



STEAM HEATING SERVICE



ITS DEVELOPMENT
AND APPLICATION IN
BOSTON



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STEAM HEATING
SERVICE



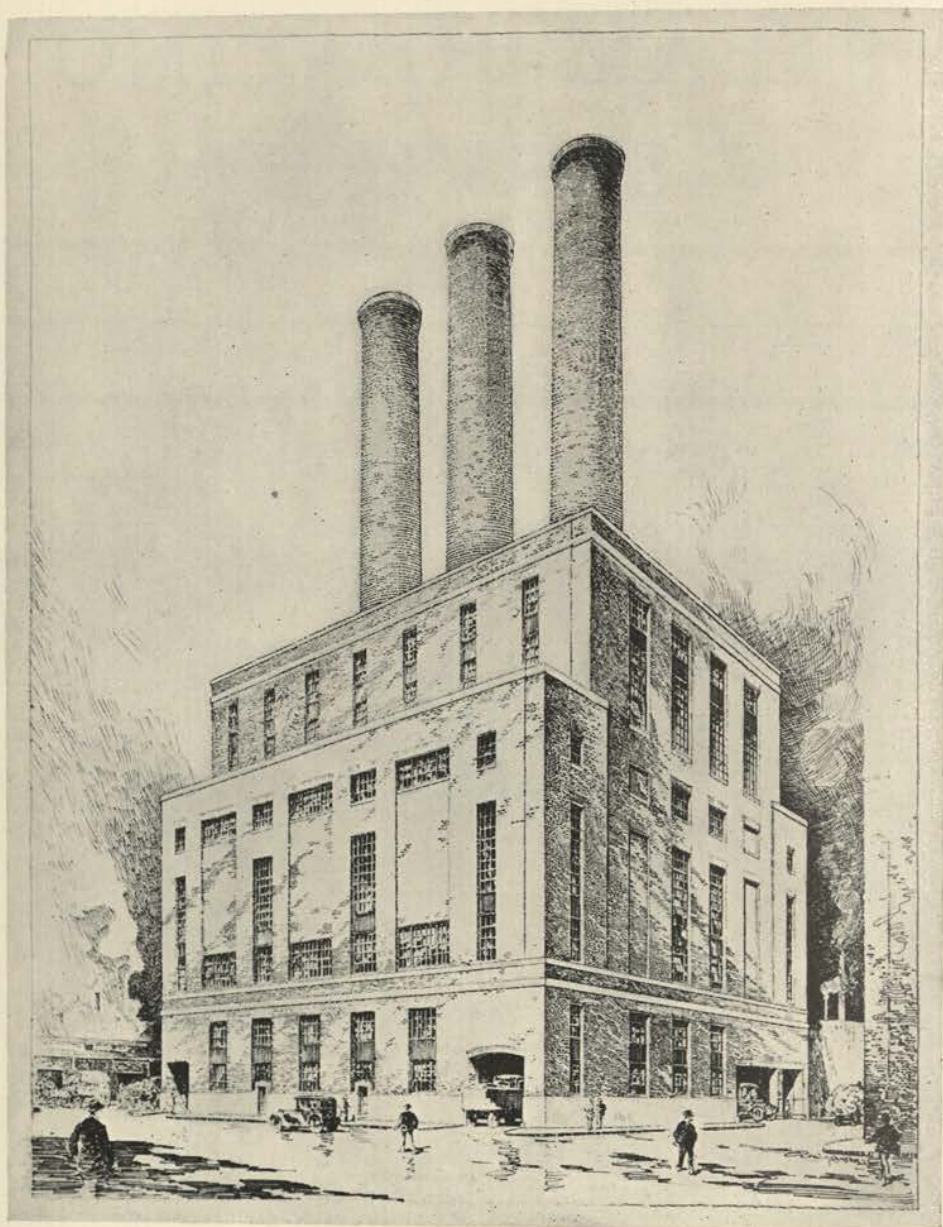
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Issued by
THE STEAM HEATING SERVICE DEPARTMENT

