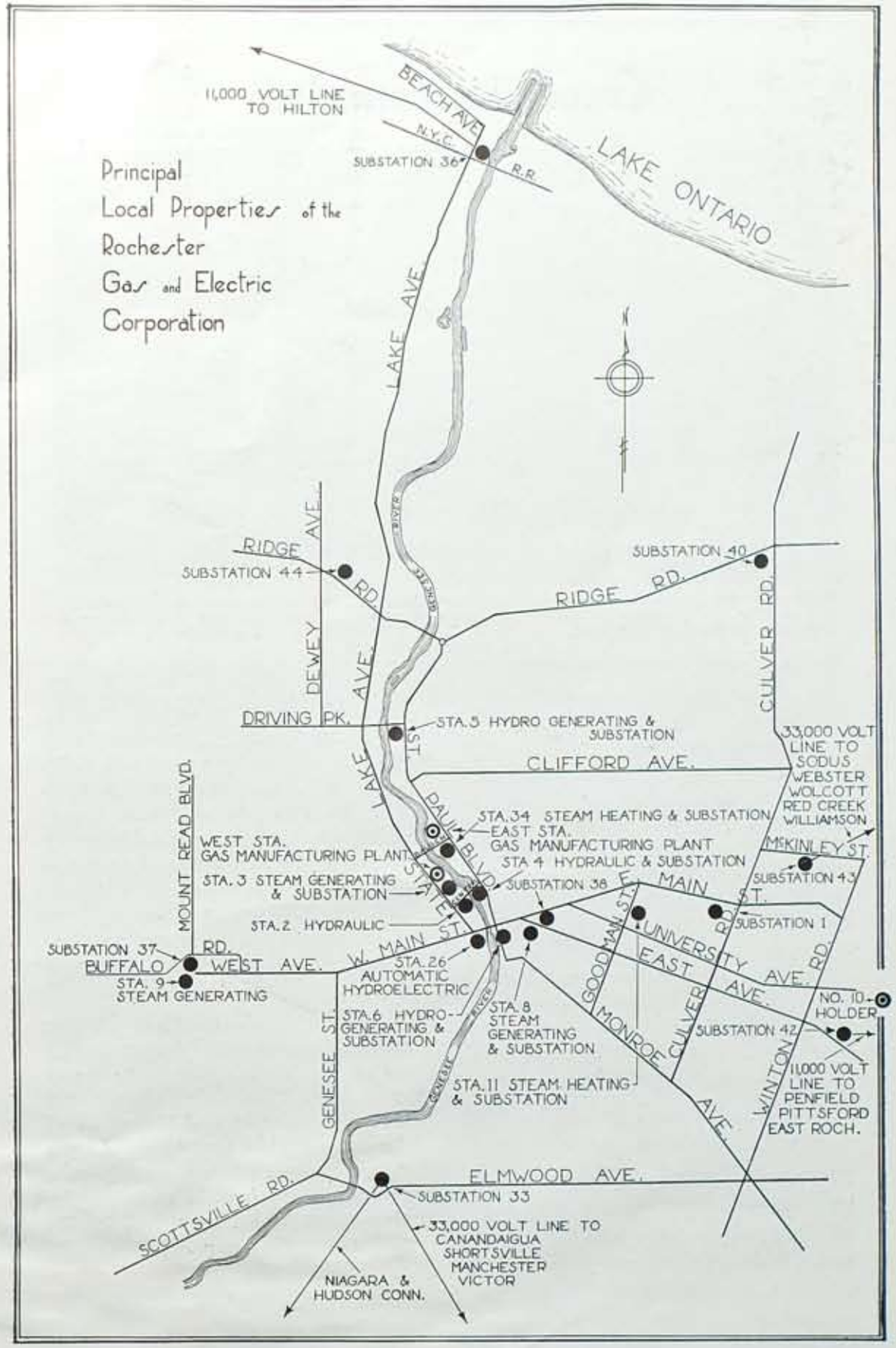
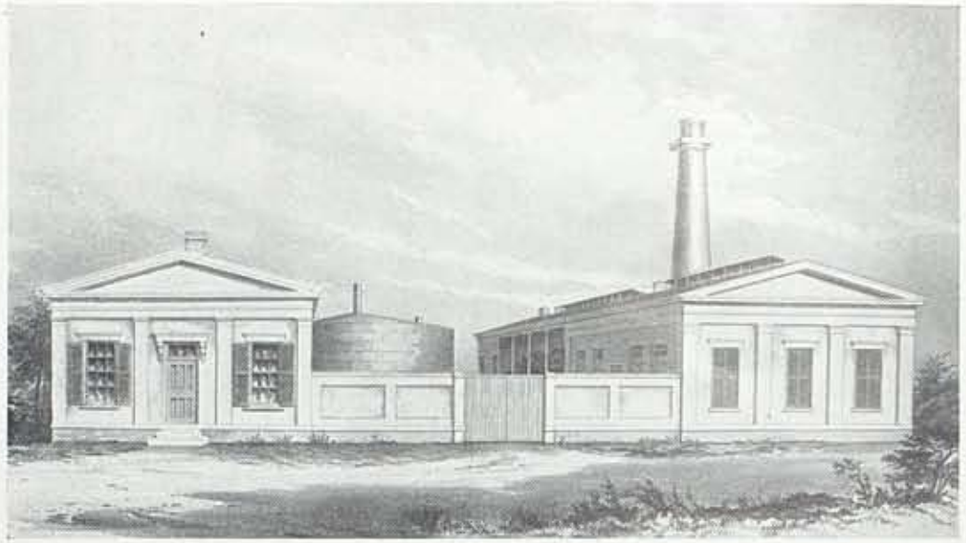




*View of West Station Gas Manufacturing plant from the Coke Bins. In the foreground are some of the coke conveying belts, and at the left is one of the large coal bunkers. The Koppers ovens occupy the center portion of the picture, and Station Three is seen at the right, at the western terminal of the Platt Street bridge over the Genesee River which bisects the picture horizontally.*



# General Information



*With the exception of water, gas comprises the oldest of our modern public utilities. The world's first gas plant was built in London, England, in 1812. The first American plant was built in Baltimore in 1816, and shown above is Rochester's first gas plant, constructed by the Company in 1848.*

The Rochester Gas and Electric Corporation is a business organization incorporated under the laws of the State of New York for the purpose of manufacturing and distributing to the City of Rochester and the adjacent territory, which includes several counties, its chief products, gas, electricity and steam and various by-products of its gas manufacturing operations.

The Company owns a number of electric power houses, sub-stations and gas plants in the city and surrounding territory which are described in part in this booklet.

## Incorporated in 1848

The first gas company was incorporated in Rochester in 1848. Various consolidations of gas and electric companies since that time have resulted in the present organization which has invested in plants and equipment a total of more than $80,000,000.

## The Electric Department

Eighteen electric generating stations total a capacity of 140,000 K.W. Eleven of these stations are in Rochester, and six are steam operated, the largest being able to carry a major portion of the load in emergencies. In 1936 about 27% of our requirements were purchased from the Niagara system through interconnection of lines. The Company's hydro capacity is 46,654 K.W.

The electric distribution division maintains fifty-six sub-stations, 924 miles of overhead high voltage transmission line, 8,236 miles of overhead distribution wire, and 3,019 miles of underground cable, supplying 133,520 installed meters. The street lighting system supplied by the company includes 1,397 arc lamps and 26,381 street and traffic lamps.

## Steam

The company also operates an extensive steam distribution system supplying many of the major industries and a large part of the business district. All of the steam-electric stations and both of the gas manufacturing plants have their steam generating equipment connected to this system.



## Gas Plants

Two large gas manufacturing plants are operated in Rochester. They are known as West Station and East Station, the former manufacturing both coal and water gas, the latter, water gas only. Various by-products incident to the coal gas process are recovered, among which are: Coke, Tar, Creosote Oil, Carbolic Oil, Concentrated Ammonia Liquor, Ammonium Sulphate, Ammonium, Thiocyanate, Sulphur, and Light Oil.

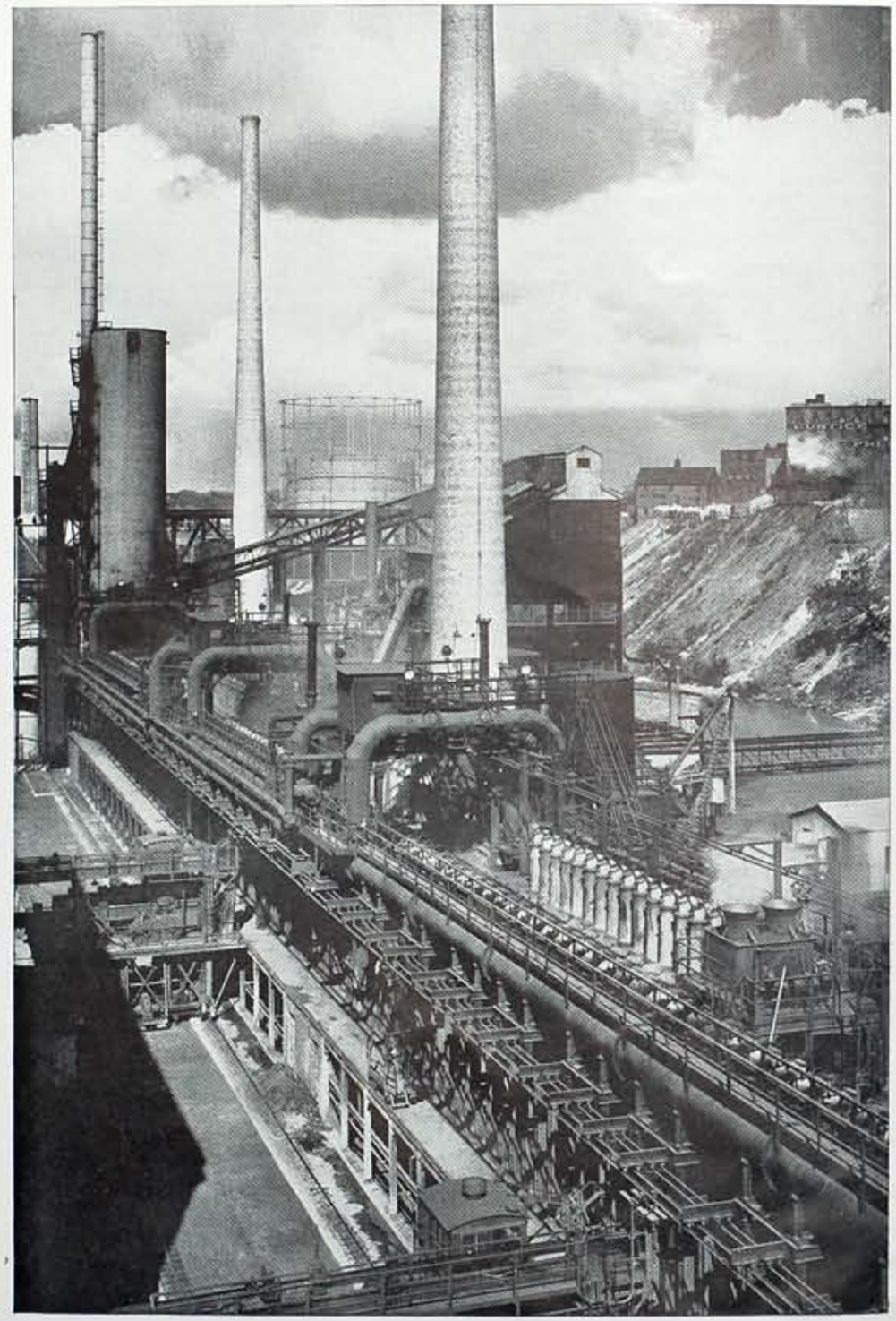
Guaranteed Coke is sold to local domestic and industrial consumers. Ammonium Sulphate is an excellent fertilizer, large quantities of which are also sold locally. Some of the Light Oil is blended and used as fuel in the Company's automotive equipment while the remainder of the by-products are, for the most part, sold to the various chemical industries.

## Service Departments

Various other units such as the engineering, industrial and domestic service departments, storehouses, repair shops and a well organized transportation system all contribute their share toward maintaining the high standard of service which the company offers its patrons.

One of the purposes of this booklet is to aid employees, customers, visitors and the general public in better visualizing the Company's gas manufacturing and distribution activities.

*Aeroplane view of a section of Rochester showing the Genesee Gorge between Platt Street bridge and the N. Y. C. Railroad bridge, with Smith Street bridge near the center. Kodak office building is in the center foreground; east of it are to be seen the chimneys of Station 3 and the West Station Gas manufacturing plant. Below Smith Street bridge are East Station, the Bausch and Lomb Optical Company.*



*Section of West Station Gas Manutacturing plant along the Genesee River north of Platt Street bridge. In the foreground are the three batteries of Koppers gas ovens. They are of the Becker type and total ninety-seven in number. Design permits almost smokeless operation. In average operation these ovens carbonize about 1300 tons of coal daily, producing 15.5 million cubic feet of 550 B.T.U. gas.*



# Gas Manufacture at West Station

**Conveying:** Gas coal received from cars on the river track in the State Street Yards of the New York Central Railroad is placed in a track hopper of 50 tons capacity, conveyed to the crusher house where it is crushed to suitable size and then conveyed to the two coal bins at the Coke Ovens. From the bins it is charged into the ovens by means of a weighing larry.

### Coke Conveyors

The coke taken from the ovens is quenched in dry quenchers, discharged onto the coke wharf, conveyed to the crusher house and finally to the coke bins where it is sized and stored ready for distribution to the consumers.

Over 5000 feet of rubber belting from 18 inches to 36 inches in width is employed. This equipment was built by The Robbins Conveying Belt Company. There are also two Link Belt Steam Locomotive Cranes and one Gasoline engine driven crane used for stocking and reclaiming coke in yard storage.