THE EDISON ELECTRIC
ILLUMINATING COMPANY OF BOSTON
THIRTY-NINE BOYLSTON STREET
BOSTON, MASSACHUSETTS



Steam Heating Station S-2, at Kneeland and Utica Streets, Boston

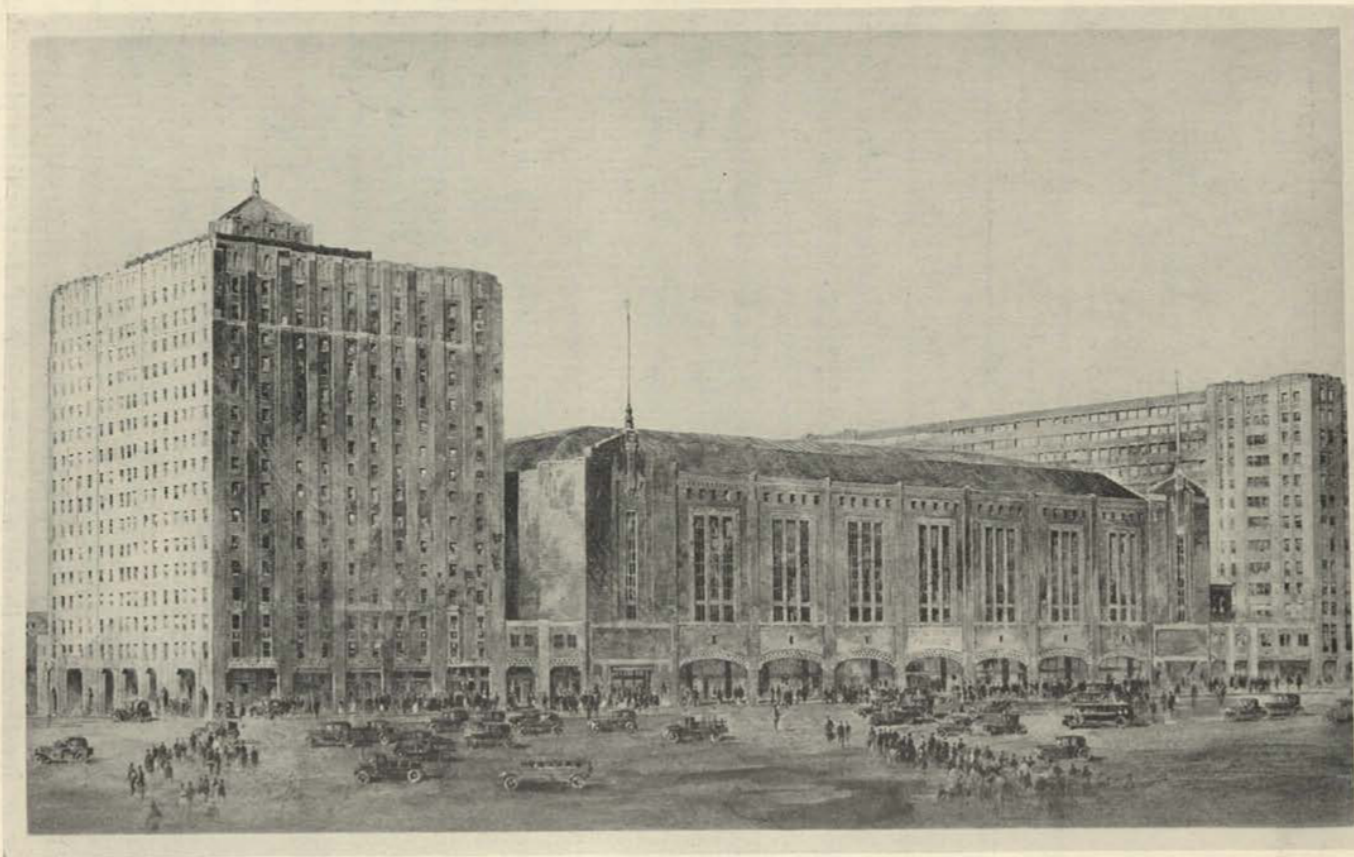
STEAM HEATING SERVICE

ITS DEVELOPMENT IN BOSTON

S long ago as 1887, in this city, The Boston Edison Company supplied steam to properties adjoining its generating plants. The supply was, of course, limited to the immediate vicinities of the generating stations and for several years a small amount of equipment and comparatively few steam mains were sufficient to meet the demands for district steam heating. With the growth of Boston, the demand for district steam heating increased rapidly and provisions were made to supply steam to many new, growing districts.

In 1922, a definite extension program was adopted. The first step, in the new development, was to install underground steam mains through Avery, Mason, West, and Bedford Streets, and Temple Place, thus connecting all the steam heating plants then controlled by the company. Since that time, more mains have been added until ten plants in this section are now operating together through a common distribution system.

Early in 1928, The Boston Edison Company started to supply the entire steam requirements of the North Station and associated buildings. To do this, the company purchased, from the Boston and Maine Railroad, a boiler plant located at Minot and Nashua Streets, and converted it into a steam generating plant. At that time, the opportunity was taken to extend steam mains into Friend and Portland Streets. It is expected that these mains will be extended further as development in the northern sections of the city takes place; thus

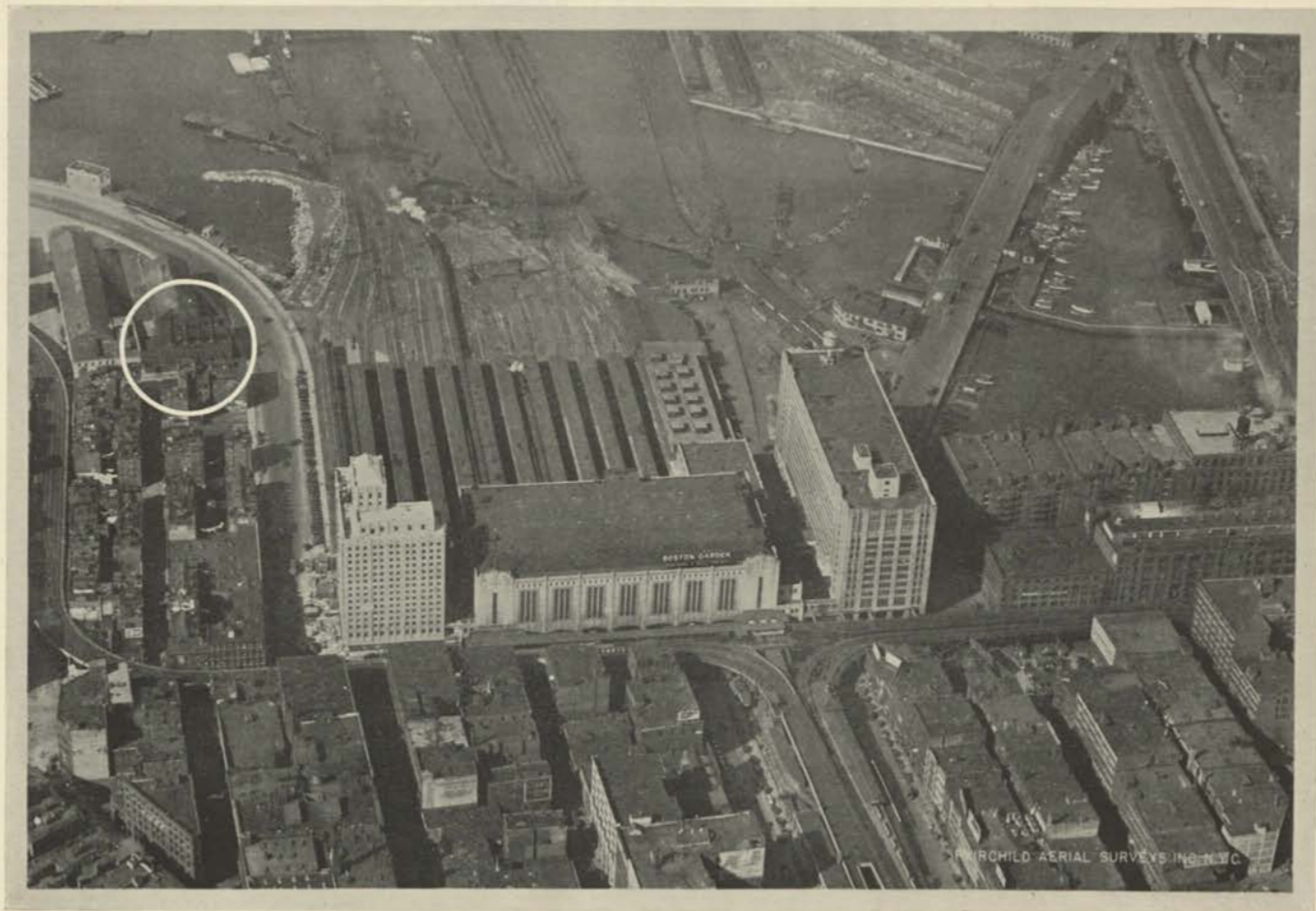


Hotel Manger

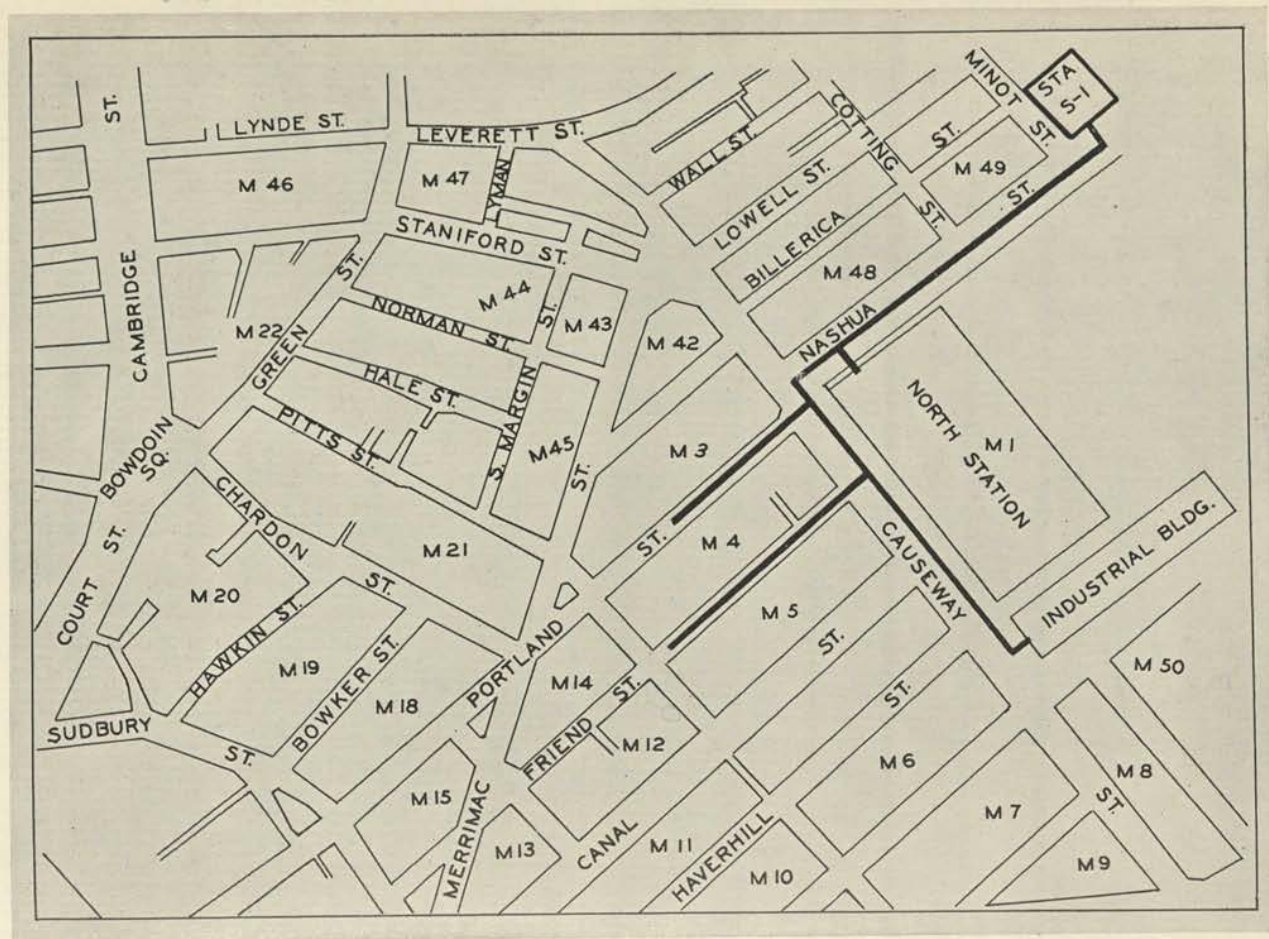
North Station and Boston Garden

Industrial Building

The steam heating requirements of this group of buildings are supplied by The Boston Edison Company



Aerial view of the northern section of Boston. Steam Heating Station S-1, on Minot Street, is shown in white circle



Street plan showing steam mains in the vicinity of Steam Heating Station S-1

making steam service available throughout practically the entire section around the North Station.

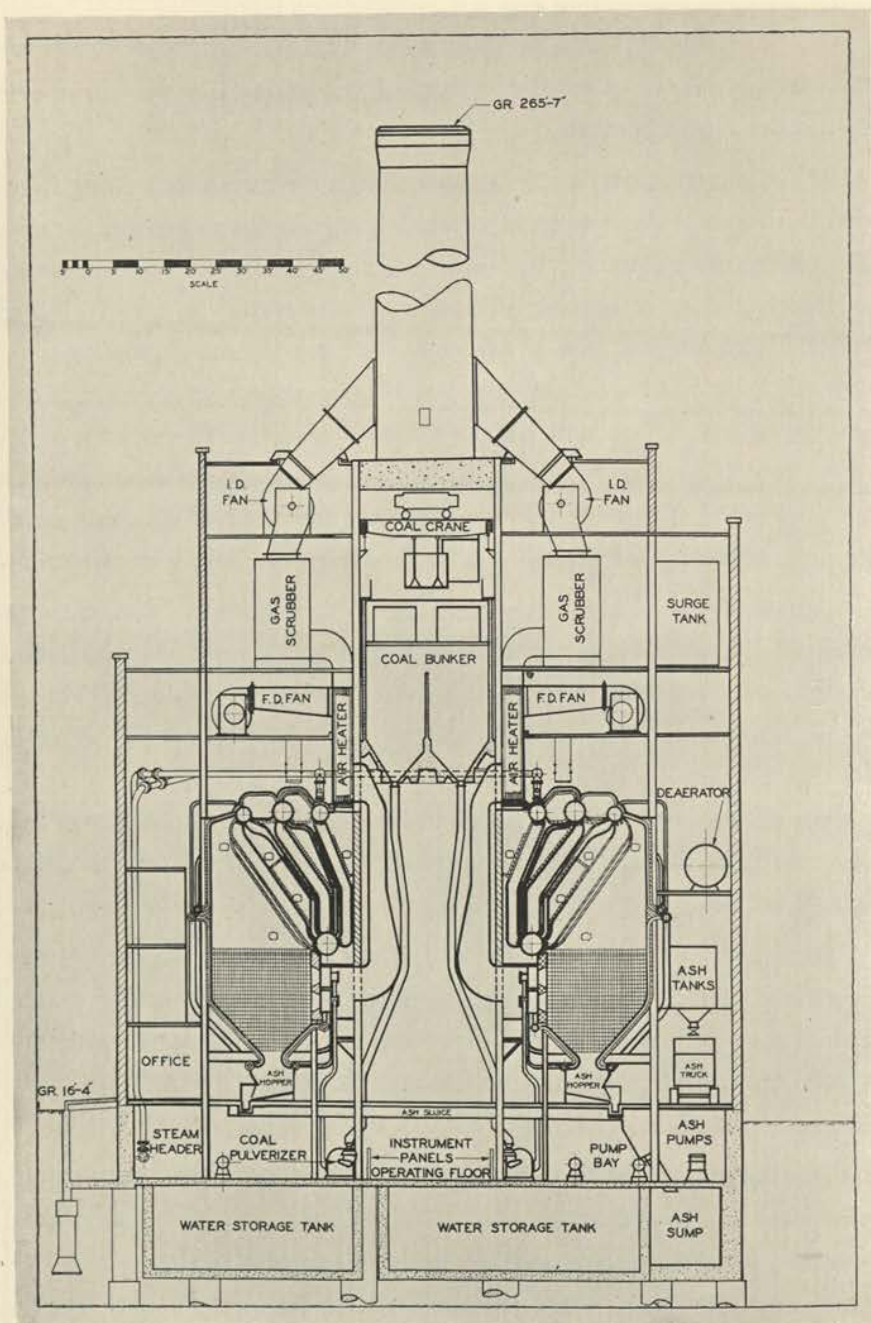
It became apparent, several years ago, that district steam heating in downtown Boston was about to enter a period of unprecedented growth. In anticipation of this development, The Boston Edison Company has undertaken to provide facilities for heating all buildings within the district of high rental values. To accomplish this, a new steam generating plant of large capacity and high efficiency has been constructed at Kneeland and Utica Streets. The site, adjacent to the Boston and Albany Railroad tracks, covers an area of 16,977 square feet. This huge plant, solely for the generation of steam, modern in every way, and including features the most advanced engineering skill can produce, is capable of supplying a large section of downtown Boston.