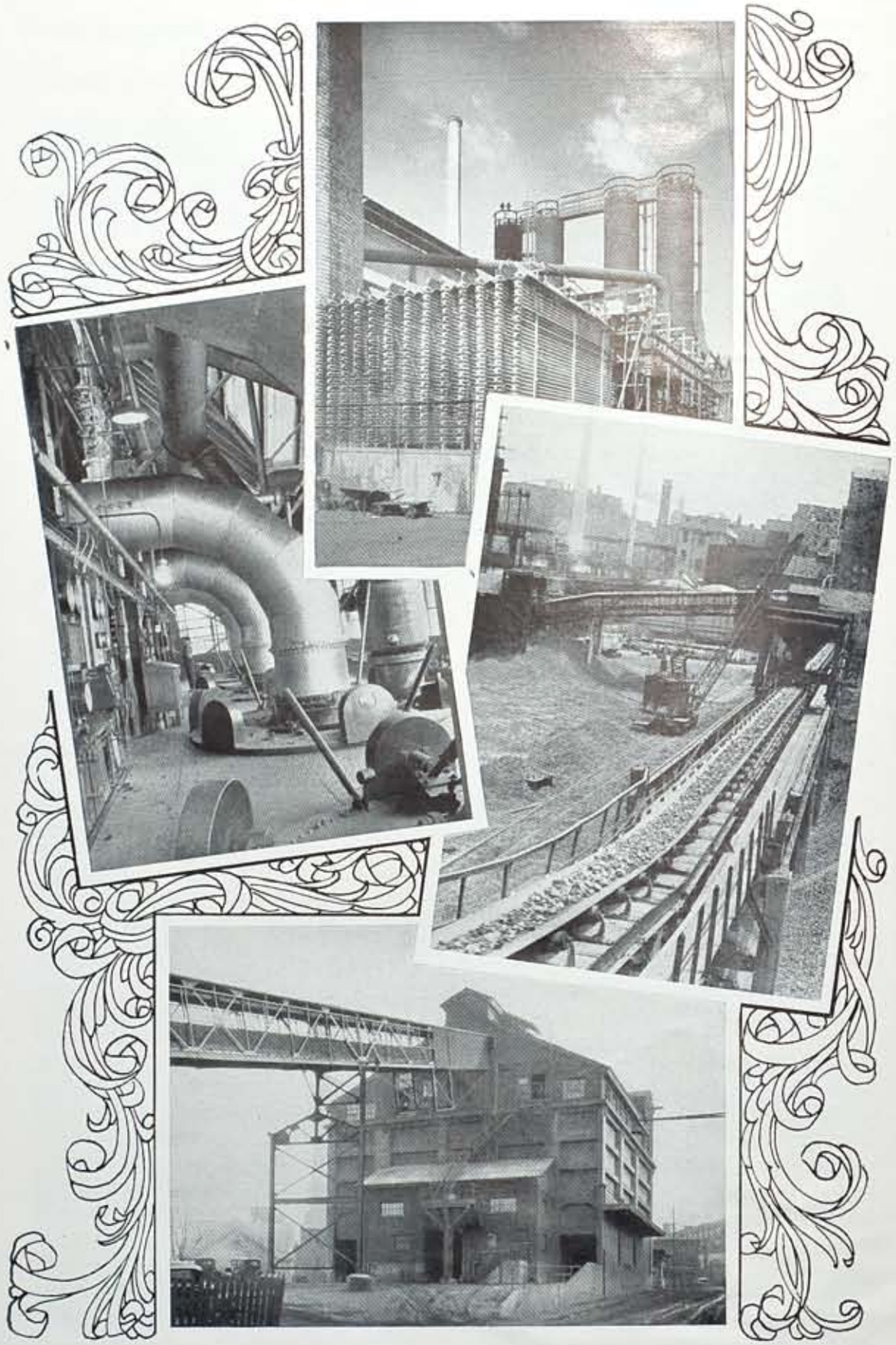
**Coke Ovens:** Coal Gas is one of the products obtained in the destructive distillation of bituminous coal, being the principal fraction of the distillate. Coke Ovens are chambers in which this distillation takes place.

There are at West Station three batteries of the Becker-type with a total of 97 ovens. The design of these ovens permits almost smokeless operation, a very desirable feature where the plant is centrally located. Each oven is provided with a single charging-hole and two gas offtakes, so that while charging, the gas is drawn away as fast as it is evolved. The individual ovens measure 20 feet between doors, 13 feet in height and have an average width of 13¾ inches, the coke discharge end being wider than the other. They receive an average charge of 6.85 tons of coal twice daily when operating at full rating. This requires an average temperature of 2385°F in the combustion chambers at the base of the heating flues.

Operating at this rate, the ovens can carbonize 1300 tons of coal daily, producing 15.5 million cubic feet of 550 B.T.U. gas. The carbonizing capacity can be varied considerably by changing the flue temperature. Thus during the summer months, the ovens operate on a slower charging schedule. The gas output can be still further reduced, when necessary, by using oven gas to heat the ovens. When this is done, about 35% of the gas made is required. Normally the ovens are heated by producer gas in a regenerative system, the direction of flow being changed automatically in either a 20 or 30 minute cycle.

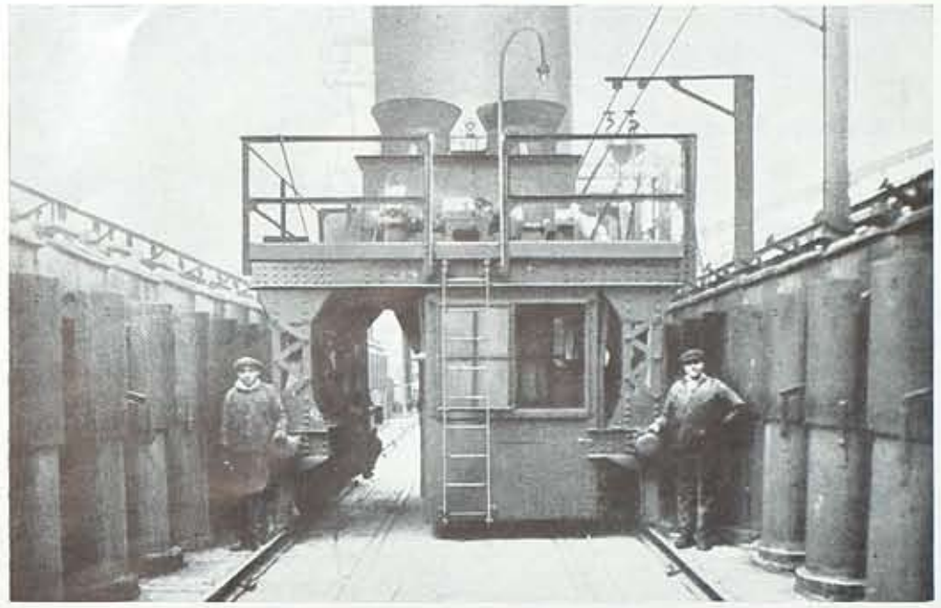
**Condensing Plant:** As the gas leaves the coke oven its temperature is well over 1000°F and among other things contains considerable tar vapor. It is the function of the condensing plant to cool the gas and to remove the tar thereby preparing the way for further purification. The Flush System, the Primary and Secondary Coolers, cooling coils, the separating tanks or decanters and various storage tanks are the units involved. The Exhausters or gas pumps are also located here.

All of the gas cooling is by direct contact with the cooling liquid which is circulated in a closed system. One



*Some of the Company's gas properties at West Station. Top, gas coolers at the condensing plant. Center, left, charging floor at the Koppers producer house. Center, right, one of the longer sections of conveyor belt which carries the coke to the sizing screens. Bottom, the coke bins, where mechanical screening assures a clean coke of highly uniform quality.*





*Traveling charging larry on the Becker ovens, West Station. In the distance is seen one of the two cylindrical coal bunkers, each of which has a capacity of 600 tons. From these bunkers the larry receives coal for charging into the ovens below.*

of the chief constituents of this solution being Ammonia, it is usually referred to as weak Ammonia Liquor and identified by the system within which it circulates; Flush liquor, Primary liquor and Secondary liquor.

**Flush System:** This system accomplishes the first stage of the condensing process. As the gas passes from the oven through the offtakes it is subjected to a spray of "flush liquor," becoming saturated with water vapor and reduced in temperature to about 170°F. A large part of the tar vapor is condensed, flowing with the flush liquor along the bottom of the gas suction main to the separating tank or decanter.

**Primary System:** The second stage of the condensation in which the gas is cooled to approximately 100°F takes place in the primary washer coolers of which there are two operating in parallel. These coolers are cylindrical steel shells, filled with wooden grids. The flow is countercurrent. The lower part of the cooler serves as a settling chamber and a balance tank.

The circulating pump draws the liquor from this chamber and sends it through a set of cooling coils from which it passes to the sprays, completing the cycle.

There is a condensation of water and tar vapors, the excess liquor and the tar overflowing through seals to their respective compartments in the decanter.

**Secondary System:** The primary and secondary systems are alike except for minor details. The secondary coolers are so connected that they may be used before or after the exhausters. The outlet gas temperature is 80°F, but the amount of cooling depends upon the position in which it is operating, since when used after the exhausters the heat of compression must also be removed.

**Cooling Coils:** Unlike the Flush System, the Primary and Secondary systems depend for their cooling upon the contact of the gas with a medium of lower temperature. The cooling of the circulating liquor in each system is accomplished by passing it through coils of pipe over which

water is allowed to flow. Over four and one half miles of 2" pipe are used to form these coils.

**Separating Tank or Decanter:** The purpose of this unit is to separate tar from ammonia liquor. There are two of these operating in parallel, receiving the overflow from the flush system. The tar settles to the bottom of the tank from which it overflows through a differential seal to the tar compartment. The weak ammonia liquor overflows a weir to the balance tank of the flush system, the excess overflowing to the liquor compartment.

**Exhausters:** These machines are the means of propelling the gas through the various stages of treatment and finally into the holders. For convenience they are located at the condensing plant, from which point they draw the gas from the ovens and send it under pressure to East Station. There are four exhauster units, three of which are identical, being three stage centrifugal fans driven by two stage Curtis steam turbines. Two of these machines operate in parallel to handle the load. The fourth unit is a single stage centrifugal fan driven by a two stage Curtis turbine and has a capacity sufficient to handle the load alone. Each machine is provided with a constant suction governor.

With this arrangement, there is always standby equipment though one unit may be shut down for repairs.

**Gas Producers:** There are two installations of gas producers which supply gas for heating the ovens and for controlling the heating value of the coal gas. The first plant was erected by the United Gas Improvement (U.G.I.) Company and was the first of its kind in this country. The second installation was made about 10 years later by the Koppers Construction Company.

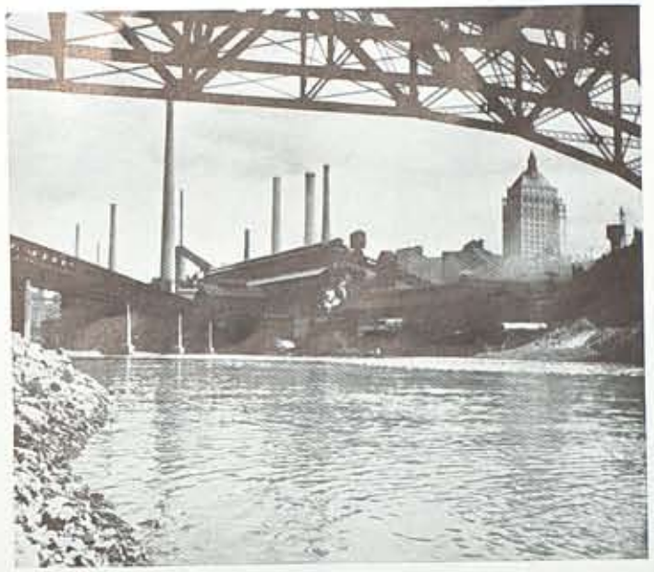
The producers in both installations are basically alike. Both are the Kerperly type, 8'6" effective fuel bed diameter, annular magazine fuel feed, water-cooled steel shells and revolving, eccentric conical step grate. The annular fuel magazine provides continuous feeding while permitting intermittent charging, thus maintaining a constant depth of fuel-bed and providing an automatic segregation of fuel sizes which prevents side-wall channeling. The water-cooled steel shell prevents any formation of wall clinker. The step-type grate provides for better distribution of the blast and because of its eccentric mounting, stirs the fuel bed, breaks up clinker formation and assists in the removal of the ashes. Exhaust steam from the various auxiliaries is used for mixing with the air blast, the temperature of the mixture being controlled automatically.

*Tower of large light oil scrubber installed at East Station during 1937. It operates in parallel with the original scrubber there.*

The economy of this design lies in the ability to burn small sized fuel efficiently at high rates. The greater part of the fuel normally consists of sizes too small for the domestic market, the usual mixture being one-third small coke and two thirds breeze.

**Boilers:** Four Koppers waste heat boilers generate 40 B. H. P., each, from the waste heat of the gas made in the four Koppers producers. Jackets around these producers furnish low pressure steam used in the producers themselves.