Each boiler is capable of evaporating 250,000 pounds of water per hour, continuously, when operating at a pressure of 200 pounds gauge. The furnace of each boiler is 20 feet wide, with a volume of 12,500 cubic feet. Three sides of each furnace are water-cooled, constructed of block-covered $3\frac{1}{4}$ -inch tubes, connected to headers which, in turn, are connected to the boiler drums. At the bottom of the furnace, in each boiler, there is a water-cooled hearth suitable for cooling the ashes as they drop into the ash pit. The station will ultimately contain six boilers.

Some idea of the size of these boilers can be gained from the fact that the center line of the rear steam drum is 48 feet 6 inches from the center line of the lower water wall centers. The water column is equipped with shut-off devices and tricocks, chain-operated from a floor approximately 40 feet below the gauge glass.

The boilers are fired with pulverized semi-bituminous coal, using two pulverizers and four burners to each boiler. Each pulverizer is designed for a continuous coal-grinding capacity of 12,500 pounds of coal per hour.

The boilers are designed for air heaters of the tubular type. Cold air is discharged by the forced draft fans into the inlets of the air heaters, and the



Cross-section of Steam Heating Station S-2

hot air is discharged from the outlets of the air heaters at the bottom. The passage of the gases and air through the air heaters is counter flow, the gas making a single pass upward and the air a single pass downward.

From the air heaters, the hot gases of combustion pass to the gas scrubbers which remove the cinders. Two types of scrubbers are installed, one each to a boiler. One type is a rotating disk water atomizing device. The other is a spray type device. Each has a capacity of 72,500 cubic feet per minute of gas at a temperature of 515 degrees Fahrenheit.

On passing through the wet scrubbers, the flue gases of combustion are completely humidified and their temperature reduced to 135 degrees Fahrenheit. Before being discharged to the chimney, the gases are heated to 165 degrees Fahrenheit, to reduce their relative humidity to 50 per cent. The gases are, from this point, moved on by induced draft fans, which are designed to remove, from the gas scrubbers, 145,000 cubic feet of gas per minute when operating at a speed of 1100 revolutions per minute.

The discharge of each induced draft fan is provided with balanced Louvre type dampers, to enable the fans to be inspected or repaired. The induced draft fans discharge the gases to superimposed radial brick chimneys, which reach to a height of 250 feet above street level, and have an inside diameter of 15 feet at the top.

The fuel, pulverized and burned in this plant, is semi-bituminous coal. The coal is delivered by coal trucks with detachable bodies. A 15-ton electric crane is used to hoist the truck bodies from street grade to the bunkers 100 feet from the street level. The crane has a hoist speed of 100 feet per minute.

The method of handling ashes differs somewhat from the method used in smaller plants. The bottom of the furnace forms a smooth, sloping, water-cooled hearth to cool the ash as it drops into the ash pit below. The sluicing system is so designed that the ashes are removed from the ash pit and deposited into the ash sluice by means of water jets. Other water jets move the



The uptown section. Location of Station S-2 is shown in white circle

ashes along the sluice to the ash sump. The ashes from the third pass of the boiler can also be discharged into the sluice at each end of the ash hopper. The only labor required is for the operation of the oscillating nozzles for removing the ashes from the ash pit and breaking up large clinkers.

The water used in the plant for all purposes is taken from the city water mains. No condensation from the distribution system is returned to the boiler plant; therefore, the water supplied to the boilers is approximately 84 per cent softened city water and 16 per cent condensate returned from the station auxiliaries.

From the softeners, the water is delivered to a storage tank located below the pump room. The water is taken from this tank by means of two duplicate service pumps, one driven by a steam turbine and the other by a constant speed induction motor. The capacity of each pump is 600,000 pounds per hour at a pressure of 165 feet of water.

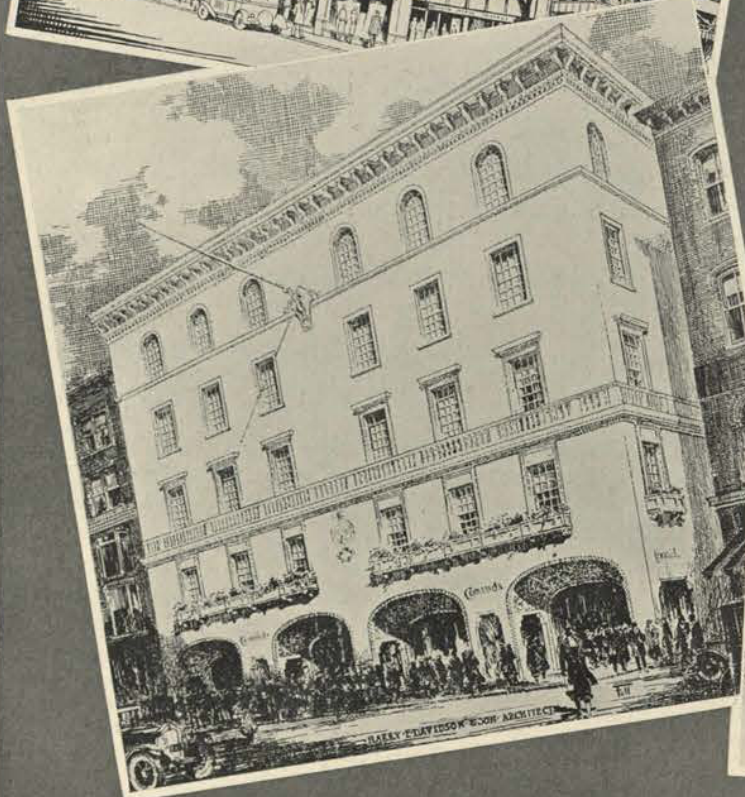
Automatic combustion control operates to hold the steam pressure in the station header within 2 per cent of the determined pressure. This equipment also maintains the excess air value within 5 per cent of that for which the apparatus is set. The furnace draft does not vary more than one-tenth of an inch from the desired draft.

The station will have an ultimate capacity of approximately a million and a quarter pounds of steam per hour to the distributing mains. This amount of available steam is sufficient to heat one hundred buildings the size of the new United Shoe Machinery Building at High and Federal Streets. Incidentally, this building was the first set-back type of structure in Boston to utilize district steam heating service. Another large building of the same style architecture to take its full steam heating requirements from this company is the 75 Federal Street Building.

A comprehensive idea of the extension project can be had from the accompanying district maps and from the aerial picture of the section around the plant location.

The difficulties in the way of the advancement of district steam heating, which were economic rather than technical, have been practically eliminated by recent developments. The engineering phases have made remarkable progress and have reached a very satisfactory stage. Heating engineers, building owners, and others interested in heating problems have come to a realization of the economy and the efficiency of district steam heating.





BOSTON DEPARTMENT STORES USE DISTRICT STEAM HEATING

Jordan Marsh Company
Conrad & Company, Inc.

Houghton & Dutton Company
R. H. Stearns Company

R. H. White Company
Chandler & Company



United Shoe Machinery Building

STEAM HEATING SERVICE

ITS APPLICATION IN BOSTON

THE customers of The Boston Edison Company, using steam service, represent all classes of buildings and industries. There are office buildings, hotels, department and specialty stores, theatres, churches, turkish baths, restaurants, candy manufacturers, as well as clothing and hat manufacturers.

In office buildings, steam is used for atmospheric heating and for heating water. This applies also to department and other stores. In restaurants, steam is used to heat water for dish washing, also for warming ovens, vegetable steamers, and for many other incidental purposes. Clothing and hat manufacturing establishments use steam in their presses as well as for heating space and water. In candy factories, steam is used to heat jacketed kettles in which the candy mixtures are cooked.

Boston department stores have been particularly progressive in adopting district steam heating. They have found that the space thus released has a value far in excess of the cost of buying steam.

In our congested mercantile districts, where ground values and high construction costs make every square foot of space extremely valuable, district steam heating has contributed immeasurably to the progress of business.

This service is proving so attractive to operators and owners of property in congested sections that new buildings are being designed without any heating plants, relying upon the Edison Company for their entire steam requirements. This releases, for other uses, the space required for coal bunkers, boiler rooms, and chimneys. Through elimination of a large number of small heat-



75 Federal Street Building

ing plants, much is done toward improving the general cleanliness of an area by ridding it of local smoke and the dirt incident to coal or oil delivery and ash removal.

The smoke nuisance has become a vital question. It has commanded the attention of city officials and necessitated the appointment of a special committee to investigate and recommend methods of proper smoke abatement. In addition, special laws have been passed to control the smoke situation.

As has been described in the foregoing pages, the Edison Company's steam heating stations are provided with the most efficient equipment to insure complete combustion of fuel and consequent smoke elimination.

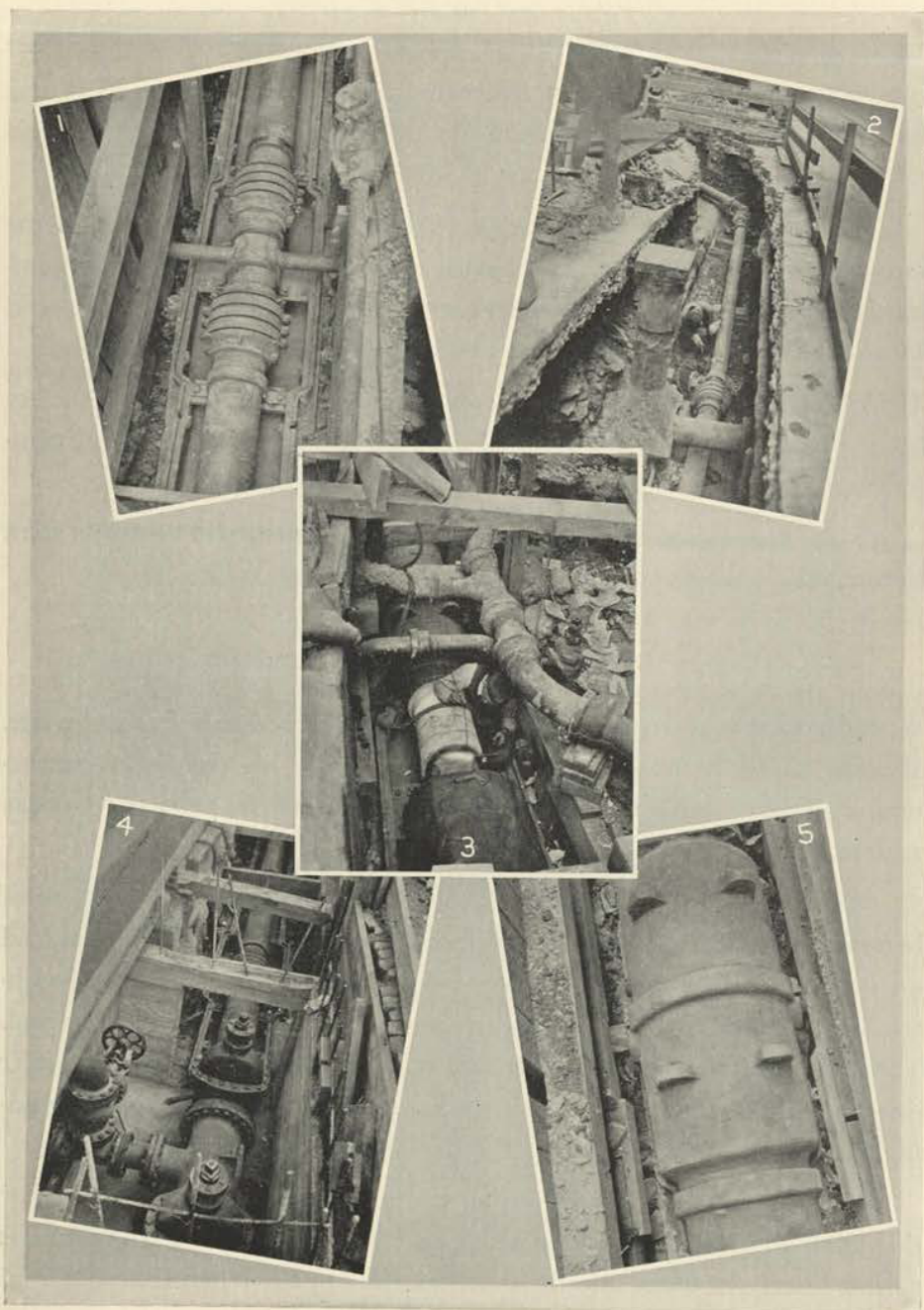
As the use of district steam heating increases, the city will become a safer, cleaner, and healthier place in which to live and work.