*Looking south-west under the Smith Street bridge from East Station, toward West Station. The bridge in the left distance connects East and West stations and carries three gas mains which transport gas from West Station to East Station, from where it enters the distribution system.*

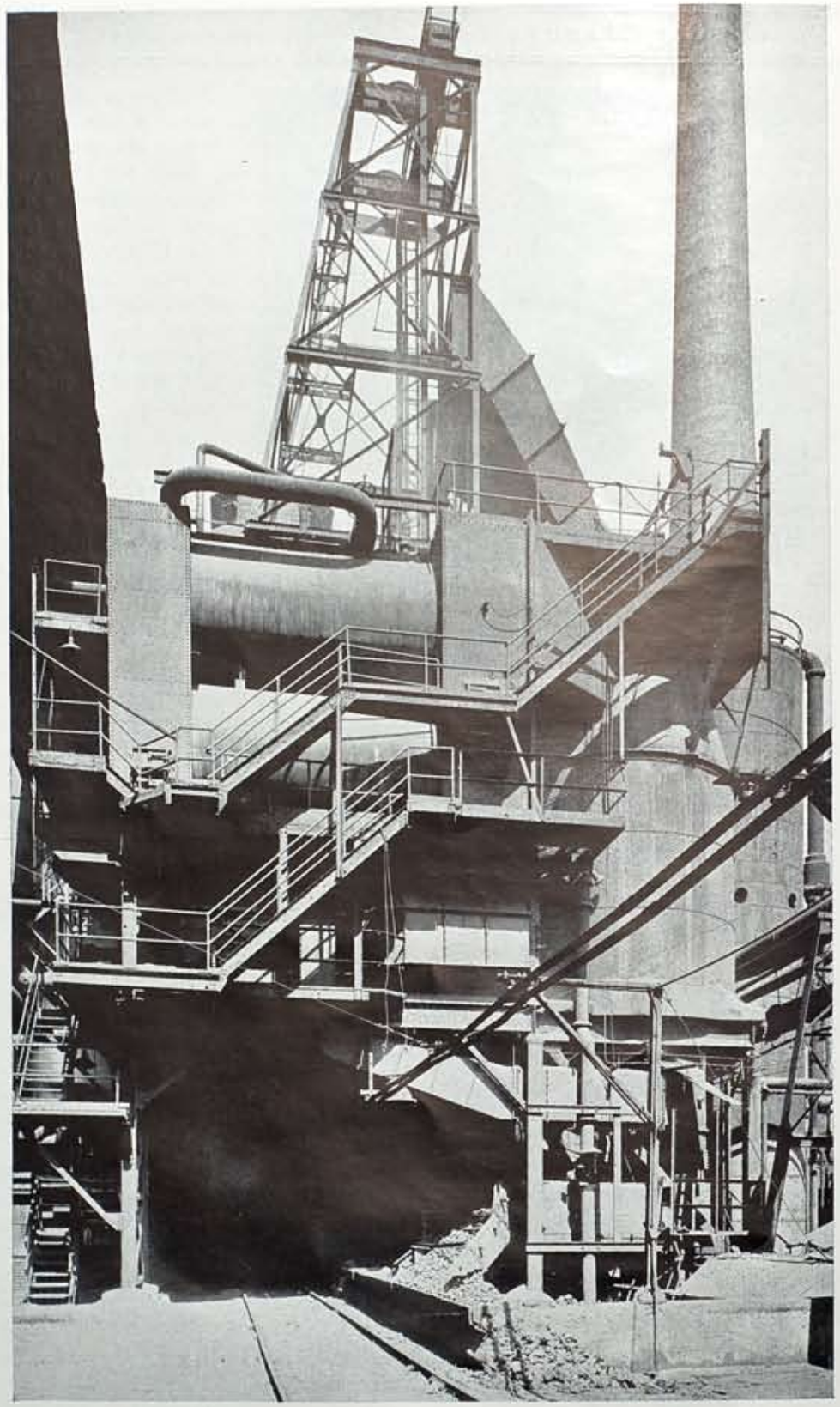
**Coolers:** Two cooler-humidifiers cool the gas coming from the U. G. I. producers from about 900° F to 120° F. This apparatus is also used to humidify the air for the producers.

Gas coming from the cooler-humidifiers and the four Kopper's Producer waste heat boilers at about 400° F. is further cooled and cleaned by two producer gas coolers, the temperature being reduced to about 60° F. before the gas is sent to the ovens for heating and B.T.U. Control.

**Dry Quencher:** This installation was the first of its kind in America. It utilizes the sensible heat of the coke coming from the ovens to make steam of about 135 pounds pressure, making about 460 pounds of steam per 1,000 pounds of coke charged. The coke is brought to the dry quencher by means of a hot coke car and dumped into a skip hoist, after which it is charged into either one or the other of two containers where it stays for a period of approximately four hours.

The coke is charged at about 1,800° F. and is discharged on the coke wharf at a temperature of about 400° F. Motor driven fans attached to each container circulate a volume of 23,000 cu. ft. of inert gas per minute.

Two fire tube boilers of special design placed one above the other are used for each container. The fans draw inert gas from the top of the container, through the upper boiler



*The Dry Quencher at West Station, the first installation of its kind in America. It utilizes heat in the coke coming from the ovens to generate steam at 135 pounds pressure, making about 460 pounds of steam per 1,000 pounds of coke 'charged'.*



and a portion of the lower boiler, through the remaining portion of the lower boiler, through a dust collector and then discharge these products to the lower portion of the container. The gases then pass through the coke and the cycle as outlined above is repeated.

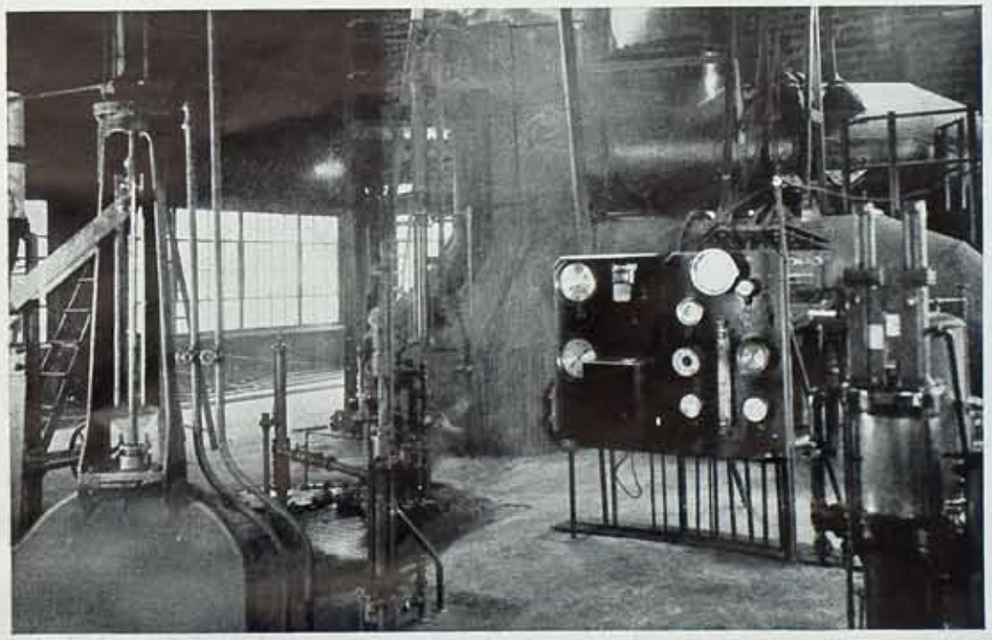
The operation of the dry quencher is continuous and practically automatic. An amount equal to a charge being taken out from the bottom each time before a fresh charge is put into the container.

The installation of the Dry Quencher is found to be successful economically. The coke passed through this apparatus has been found superior both for domestic and plant use. Beside these concrete benefits there are numerous intangible benefits derived from dry quenching as compared with the wet quenching process. Some of the benefits are (1) Elimination of vapors. This is of great value because of the location of our coke oven plant near a residential and office community; (2) Elimination of vapors reduces corrosion of steel work at the plant; (3) The life of hot car equipment is prolonged: (4) Power and maintenence cost are saved in coke crusher operation by the breaking up of the large coke passing through the Quencher; (5) Dry coke lessens difficulties with conveyors in freezing weather; and (6) Improved combustion characteristics.

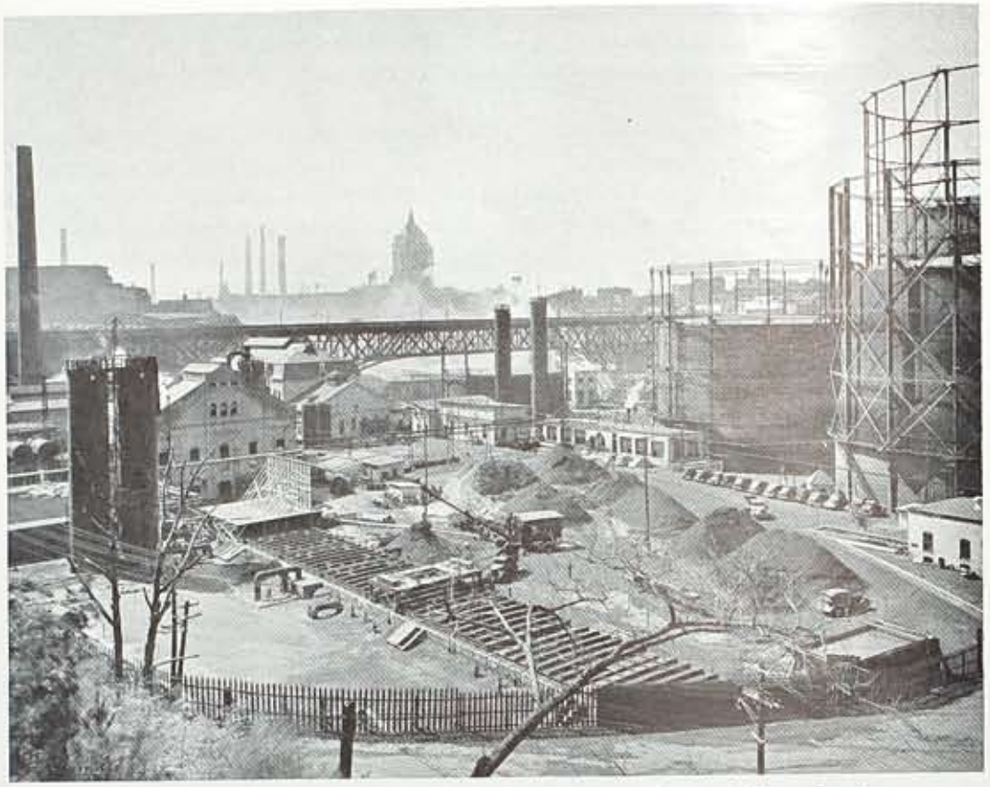
## Water Gas Manufacture at West Station

The first unit of the new water gas plant was built in 1923. It consists of one modern 12 foot U. G. I. water gas set with all necessary appurtences for gas generation. The capacity of this machine is 4,700,000 cubic feet of carbureted blue gas. To make this amount of gas, about 80 tons of coke and 14,000 gallons of oil are used.

**Coke Handling:** The coke for water gas generation is transferred from storage at West Station by crane and belt conveyors or conveyed direct from the coke wharf and placed in a coke bunker at the top of the water gas building. This bin



*Operating floor of the water gas plant at West Station.*



*Another view of East Station, looking southward toward Smith Street bridge. In the center are the oxide purifying boxes which remove the final traces of sulphur from the gas, after it has passed through the liquid purifying towers, seen at the left. The two towers in the distance are the light oil scrubbers.*

*East Station gas manufacturing plant as seen from the eastern end of Smith Street bridge, at the Bausch and Lomb plant. At this plant, gas is purified and metered before entering the gas holders for distribution.*



is lined with steel plates and tile and has a capacity of 250 tons.

From the bunker the fuel is drawn by gravity into a larry which weighs the fuel and then discharges it by gravity into the water gas generator.

**Control**: The opening and closing of valves in their proper sequence is governed by an automatic control manufactured by the Western Gas Construction Company.

**Blowers**: Air for blasting is supplied by a Connersville Blower. This blower, with a capacity of 30,000 cubic feet of air per minute at 50 inches pressure, is driven by a Hamilton Corliss Engine.

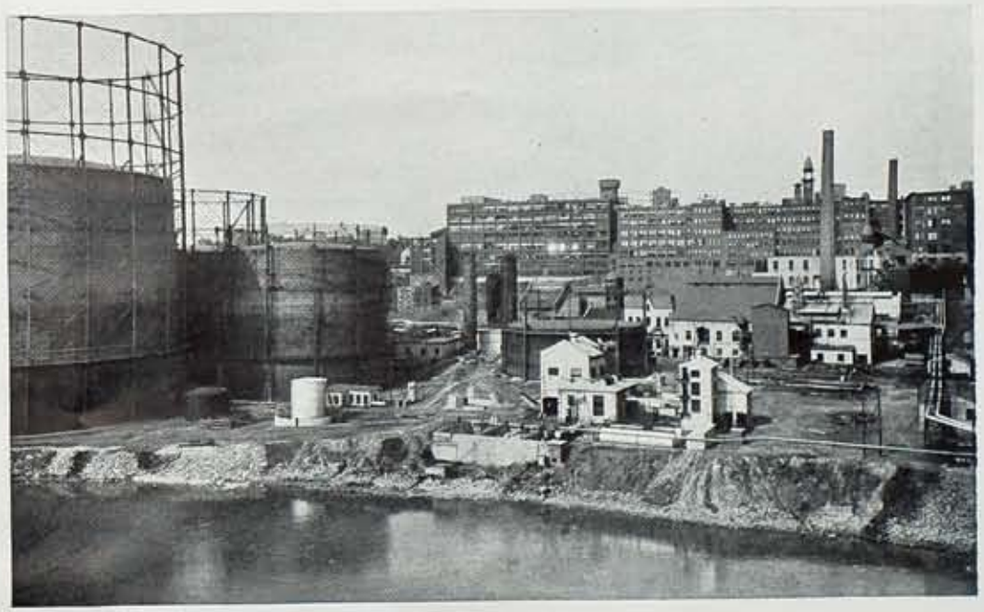
**Regenerator**: The exhaust steam from the blower engine is conducted to a Rateau Steam Regenerator and thence to the water gas generator for gas making purposes. Thus, by the use of a regenerator which is, in fact, a reservoir for the storage of steam, the steam is first used to drive the blower and a few minutes later for gas making purposes.

**Boilers**: Two waste heat boilers are operated in connection with the set, one boiler generates steam from the waste heat in the blast gases, one from the sensible heat in the illuminating gas, previous to its condensation. These two boilers have a rating of about 400 H. P.

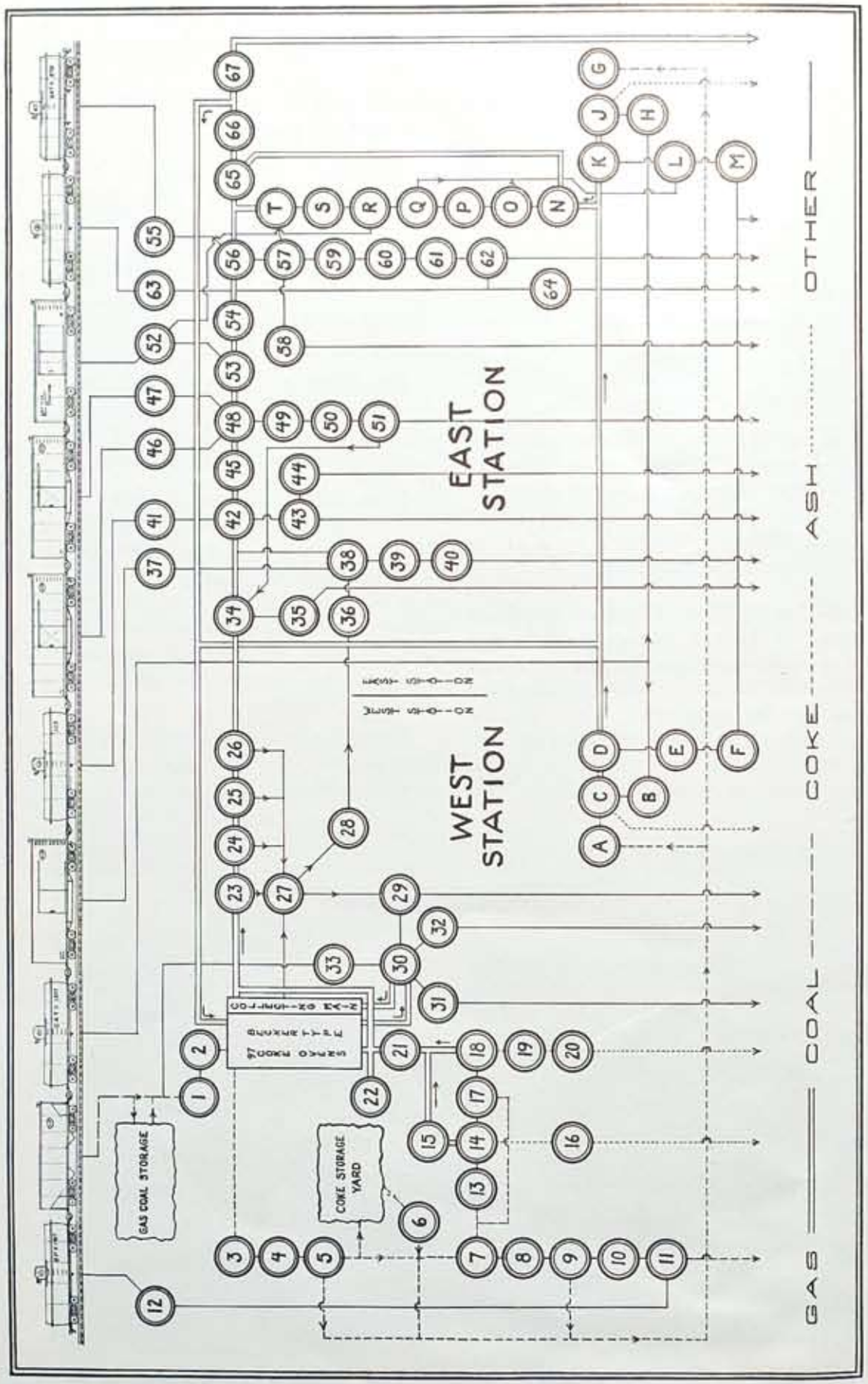
**Condenser**: An Isbell-Porter water tube condenser, containing 1350 3-inch by 19-foot steel tubes, cools the gas from 180° F to 80° F.

**Pipe Lines**: From the condenser the gas is carried through 1,800 feet of 48-inch pipe to the relief holder at East Station. This pipe line is of cast iron and is buried under the ground with the exception of 650 feet of steel welded pipe which extends across the bridge from West to East Station.

**Tanks**: One 100,000-gallon tank for gas oil and one 100,000-gallon tank for oil tar, are utilized.



*East Station as seen from the west end of Smith Street Bridge. In the distance is the plant of the Bausch and Lomb Optical Company.*




*Flow chart showing the various stages or processes connected with the manufacture of gas, and its ultimate preparation for the consumer, together with equipment utilized in the process at the plants of the Rochester Gas and Electric Corporation.*



# Flow Chart of Gas Manufacture

## COAL GAS

### WEST STATION

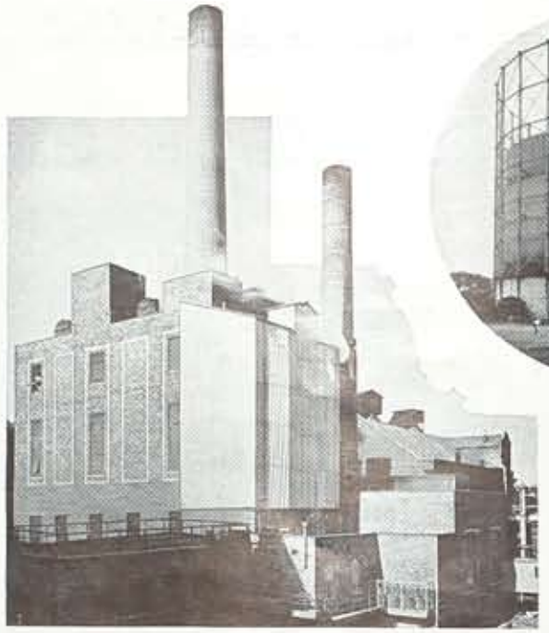
1. Coal Crusher
2. Coal Bunkers
3. Coke Quencher
4. Coke Wharf
5. Screen for Water Gas Fuel
6. Locomotive Cranes
7. Screen for Producer Fuel
8. Coke Screen for Domestic Fuel
9. " Bins " " "
10. " Screen for Removal of Fines
11. Dust Proofing Treatment
12. " " Preparation Plant
13. U.G.I. Producer Fuel Bins
14. U.G.I. Producers
15. Producer Gas Cooler Air-Humidifier
16. U.G.I. Producer Ash Bunker
17. Koppers Producer Fuel Bins
18. Koppers Producers
19. Koppers Producer Ash Dump
20. " " " Bunker
21. Producer Gas Coolers
22. " " Holder
23. Separator
24. Coal Gas Primary Condenser
25. " " Secondary "
26. " " Exhauster
27. Hot Drain or Decanter
28. Weak Ammonia Liquor Storage
29. Coal Tar Storage
30. Tar Still
31. Creosote Oil Storage
32. Carbolic " "
33. Pitch Bin

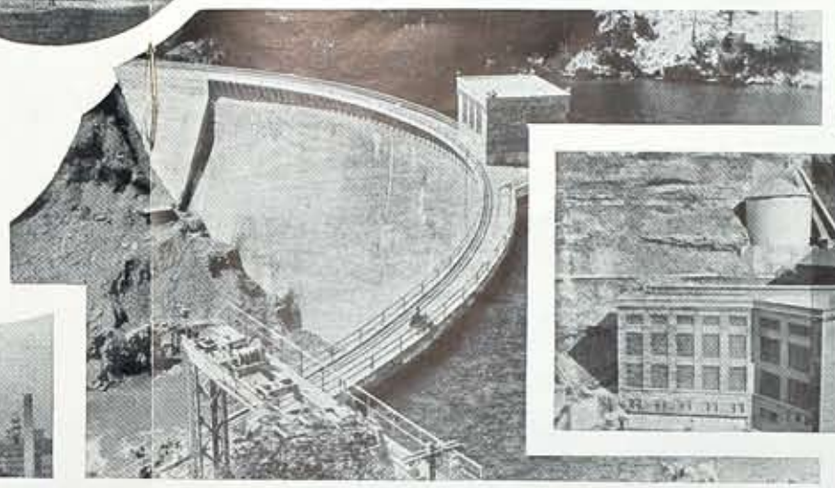
### EAST STATION

34. Cyanogen Scrubber
35. Ammonium Thiocyanate Storage
36. Weak Ammonia Liquor Storage
37. Lime Storage
38. Ammonia Still
39. Condenser
40. Concentrated Ammonia Liquor Storage
41. Sulphuric Acid Storage
42. Saturators
43. Ammonium Sulphate Storage
44. " " Dryers
45. Acid Separator
46. Thylox Storage
47. Alkali
48. Liquor Purification Scrubbers
49. " " Thionizers
50. Filter Press
51. Sulphur Storage
52. Dry Purification Material
53. Coal Gas Purification Boxes
54. Coal Gas Meters
55. Wash Oil Storage
56. Coal Gas Light Oil Scrubbers
57. Crude Light Oil Still
58. " " " Storage
59. Acidifier
60. Silica Gel Treatment
61. Rectifying Still
62. Rectified Light Oil Storage
63. Gasoline Storage
64. Bengas
65. Gas Holders
66. Gas Boosters
67. Gas Distribution System

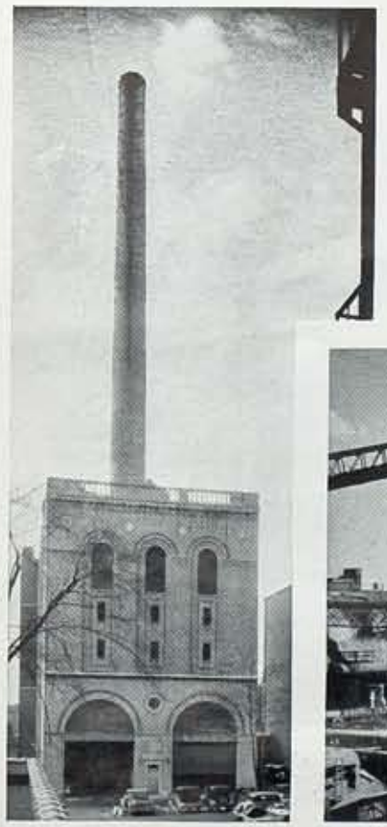
## WATER GAS

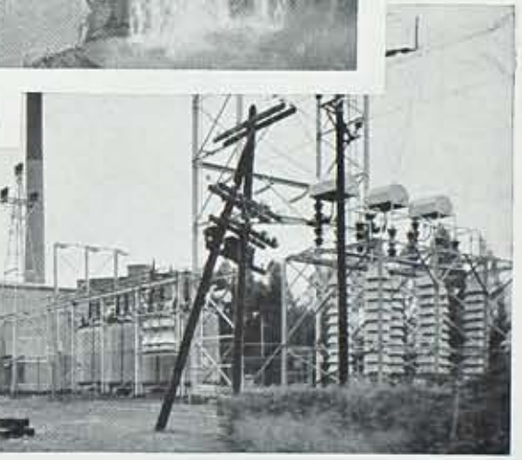
A. Water Gas Fuel Bins
B. Gas Oil Storage
C. Water Gas Generators
D. Condenser
E. Water Gas Tar Separator
F. Water Gas Tar Storage
G. Water Gas Fuel Bins
H. Gas Oil Storage
J. Water Gas Generators
K. Water Gas Condenser
L. " " Tar Separator
M. " " Tar Storage
N. " " Relief Holder
O. " " Condenser
P. " " Exhauster
Q. " " Tar Extractor
R. " " Dry Purification Boxes
S. " " Meters
T. " " Light Oil Scrubbers