DISTRIBUTION OF STEAM

THE distribution of steam is analogous to the distribution of gas and water. The essential difference is in the modern method of underground construction, which provides for expansion and contraction of the pipes and protects against excessive heat losses.

Steam leaves the plant and enters the distribution mains at a pressure of between 100 pounds and 200 pounds per square inch, depending on the load on the system. Steam mains, valves, and fittings are today capable of withstanding a much higher pressure than that which was formerly attempted. The supply lines are 16 inches, 14 inches, and 12 inches in size, and either 6-inch, 4-inch, or 2½-inch pipe is used from the supply lines to the building supplied with steam service.

In the latest type of construction, where the grade of the pipe is below tide level, a cast-iron conduit construction has been developed, which insures against leakage of water into the space occupied by the steam line.



UNDERGROUND CONSTRUCTION OF STEAM MAINS

1. Expansion Joints and Service Connections with cast-iron conduit open.

4. Sectionalizing Valves.

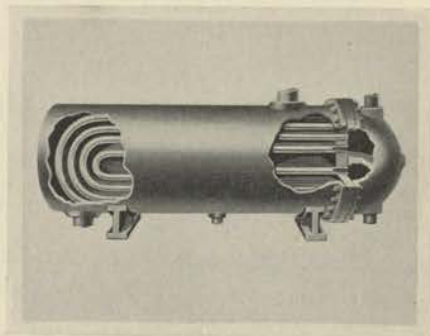
3. Welding a Joint. Showing obstructions met in underground construction.

2. Welding a Joint in 8-inch Steam Pipe.

5. Expansion Joints and Service Connections with cast-iron conduit closed.

THE CUSTOMER'S HEATING APPARATUS

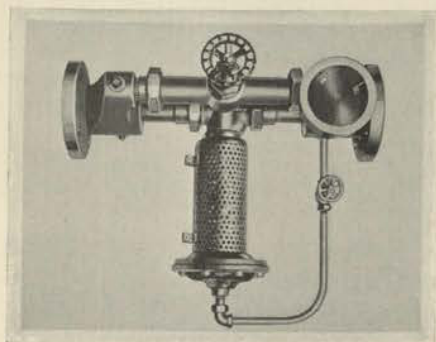
EXPERIENCE has demonstrated that in order to supply the most satisfactory heating service to the consumer, both as to quality and cost, the operators of a district heating system should assist the consumer in planning a suitable heating system. The quality of the steam service depends entirely upon the heating equipment in the customer's building. Consequently, the proper design and maintenance of this equipment are very important in the rendering of satisfactory and economical steam heating service.



Economizer or Heat Exchanger

Present day practice, in the design of heating apparatus, has reached a satisfactory stage of development. There are, however, certain principles which should be observed when heating service is to be supplied by the district heating system.

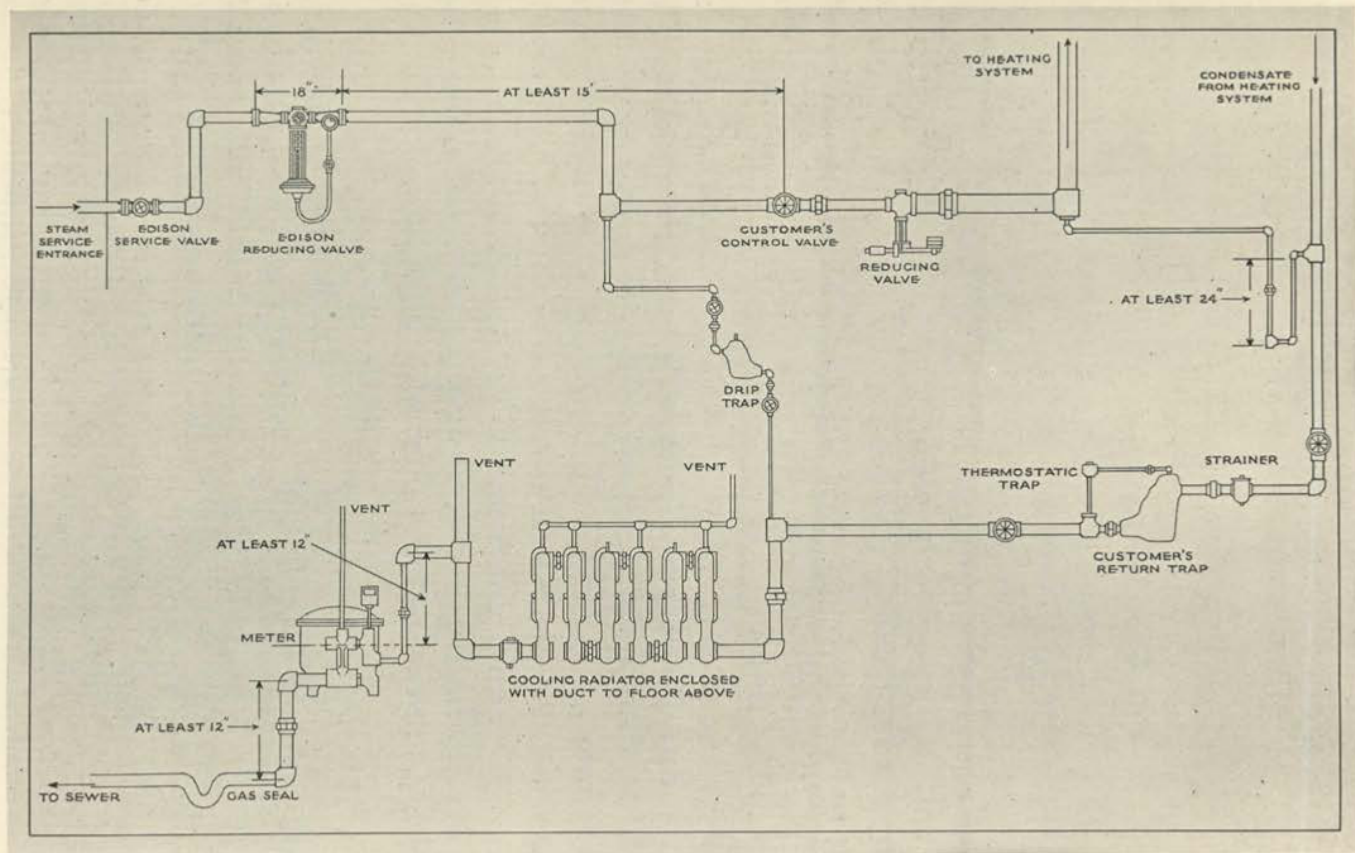
An illustration of a typical installation is shown. There are many variations of this in actual practice, depending on the use to be made of the steam and also the arrangement and design of the customer's other apparatus. Each building must receive individual attention and the details worked out to suit the conditions.