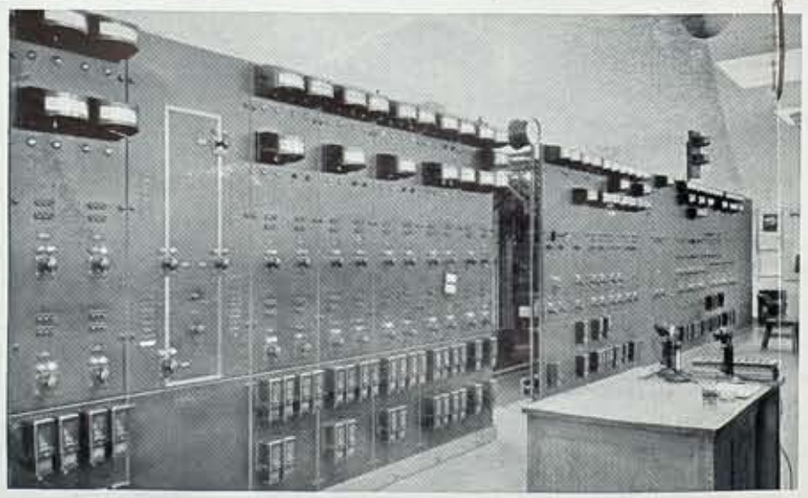


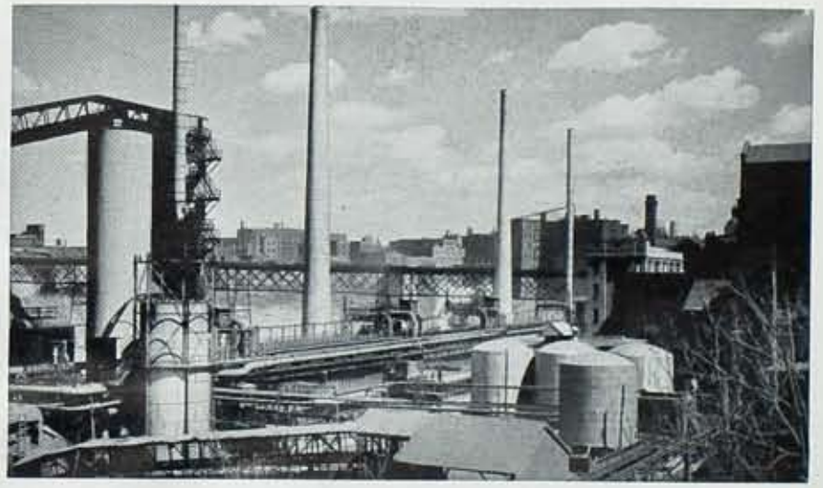




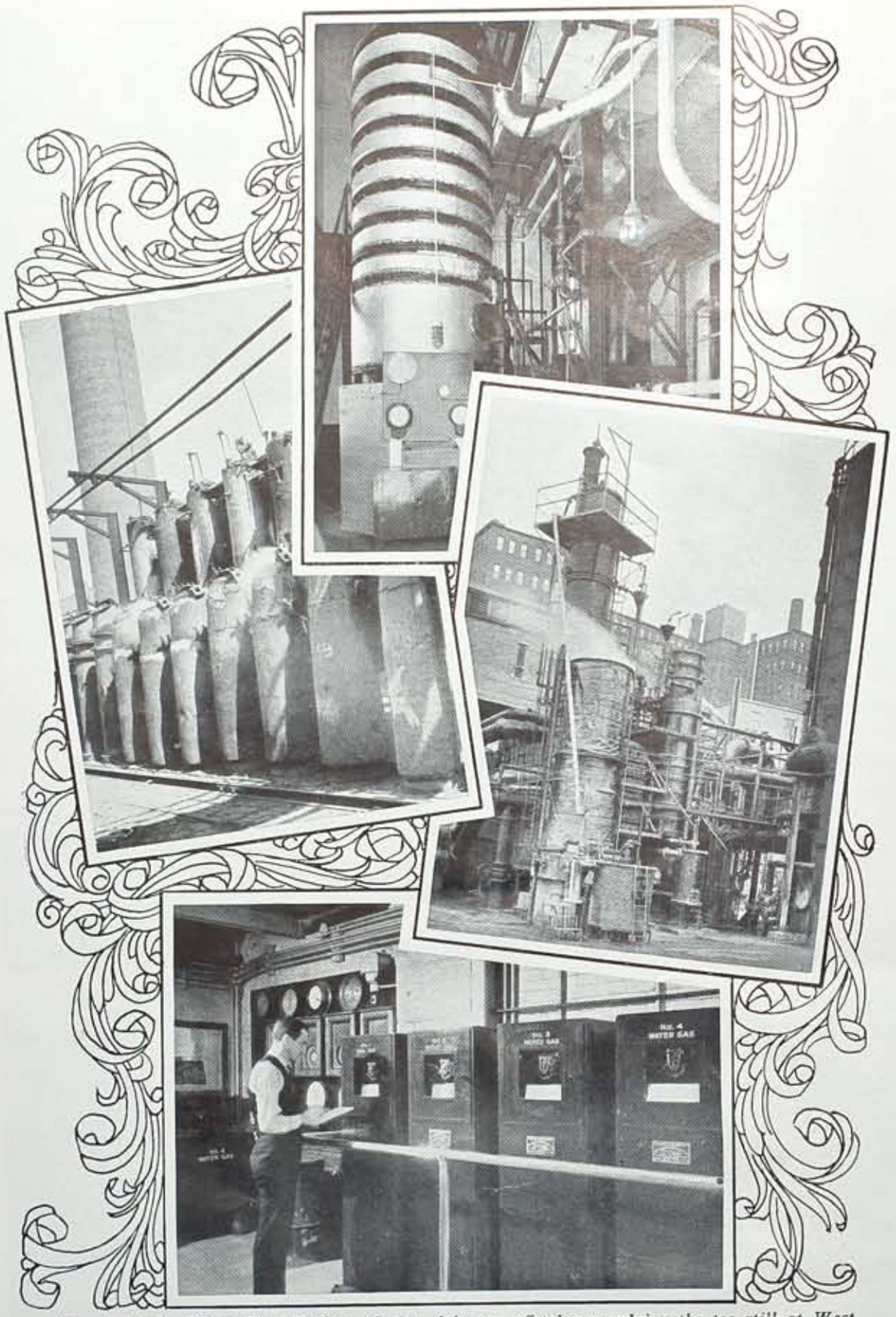








*A few Company properties, left to right, top row, Gas and Electric Building; Station 3 steam plant; Blossom Road gas holder, in circle; Middle Falls of the Genesee, sector dam and headworks; and Substation 38 (top right). Center row, section of East Station Gas Manufacturing plant; Upper Falls of the Genesee River and Station 2 and 4; Caneadea Dam; Station 5, Lower Falls of the Genesee River, and just beneath it, Station 33, where Niagara power is received and transformed. Bottom row, left to right, Station 9 steam plant; Operating floor, Station 3; Station 8 steam plant and a section of West Station Gas Manufacturing plant.*



*Top, light oil still at East Station. Center, left, gas off-takes supplying the tar still at West Station. Center, right, Ammonia recovery equipment at East Station. Bottom. Recording gas calorimeters at East Station, where gas is continuously checked for quality, thereby assuring a consistently fine gas product.*

# Water Gas Manufacture at East Station

**Water Gas Plant:** The water gas plant at East Station includes two U. G. I. Lowe Water Gas Machines of 1,000,000 cubic feet daily capacity; one of 1,300,000; one of 1,800,000; and one of 3,500,000, or a total capacity of 8,600,00 cubic feet daily.

**Coke Bunkers:** There is one steel bunker and one concrete bunker with a combined storage capacity of 300 tons, these being filled by dump trucks from a platform at Smith and Redfield Streets. Coke is then conveyed to the water gas machines by industrial cars over a trestle giving direct access to the operating floors.

**Gas Oil Tanks:** There are two steel tanks having a total capacity of 188,000 gallons.

**Purifiers:** All gas is purified in the oxide boxes, and the final purification of coal gas is accomplished by the same means. There are ten boxes having a total capacity of 40,000 bushels of material. Four of these boxes are used for water gas, four for coal gas and two are spares. The purifier boxes of monolithic concrete are unique in design and are located in the open yard. This construction adds materially to the safety of operation and to the convenience and economy of cleaning and refilling.

**Condensers and Tar Extractors:** Five tubular water cooled condensers attached directly to the water gas machines and three tubular condensers at the outlet of the relief holder are used, as well as two P. & A. tar extractors, of 3,000,000 cubic feet daily capacity, each.

**Exhausters:** There is one Connersville exhauster, capacity 250,000 cubic feet per hour, and one Wilbraham-Greene exhauster with a capacity of 300,000 cubic feet per hour, both driven by direct connected steam engines.

**Boilers:** There are two B. & W. boilers of 250 H. P. each and one B. & W. of 610 H. P. rating equipped to burn oil tar or coal tar, and a U. G. I. waste heat boiler connected to No. 4 and No. 5 water gas machines. The latter boiler will develop 35 pounds of steam per thousand cubic feet of gas made on the machines with which it is connected. This boiler uses the waste heat from the blast gases only.

**Gas Boosters:** One Connersville booster, capacity 1,250,000 cubic feet per hour at 5 pounds per square inch pressure, driven by two Buck-Eye steam engines; one Sturtevant Booster, capacity 500,000 cubic feet per hour at 5 pounds pressure, driven by a horizontal steam engine; and one Connersville pump, capacity 750,000 cubic feet per hour at 5 pounds pressure, direct connected to a 300-H.P., 440-volt motor.

**Relief Holder:** One 400,000 cubic feet relief holder with underground water pit.

**Meters:** One Wet Meter of 125,000 cubic feet hourly capacity; one Rotary meter of 125,000 cubic feet hourly capacity; and two Cutler Hammer Thomas meters, one having a capacity 300,000 cu. ft. per hour, the other 500,000 cu. ft. per hour.

**Storage Holders:** One 1,000,000, one 2,000,000 and one of 5,000,000 cubic feet capacity at East Station.

A holder of 6,000,000 cubic feet capacity is located at Blossom Road.

**Sulphate and Purification Plants:** Included under By-Products.

**Note:** The Water Gas Equipment at both East and West Stations is generally operated only when the coal gas plant cannot meet our gas load.

# The Company Laboratories

THE Chemical Laboratory located at East Station is excellently equipped and is considered to be one of the best of its kind in the country.

This organization, which serves both the Gas and Electric Departments, is operated partly as a control and partly as a research laboratory.

The manufacture of gas and the recovery of residuals being almost entirely chemical processes it is necessary to exercise strict technologic control, so that maximum yield and uniformity of product may be obtained.

A continuous record of the calorific value of the gas is taken by means of the Thomas Recording Calorimeter. Twelve check tests per day are made on the Junkers Calorimeter, the official instrument of the Public Service Commission, State of New York. The continuously recorded calorific value is of inestimable service to the gas maker enabling him to have continuous, instead of intermittent information, as under the old system, regarding the quality of his product. This assists him to obtain better control and additional economies in manufacture.

*The Chemical Laboratory serves all departments partly as a control and partly as a research laboratory and helps assure higher quality for Company products and by-products.*

Analyses and tests of the coal purchased by the company for carbonizing are made on samples continuously taken thereby insuring a high quality of coke and other by-products.

The same care is given to the analysis and testing of coke, gas, ammonia liquor, ammonium sulphate and other products which at all times insures a product uniformly high in quality.

The laboratory also controls the chemical treatment of the feed water for the company's various boiler plants.

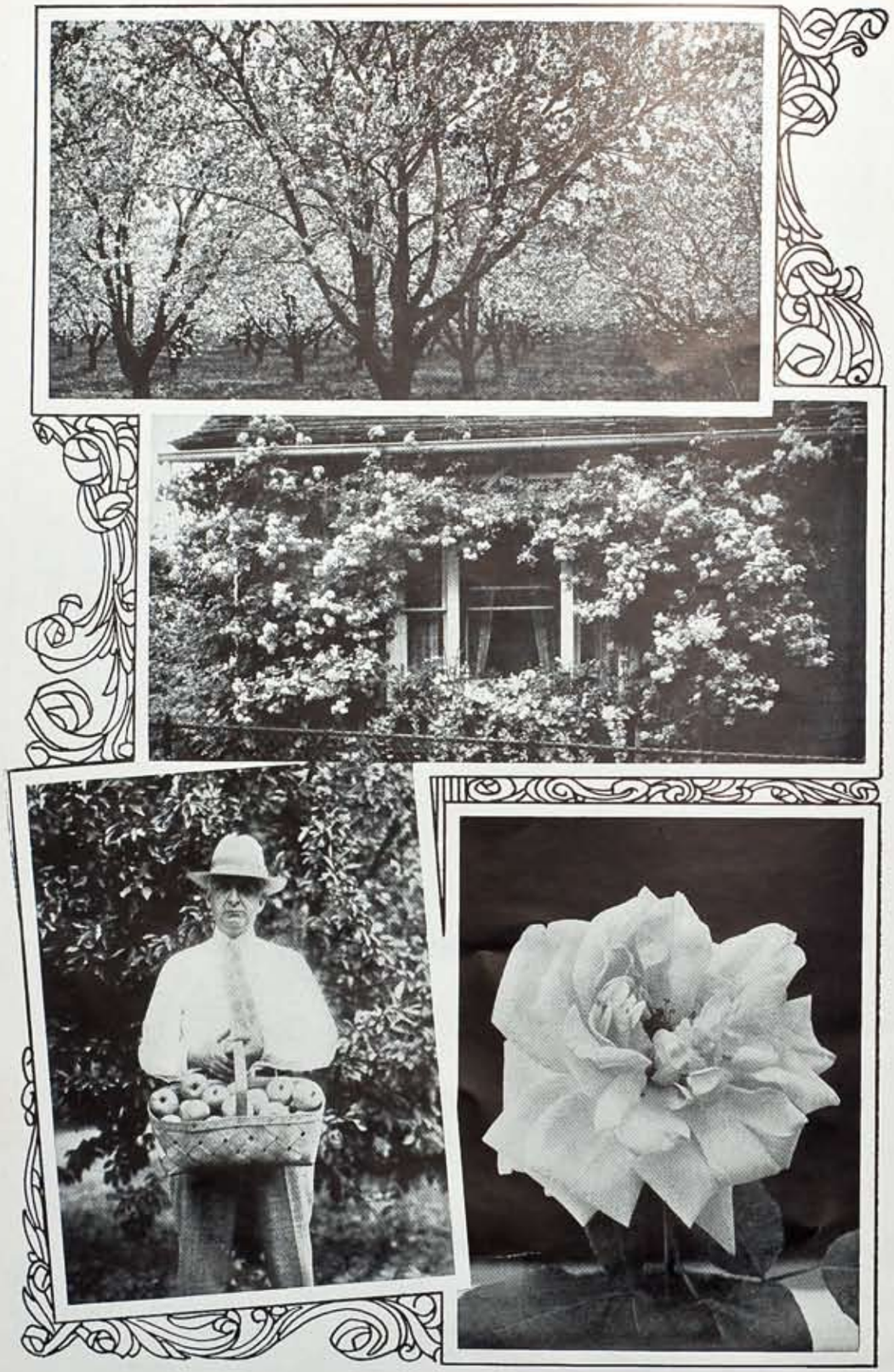
Regular analyses of the raw water supply, the treated water and the boiler water are made so that proper conditioning of the boiler feed water may be attained.

Co-operative research with various National Scientific and engineering societies is carried on continuously in addition to a large amount of research of purely local interest, some of which later has attracted national attention.

Many of the materials purchased by the Company for its use are tested in the Chemical Laboratory for quality and adaptability.