Pressure Reducing Valve

The special apparatus, which is necessary to adapt a consumer's heating system to the use of steam from a district heating system, consists of:

- (a) A pressure reducing valve — the steam pressure carried in the district heating mains is always higher than is desirable for use in radiators and other equipment and must be reduced.



Typical installation on property of a customer using district steam heating

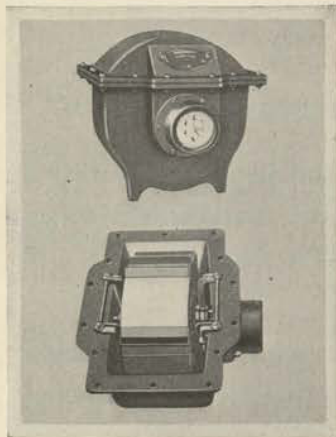
- (b) A trap which will permit the drainage of condensation from the pipes and radiators without leakage of steam.
- (c) An economizer to utilize the heat in the condensation.
- (d) A meter (supplied by the Edison Company) to measure the amount of steam used.

STEAM METERS

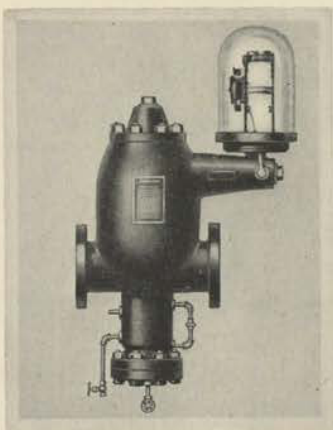
STEAM is an aqueous gas generated by the application of heat to water, and may be measured as steam by a steam flow meter, or as water, after condensing, by a condensation meter.

The weight of water, before it is evaporated into steam, furnishes the base for the method of measuring. Thus, a pound of steam is a pound of water evaporated by heat. When this steam is condensed, there will remain a pound of water. Consequently, in measuring pounds of condensation, the meter simply measures and records the pounds of steam that have been used or condensed.

Steam, like gas, water, and electricity, is measured by meter. This has been found to be the only equitable method of computing charges for steam service.



Condensation Meter



St. John Steam Flow Meter

The usual method of metering is to measure the condensation at its point of discharge from the customer's piping. In order to accomplish this, it is necessary that the condensation be collected at one point, that the pipes be free from leaks, and that the condensation be drained to the meter without the escape of steam or water.

One form of condensation meter consists

of a drum having six compartments which are filled in succession from a central inlet spout. The drum revolves slowly, due to the unbalanced weight of water in it. The revolutions are transmitted through a train of gears to a dial which shows the accumulated consumption.



Bailey Steam Flow Meter

The metering of the condensation is impractical in some cases, particularly where it is not possible to return the condensation; as when steam is used for process work. Some form of steam flow meter is necessary in such cases. There are several types of these in use. Some are piped directly into the steam service pipe inside the customer's premises, while others record a variation in pressure across an

orifice installed in the customer's service. Two types of steam flow meters, the Bailey and the St. John, are shown.

All steam flow meters depend on a constant pressure of steam for accurate registration. For this reason, considerable care is exercised in maintaining the company's pressure reducing valves, which are installed inside the customer's premises. The pressure is checked by inspectors at least twice a week. The larger installations are inspected every day.

HIGH PRESSURE NOT NEEDED

STEAM pressures are believed to have a direct and important bearing on steam costs, but, in fact, have little influence on them. Steam may be successfully used for heating at a few ounces pressure — at the most, only a few pounds pressure are needed.

The fundamental laws of steam manufacture are such that steam pressure has little effect on the amount of coal required to produce it. For example, steam at atmospheric pressure, contains about 1151 heat units per pound.

Steam at 100 pounds pressure contains about 1189 heat units per pound. From these facts it will be seen that by increasing the steam pressure several hundred per cent, the heat content is increased an insignificant amount. In simple language, one pound of steam at 100 pounds pressure has less than 4 per cent more heat than the same quantity of steam contains at atmospheric pressure.

STEAM SERVICE RATES

THE rates at which steam is sold are so designed that they compare favorably with the cost of producing steam in the isolated plant. Wherever the initial investment in boilers can be omitted from building construction, the cost of steam service shows a distinct saving over other methods of heating.

EMERGENCY SERVICE

TO give service, day and night, to steam customers and to aid them in every way possible in the operation of their heating equipment, a Steam Heating Service Department is maintained by the Edison Company. The men in this department are selected because of qualifications which enable them to care for emergencies which might develop with the various types of equipment used by steam customers, as well as with the equipment in the Edison steam heating system.

FACTS TO REMEMBER

Heat is Conserved:

When only sufficient steam is used to produce the desired temperature in the building.

When only the necessary air changes are made to properly ventilate the building.

When all air inlets, other than ventilating devices, are closed.

Heat is Wasted:

When piping, not required as radiating surface, is not protected against loss of heat by being covered with efficient insulating material.

When the heating system has not been installed with a view to securing the highest economy.

When the sensible heat in the condensation is not utilized. The wasting of this heat means a considerable loss in heating efficiency.

THE ADVANTAGES OF DISTRICT STEAM HEATING

DISTRICT steam heating implies more than just heat alone. Supplying heat in such a convenient and useful manner is a matter of real service, eliminating as it does the cost and annoyance of purchasing fuel, maintaining a boiler plant, and caring for the many other accompanying details. Its advantages are many and far-reaching, affecting builder, owner, tenant, and occupants, to the benefit of all.