The Laboratory contains a well equipped library numbering some five hundred books in addition to complete files of many scientific and technical magazines.

*Company Laboratories are more and more coming to be high-spots in Company operation and service. Top, Standards sections of the electrical and gas laboratory at Front Street; center, the Chemical Laboratory at East Station, and bottom, the new laboratory recently installed at the Station Three high-pressure steam plant.*



*Some striking results of the use of Sulphate of Ammonia. Top, Sulphate of Ammonia is widely used by orchardists and farmers in this section. Center, Sulphate of Ammonia is also used for fertilizing lawns, gardens and flowers. Bottom, left, Some fine apples grown in healthy orchards along the Ridge Road, in the Ontario Fruit Belt, where this excellent and very reasonable fertilizer is utilized. Bottom, right, Flower lovers are finding Sulphate of Ammonia of great help in growing strong, virile flowers and shrubs. About fourteen tons of sulphate can be made daily in Company plants.*



# By-products of Gas Manufacture

**Coke:** Coke ranks first in importance among the by-products, being the residue obtained in the distillation of gas coal. Approximately fifty percent, by weight, of the coal treated is recovered as coke in sizes which have commercial value. Because all of our coke is sold locally and for domestic use it is not necessary to produce a fuel of great hardness and its users benefit in good combustibility over a wider range of firing rates.

Each process through which it passes is subject to rigid control.

**Screening Plant:** In preparing the coke for sale it is separated into several sizes which, in response to popular demand are as follows:

| | |
|---|---|
| Egg | 2½"+ |
| Stove | 1½" — 2½" |
| Large Nut | ⅞" — 1½" |
| Small " | ⅝" — 1½" |
| Range " | ⅝" — ⅞" |

This separation is accomplished by passing the coke over a series of high speed, motor driven screens which deliver a closely sized product into the various storage bins directly below. These bins are provided with spiral chutes so that the coke is not allowed to fall into the bin with resultant breakage, but rather slides over a smooth tiled surface.

In each of the loading chutes of which there are 34 is installed a high speed vibrating screen and a set of sprays for dust-proofing. As the coke is drawn from the bin it passes over this screen which removes any fines which may be present and then just before it passes into the truck it is dust proofed, by spraying with a solution of Calcium chloride.

The Company's customers, therefore, receive a clean, well sized fuel that will remain dustless until it is put into the firepot.

The coke industry is recognized as an important factor in our national economics. It provides a high grade solid fuel as a residual from the production of gas.

**Tar:** In volume, tar ranks second among the by-products. It is the heaviest fraction of the distillate, its recovery being described previously under "Condensing Plant." Approximately half of the tar is distilled for the recovery of Creosote and Carbolic oils, the balance being sold for industrial uses.

**Creosote and Carbolic Oils:** These are the fractions of the distillate recovered from the distillation of coal tar. The Creosote oil is sold to be used for wood preserving. The Carbolic oil, sold as such, is recovered as a separate fraction because of its high phenol content.

The distillation is accomplished in what is known as a "direct recovery unit." The hot coal gas from seven coke ovens is led through a retort where it comes in contact with the tar. From this point it passes successively through the Hot Gas scrubber, the tar preheater, the rectifier, the condenser and the separator.

By controlling the temperatures at which these units operate, considerable variation of the product may be obtained.

**Ammonium Thiocyanate:** After the gas leaves the secondary washer cooler at West Station, it is scrubbed in a cyanogen tower at East Station with weak ammonia liquor. To this solution is added finely divided sulphur recovered from the liquid purification process. These two materials will react with the cyanogen in the gas to form ammonium thiocynate. This process also removes a good portion of the hydrogen sulphide

formerly removed entirely by the liquid purification towers and dry oxide boxes. The removal of hydrogen sulphide and cyanogen in the cyanogen tower effect a large saving in alkali which would be necessary for their removel in the liquid purification towers. Thus by using by-products of our own coal gas plant economies have been effected in our purification costs. Ammonium thiocyanate has a market as weed killer and as a raw product for the plastics industry.

**Ammonium Sulphate:** After gas leaves the cyanogen tower it is passed through the saturators. Here ammonium sulphate is precipitated by passing the gas through a solution of sulphuric acid. The sulphate then settles out from the mother liquor and is dried in a centrifugal dryer. If a refined and dry product is desired, the salt after it leaves the centrifugal dryer is passed through a rotating kiln. The finished salt is weighed, bagged and shipped to the customer. About 14 tons of sulphate can be made daily.

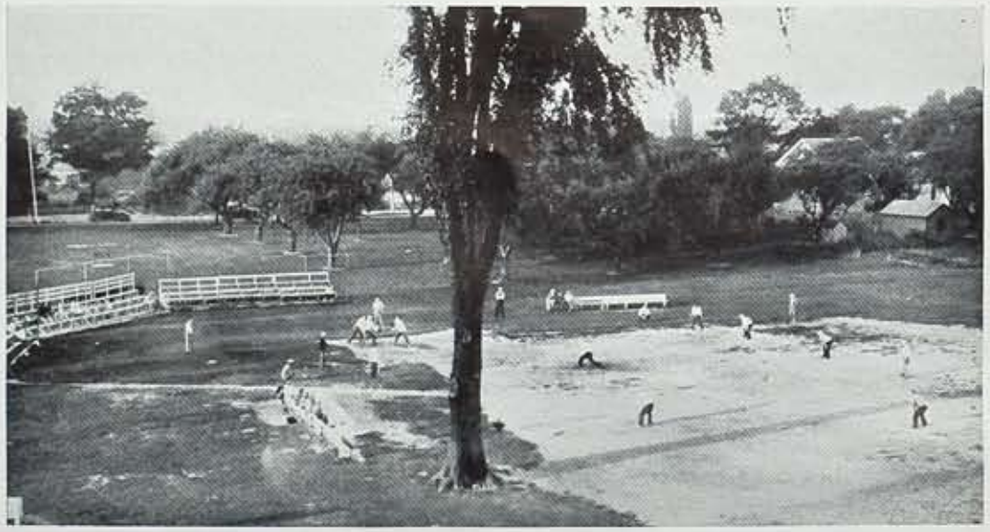
Sulphate of ammonia, beside numerous commercial uses, is an excellent fertilizer. It can be used in this manner for lawns, gardens and flowers. In connection with the sulphate plant an ammonia still is operated. This converts the weak ammonia liquor into ammonia gas which is piped into the gas line going to the saturators and made into sulphate, or the ammonia gas can be condensed to form concentrated ammonia liquor and sold as such.

**Sulphur:** From the sulphate plant the gas goes to the Koppers Liquid Purification Plant, known as the Sulphur Recovery Process.

The appartus used comprises two absorber towers in which the gas is brought into contact with the circulating liquid and a thionizer in which the solution coming from the absorbers is aereated, which revives the purifying medium, liberates free sulphur and separates this sulphur by flotation.

The circulative liquid, consists of a slightly alkaline solution containing a small amount of "Thylox."

Hydrogen sulphide is removed by the absorber towers which have an efficiency of approximately 90%. The



*Searle Park is popular as a Neighborhood Recreation Center for baseball, tennis and other outdoor sports and picnics.*



remaining H2S is removed by passing the gas through dry purifier boxes. About 5 pounds of sulphur per ton of coal carbonized is removed.

**Light Oil:** The light oil plant at East Station was the first built by any New York State Public Utility and was operated during the war for the recovery of toluol for the manufacture of T.N.T. After the armistice in November, 1918, additions in equipment were made for the purpose of refining the crude oil for motor fuel uses.

In the recovery process the coal gas is passed, counter current to a shower of wash oil, through a steel scrubbing tower 80 feet high by 11 feet in diameter. This removes from the gas the benzol, toluol, etc. The oil then passes through a still in which the products it has collected are distilled off into a storage tank. The wash oil is then cooled and recirculated through the scrubbing tower. The crude light oil is then piped to the Silica Gel Plant where it is further refined.

**The Silica Gel Process:** The Silica Gel plant, adjacent to the Light Oil Plant, was built in 1926 and was the first commercial plant of the kind in the world. It reduces by approximately 80% the amount of sulphuric acid and caustic soda used normally in the purification of the by-product light oils.

Silica Gel as now used at East Station removes the impurities in the oil without disturbing the desirable unsaturated hydrocarbons. By this means, the yield of saleable oil is increased by approximately 12 to 15 per cent, with but slight increase in the cost of purification over the more destructive and inefficient sulphuric acid method.

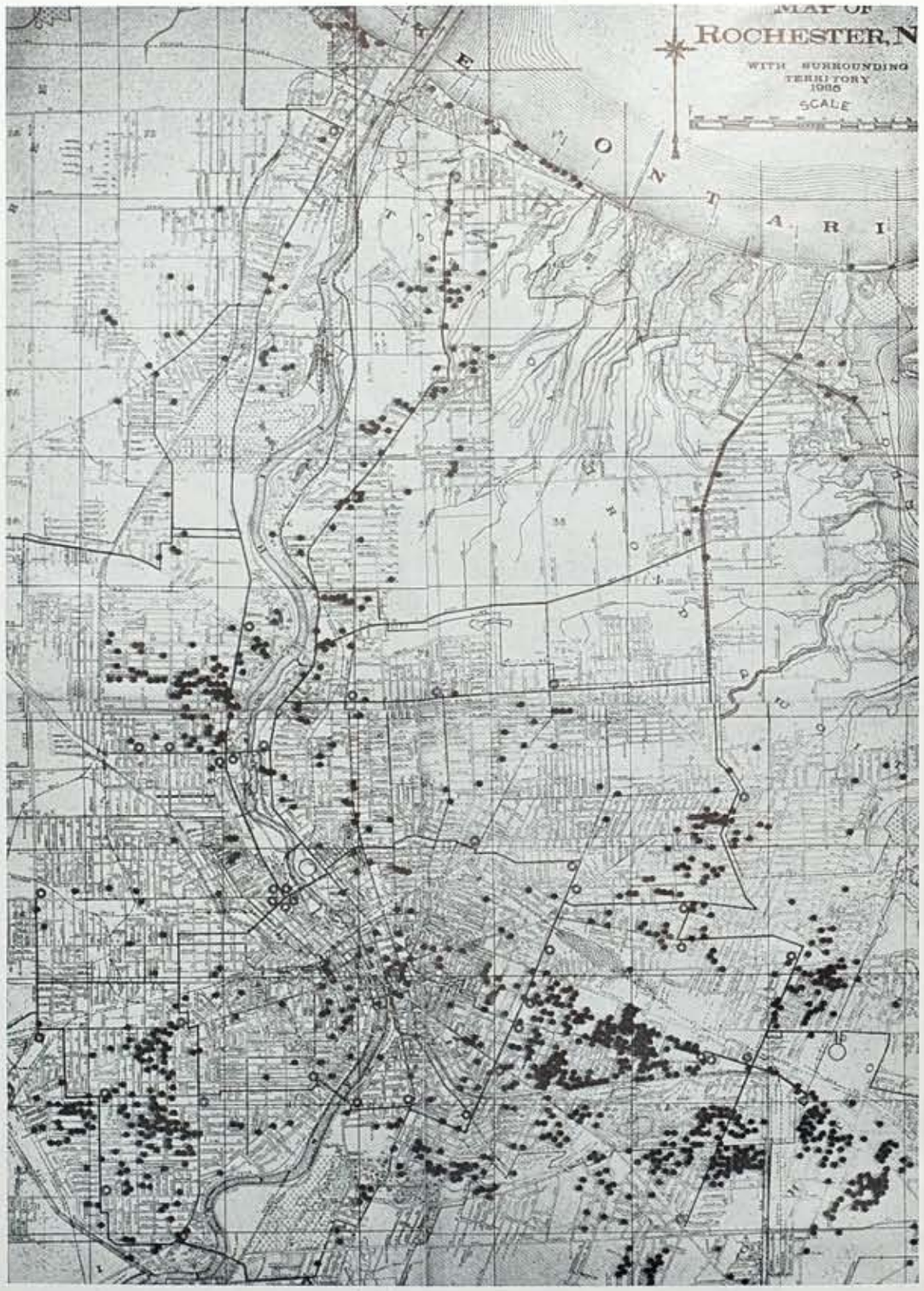
Silica Gel is made by processing sulphuric acid and sodium silicate. Its chemical composition is almost exactly like that of sand or quartz. If a microscope sufficiently powerful to see the minute structure were available, Silica Gel would present a decidedly spongy appearance. Each tiny-sand-like grain has myriads of air cells and it is estimated that one grain of Silica Gel has an exposed surface equivalent to 5000 square feet. The function of the Silica Gel is to bring about through this feature of exposed surface, chemical reactions desired in the purification processes.

**Bengas:** At East Station, motor fuel obtained from the Silica Gel Process is blended with gasoline in equal parts. It starts easier than high test gasoline, is more powerful and has fine anti-knock properties.

The storage capacity of the light oil plant is 187,000 gallons of crude and refined products.

The plant is equipped with a complete "Foamite" System for protection against fire.


*This product is sold largely in this vicinity. Farmers come for it at East Station, back of the Bausch and Lomb plant, in the Genesee flats, and small bags of it are obtainable at the Gas and Electric Building, in the Coke Sales department.*




*Each of these little black dots superimposed on the map of Rochester represents a gas house heated home. There are at the present time about 1,800 such homes, many of which are shown above.*



# Gas Distribution

A Gas Distribution System can be defined as a transportation system whereby gas produced is delivered to the customer for his utilization. Both Gas and Electric Systems differ from most transportation systems in that the customer's requirements must be met instantly. There can be no lapse of time between the demand for gas and its delivery. This involves a very large investment in boosters, compressors, pipe lines and meters, which in the case of Manufactured Gas represents about one-half the total Gas Department Investment.

## Gas Holders

The gas after being metered at the Works is pumped into holders for storage where it is ready for distribution to our customers. Three of these holders are located at East Station and the fourth and largest (No. 10 holder) is at Searle Park on Blossom Road at the eastern extremity of the city.

In order to transport gas to customers located many miles from our Plant, it is necessary to force the gas through pipe lines so that these customers will always have an adequate supply available. The equipment used to push the gas through the pipe lines is known as a booster or compressor. There are several large size pipe lines which leave the Plant and carry the gas to parts of our System remote from the holder. From these large pipe lines or Transmission Lines the gas is put into smaller pipes which are called Distribution Lines and thence it passes through a much smaller pipe called the Service, through the meter and to the customer's appliance.

## Line Extensions

In order to keep pace with the growth and development of the City and environs, it is necessary to continually make new gas line extensions; the Company's policy in this connection has always been a very liberal one. The proper planning of

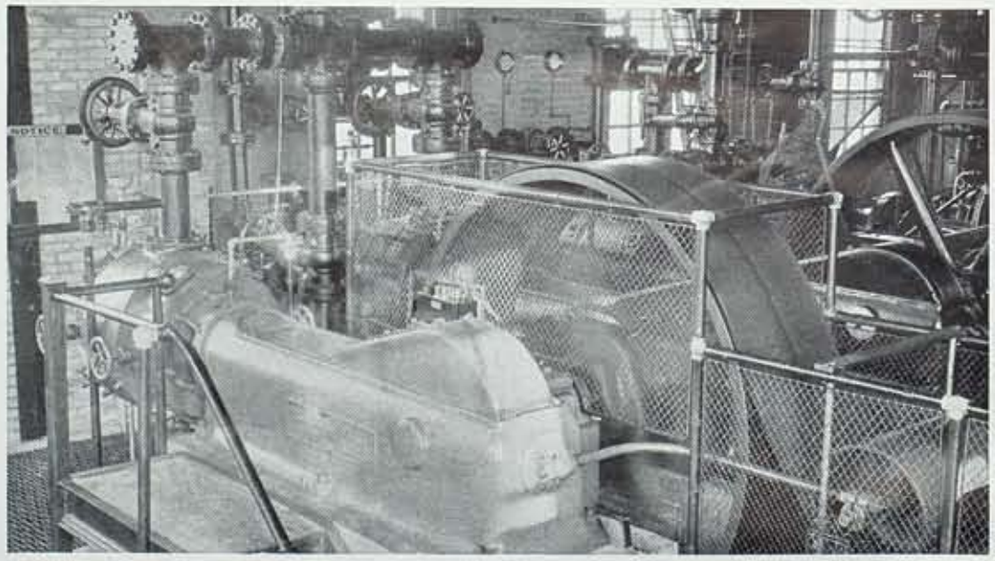
*Installing gas mains along one of Rochester's newer residential streets. The Gas Street Department makes every effort to prevent any damage to property. Canvas is laid over lawns to keep the piled-up soil from harming it, and after the mains are laid the sod is carefully replaced in its original position.*

*High pressure Gas Storage Tanks at Searle Park. The tanks are painted with aluminum paint to minimize heating.*

a Distribution System is, of course, most important. Before a pipe line is installed the future loads must be accurately estimated and the proper size and kind of pipe installed. A number of years ago the Company constructed a Medium Pressure Transmission Line which carries gas under transmission pressures to all parts of the city and its suburbs.

Regulators or Governors are installed along this line at regular intervals in order that each regulator will maintain a definite gas pressure within a given area. The Low Pressure Distribution Mains are fed through these regulators; the mains are designed in a network pattern so that our customers will always be supplied with gas at a uniform pressure. Over 850 miles of main are required to supply our customers.

The complete System includes mains on practically every street in Rochester and vicinity. This complexity of physical layout gives an indication of the problems of operation and maintenance of the System.



*Gas booster at Blossom Road gas holder. It is maintained to provide an emergency gas supply to the East Avenue heating district, and boost the pressure during peak hours of demand. It is electrically operated, being fed by lines from two different electric stations to insure service in the emergency of possible electric interruption.*



**Type of Construction:** The pipe lines in our System vary in size from 30 inches to 1½ inches in diameter. These pipes are placed in the streets and parkways at a depth of about 3½ feet below the surface. Cast Iron pipe is generally used on Low and Medium Pressure Mains and the joints are of the so-called mechanical type.

In order to supply the suburban districts of East Rochester, Fairport, Pittsford, Penfield and Webster, a High Pressure Line is extended from No. 10 holder on Blossom Road to these areas. This pipe line is 6 inches in diameter and is constructed of steel pipe with welded joints. The pressures carried on the line vary in accordance with the load—the maximum pressure being 40 pounds. The mains installed years ago were laid beneath the pavement, but the present practice is to install mains between the curb and sidewalk. Labor saving devices such as trenchers, backfillers, compressed air tools, etc., are used in the construction of gas mains.

The pipe that is run from the main in the street to the customer's premises is called a gas service. The Company has approximately 90,000 of these services in use and they are used to carry the gas to about 109,000 gas meters.

**Gas Shop:** The Company maintains a large and completely equipped Gas Shop where meters and appliances are continuously inspected, tested, adjusted and repaired. Each year some 22,000 to 25,000 gas meters are repaired, tested and sealed by a representative of the Public Service Commission. Every meter installed on the customer's premises must bear the seal of approval of the Public Service Commission.

Perhaps the most important duty of the Gas Shop is to maintain a service department that inspects, adjusts and repairs customers' gas burning equipment. This service is provided for the public 24 hours a day,

*Scene in the Gas Shop, at the Andrews and Front Street offices. Here are inspected, tested, adjusted and repaired, meters and appliances used in homes and industrial plants. From 22,000 to 25,000 gas meters are tested here each year.*

seven days a week. The Company makes every effort to give prompt, courteous and efficient service to all customer complaints.

The number of appliances in use has increased tremendously during the past few years. The use of automatic Gas Ranges, Water Heaters, Refrigerators and Househeating has increased the service man's problems many fold. In an effort to keep our men informed of the latest developments in the appliance field, we periodically operate a school for training the service men. We have found this practice highly beneficial and it is one of the most important tasks connected with providing proper service to our customers.

A Gas Laboratory is maintained where gas appliances are rigidly tested and inspected in order that the quality of the appliances sold by our Company be of the highest order.

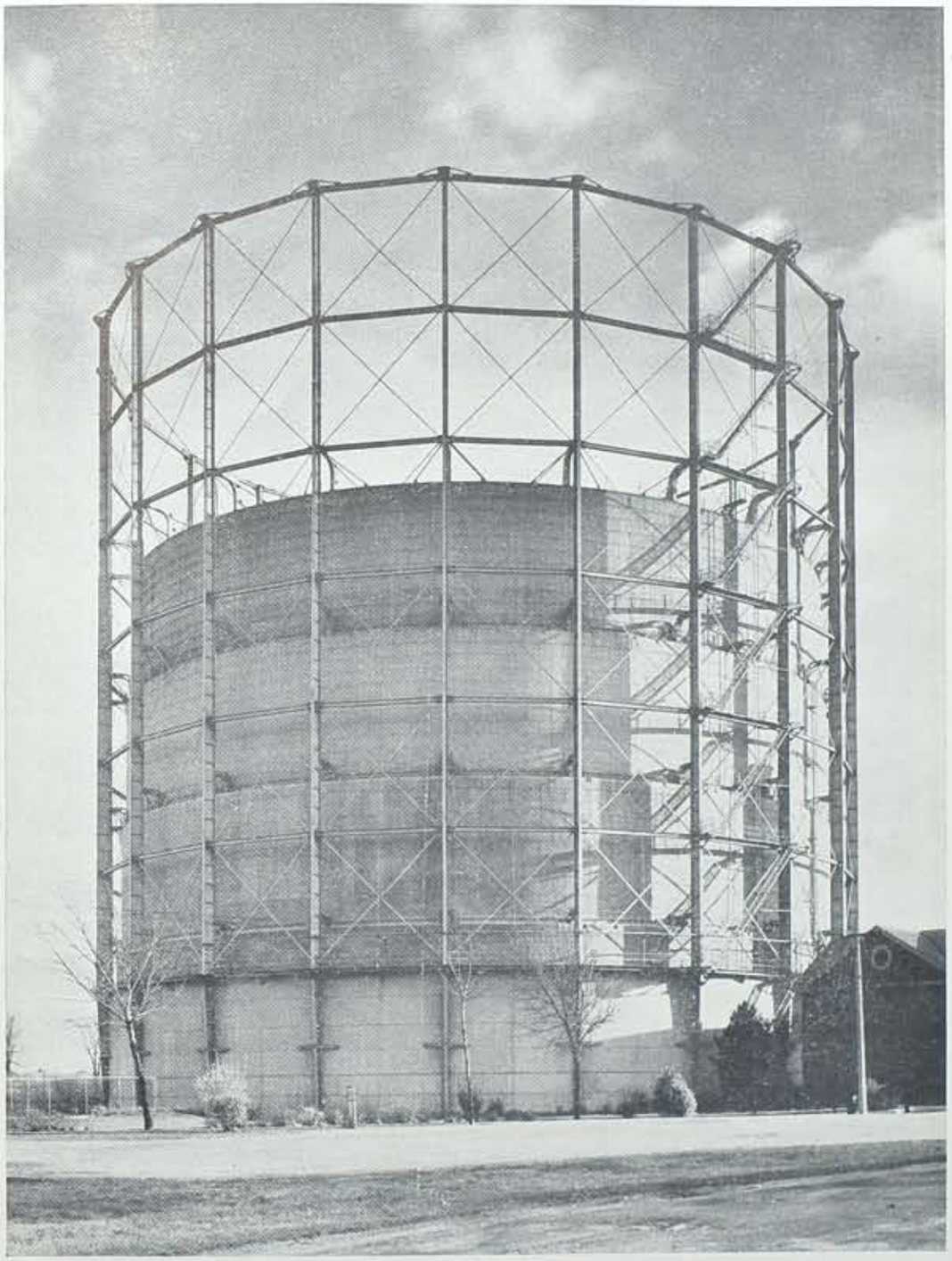
## Blossom Road Holder

The Blossom Road holder is a five-lift steel tank, with a capacity of 6,000,000 cubic feet and is used for reserve storage and distribution purposes. It was built in 1912, is about 220 feet high when fully inflated, and contains 46,000 tons of steel.

In connection with the gas holder at Blossom Road there is an operating house which contains two B. & W. Sterling boilers of 125-H.P. capacity each, which serve for heating the holder tank and cups to prevent freezing in the winter. These boilers burn approximately 500 tons of coal each season. There are also four gas pumps or "Boosters" which are used for pumping gas to East Rochester, Fairport, Pittsford, Penfield and Webster, and also for pumping it back into the city distribution system during periods of heavy load.


*Typical gas distribution construction job, East Avenue near Winton Road. Replacing 6-inch medium pressure gas distribution line with 12-inch line to provide greater capacity in the East Avenue district. Modern equipment aids greatly in speeding such work and cutting to a minimum the time necessary to accomplish necessary construction work.*





*The Blossom Road gas holder at Searle Park, has a capacity of 6,000,000 cubic feet of gas. This park is popular as a recreational center for the section of the city in which it is located, and has some fine tennis courts and a baseball diamond with bleachers. This fine park is a tribute to the aesthetic taste and vision of former President of the Company Robert M. Searle*