With district steam heating, there is:

- An assurance of dependable heat, ready day and night, its capacity far exceeding any possible individual demand.
- Elimination of coal and ash handling with its consequent expense; its noise and dirt and the obstruction of public ways.
- Absence of excessive heat in usable portions of the premises.
- Decreased fire hazard resulting in lower insurance rates.
- Freedom from worry about a fuel supply and the maintenance of mechanical equipment.
- Release of space, ordinarily used for heating plant equipment, for revenue producing purposes.
- An appreciable saving in investment in heating plant equipment.
- The advantage of a metered heating service making it possible, at all times, to know the exact amount of steam being used, and a definite control of heat to coincide with weather conditions.
- And, without cost or obligation, the availability of expert engineering advice about steam or other heating problems.

These are a few of the numerous reasons why district steam heating is used in so many buildings, why it is accepted and acknowledged to be that convenient and economical method of heating so necessary in the progress of industrial life in Boston.

SOME OF THE FIRMS USING
BOSTON EDISON STEAM HEATING SERVICE

Atlantic National Bank	144 Tremont Street
Atlas Hat, Incorporated	11A Kingston Street
Avery Hotel	24 Avery Street
Avery Real Estate Trust	172 Tremont Street
E. T. Bannwart	60 Pemberton Square
Beacon Theatre, Incorporated	47 Tremont Street
Bedford Sandwich Shop	82 Bedford Street
M. T. Bird and Company	5 West Street
V. Bonzagni	222 Friend Street
Boston and Maine Railroad	North Station
Boston Publishing Company	171 Tremont Street
Boston Recreation Company, Incorporated	615 Washington Street
Boylston Market Associates	2 Boylston Street
William H. Brown	212 Friend Street
Sylvester Brown, Trustee	269 Washington Street
Brown and Wells, Incorporated	39 Kingston Street
E. W. Burt and Company, Incorporated	17 West Street
Cann's Sea Grill	122 Canal Street
George A. Carpenter	59 Temple Place
Chandler and Company	150 Tremont Street
Cora Chandler Shop	50 Temple Place
Charles Chauncy Building Company	38 Chauncy Street
Chauncy-Bedford Building, Incorporation	27-33 Bedford Street
Child's Dining Hall Company	177 Tremont Street
Child's Dining Hall Company	605 Washington Street
Conrad and Company, Incorporated	25 Winter Street
Commonwealth Clothing Company	65 Bedford Street
The Continental	2 Boylston Street
D and D Clothing Company	11A Kingston Street
W. T. DeFriest and Company	30 Avery Street
Dines Sea Grill, Incorporated	613 Washington Street
Dorothy Dodd Boot Shop	23 West Street
S. E. W. Dow	45 West Street
Dufourde Restaurant	15 Avon Street
Durgin Park and Company	16 Hayward Place
D. R. Emerson Company	35 Temple Place
Estate of George F. Fabyan	32 West Street
Peter L. Flynn Company	164 Tremont Street
Foley-Young Company	11A Kingston Street
The Georgian, Incorporated	21 Kingston Street

STEAM HEATING SERVICE

The Georgian, Incorporated	4 Boylston Street
The Ginter Company	41 Winter Street
The Ginter Company	531 Washington Street
The Ginter Company	461 Washington Street
The Ginter Company	126 Tremont Street
Myer Gross	259 Friend Street
Harvard College President and Fellows	161 Tremont Street
H. L. Hemenway	21 Kingston Street
Hill Land Trust	43-45 Bedford Street
C. Crawford Hollidge	141 Tremont Street
Hotel Paramount	19 Boylston Street
A. H. Howe and Sons, Incorporated	170 Tremont Street
Houghton and Dutton Company	55 Tremont Street
Huyler's	146 Tremont Street
Jays, Incorporated	11 Temple Place
Jones, Peterson and Newhall Company	51 Temple Place
Jordan Marsh Company	450 Washington Street
Jus-Difrent Confectionery Company	224 Friend Street
Kaitz Brothers	20 Chauncy Street
Society of King's Chapel	52 Tremont Street
Knitbac Service Company, Incorporated	62 Summer Street
S. S. Kresge Company	477 Washington Street
Lamson and Hubbard Hat Company	25 Kingston Street
Leopold Morse Company	217 Friend Street
Lerner Stores Corporation	168 Tremont Street
Locke Ober Company	3 Winter Place
Annie F. Luke	78 Bedford Street
Marcus Cap Company	33 Kingston Street
Markson Brothers	565 Washington Street
Merrimac Cleansing Company	205 Portland Street
Joseph Miller	134 Canal Street
Municipal Real Estate Trust	77 Summer Street
New Hat Frame Company	63 Summer Street
Niagara Shower Bath Company	621 Washington Street
Page & Shaw, Incorporated	9 West Street
Park Amusement Company	617 Washington Street
Park Street Church	1 Park Street
Pascarelli Brothers	86 Bedford Street
Peoples Cleansing Shops	252 Friend Street
A. W. Perry, Incorporated	453 Washington Street
H. G. Perry	27 Kingston Street
Andrew J. Peters	128 Tremont Street
S. S. Pierce Company	65 Summer Street
S. S. Pierce Company	11-17 Kingston Street
Pieroni Brothers Company	603 Washington Street

STEAM HEATING SERVICE

A. H. Pinkson	15 Boylston Street
Provident Institute for Savings	36 Temple Place
Queen Quality Boot Shop	158 Tremont Street
Royal Curtain Manufacturing Company	35 Kingston Street
Samuel H. Sawar	35 Kingston Street
W. F. Schrafft and Sons Corporation	11 Summer Street
F. G. Shattuck Company	11 Summer Street
F. G. Shattuck Company	16 West Street
Singer Sewing Machine Company	55 Temple Place
St. Clairs, Incorporated	159 A Tremont Street
R. H. Stearns Company	140 Tremont Street
A. Stowell and Company, Incorporated	24 Winter Street
Thayer McNeil Company	47 Temple Place
Thresher Brothers	19 Temple Place
Thompson's Spa, Incorporated	44-46 Temple Place
Touraine Glove Company	11 Avon Street
Tremont Theatre	176 Tremont Street
Tremont Turkish Baths	176 Tremont Street
Trustees, Lotta A. Crabtree Estate	621 Washington Street
United Shoe Machinery Corporation	140 Federal Street
Arthur Wallace	160 Tremont Street
Walter Wong	144-152 Canal Street
Walton Lunch Company	629 Washington Street
Walton Lunch Company	105 Causeway Street
George M. Wethern Company	21 Temple Place
R. H. White Company	518 Washington Street
T. D. Whitney Company	39 Temple Place
W. W. Winship, Incorporated	71 Summer Street
George S. Winslow Estate	33 Kingston Street
F. W. Woolworth Company	55 Summer Street
F. W. Woolworth Company	558 Washington Street
F. W. Woolworth Company	122 Tremont Street

Issued by
The Steam Heating Service Department
August 1, 1930