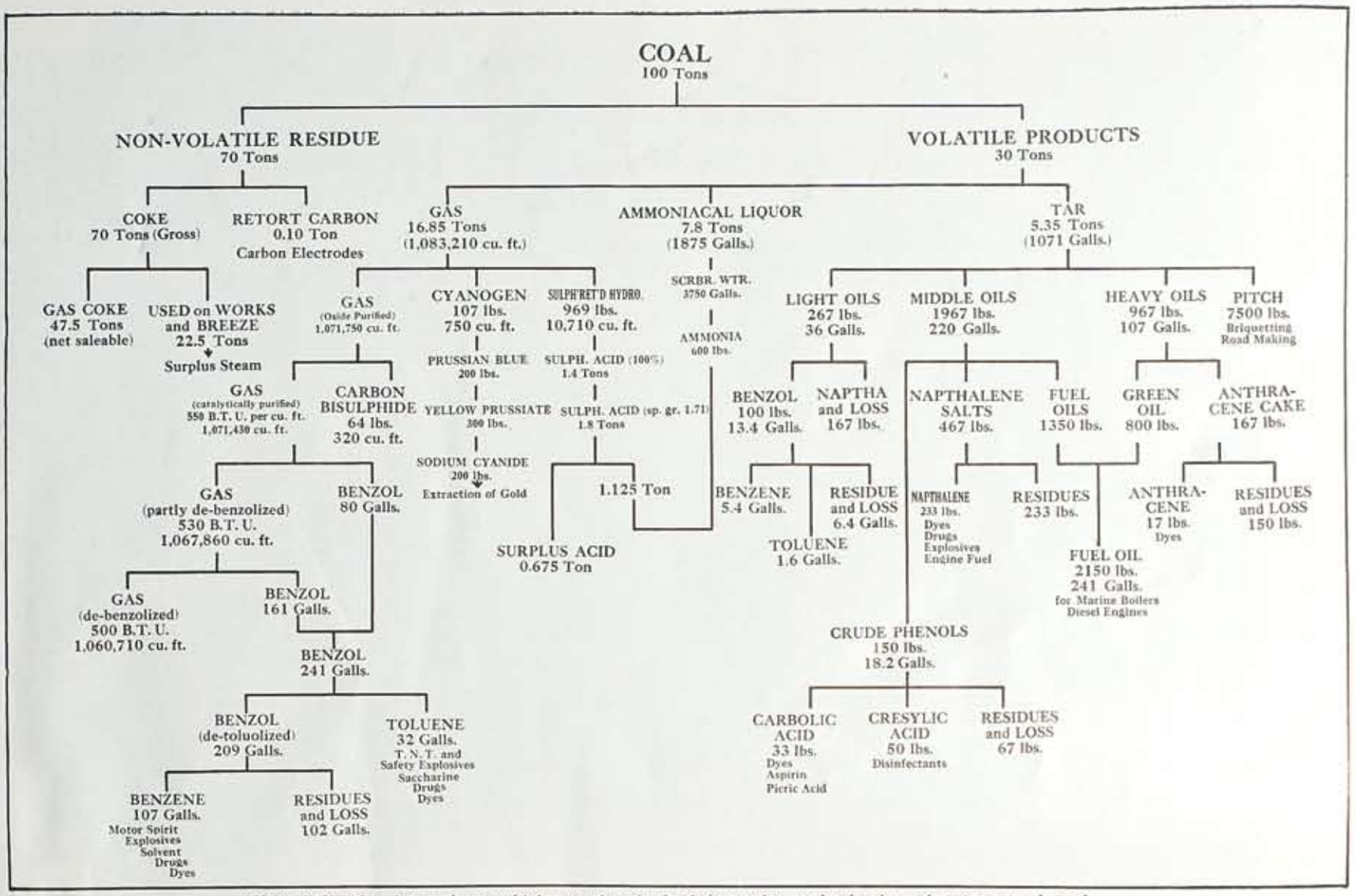
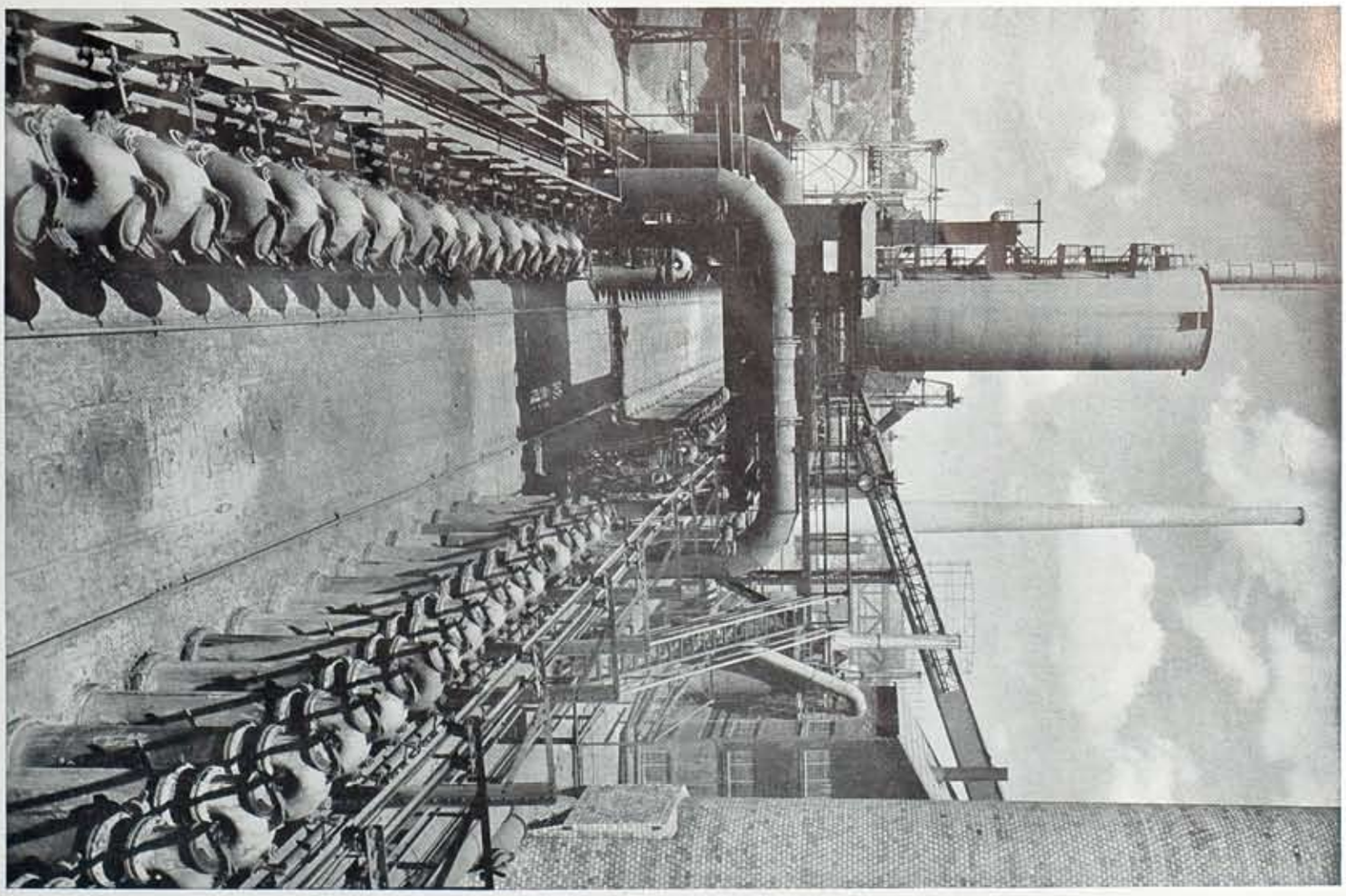



*Chart indicating by-products which may be obtained from the carbonization of 100 tons of coal*

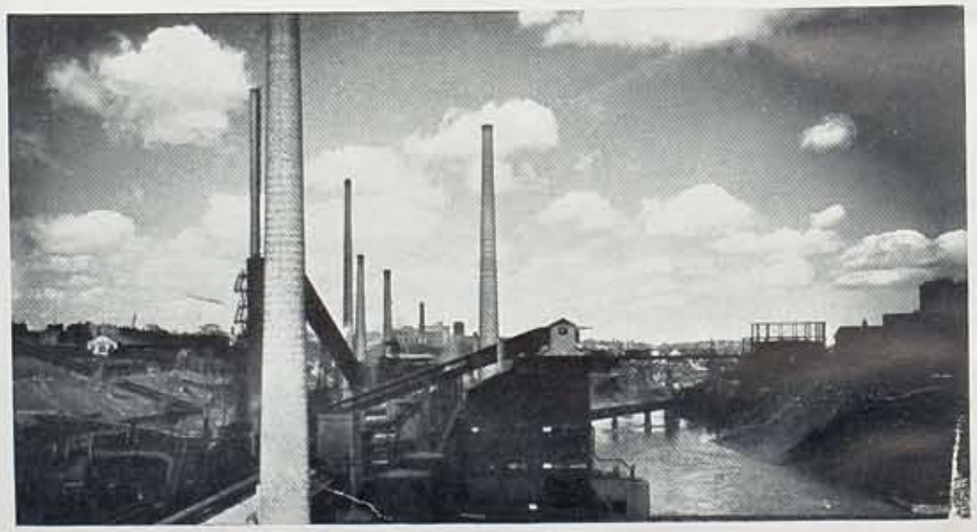


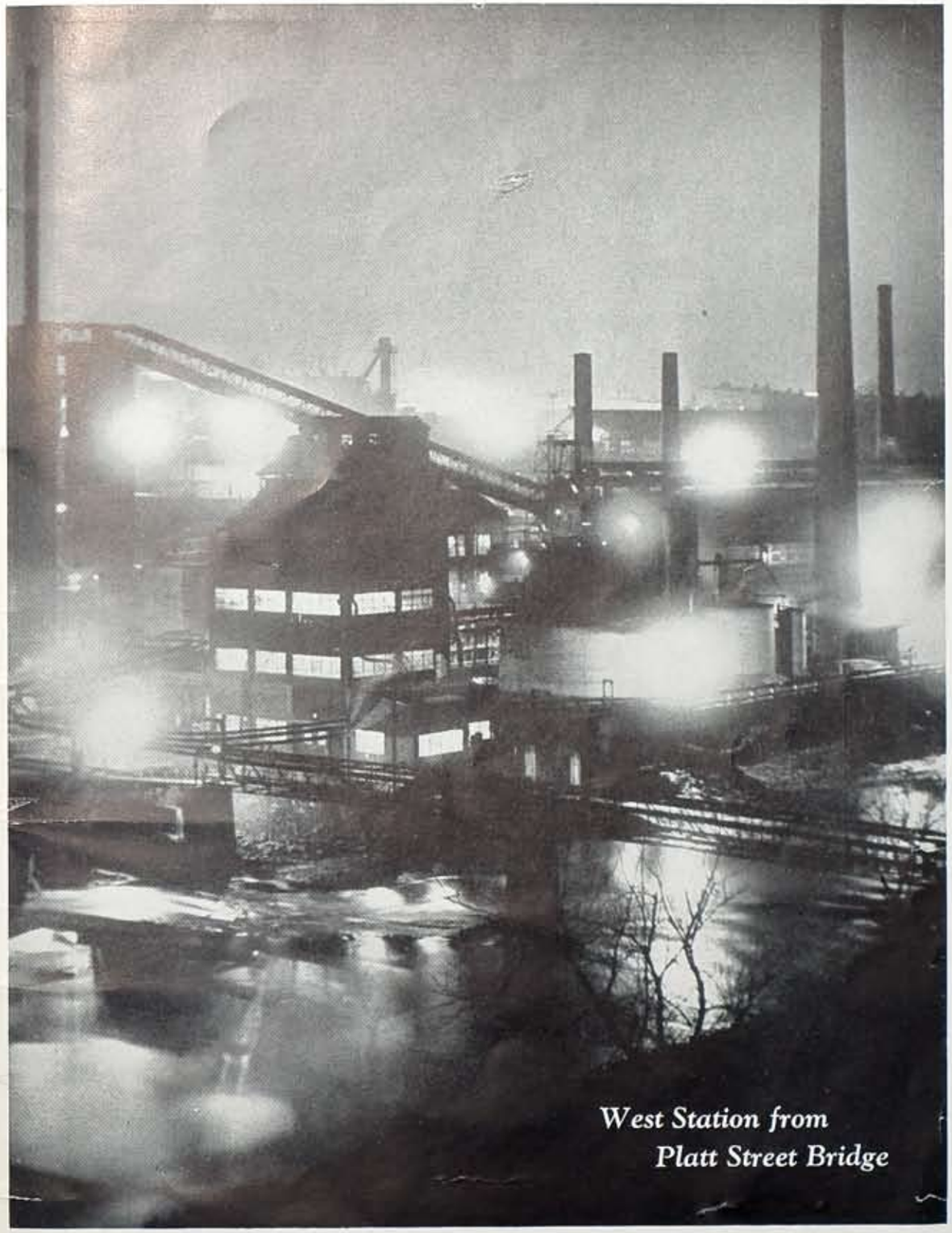
*View of top of Koppers Gas Ovens at West Station Gas Manufacturing Plant.*

# Gas Manufacturing Department
# Statistical Data

**Typical Results Obtained in Daily Operation**

| **Coal Gas Operation** | **(97 Koppers Becker Type Ovens)** |
|---|---|
| Gross coking time | 14.1 hrs. |
| Weight of Coal charged per oven, wet coal basis | 13,620 lbs. |
| Coal Carbonized per day, wet coal basis | 1,129 tons |
| Coal Gas made per day (550 B. t. u.) | 13,492 M. cu. ft. |
| Yield Dry Basis (550 B. t. u.) | 6.37 cu. ft. per lb. |
| B. t. u. Feet, Dry Basis (550 B. t. u.) | 3,476 B. t. u. per lb. |
| Coal Gas B. t. u., Controlled | 546 B. t. u. |
| Dry Fuel per ton coal carbonized, gross | 303 lbs. |
| Dry Fuel per ton coal carbonized, net | 272 lbs. |
| Dry Fuel used for B. t. u. Control only, per ton coal carbonized | 31 lbs. |
| Producer Gas used for B. t. u. Control, per day | 2,459 M. cu. ft. |
| Oven Gas made per day, net | 11,033 M. cu. ft. |
| Oven Gas B. t. u. | 636 B. t. u. |
| Oven Gas B. t. u. feet | 3,187 B. t. u. ft. per lb. |
| Coal Tar yield per ton coal carbonized | 13.01 gals. |
| Ammonium Sulphate per ton coal carbonized | 10.54 lbs. |
| Coke made per day | 753 tons |
| Oven through-put in per cent of rated capacity | 88.23% |
| **Dry Quencher Operation** | |
| Steam made per day | 498,000 lbs. |
| Steam made per M. lbs. of Coke dry quenched | 381 lbs. |
| Per cent of Coke charged Dry Quencher was operated | 91.77% |
| **Liquid Purification Operation** | |
| Efficiency of $H_2S$ removal | .866 |
| Soda used per M. cu. ft. Gas purified | .314 lbs. |
| Catalyzer Used per M. cu. ft. Gas purified (Arsenic) | .0081 |
| **Mixed Gas Operation** | |
| Send-out | 13,595 M. cu. ft. |





*West Station from Platt Street Bridge*

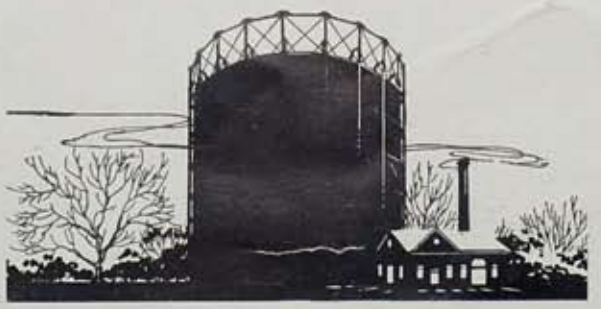
GAS MANUFACTURE AND DISTRIBUTION

ROCHESTER GAS AND ELECTRIC CORPORATION

# GAS

## MANUFACTURE and DISTRIBUTION

ROCHESTER GAS
AND ELECTRIC
CORPORATION



10/38—Flower City Press, Rochester, N. Y.